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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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3 **Laying the foundation for an ICF core set for community-dwelling elderly adults in**
4 **primary care: the research perspective identified by a review of the literature**
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53 **Word count:** 3.809
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58 **Abstract**
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3 **Objectives:** Overmedicalization grows with ageing. Concentrating on functioning might help
4
5 to discriminate between necessary and unnecessary medicine. The International Classification
6
7 of Functioning, Disability and Health (ICF) is a tool for describing functioning. Being too
8
9 detailed, the aim is to develop a Core Set for geriatric patients in primary care. The objective
10
11 of this study was to find relevant concepts of functioning within the scientific literature.
12
13

14 **Design:** A systematic literature review was conducted. Articles dealing with functioning in the
15
16 elderly were searched and assessed for eligibility. Relevant concepts were extracted and
17
18 linked to the ICF following established linking rules. Finally, a frequency analysis was
19
20 conducted.
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22

23 **Setting:** Home, primary care.
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26 **Participants:** Community-dwelling adults aged 75 and older.
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29 **Results:** From 5,060 identified publications 82 were included. Overall 1,182 concepts were
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31 retrieved. Most were linked to the 'activities and participation' component. The most frequently
32
33 identified categories were '*memory functions*', '*dressing*', and '*changing basic body position*'.
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36 **Conclusions:** This review provides a list of relevant ICF categories from the research
37
38 perspective that will be used for developing the ICF Core Set for older primary care patients.
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41 **Trial registration number:** The study is registered in PROSPERO (CRD42017067784),
42
43 *Versorgungsforschung Deutschland Datenbank* [VfD_17_003833] and *clinicaltrials.gov*
44
45 [NCT03384732].
46
47

48 **Keywords:** International Classification of Functioning, Disability and Health, community-
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50 dwelling older persons, geriatric health services, general practice
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58 **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, Jamouille 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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3 role. In Germany they are the primary contact for the ambulatory care of older patients. There
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5 is some evidence that with increasing age the potential of chronic conditions to predict mortality
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7 decreases, while functioning limitations seem to become stronger predictors(12). Functioning
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9 limitations are not only a predictor of mortality, but also provide important information about
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11 the severity and consequences of chronic conditions(13). Thus, functioning information
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13 together with disease information might be a better indicator of necessary and unnecessary
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15 medicine in older persons than disease information alone. The term *functioning* can be defined
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17 as a person's intrinsic health capacity, as well as what the person actually does or is not able
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19 to do in everyday life in light of the interaction between this health capacity and environmental
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21 factors(14-16). Functioning can be described using the International Classification of
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23 Functioning, Disability and Health (ICF). Launched by World Health Organization (WHO) in
24
25 2001, the ICF is an internationally recognized reference framework for health and health-
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27 related states from a bio-psycho-social perspective(17). Functioning can be documented with
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29 ICF domains and categories that are structured hierarchically at different levels within the
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31 components of 'body functions' (b), 'body structures' (s), 'activities and participation' (d),
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33 'environmental factors' (e) and 'personal factors' (not classified) using an alphanumeric coding
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35 system. With more than 1,400 categories, the ICF is, however, too extensive to be used in
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37 daily practice. To address this issue, shorter lists of categories, so-called ICF Core Sets (ICF-
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39 CS), have been developed for several health conditions.¹ These ICF-CSs comprise categories
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41 that cover the typical spectrum of functioning aspects relevant to persons living with the given
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43 condition(18). ICF-CS for primary care and for geriatric patients have already been
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45 developed(19-21). However, none of these were developed according to the standardized
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47 process for developing ICF-CS(18). For this reason, we aimed to develop an ICF-CS, covering
48
49 the life and functioning of geriatric patients aged 75 years and older in primary care, following
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51 the standardized process. This process includes a preparatory phase followed by an
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53 international ICF consensus conference and the implementation of the first version of the ICF-
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55 CS. During the preparatory phase, four studies are conducted to identify relevant ICF
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57 CS. During the preparatory phase, four studies are conducted to identify relevant ICF
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59 categories from four different perspectives: a systematic literature review (research
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3 perspective), a qualitative study (perspective of the target population)(22), an expert survey
4 (experts' perspective), and an empirical study (clinical perspective)(23). It is important to
5 capture these different perspectives in the development process in order to gain a holistic
6 understanding of the functioning of people living with a specific health condition.
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12 In this paper, the methods and the results of the systematic literature review of the project to
13 develop ICF-CS for older persons in primary care are presented. The aims were (a) to identify
14 concepts contained in instruments for assessing functioning of older persons (≥ 75 years) that
15 are frequently used in published studies and (b) to link these concepts to the ICF.
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21 **3 Methods**

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23 This systematic literature review was conducted following the methodology proposed by the
24 ICF Research Branch(18).² This methodology is composed of five steps: 1) literature search,
25 2) study selection, 3) extraction of relevant concepts, 4) linkage of the concepts to the ICF and
26 5) frequency analysis. In contrast to other systematic reviews, we did not aim to answer clinical
27 questions by reviewing existing evidence, but to systematically extract the concepts used by
28 the scientific community to operationalize functioning. A study protocol has recently been
29 published elsewhere(24). This review was registered in PROSPERO (CRD42017067784) on
30 07/10/2017 and is reported according to the Preferred Reporting Items for Systematic Reviews
31 and Meta-Analyses (PRISMA) guidelines(25).
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44 **3.1 Eligibility Criteria**

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46 The selection of the eligibility criteria was guided by the PICOS (Population, Intervention,
47 Comparison, Outcomes, Study design) framework(26). Due to the special focus of this review,
48 only the 'P', 'O', and 'S' were relevant for our search.
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52 Population: For a publication to be included in this review, all the participants included in the
53 published study had to be community-dwelling and at least 75 years old. Studies that included
54 institutionalized participants (e.g. nursing home), participants recruited in a hospital or
55 rehabilitation center, or participants with dementia were excluded. As the intended ICF-CS is
56 meant to be used in primary care practices in Germany, only studies conducted in high-
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3 resource countries with a similar socio-economic and cultural background were considered.
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5 Consequently, only studies conducted in the member states of the European Union and the
6
7 European Free Trade Association, the United States, Australia and New Zealand were
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9 included. Moreover, to get a representative picture of the health reality of old adults, studies
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11 with participants suffering from only one specific health condition were excluded.
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14 Outcomes: The publications had to be related to functioning as defined by the ICF (e.g.
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16 activities of daily living, social interaction, physical mobility). Publications reporting on studies
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18 that solely focused on body structures without considering any other features of functioning
19
20 were excluded to ensure that the resulting candidate categories reflect the integrative
21
22 biopsychosocial nature of functioning.
23

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25 Study design: As suggested in the ICF-CS development guidelines, randomized controlled
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27 trials, clinical controlled trials, cross-sectional studies, observational studies and qualitative
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29 studies were included(18). Study protocols, case studies, economic evaluation studies,
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31 conference papers, psychometric studies, prevention studies, studies of phase-II clinical trials,
32
33 studies exclusively showing laboratory parameters, animal experiments, letters, comments
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35 and editorials were excluded, as those publications usually do not include relevant information
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37 on functioning(18). Furthermore, systematic reviews and meta-analyses were not included in
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39 this review.
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41 **3.2 Literature search**

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43 Electronic searches were carried out in PubMed, PsycINFO, EMBASE, CINAHL und Scopus
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45 to identify potentially relevant publications. The search terms were organized into population
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47 (e.g. aged, elderly, older adults), living condition (e.g. community-dwelling, independently
48
49 living) and outcome variables according to the ICF-related terms (e.g. social life, self-care,
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51 home environment) using the thesaurus of the respective database (e.g. Medical subject
52
53 headings in PubMed) as well as free text words. Only studies published between 2007 and
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55 2017 in peer-reviewed journals in English or German were considered for inclusion. The search
56
57 strategy was reviewed by an experienced librarian. The whole search strategy is available at
58
59 PROSPERO(27).
60

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

- 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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3 maximum count of one category can exceed the number of identified studies included in the
4 review. We used descriptive statistics to report the most frequently identified ICF categories.
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6 Only first-level and second-level ICF categories are reported in this paper.³ If a concept was
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8 linked to a third- or fourth-level ICF category, the overarching second-level category was
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10 included for analysis. Due to the hierarchical nature of the ICF, a lower-level category shares
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12 the attributes of the higher-level category of which it is a member(17).
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15 16 **3.7 Patient and public involvement**

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18 Patients and the public were not involved in this study.
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20 21 **4 Results**

22 23 **4.1 Study Selection**

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25 A total of 10,043 publications were identified. After removing duplicates, 5,060 potentially
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27 relevant publications were left. In the abstract screening 681 articles were identified for full-text
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29 screening. Of these, a random sample of 341 articles (50%) was drawn for the full text
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31 screening, from which 82 articles were subsequently included for data extraction (see figure
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33 1). The references of the included studies are available in Appendix A, the study characteristics
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35 in Appendix B.
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40 **Please insert figure 1 here**
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42 43 **4.2 Study characteristics**

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45 The 82 publications included studies that were conducted in 17 different countries. About 20%
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47 of the studies were conducted in Finland (n = 16), 14.6% in Sweden (n = 12) and 12.2% in the
48
49 United States (n = 10). The investigated study population consisted of 74,351 community-
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51 dwelling elderly, of whom 68.6% were female. Three publications did not provide information
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53 about the gender of their participants. Most of the studies (65.9%) had an observational design
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55 (longitudinal or cross sectional), 15.6% were qualitative studies, 12.2% intervention studies,
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57 4.9% analyzed secondary data and one study (1.2%) used mixed methods.
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60 **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).

Table 1

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

Assessment instrument	Nr. of studies	Cognition	Mobility	Functioning status	Environmental 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

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 *dressings (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 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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2			
3	b530	Weight maintenance functions	3
4			
5	b620	Urination functions	25
6			
7	b755	Involuntary movement reaction functions	13
8			
9	b730	Muscle power functions	7
10			
11	b810	Protective functions of the skin	3
12	b820	Repair functions of the skin	3
13			
14		Body structures	
15	s750	Structure of lower extremity	2
16			
17	s730	Structure of upper extremity	2
18			
19		Environmental factors	
20	e110	Products or substances for personal consumption	17
21			
22	e155	Design, construction and building products and technology of buildings for private use	12
23			
24	e115	Products and technology for personal use in daily living	5
25			
26	e120	Products and technology for personal indoor and outdoor mobility and transportation	4
27			
28	e125	Products and technology for communication	2
29			
30	e160	Products and technology of land development	2
31			
32	e165	Assets	2
33			
34	e210	Physical geography	2
35			
36	e225	Climate	2
37			
38	e240	Light	2
39			
40	e250	Sound	2
41			
42	e310	Immediate family	5
43			
44	e315	Extended family	5
45			
46	e320	Friends	5
47			
48	e325	Acquaintances, peers colleagues, neighbors and community members	5
49			
50	e355	Health professionals	3
51			
52	e575	General social support services, systems and policies	5
53			
54	e580	Health services, systems and policies	5
55			
56	e530	Utilities services, systems and policies	4
57			
58	e520	Open space planning services, systems and policies	2
59			
60			

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.

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

1
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3 'personal factors' included living arrangements, self-sufficiency and medication adherence.⁴
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5 The commonly reported health conditions according to organ systems were diseases of the
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7 skin and subcutaneous tissue, psychiatric disorders, neurological diseases, infectious
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9 diseases, diseases of the digestive system, sensory disorders, diseases of the
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11 musculoskeletal system, and cancer.
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14 **5 Discussion**

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17 From the research perspective, the component 'activities and participation' has shown to be
18
19 the most relevant among all ICF components with regard to functioning of older persons.
20
21 Almost half of all assigned categories are in this component. ICF categories that belong to the
22
23 components 'body functions' and 'environmental factors', were less frequently assigned. With
24
25 only two ICF categories, 'body structures' seems to be the least relevant component of the
26
27 four. However, this might be due to the fact that studies which solely focused on body
28
29 structures without considering any other features of functioning were excluded. Such studies
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31 were excluded to ensure that the resulting candidate categories reflect the integrative
32
33 biopsychosocial nature of functioning.
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37 The ICF chapters with the most frequently assigned categories were: b1 'mental functions', d4
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39 'mobility', d5 'self-care', and d6 'domestic life'. These areas are of special interest as they are
40
41 prerequisites for being able to live independently at home. In a meta-analysis, indicators of
42
43 functional and cognitive impairments were identified as the strongest predictors for
44
45 necessitating admission to a nursing home(41). Cognitive impairment has also been identified
46
47 as the strongest predictor for necessitating nursing home placement in a study investigating
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49 caregivers reasons for nursing home placement(42). Frequently identified categories referring
50
51 to d5 'self-care' were *dressing (d540)*, *washing oneself (d510)*, *eating (d550)*, and *toileting*
52
53 *(d530)*. These are all activities of daily living. Literature indicates, that older adults with
54
55 problems in three or more activities of daily living had a higher risk of being admitted to a
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57 nursing home than adults without problems(41). Household activities, like *doing housework*
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59 *(d640)* or *preparing meals (d630)*, have frequently been identified in this review, but have not
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3 been found to be a major predictor for nursing home placement(41). This might be due to the
4 fact that impairments in these areas can easily be compensated e.g. with household aids or
5 assistance from family members.
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9 No concepts were identified referring to the chapter b4 'functions of the cardiovascular,
10 hematological, immunological and respiratory systems'. This might be due to the fact, that
11 health conditions are coded with 'nc-hc' and not with the ICF category representing the
12 underlying functions affected by a certain disease. Another explanation might be that, although
13 the prevalence of diseases in these systems, especially of cardiovascular diseases, has
14 increased since the 1980s, inability to perform activities of daily living as well as mortality
15 induced by these diseases has decreased in the same period(2). This might be an explanation
16 why recent research that focuses on functioning of the elderly, as reflected by the publications
17 from 2007-2017, is less concerned with functions of the cardiovascular, hematological,
18 immunological and respiratory systems. Moreover, no concepts were identified in the chapter
19 e4 'attitudes'. As several studies and systematic reviews provide evidence that negative
20 attitudes towards old age negatively affect the health of the elderly, attitudes might be a
21 relevant aspect to be included in instruments assessing functioning(43-45).
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36 Concepts referring to environmental factors with an impact on an individual's life were
37 minimally addressed in the assessment instruments reported in the included articles. The most
38 frequently identified category in this section was *products or substances for personal*
39 *consumption (e110)*, mainly assigned for the concept of medication. However, environmental
40 factors like housing design (e.g. lighting conditions, uneven surfaces), neighborhood planning
41 (e.g. public transportation, walkable community services), and social support (e.g. family,
42 friends, or health professionals) play a crucial role in old age. Considering these environmental
43 factors can contribute to the prevention of falls, nursing home placement as well as to the
44 compensation of other negative effects of age-related declines(41, 46-48). Thus, developing
45 instruments that addresses these essential environmental factors or revising current
46 assessment instruments to include more environmental factors items may be warranted.
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5.1 Strengths and limitations

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

11
12 A limitation of this literature review is the restriction to articles published in English or German
13 in specific high-resources countries. Thus, relevant studies that were conducted in other
14 countries or published in other languages were possibly missed. Also drawing a random
15 sample for full text screening carries the risk of losing potentially relevant publications. Finally,
16 excluding studies that focus solely on body structures may have introduced some bias in the
17 results. The reason for excluding these studies was mentioned above.

18
19 Some potentially relevant information may have been lost in the linking process, as the ICF is
20 not precise enough to represent some relevant concepts for older adults. For example, fatigue,
21 falls or fear of falling could not easily be linked to one specific ICF category. Sometimes more
22 than one category was necessary to be able to describe these concepts; e.g. fear of falling
23 was linked using *involuntary movement reaction functions (b755)*, *sensation of falling (b2402)*,
24 and *emotional functions (b152)*. Other concepts could only be linked to the very general first-
25 level ICF categories, not allowing a detailed representation of the concept; e.g. isolation was
26 linked to *support and relationships (e3)*. Sometimes, the same concept could be linked to
27 different categories. This was especially the case for concepts regarding the change of body
28 positions. For example the concept “get into bed” can be linked to:

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- *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

- 1
2
3 - *standing (d4104)*; defined as “Getting into and out of a standing position or changing
4 *body position from standing to any other position, such as lying down or sitting*
5 *down”(17).*
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9 This was one reason why we decided to link all concepts to second-level categories only. Being
10 aware of these issues, WHO created a mechanism of updating ICF categories to further
11 enhance the use of this classification(49). We will report the linking problems we faced to WHO
12 after publication of this study.
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17 **5.2 Implications for practice**

18 As mentioned above, functioning information together with disease information might be a
19 better indicator of necessary and unnecessary medicine in older persons than disease
20 information alone. This systematic literature review provides a list of relevant ICF categories
21 from the research perspective that will be used, together with the results of the other three
22 preparatory studies, for developing the ICF-CS for older primary care patients. In the long term,
23 this ICF-CS is expected to support general practitioners in assessing functioning of their
24 patients, defining treatment goals, and based on these goals, differentiating between
25 necessary and unnecessary medical interventions.
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38 **6 Conclusions**

39 In conclusion, this systematic literature review demonstrates that frequently used instruments
40 for assessing functioning in older persons focus mainly on activities of daily living and mental
41 functions, whereas environmental factors are only minimally addressed. Despite some
42 limitations experienced in the linking process, the ICF provides a useful reference to identify
43 and cluster the concepts used in instruments for assessing functioning of older adults.
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54 Universität Erlangen Nürnberg for his support and advice in the development of the electronic
55 search strategy.
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3 The present work was performed in partial fulfilment of the requirements for obtaining the
4 degree 'Dr. rer. biol. hum.' for Johanna Tomandl.
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8 Footnotes

8.1 Contributors

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12
13 JT was involved in the development of the search strategy; performed the literature search;
14 took part in the screening of the papers, the data extraction and the linking process; performed
15 the data analysis; was involved in the interpretation of the data; drafted parts of the manuscript
16 and collated all sections from the co-authors. SHe was involved in the development of the
17 search strategy, the screening of the papers, the data extraction, the linking process and the
18 interpretation of the data. MS advised the research team on the ICF Core Set methodology
19 and revised the draft. EF was involved in the conception of the study, the development of the
20 search strategy and the abstract screening; provided supervision and revised the draft.
21 EG/TK/SHu were involved in the conception of the study and in the development of the search
22 strategy; provided supervision and revised the draft. SB/SG were involved in the development
23 of the search strategy, the screening of the papers, the data extraction, the linking process and
24 the interpretation of the data; drafted parts of the manuscript. All authors read and approved
25 the final version of the manuscript. SB and SG contributed equally to this work.
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41
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47

8.3 Disclaimer

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49 The funders had no role in the study design, data collection and analysis, decision to publish,
50 or preparation of the manuscript.
51
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8.4 Competing interests

55
56 None declared.
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8.5 Patient consent for publication

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3 Not required.
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6 **8.6 Ethics approval**

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8 Not required.
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10 **8.7 Data availability statement**

11 The datasets used and analyzed during the current study are available from the corresponding
12 author upon reasonable request.
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16 **8.8 Notes**

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20 ¹ A list of accredited ICF-CS can be found here: <https://www.icf-core-sets.org/en/page1.php>.²

21 The ICF Research Branch is a cooperation partner within the WHO collaborating center for
22 the Family of International Classifications (WHO-FIC) in Germany, which aims to promote
23 health by implementing ICF based tools and models(50).³ The categories of the ICF are
24 divided into different levels. First-level categories are coded using the component letter (b, s,
25 d, or e) followed by the chapter number (one digit). Second-level categories are coded using
26 the letter and three digits; the third- and fourth-level categories using the letter and four or
27 five digits. ⁴“Personal factors are contextual factors that relate to the individual such as age,
28 gender, life experiences and so on” whereas environmental factors “refer to all aspects of the
29 external or extrinsic world that form the context of an individual’s life and, as such, have an
30 impact on that person’s functioning” such as human-made physical world, social systems or
31 laws(17).
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46 **9 References**

- 47
48
49 1. Christensen K, Doblhammer G, Rau R, et al. Ageing populations: the challenges ahead.
50 *Lancet*. 2009;374(9696):1196-208.10.1016/S0140-6736(09)61460-4.
51
52 2. Crimmins EM. Trends in the health of the elderly. *Annu Rev Public Health*. 2004;25:79-98.
53
54 3. Johansson T, Abuzahra ME, Keller S, et al. Impact of strategies to reduce polypharmacy
55 on clinically relevant endpoints: a systematic review and meta-analysis. *Br J Clin*
56 *Pharmacol*. 2016;82(2):532-48.10.1111/bcp.12959.
57
58 4. Masnoon N, Shakib S, Kalisch-Ellett L, et al. What is polypharmacy? A systematic review
59 of definitions. *BMC Geriatr*. 2017;17(1):230.10.1186/s12877-017-0621-2.
60

- 1
2
3 5. Frazier SC. Health outcomes and polypharmacy in elderly individuals. *J Gerontol Nurs.*
4 2005;31(9):4-9.
5
- 6
7 6. Calderón-Larrañaga A, Poblador-Plou B, González-Rubio F, et al. Multimorbidity,
8 polypharmacy, referrals, and adverse drug events: are we doing things well? *Br J Gen*
9 *Pract.* 2012;62(605):e821-e6.10.3399/bjgp12X659295.
10
- 11
12 7. Martins C, Godycki-Cwirko M, Heleno B, et al. Quaternary prevention: reviewing the
13 concept. *Eur J Gen Pract.* 2018;24(1):106-11.10.1080/13814788.2017.1422177.
14
- 15
16 8. Wonca international dictionary of general/family practice. Copenhagen2003. Quaternary
17 Prevention.
18
- 19
20 9. Morgan DJ, Brownlee S, Leppin AL, et al. Setting a research agenda for medical overuse.
21 *BMJ.* 2015;351:h4534.
22
- 23
24 10. Moynihan R, Henry D. The fight against disease mongering: generating knowledge for
25 action. *PLoS Med.* 2006;3(4):e191.10.1371/journal.pmed.0030191.
26
- 27
28 11. Kuehlein T, Freund T, Joos S. Von der Kunst des Weglassens. *Dtsch Ärztebl.*
29 2013;110(48):2312-4.
30
- 31
32 12. Lee SJ, Go AS, Lindquist K, et al. Chronic conditions and mortality among the oldest old.
33 *Am J Public Health.* 2008;98(7):1209-14.10.2105/Ajph.2007.130955.
34
- 35
36 13. Chatterji S, Byles J, Cutler D, et al. Health, functioning, and disability in older adults -
37 present status and future implications. *Lancet.* 2015;385(9967):563-75.
38
- 39
40 14. Bostan C, Oberhauser C, Stucki G, et al. Biological health or lived health: which predicts
41 self-reported general health better? *BMC Public Health.* 2014;14:189.10.1186/1471-2458-
42 14-189.
43
- 44
45 15. Stucki G, Bickenbach J. Functioning: the third health indicator in the health system and
46 the key indicator for rehabilitation. *Eur J Phys Rehabil Med.* 2017;53(1):134-
47 8.10.23736/S1973-9087.17.04565-8.
48
- 49
50 16. World Health Organization. World report on ageing and health: World Health Organization
51 2015.
52
- 53
54 17. World Health Organization. International Classification of Functioning, Disability and
55 Health: ICF: World Health Organization 2001.
56
- 57
58 18. Selb M, Escorpizo R, Kostanjsek N, et al. A guide on how to develop an International
59 Classification of Functioning, Disability and Health Core Set. *European Journal of Physical*
60 *and Rehabilitation Medicine.* 2015;51(1):105-17.

19. Grill E, Hermes R, Swoboda W, et al. ICF Core Set for geriatric patients in early post-acute rehabilitation facilities. *Disabil Rehabil.* 2005;27(7-8):411-416. doi:10.1080/09638280400013966.
20. Spoorenberg SLW, Reijneveld SA, Middel B, et al. The Geriatric ICF Core Set reflecting health-related problems in community-living older adults aged 75 years and older without dementia: development and validation. *Disabil Rehabil.* 2015;37(25):2337-43. doi:10.3109/09638288.2015.1024337.
21. Emmen B, van Boven K, ten Napel H. Exploration of the desired content of an 'International Classification of Functioning' (ICF) item set for multimorbid patients in general practice. *Newsletter WHO-FIC Annual Network Meeting.* 2014;12(1):9-11.
22. Tomandl J, Book S, Hoefle A, et al. Laying the foundation for an ICF core set for community-dwelling elderly adults in primary care: the patient-perspective identified in a qualitative study. Manuscript submitted for publication.
23. Book S, Ulbrecht G, Tomandl J, et al. Laying the foundation for an ICF Core Set for community-dwelling elderly adults in primary care: The clinical perspective identified in a cross-sectional study. Manuscript submitted for publication.
24. Tomandl J, Book S, Gotthardt S, et al. Laying the foundation for a core set of the International Classification of Functioning, Disability and Health for community-dwelling adults aged 75 years and above in general practice: a study protocol. *BMJ Open.* 2018;8(8):e024274. doi:10.1136/bmjopen-2018-024274.
25. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med.* 2009;151(4):264-9.
26. Tacconelli E. Systematic reviews: CRD's guidance for undertaking reviews in health care. *The Lancet Infectious Diseases.* 2010;10(4):226.
27. Tomandl J, Heinmueller S, Graessel E, et al. 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. *PROSPERO* 2017.
28. Geyh S, Cieza A, Schouten J, et al. ICF Core Sets for stroke. *J Rehabil Med.* 2004;36(0):135-41.
29. de Schipper E, Lundequist A, Coghill D, et al. Ability and disability in autism spectrum disorder: A systematic literature review employing the international classification of functioning, disability and health-children and youth version. *Autism Res.* 2015;8(6):782-94.

- 1
2
3 30.Granberg S, Dahlström J, Möller C, et al. The ICF core sets for hearing loss—researcher
4 perspective. Part I: Systematic review of outcome measures identified in audiological
5 research. *Int J Audio*. 2014;53(2):65-76.
6
7
8 31.Gorostiaga A, Balluerka N, Guilera G, et al. Functioning in patients with schizophrenia: a
9 systematic review of the literature using the International Classification of Functioning,
10 Disability and Health (ICF) as a reference. *Qual Life Res*. 2017;26(3):531-43.
11
12 32.Random Integer Set Generator 2018. Available from: [https://www.random.org/integer-](https://www.random.org/integer-sets/)
13 [sets/](https://www.random.org/integer-sets/). (Accessed 20 Dec 2018).
14
15
16 33.Offenbächer M, Cieza A, Brockow T, et al. Are the contents of treatment outcomes in
17 fibromyalgia trials represented in the international classification of functioning, disability,
18 and health? *Clin J Pain*. 2007;23(8):691-701.
19
20 34.Wolff B, Cieza A, Parentin A, et al. Identifying the concepts contained in outcome
21 measures of clinical trials on four internal disorders using the International Classification of
22 Functioning, Disability and Health as a reference. *J Rehabil Med*. 2004(44 Suppl):37-
23 42.10.1080/16501960410015407.
24
25 35.Wasiak J, McMahon M, Danilla S, et al. Measuring common outcome measures and their
26 concepts using the International Classification of Functioning, Disability and Health (ICF)
27 in adults with burn injury: a systematic review. *Burns*. 2011;37(6):913-24.
28
29 36.Brockow T, Cieza A, Kuhlrow H, et al. Identifying the concepts contained in outcome
30 measures of clinical trials on musculoskeletal disorders and chronic widespread pain
31 using the International Classification of Functioning, Disability and Health as a reference.
32 *J Rehabil Med*. 2004;36(0):30-6.
33
34 37.Geyh S, Kurt T, Brockow T, et al. Identifying the concepts contained in outcome
35 measures of clinical trials on stroke using the International Classification of Functioning,
36 Disability and Health as a reference. *J Rehabil Med*. 2004;36(0):56-62.
37
38 38.Scheuringer M, Grill E, Boldt C, et al. Systematic review of measures and their concepts
39 used in published studies focusing on rehabilitation in the acute hospital and in early post-
40 acute rehabilitation facilities. *Disabil Rehabil*. 2005;27(7-8):419-29.
41
42 39.Bartoszek G, Fischer U, Müller M, et al. Outcome measures in older persons with
43 acquired joint contractures: a systematic review and content analysis using the ICF
44 (International Classification of Functioning, Disability and Health) as a reference. *BMC*
45 *Geriatr*. 2016;16(1):40.
46
47 40.Cieza A, Fayed N, Bickenbach J, et al. Refinements of the ICF Linking Rules to
48 strengthen their potential for establishing comparability of health information. *Disabil*
49 *Rehabil*. 2016;41(5):574-83.10.3109/09638288.2016.1145258.
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 41. Gaugler JE, Duval S, Anderson KA, et al. Predicting nursing home admission in the US: a
4 meta-analysis. *BMC Geriatr*. 2007;7(1):13.10.1186/1471-2318-7-13.
5
6
7 42. Buhr GT, Kuchibhatla M, Clipp EC. Caregivers' reasons for nursing home placement:
8 clues for improving discussions with families prior to the transition. *Gerontologist*.
9 2006;46(1):52-61.
10
11
12 43. Horton S, Baker J, Pearce G, et al. On the malleability of performance: Implications for
13 seniors. *J Appl Gerontol*. 2008;27(4):446-65.
14
15
16 44. Meisner BA. A meta-analysis of positive and negative age stereotype priming effects on
17 behavior among older adults. *Journals of Gerontology Series B: Psychological Sciences*
18 *and Social Sciences*. 2011;67(1):13-7.
19
20
21 45. Levy BR, Slade MD, Chang ES, et al. Ageism Amplifies Cost and Prevalence of Health
22 Conditions. *Gerontologist*. 2018:gny131-gny.10.1093/geront/gny131.
23
24
25 46. Lawton MP. Residential environment and self-directedness among older people. *Am*
26 *Psychol*. 1990;45(5):638.
27
28 47. Lien WC, Chang JH, Guo NW, et al. Determinants of perceived physical environment
29 barriers among community-dwelling elderly in Taiwan. *J Nutr Health Aging*.
30 2015;19(5):575-82.10.1007/s12603-015-0473-4.
31
32
33 48. Wahl H-W, Iwarsson S, Oswald F. Aging well and the environment: Toward an integrative
34 model and research agenda for the future. *Gerontologist*. 2012;52(3):306-16.
35
36
37 49. WHO-FIC Update and Revision Committee. ICF Update Platform. User Guide. 2013.
38
39 50. ICF Research Branch. Our Mission 2007. Available from: <https://www.icf-research-branch.org/about-us/our-mission>. (Accessed 27 Jan 2020).
40
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42 **10 List of abbreviations**

43
44
45 ICF: International Classification of Functioning, Disability and Health

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

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

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

49 **11 List of figures**

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58 *Figure 1.* Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
59 flow chart.
60

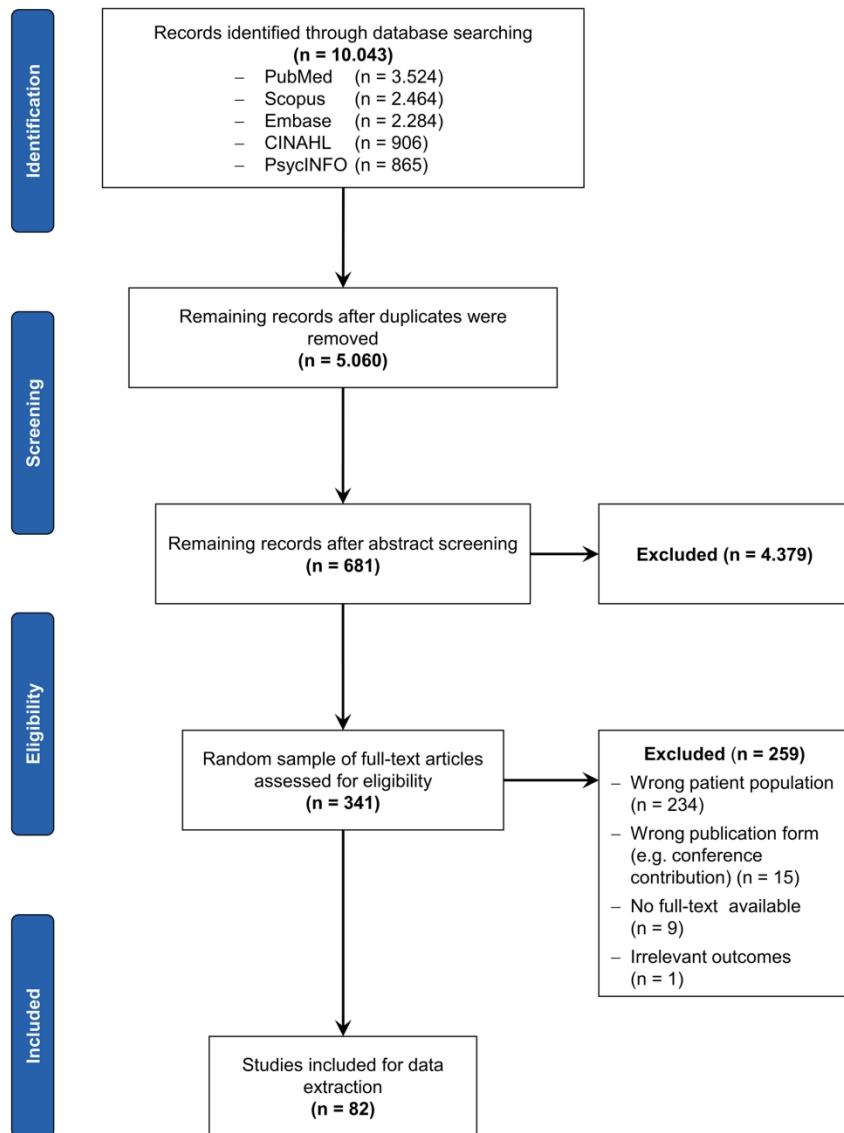


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

169x225mm (300 x 300 DPI)

Appendix A

References for included articles

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4
5
6
7 Aartolahti E, Hakkinen A, Lonroos E, et al. Relationship between functional vision and balance and
8 mobility performance in community-dwelling older adults. *Aging Clin Exp Res*.
9 2013;25(5):545-52.10.1007/s40520-013-0120-z.
- 10 Abellan van Kan G, Cesari M, Gillette-Guyonnet S, et al. Sarcopenia and cognitive impairment in
11 elderly women: results from the EPIDOS cohort. *Age Ageing*. 2013;42(2):196-
12 202.10.1093/ageing/afs173.
- 13 Ahluwalia SC, Gill TM, Baker DI, et al. Perspectives of older persons on bathing and bathing
14 disability: A qualitative study. *J Am Geriatr Soc*. 2010;58(3):450-6.
- 15 Almeida OP, Yeap BB, Hankey GJ, et al. Association of depression with sexual and daily activities:
16 A community study of octogenarian men. *Am J Geriatr Psychiatry*. 2015;23(3):234-
17 42.10.1016/j.jagp.2013.09.007.
- 18 Behm L, Eklund K, Wilhelmson K, et al. Health Promotion Can Postpone Frailty: Results from the
19 RCT Elderly Persons in the Risk Zone. *Public Health Nurs*. 2016;33(4):303-
20 15.10.1111/phn.12240.
- 21 Berkemeyer S, Schumacher J, Thiem U, et al. Bone T-scores and functional status: A cross-
22 sectional study on german elderly. *PLoS ONE*. 2009;4(12).10.1371/journal.pone.0008216.
- 23 Blain H, Carriere I, Sourial N, et al. Balance and walking speed predict subsequent 8-year mortality
24 independently of current and intermediate events in well-functioning women aged 75 years
25 and older. *J Nutr Health Aging*. 2010;14(7):595-600.10.1007/s12603-010-0111-0.
- 26 Bollwein J, Diekmann R, Kaiser MJ, et al. Dietary quality is related to frailty in community-dwelling
27 older adults. *J Gerontol A Biol Sci Med Sci*. 2013;68(4):483-9.10.1093/gerona/gls204.
- 28 Brännström H, Bäckman M, Fischer RS. Walking on the edge: Meanings of living in an ageing body
29 and using a walker in everyday life - A phenomenological hermeneutic study. *International
30 Journal of Older People Nursing*. 2013;8(2):116-22.10.1111/j.1748-3743.2012.00334.x.
- 31 Brown CJ, Kennedy RE, Lo AX, et al. Impact of Emergency Department Visits and Hospitalization
32 on Mobility Among Community-Dwelling Older Adults. *Am J Med*. 2016;129(10):1124.e9-
33 .e15.10.1016/j.amjmed.2016.05.016.
- 34 Byles JE, Leigh L, Vo K, et al. Life space and mental health: a study of older community-dwelling
35 persons in Australia. *Aging & Mental Health*. 2015;19(2):98-
36 106.10.1080/13607863.2014.917607.
- 37 Calvert JF, Kaye J, Leahy M, et al. Technology use by rural and urban oldest old. *Technol Health
38 Care*. 2009;17(1):1-11.10.3233/THC-2009-0527.
- 39 Chipperfield JG, Newall NE, Chuchmach LP, et al. Differential determinants of men's and women's
40 everyday physical activity in later life. *Journals of Gerontology - Series B Psychological
41 Sciences and Social Sciences*. 2008;63(4):S211-S8.
- 42 Dahlin-Ivanoff S, Haak M, Fange A, et al. The multiple meaning of home as experienced by very old
43 Swedish people. *Scandinavian journal of occupational therapy*. 2007;14(1):25-
44 32.10.1080/11038120601151714.
- 45 Diez-Ruiz A, Bueno-Erandonea A, Nunez-Barrio J, et al. Factors associated with frailty in primary
46 care: a prospective cohort study. *BMC Geriatr*. 2016;16:91.10.1186/s12877-016-0263-9.
- 47 Eckerblad J, Theander K, Ekdahl A, et al. To adjust and endure: a qualitative study of symptom
48 burden in older people with multimorbidity. *Appl Nurs Res*. 2015;28(4):322-
49 7.10.1016/j.apnr.2015.03.008.
- 50 El-Khoury F, Cassou B, Latouche A, et al. Effectiveness of two year balance training programme on
51 prevention of fall induced injuries in at risk women aged 75-85 living in community: Ossébo
52 randomised controlled trial. *BMJ (Online)*. 2015;351.10.1136/bmj.h3830.
- 53
54
55
56
57
58
59
60

- 1
2
3 Eronen J, von Bonsdorff M, Rantakokko M, et al. Socioeconomic Status and Life-Space Mobility in
4 Old Age. *Journal of aging and physical activity*. 2016;24(4):617-23.10.1123/japa.2015-0196.
- 5 Fabre JM, Wood RH, Cherry KE, et al. Age-related deterioration in flexibility is associated with
6 health-related quality of life in nonagenarians. *J Geriatr Phys Ther*. 2007;30(1):16-22.
- 7 Fänge A, Ivanoff SD. The home is the hub of health in very old age: Findings from the ENABLE-
8 AGE Project. *Arch Gerontol Geriatr*. 2009;48(3):340-5.10.1016/j.archger.2008.02.015.
- 9 Formiga F, Ferrer A, Padrós G, et al. Diabetes Mellitus as a Risk Factor for Functional and Cognitive
10 Decline in Very Old People: The Octabaix Study. *Journal of the American Medical Directors
11 Association*. 2014;15(12):924-8.10.1016/j.jamda.2014.07.019.
- 12 Formiga F, Ferrer A, Padros G, et al. Evidence of functional declining and global comorbidity
13 measured at baseline proved to be the strongest predictors for long-term death in elderly
14 community residents aged 85 years: A 5-year follow-up evaluation, the OCTABAIX study.
15 *Clin Interv Aging*. 2016;11:437-44.10.2147/CIA.S101447.
- 16 Fritel X, Lachal L, Cassou B, et al. Mobility impairment is associated with urge but not stress urinary
17 incontinence in community-dwelling older women: results from the Ossebo study. *BJOG*.
18 2013;120(12):1566-72.10.1111/1471-0528.12316.
- 19 Gustafsson S, Eklund K, Wilhelmson K, et al. Long-term outcome for ADL following the health-
20 promoting RCT - elderly persons in the risk zone. *Gerontologist*. 2013;53(4):654-
21 63.10.1093/geront/gns121.
- 22 Gustafsson S, Wilhelmson K, Eklund K, et al. Health-promoting interventions for persons aged 80
23 and older are successful in the short term - results from the randomized and three-armed
24 Elderly Persons in the Risk Zone study. *J Am Geriatr Soc*. 2012;60(3):447-
25 54.10.1111/j.1532-5415.2011.03861.x.
- 26 Haak M, Fänge A, Iwarsson S, et al. Home as a signification of independence and autonomy:
27 Experiences among old Swedish people. *Scandinavian Journal of Occupational Therapy*.
28 2007;14(1):16-24.10.1080/11038120601024929.
- 29 Hammar IO, Dahlin-Ivanoff S, Wilhelmson K, et al. Shifting between self-governing and being
30 governed: A qualitative study of older persons' self-determination. *BMC Geriatr*.
31 2014;14(1).10.1186/1471-2318-14-126.
- 32 Hegendörfer E, Vaes B, Andreeva E, et al. Predictive Value of Different Expressions of Forced
33 Expiratory Volume in 1 Second (FEV1) for Adverse Outcomes in a Cohort of Adults Aged 80
34 and Older. *Journal of the American Medical Directors Association*. 2017;18(2):123-
35 30.10.1016/j.jamda.2016.08.012.
- 36 Heyl V, Wahl H. Cognitive ability as a resource for everyday functioning among older adults who are
37 visually impaired. *Journal of Visual Impairment & Blindness*. 2010;104(7):391-403.
- 38 Hoeksema AR, Spoorenberg S, Peters LL, et al. Elderly with remaining teeth report less frailty and
39 better quality of life than edentulous elderly: a cross-sectional study. *Oral Dis*.
40 2017;23(4):526-36.10.1111/odi.12644.
- 41 Horgen G, Eilertsen G, Falkenberg H. Lighting old age - how lighting impacts the ability to grow old
42 in own housing, part one. *Work*. 2012;41 Suppl 1:3385-7.10.3233/wor-2012-0612-3385.
- 43 Houston DK, Tooze JA, Davis CC, et al. Serum 25-hydroxyvitamin D and physical function in older
44 adults: the Cardiovascular Health Study All Stars. *J Am Geriatr Soc*. 2011;59(10):1793-
45 801.10.1111/j.1532-5415.2011.03601.x.
- 46 Idland G, Rydwik E, Smastuen MC, et al. Predictors of mobility in community-dwelling women aged
47 85 and older. *Disabil Rehabil*. 2013;35(11):881-7.10.3109/09638288.2012.712195.
- 48 Iwarsson S, Horstmann V, Carlsson G, et al. Person-environment fit predicts falls in older adults
49 better than the consideration of environmental hazards only. *Clin Rehabil*. 2009;23(6):558-
50 67.10.1177/0269215508101740.
- 51
52
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57
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- 1
2
3 Landi F, Russo A, Liperoti R, et al. Anorexia, physical function, and incident disability among the frail
4 elderly population: Results from the iSIRENTE study. *Journal of the American Medical*
5 *Directors Association*. 2010;11(4):268-74.10.1016/j.jamda.2009.12.088.
6
7 Landi F, Russo A, Liperoti R, et al. Midarm muscle circumference, physical performance and
8 mortality: Results from the aging and longevity study in the Sirente geographic area
9 (iSIRENTE study). *Clin Nutr*. 2010;29(4):441-7.10.1016/j.clnu.2009.12.006.
10
11 Larsson A, Haglund L, Hagberg J. Doing everyday life-experiences of the oldest old. *Scandinavian*
12 *Journal of Occupational Therapy*. 2009;16(2):99-109.10.1080/11038120802409762.
13
14 Laudisio A, Marzetti E, Antonica L, et al. Metabolic syndrome and quality of life in the elderly: Age
15 and gender differences. *Eur J Nutr*. 2013;52(1):307-16.
16
17 Laudisio A, Marzetti E, Franceschi F, et al. Disability is associated with emergency room visits in the
18 elderly: a population-based study. *Aging Clin Exp Res*. 2015;27(5):663-71.10.1007/s40520-
19 015-0324-5.
20
21 Laudisio A, Marzetti E, Pagano F, et al. Masticatory dysfunction is associated with worse functional
22 ability: a population-based study. *J Clin Periodontol*. 2010;37(2):113-9.10.1111/j.1600-
23 051X.2009.01518.x.
24
25 Lofqvist C, Tomsone S, Iwarsson S, et al. Changes in Home and Health over Nine Years among
26 very Old People in Latvia - Results from the ENABLE-AGE Project. *Journal of cross-cultural*
27 *gerontology*. 2017;32(1):17-29.
28
29 Mahler M, Sarvimäki A. Fear of falling from a daily life perspective; narratives from later life. *Scand J*
30 *Caring Sci*. 2012;26(1):38-44.10.1111/j.1471-6712.2011.00901.x.
31
32 Mangani I, Cesari M, Russo A, et al. Physical function, physical activity and recent falls. Results
33 from the 'Invecchiamento e Longevità nel Sirente (iSIRENTE)' Study. *Aging Clinical &*
34 *Experimental Research*. 2008;20(3):234-41.
35
36 Manty M, Rantanen T, Era P, et al. Fatigue and depressive symptoms in older people. *J Appl*
37 *Gerontol*. 2014;33(4):505-14.10.1177/0733464812454011.
38
39 Mikkola TM, Polku H, Portegijs E, et al. Self-reported hearing is associated with time spent out-of-
40 home and withdrawal from leisure activities in older community-dwelling adults. *Aging Clin*
41 *Exp Res*. 2016;28(2):297-302.10.1007/s40520-015-0389-1.
42
43 Mikkola TM, Portegijs E, Rantakokko M, et al. Association of self-reported hearing difficulty to
44 objective and perceived participation outside the home in older community-dwelling adults. *J*
45 *Aging Health*. 2015;27(1):103-22.10.1177/0898264314538662.
46
47 Murabito JM, Pencina MJ, Kelly-Hayes M, et al. Temporal trends in self-reported functional
48 limitations and physical disability among the community-dwelling elderly population: the
49 Framingham Heart Study. *Am J Public Health*. 2008;98(7):1256-
50 62.10.2105/AJPH.2007.128132.
51
52 Muscari A, Bianchi G, Forti P, et al. Physical Activity and Other Determinants of Survival in the
53 Oldest Adults. *J Am Geriatr Soc*. 2017;65(2):402-6.10.1111/jgs.14569.
54
55 Nitsch D, Mann AG, Bulpitt C, et al. Impairment of kidney function and reduced quality-of-life in older
56 people: A cross-sectional study. *Age Ageing*. 2011;40(3):381-7.10.1093/ageing/afw024.
57
58 Nykänen I, Lönnroos E, Kautiainen H, et al. Nutritional screening in a population-based cohort of
59 community-dwelling older people. *European Journal of Public Health*. 2013;23(3):405-
60 9.10.1093/eurpub/cks026.
61
62 Polku H, Mikkola TM, Rantakokko M, et al. Self-reported hearing difficulties and changes in life-
63 space mobility among community-dwelling older adults: a Two-year follow-Up study. *BMC*
64 *Geriatr*. 2015;15:121.10.1186/s12877-015-0119-8.
65
66 Portegijs E, Rantakokko M, Viljanen A, et al. Is frailty associated with life-space mobility and
67 perceived autonomy in participation outdoors? A longitudinal study. *Age & Ageing*.
68 2016;45(4):550-3.10.1093/ageing/afw072.

- 1
2
3 Quail JM, Addona V, Wolfson C, et al. Association of unmet need with self-rated health in a
4 community dwelling cohort of disabled seniors 75 years of age and over. *European Journal*
5 *of Ageing*. 2007;4(1):45-55.10.1007/s10433-007-0042-8.
6
7 Rantakokko M, Iwarsson S, Vahaluoto S, et al. Perceived environmental barriers to outdoor mobility
8 and feelings of loneliness among community-dwelling older people. *Journals of Gerontology -*
9 *Series A Biological Sciences and Medical Sciences*. 2014;69(12):1562-
10 8.10.1093/gerona/glu069.
11 Rantakokko M, Portegijs E, Viljanen A, et al. Mobility Modification Alleviates Environmental Influence
12 on Incident Mobility Difficulty among Community-Dwelling Older People: A Two-Year Follow-
13 Up Study. *PLoS ONE*. 2016;11(4):e0154396.10.1371/journal.pone.0154396.
14
15 Rantz M, Lane K, Phillips LJ, et al. Enhanced registered nurse care coordination with sensor
16 technology: Impact on length of stay and cost in aging in place housing. *Nurs Outlook*.
17 2015;63(6):650-5.10.1016/j.outlook.2015.08.004.
18
19 Rao SK, Wallace LMK, Theou O, et al. Is it better to be happy or not depressed? Depression
20 mediates the effect of psychological well-being on adverse health outcomes in older adults.
21 *Int J Geriatr Psychiatry*. 2016.10.1002/gps.4559.
22 Rapo-Pylkko S, Haanpaa M, Liira H. Chronic pain among community-dwelling elderly: a population-
23 based clinical study. *Scand J Prim Health Care*. 2016;34(2):159-
24 64.10.3109/02813432.2016.1160628.
25
26 Rasinaho M, Hirvensalo M, Leinonen R, et al. Motives for and barriers to physical activity among
27 older adults with mobility limitations. *Journal of Aging and Physical Activity*. 2007;15(1):90-
28 102.
29
30 Richards J, Rankaduwa W. Housing Canada's oldest-old: correlates of their residential status.
31 *Journal of Housing for the Elderly*. 2008;22(4):376-403.
32
33 Rydwick E, Frändin K, Akner G. Effects of a physical training and nutritional intervention program in
34 frail elderly people regarding habitual physical activity level and activities of daily living-A
35 randomized controlled pilot study. *Arch Gerontol Geriatr*. 2010;51(3):283-
36 9.10.1016/j.archger.2009.12.001.
37
38 Rydwick E, Lammes E, Frändin K, et al. Effects of a physical and nutritional intervention program for
39 frail elderly people over age 75. A randomized controlled pilot treatment trial. *Aging Clinical*
40 *and Experimental Research*. 2008;20(2):159-70.
41
42 Sabayan B, Oleksik AM, Maier AB, et al. High blood pressure and resilience to physical and
43 cognitive decline in the oldest old: The Leiden 85-Plus Study. *J Am Geriatr Soc*.
44 2012;60(11):2014-9.
45
46 Sallinen M, Hentonen O, Karki A. Technology and active agency of older adults living in service
47 house environment. *Disability and Rehabilitation Assistive technology*. 2015;10(1):27-
48 31.10.3109/17483107.2013.836685.
49
50 Sampson EL, Bulpitt CJ, Fletcher AE. Survival of Community-dwelling older people: The effect of
51 cognitive impairment and social engagement. *J Am Geriatr Soc*. 2009;57(6):985-91.
52
53 Savikko N, Routasalo P, Tilvis R, et al. Psychosocial group rehabilitation for lonely older people:
54 Favourable processes and mediating factors of the intervention leading to alleviated
55 loneliness. *International Journal of Older People Nursing*. 2010;5(1):16-24.10.1111/j.1748-
56 3743.2009.00191.x.
57
58 Sixsmith J, Sixsmith A, Fange AM, et al. Healthy ageing and home: The perspectives of very old
59 people in five european countries. *Soc Sci Med*. 2014;106:1-9.
60
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3 Tsai LT, Portegijs E, Rantakokko M, et al. The association between objectively measured physical
4 activity and life-space mobility among older people. *Scand J Med Sci Sports*.
5 2015;25(4):e368-73.10.1111/sms.12337.
6
7 Tsai LT, Rantakokko M, Portegijs E, et al. Environmental mobility barriers and walking for errands
8 among older people who live alone vs. with others. *BMC Public Health*.
9 2013;13(1).10.1186/1471-2458-13-1054.
10
11 van Bommel T, Delgado V, Bax JJ, et al. Impact of valvular heart disease on activities of daily living
12 of nonagenarians: the Leiden 85-plus study a population based study. *BMC Geriatr*.
13 2010;10:17.10.1186/1471-2318-10-17.
14
15 van Houwelingen AH, den Elzen WP, le Cessie S, et al. Consequences of interaction of functional,
16 somatic, mental and social problems in community-dwelling older people. *PLoS ONE*.
17 2015;10(4):e0121013.10.1371/journal.pone.0121013.
18
19 Vasara P. Not ageing in place: Negotiating meanings of residency in age-related housing. *Journal of*
20 *aging studies*. 2015;35:55-64.10.1016/j.jaging.2015.07.004.
21
22 Vestergaard S, Kronborg C, Puggaard L. Home-based video exercise intervention for community-
23 dwelling frail older women: A randomized controlled trial. *Aging Clin Exp Res*.
24 2008;20(5):479-86.
25
26 Von Humboldt S, Leal I. The Old and the Oldest-old: Do They Have Different Perspectives on
27 Adjustment to Aging? *International Journal of Gerontology*. 2015;9(3):156-60.
28
29 Wang K, Delbaere K, Brodie M, et al. Differences between Gait on Stairs and Flat Surfaces in
30 Relation to Fall Risk and Future Falls. *IEEE journal of biomedical and health informatics*.
31 2017.10.1109/jbhi.2017.2677901.
32
33 Werth BL, Williams KA, Pont LG. Laxative Use and Self-Reported Constipation in a Community-
34 Dwelling Elderly Population: A Community-Based Survey From Australia. *Gastroenterol*
35 *Nurs*. 2017;40(2):134-41.10.1097/sga.000000000000144.
36
37 Williams ID, O'Doherty LJ, Mitchell GK, et al. Identifying unmet needs in older patients: Nurse-GP
38 collaboration in general practice. *Aust Fam Physician*. 2007;36(9):772-6.
39
40 Wilson K, Mottram P, Sixsmith A. Depressive symptoms in the very old living alone: Prevalence,
41 incidence and risk factors. *Int J Geriatr Psychiatry*. 2007;22(4):361-6.10.1002/gps.1682.
42
43 Wong CH, Weiss D, Sourial N, et al. Frailty and its association with disability and comorbidity in a
44 community-dwelling sample of seniors in Montreal: A cross-sectional study. *Aging Clin Exp*
45 *Res*. 2010;22(1):54-62.10.3275/6675.
46
47 Young Y. Factors Associated With Permanent Transition From Independent Living to Nursing Home
48 in a Continuing Care Retirement Community. *Journal of the American Medical Directors*
49 *Association*. 2009;10(7):491-7.10.1016/j.jamda.2009.03.019.
50
51 Zingmond DS, Ettner SL, Wilber KH, et al. Association of claims-based quality of care measures
52 with outcomes among community-dwelling vulnerable elders. *Med Care*. 2011;49(6):553-
53 9.10.1097/MLR.0b013e31820e5aab.
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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	

1			study							
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4	Brännström	Sweden	qualitative	n/a	n/a	7	community-	79-95	85.7	
5	et al. (2013)		study using				dwelling			
6			narrative							
7			interviews and							
8			phenomenolo							
9			gical							
10			hermeneutic							
11			method							
12										
13	Brown et al.	USA	longitudinal	n/a	n/a	410	community-	≥75	57.0	
14	(2016)		cohort study				dwelling			
15										
16	Byles et al.	Australia	cross-	n/a	n/a	260	community-	75-80	50.4	
17	(2015)		sectional				dwelling			
18			study							
19										
20	Calvert et al.	USA	cross-	n/a	n/a	306	community-	≥85	62.0	
21	(2009)		sectional				dwelling			
22			study							
23	Chipperfield	Canada	prospective	n/a	n/a	198	community-	80-98	63.1	
24	et al. (2008)		cohort study				dwelling			
25										
26	Dahlin-	Sweden	qualitative	n/a	n/a	40	community-	80-89	57.5	
27	Ivanoff et al.		study using				dwelling			
28	(2007)		interviews and							
29			grounded							
30			theory							
31										
32	Diez-Ruiz et	Spain	prospective	n/a	n/a	215	community	≥75	63.0	
33	al. (2016)		cohort study				dwelling			
34			with 2 years							
35			follow-up							
36	Eckerblad et	Sweden	qualitative	n/a	n/a	20	community-	79-89	80.0	
37	al. (2015)		study using				dwelling			
38			semi-							
39			structured							
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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	n/a	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	n/a	848	community-dwelling	75-90	62.0
Fabre et al. (2007)	USA	population-based cohort study	n/a	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	n/a	40	community-dwelling	80-89	57.5
Formiga et al. (2014)	Spain	longitudinal study	n/a	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	n/a	general primary care assessment	328	community-dwelling	≥85	61.6
Fritel et al. (2013)	France	observational cross-sectional study	n/a	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	n/a	ordinary range of community services offered by the municipal care for the aged	459	community-dwelling	80-97	64.0

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3	Gustafsson	Sweden	RCT	preventive home visit group,	access to the ordinary	459	community-	80-97	64.0	
4	et al. (2012)			senior meeting group	range of community services		dwelling			
5					offered by the municipal					
6					agency					
7										
8	Haak et al.	Sweden	qualitative	n/a	n/a	40	community-	80-89	57.5	
9	(2007)		study using				dwelling			
10			interviews and							
11			grounded							
12			theory							
13	Ottenval	Sweden	qualitative	n/a	n/a	11	community-	84-95	54.5	
14	Hammar et		study using				dwelling			
15	al. (2014)		interviews and							
16			grounded							
17			theory							
18										
19	Hegendörfer	Belgium	prospective,	n/a	n/a	501	community-	≥80	63.0	
20	et al. (2017)		observational,				dwelling			
21			population							
22			based							
23			cohort study							
24										
25	Heyl & Wahl	Germany	cross-	n/a	n/a	271	community-	75-94	54	
26	(2010)		sectional				dweeling			
27			study							
28										
29	Hoeksema	Netherlan	cross-	n/a	n/a	1026	community-	≥75	59.0	
30	et al. (2017)	ds	sectional				dwelling			
31			study							
32	Horgen et al.	Norway	mixed	n/a	n/a	165	community-	75	n/a	
33	(2012)		methods				dwelling			
34			study							
35										
36	Houston et	USA	secondary	n/a	n/a	988	community-	77-	64.5	
37	al. (2011)		analysis of a				dwelling	100		
38			longitudinal							
39			study with 3							
40			years of							
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For peer review only

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

1			study							
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4	Laudisio et	Italy	longitudinal,	n/a	n/a	342	community-	≥75	56.0	
5	al. (2015)		population-				dwelling			
6			based study							
7			with 1-year							
8			follow-up							
9										
10	Laudisio et	Italy	cross-	n/a	n/a	350	community-	≥75	54.3	
11	al. (2010)		sectional				dwelling			
12			study							
13										
14	Lofqvist et	Latvia	secondary	n/a	n/a	59	community-	77-90	90.0	
15	al. (2017)		analysis of a				dwelling			
16			longitudinal							
17			study with 9							
18			years follow-							
19			up							
20										
21	Mahler &	Denmark	qualitative	n/a	n/a	5	community-	81-94	100.0	
22	Sarvimäki		study using				dwelling			
23	(2012)		narrative							
24			interviews and							
25			thematic							
26			analysis							
27										
28	Mangani et	Italy	secondary	n/a	n/a	364	community-	≥80	67.0	
29	al. (2008)		analysis of a				dwelling			
30			prospective							
31			cohort study							
32										
33	Mänty et al.	Denmark,	secondary	n/a	n/a	561	community-	75	55.0	
34	(2014)	Finland	analysis of a				dwelling			
35			longitudinal							
36			study							
37										
38	Mikkola et	Finland	secondary	n/a	n/a	766	community-	75-90	62.7	
39	al. (2016)		analysis of a				dwelling			
40			cross							
41			sectional and							
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1			longitudinal							
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6	Mikkola et	Finland	cross-	n/a	n/a	848	community-	75-90	62.0	
7	al. (2015)		sectional				dwelling			
8			study							
9	Murabito et	USA	secondary	n/a	n/a	830	community-	79-88	61.4	
10	al. (2008)		analysis of a				dwelling			
11			prospective							
12			cohort study							
13										
14	Muscari et	Italy	prospective,	n/a	n/a	500	community-	85-	65.8	
15	al. (2017)		longitudinal				dwelling	102		
16			population-							
17			based study							
18			with 7 years							
19			follow-up							
20										
21	Nitsch et al.	UK	cross-	n/a	n/a	2,967	community-	≥75	59.7	
22	(2011)		sectional				dwelling			
23			study							
24	Nykänen et	Finland	population	n/a	n/a	696	community-	≥75	69.4	
25	al. (2013)		based				dwelling			
26			randomized							
27			comparative							
28			study							
29										
30	Polku et al.	Finland	prospective	n/a	n/a	848	community-	75-90	62.0	
31	(2015)		cohort study				dwelling			
32										
33	Portegijs et	Finland	secondary	n/a	n/a	753	community-	75-90	64.0	
34	al. (2016)		analysis of a				dwelling			
35			cross-							
36			sectional							
37			study							
38			(baseline data							
39			& follow-up)							
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3	Quail et al.	Canada	secondary	n/a	n/a	508	community-	75-96	66.9	
4	(2007)		analysis of a				dwelling			
5			population-							
6			based cohort							
7			study							
8										
9	Rantakokko	Finland	secondary	n/a	n/a	847	community-	75-90	62.0	
10	et al. (2014)		analysis of a				dwelling			
11			cross-							
12			sectional							
13			study							
14			(baseline							
15			data)							
16										
17	Rantakokko	Finland	secondary	n/a	n/a	848	community-	75-90	62.0	
18	et al. (2016)		analysis of a			(baseline),	dwelling			
19			cross-			816				
20			sectional			(1 year				
21			study			follow-up),				
22			(baseline data			761				
23			& follow-up)			(2 years				
24						follow -up)				
25										
26	Rantz et al.	USA	secondary	living with sensors	living without sensors	133	residents of	mean	64.7	
27	(2015)		analysis of a				independent	age:		
28			cross-				living facility	83		
29			sectional							
30			study							
31										
32	Rao et al.	Canada	secondary	n/a	n/a	1,668	community-	mean	58.0	
33	(2016)		analysis of a				dwelling	age:		
34			cross-					82.9		
35			sectional					(SD		
36			study					6.9)		
37										
38	Rapo-Pylkko	Finland	cross-	n/a	n/a	106	community-	75-85	74.0	
39	et al. (2016)		sectional				dwelling			
40			study							
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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

1			longitudinal							
2			analyses							
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6	Sallinen et	Finland	qualitative	n/a	n/a	12	residents of	80-92	75.0	
7	al. (2015)		study using				service			
8			thematic				houses			
9			interviews and							
10			theory-driven							
11			content							
12			analysis							
13	Sampson et	UK	prospective	n/a	n/a	10,720	community-	≥75	59.6	
14	al. (2009)		cohort study				dwelling			
15										
16	Savikko et	Finland	cross-	psychosocial group rehabilitation	not named (participants were	117	community-	75-92	74.0	
17	al. (2010)		sectional	intervention	not considered for analysis)		dwelling and			
18			study within				residents of			
19			an RCT				independent			
20							living facility			
21										
22	Sixsmith et	Hungary,	qualitative	n/a	n/a	190	community-	75-89	61.6	
23	al. (2014)	Latvia,	study using in-				dwelling			
24		United	depth, semi-							
25		Kingdom,	structured							
26		Germany,	interviews and							
27		and	grounded							
28		Sweden	theory							
29	Thompson	USA	cross-	n/a	n/a	27	inhabitants of	78-94	67.0	
30	et al. (2011)		sectional				an			
31			study				independent			
32							retirement			
33							community			
34										
35	Tsai et al.	Finland	cross-	n/a	n/a	174	community-	75-90	64.0	
36	(2015)		sectional				dwelling			
37			study							
38										
39	Tsai et al.	Finland	cross-	n/a	n/a	657	community-	75-81	75.0	
40			sectional							
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(2013)			study				dwelling		
van Bommel 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

1			survey study							
2										
3										
4	Williams et	Australia	cross-	n/a	n/a	546	community-	75-96	68.0	
5	al. (2007)		sectional				dwelling			
6			study							
7										
8	Wilson et al.	UK	cross-	n/a	n/a	242	community-	80-90	69.9	
9	(2007)		sectional				dwelling			
10			study							
11										
12	Wong et al.	Canada	cross-	n/a	n/a	740	community-	75-96	68.0	
13	(2010)		sectional				dwelling			
14			study							
15	Young	USA	prospective	n/a	n/a	298	people living	75-94	69.1	
16	(2009)		cohort study				in the			
17							independent			
18							living unit of a			
19							continuing			
20							care			
21							retirement			
22							community			
23										
24	Zingmond et	USA	retrospective	n/a	n/a	21,310	community-	≥75	78.0	
25	al. (2011)		cohort study				dwelling			
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27 Note. n/a = not applicable, N/A = not available

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Supplement
PRISMA Checklist

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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)

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
1 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
2 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
3			
4 Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	9-18
5 Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n/a
6 Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
7 DISCUSSION			
8 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
9			
10 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
11			
12 Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	21
13 FUNDING			
14 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
15			

16 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.
 17 doi:10.1371/journal.pmed1000097

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BMJ Open

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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3 **Laying the foundation for a Core Set of the International Classification of Functioning,**
4 **Disability and Health (ICF) for community-dwelling elderly adults in primary care:**
5 **Relevant categories of their functioning from the research perspective. A scoping**
6 **review**
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58 **Word count:** 4.193

59
60 **Abstract**

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3 **Objectives:** The objective of this study was to find relevant concepts of functioning in
4 community-dwelling older adults within frequently used assessment instruments published in
5 the scientific literature. This was part of a larger project to develop an International
6 Classification of Functioning, Disability and Health (ICF) Core Set for use in primary care.
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12 **Design:** A scoping review was conducted. Articles dealing with functioning in the elderly were
13 searched and assessed for eligibility. The study population included community-dwelling older
14 adults (≥ 75 years) without dementia, living in high-resources countries. Relevant concepts
15 were extracted from assessment instruments and linked to the ICF. Finally, a frequency
16 analysis was conducted.
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22 **Setting:** Home, primary care.
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26 **Participants:** Community-dwelling adults aged 75 years and above.
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29 **Results:** From 5,060 identified publications 82 were included and 30 assessment instruments
30 extracted. Overall, 1,182 concepts were retrieved. Most were linked to the 'activities and
31 participation' component. The most frequently identified categories were '*memory functions*',
32 '*dressing*', and '*changing basic body position*'.
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38 **Conclusions:** This review provides a list of relevant ICF categories from the research
39 perspective that will be used for developing an ICF Core Set for older primary care patients.
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43 **Trial registration number:** PROSPERO (CRD42017067784), *Versorgungsforschung*
44 *Deutschland Datenbank* [VfD_17_003833] and *clinicaltrials.gov* [NCT03384732].
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48 **Keywords:** International Classification of Functioning, Disability and Health, community-
49 dwelling older adults, geriatric health services, primary care
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52 53 54 55 **1 Article Summary**

56 57 58 **1.1 Strengths and limitations**

- 59
60 - 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.
- 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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3 *Functioning* can be defined as the product of the interaction between a person's intrinsic
4 capacity and his/her environment. It can be described using the International Classification of
5 Functioning, Disability and Health (ICF). With more than 1,400 categories, it is, however, too
6 extensive to be used in daily practice. Thus, shorter lists of categories, so-called ICF Core Sets
7 (ICF-CS), have been developed for several health conditions.¹ They comprise categories
8 relevant to persons living with a specific condition(10). An ICF-CS for geriatric patients in early
9 post-acute rehabilitation was developed in 2005(11). As target group and aims of rehabilitation
10 can differ from that of general medicine, the categories included in this ICF-CS may likewise
11 be different from an ICF-CS for geriatric patients in primary care. Two other ICF-CS, one for
12 primary care and one for geriatric patients, have been developed in the Netherlands(12-14).
13 Though they might turn out to be applicable to our study population, they were developed using
14 methods other than the established multi-perspective methodology for developing ICF-CS,
15 leaving out either the perspective of community-dwelling elderly or researchers. For this
16 reason, we aimed to develop an ICF-CS for community-dwelling adults (≥ 75 years) for use in
17 primary care, following the standardized process(10). This process includes a preparatory
18 phase followed by a consensus conference. During the preparatory phase, four studies are
19 conducted to identify relevant ICF categories: a systematic or scoping review (research
20 perspective), a qualitative study (perspective of the target population)(15), an expert survey
21 (experts' perspective), and an empirical study (clinical perspective)(16). To gain a
22 comprehensive understanding of functioning, it is important to capture all four perspectives.
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46 In this paper, methods and results of the scoping review are presented. The objective was to
47 identify aspects of functioning in community-dwelling elderly adults considered relevant in
48 frequently used assessment instruments published in the scientific literature.
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52 **3 Methods**

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56 This scoping review was conducted following the methodology proposed by the ICF Research
57 Branch(10).² This methodology is composed of five steps: 1) literature search, 2) study
58 selection, 3) extraction of relevant concepts, 4) linkage of the concepts to the ICF and 5)
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3 frequency analysis. We did not aim to answer clinical questions by reviewing existing evidence,
4 but to systematically extract the concepts used by the scientific community to operationalize
5 functioning related to community-dwelling older adults. A study protocol has been published
6 elsewhere(17). This review was registered in PROSPERO (CRD42017067784) on 07/10/2017
7 and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-
8 Analyses extension for scoping reviews (PRISMA-ScR) guideline(18).
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15 16 **3.1 Eligibility Criteria**

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18 The selection of the eligibility criteria was guided by the PICOS (Population, Intervention,
19 Comparison, Outcomes, Study design) framework(19). Due to the special focus of this review,
20 only the 'P', 'O', and 'S' were relevant for our search.
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24 Population: For a publication to be included in this review, all the participants included in the
25 published study had to be community-dwelling and at least 75 years old. Studies that included
26 institutionalized participants (e.g. nursing home), participants recruited in a hospital or
27 rehabilitation center, or participants with dementia were excluded. As the intended ICF-CS is
28 meant to be used in primary care practices in Germany, only studies conducted in high-
29 resources countries with a similar socio-economic and cultural background were considered.
30 Consequently, only studies conducted in the member states of the European Union and the
31 European Free Trade Association, the United States, Australia and New Zealand were
32 included. Moreover, to get a representative picture of the health reality of old adults, studies
33 with participants suffering from only one specific health condition were excluded, as they might
34 have very specific needs.
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49 Outcomes: The publications had to be related to functioning as defined by the ICF (e.g.
50 activities of daily living, social interaction, physical mobility). Publications reporting on studies
51 that solely focused on body structures without considering any other features of functioning
52 were excluded. Since physicians tend to focus on physical aspects of health anyway, and the
53 final ICF-CS is meant to complement this traditional emphasis on physical structures and
54 processes with few categories as necessary (for reasons of feasibility), we decided to forego
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3 body structures to ensure that the resulting ICF-CS reflects those components of the ICF that
4 are not yet in the focus of general physicians.
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7 Study design: As suggested in the ICF-CS development guidelines, randomized controlled
8 trials, clinical controlled trials, cross-sectional studies, observational studies and qualitative
9 studies were included(10). Study protocols, case studies, economic evaluation studies,
10 conference papers, psychometric studies, prevention studies, studies of phase-II clinical trials,
11 studies exclusively showing laboratory parameters, animal experiments, letters, comments
12 and editorials were excluded, as those publications usually do not include relevant information
13 on functioning(10). Furthermore, systematic reviews and meta-analyses were not included in
14 this review.
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24 **3.2 Literature search**

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26 Electronic searches were carried out in PubMed, PsycINFO, EMBASE, CINAHL und Scopus
27 to identify potentially relevant publications. The search terms were organized into population
28 (e.g. aged, elderly, older adults), living condition (e.g. community-dwelling, independently
29 living) and outcome variables according to the ICF-related terms (e.g. social life, self-care,
30 home environment) using the thesaurus of the respective database (e.g. Medical subject
31 headings in PubMed) as well as free text words. Only studies published between 2007 and
32 2017 in peer-reviewed journals in English or German were considered for inclusion. The search
33 strategy was reviewed by an experienced librarian. The whole search strategy is available in
34 Appendix A.
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46 **3.3 Study selection**

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48 The publications found in the databases were exported to a review manager (Covidence). After
49 removing duplicates, five researchers (JT/SHe/SG/SB/EF) performed a title and abstract
50 screening based on the predefined eligibility criteria. Title and abstract of each publication were
51 screened by two researchers independently. As an overwhelming number of publications were
52 identified for the full text screening, a random sample was drawn to ensure manageability. As
53 the purpose of this review was not to answer clinical questions by evaluating existing evidence,
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3 but only to systematically identify relevant concepts of functioning, drawing a random sample
4 was possible. This procedure has already been applied in previous ICF-CS development
5 projects(20-23) and is also recommended in the guidelines(10). It was decided that a random
6 sample, containing 50% of all publications, should be included for full text screening. The
7
8 random sample was drawn using the Random Integer Set Generator(24). The full texts were
9
10 screened by four independent researchers (one half by JT and SHe and the other half by SG
11
12 and SB) based on the predefined inclusion and exclusion criteria. Results were compared and
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14 any disagreement was solved in discussion with all four researchers.
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20 21 **3.4 Assessment of study quality**

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23 As the purpose of this review was to systematically identify relevant concepts of functioning
24 and not to assess the effectiveness of certain interventions, a quality assessment of the studies
25 was considered unnecessary. Nevertheless, only studies that were published in peer-reviewed
26 scientific journals were included for analysis. Thus, the publications have assumingly
27 undergone a level of quality control.
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34 35 **3.5 Data extraction**

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

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

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53 Other data extracted were author, title, year and country. "A concept was defined as a single
54 health aspect or a personal (internal) or environmental (external) factor with an impact on
55 health. Formally, a concept could consist of a single word or a set of words"(25). Examples for
56 concepts are living arrangements, social embeddedness or walking. Assessment instruments
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3 were defined as any kind of standardized outcome measure (e.g. questionnaires, clinical tests)
4 used in the study. The extraction process led to two different data sets: 1) assessment
5 instruments and 2) concepts extracted from the article text. The first data set is more objective
6 as the assessment instruments provide a standardized and systematic basis for further
7 analysis, whereas the second data set is more subjective. Because of this and based on the
8 methodology applied in other ICF-CS development projects, it was decided to focus only on
9 the first data set(26-29). Disagreement between the two researchers regarding the extracted
10 data was solved by discussion. When consensus between the two could not be reached, a
11 third researcher was consulted.

22 **3.6 Data synthesis**

23
24 Assessment instruments that were not available in the respective publication were accessed
25 either through the internet or by contacting the authors of the included publications. Following
26 the method of other ICF-CS development projects, only assessment instruments used in at
27 least two different studies were considered(30, 31). The items and response options of each
28 assessment instrument were listed on one table. Subsequently, meaningful concepts
29 contained within each item or response option were extracted. The concepts were linked to
30 ICF categories by four independent researchers (one half by JT and SHe and the other half
31 by SG and SB) using established linking rules(32). When consensus between the two
32 researchers was not reached, a third researcher was consulted. If an ICF category was
33 assigned repeatedly in an assessment instrument, it was counted only once. However, when
34 a publication reported on a study that used multiple instruments and a specific category was
35 identified in more than one of these instruments, this particular category was counted
36 according to the number of instruments to which it was linked. Therefore, the maximum count
37 of one category can exceed the number of identified studies included in the review. We used
38 descriptive statistics to report the most frequently identified ICF categories.
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40 Only first-level and second-level ICF categories are reported in this paper.³ If a concept was
41 linked to a third- or fourth-level ICF category, the overarching second-level category was
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3 included for analysis. Due to the hierarchical nature of the ICF, a lower-level category shares
4 the attributes of the higher-level category of which it is a member(33).
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8 **3.7 Patient and public involvement**

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10 Patients and the public were not involved in this study.
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13 **4 Results**

14 **4.1 Study Selection**

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16 A total of 10,043 publications were identified. After removing duplicates, 5,060 potentially
17 relevant publications were left. In the abstract screening 681 articles were identified for full-text
18 screening. Of these, a random sample of 341 articles (50%) was drawn for the full text
19 screening, from which 82 articles were subsequently included for data extraction (see figure
20 1). The references of the included studies are available in Appendix B and the study
21 characteristics are provided in Appendix C.
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34 **4.2 Study characteristics**

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36 The 82 included studies were conducted in 17 different countries. About 20% of the studies
37 were conducted in Finland (n = 16), 14.6% in Sweden (n = 12) and 12.2% in the United States
38 (n = 10). The investigated study population consisted of 74,351 community-dwelling elderly, of
39 whom 68.6% were female. Three publications did not provide information about the gender of
40 their participants. Most of the studies (65.9%) had an observational design (longitudinal or
41 cross sectional), 15.6% were qualitative studies, 12.2% intervention studies, 4.9% analyzed
42 secondary data and one study (1.2%) used mixed methods.
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52 **4.3 Linking Results**

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54 From the 82 included publications 111 assessment instruments were identified. Out of these,
55 30 were identified in at least two of the publications and were included for data extraction (table
56 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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3					
4	Perceived environmental barriers to outdoor mobility (54, 55)	2			x
5					
6	Cognitive Performance Scale (35, 43)	2	x		
7					
8	Functional Independence Measure (61, 62)	2		x	x
9					
10	Gait Speed (2, 15)	2		x	
11					
12	Gijón Social Scale (15, 22)	2			x
13					
14	Housing Enabler Screening Tool (34, 41)	2			x
15					
16	Housing Options for Older People (41, 79)	2			x
17					
18	Impact on Participation and Autonomy Questionnaire (46, 54)	2		x	x
19					
20	Instrumental Activity Measure (61, 62)	2			x
21					
22	Mini Nutritional Assessment (21, 22)	2		x	x
23					
24	Neuropsychological Aging Inventory (34, 67)	2			x
25					
26					
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28					
29	<i>Note.</i> The numbers in brackets refer to the studies (see Appendix B), in which the instrument was used.				
30					
31					
32	The most frequently used assessment instrument was the Mini Mental State Examination				
33	(MMSE), which was reported in 25 articles (31.3%). From the selected assessment				
34	instruments 1,182 concepts were extracted. Out of these, 24 concepts were linked to first-level				
35	ICF categories, 1,066 to second-level categories and 48 multidimensional concepts to two or				
36	more ICF categories. Forty-four concepts could not be assigned to a specific ICF category.				
37					
38	The 1,066 concepts were assigned to 87 different second-level ICF categories (see table 2).				
39	Of these, 41 (47.1%) are related to 'activities and participation', 24 (27.6%) categories refer to				
40	'body functions', 20 (23.0%) to 'environmental factors' and two (2.3%) belong to 'body				
41	structures'. Mentioned 53 times, the category <i>memory functions (b144)</i> was the most				
42	frequently identified category. Within the 'activities and participation' component, the category				
43	<i>dressings (d540)</i> and within the 'environmental factors' component, <i>products or substances for</i>				
44	<i>personal consumption (e110)</i> were identified most often. The two extracted ICF categories for				
45	'body structures' were <i>structure of upper extremity (s730)</i> and <i>structure of lower extremity</i>				
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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 *dressings (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
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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3	b620	Urination functions	25
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5	b755	Involuntary movement reaction functions	13
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7	b730	Muscle power functions	7
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8	b810	Protective functions of the skin	3
9			
10	b820	Repair functions of the skin	3
11			
12	Body structures		4
13	s750	Structure of lower extremity	2
14			
15	s730	Structure of upper extremity	2
16			
17	Environmental factors		91
18	e110	Products or substances for personal consumption	17
19			
20	e155	Design, construction and building products and technology of buildings for private use	12
21			
22	e115	Products and technology for personal use in daily living	5
23			
23	e120	Products and technology for personal indoor and outdoor mobility and transportation	4
24			
25	e125	Products and technology for communication	2
26			
27	e160	Products and technology of land development	2
28			
29	e165	Assets	2
30			
30	e210	Physical geography	2
31			
32	e225	Climate	2
33			
34	e240	Light	2
35			
35	e250	Sound	2
36			
37	e310	Immediate family	5
38			
39	e315	Extended family	5
40			
41	e320	Friends	5
42			
42	e325	Acquaintances, peers colleagues, neighbors and community members	5
43			
44	e355	Health professionals	3
45			
46	e575	General social support services, systems and policies	5
47			
48	e580	Health services, systems and policies	5
49			
49	e530	Utilities services, systems and policies	4
50			
51	e520	Open space planning services, systems and policies	2
52			
53	e530	Utilities services, systems and policies	4
54			
54	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.

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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3 general health (n = 14), physical health (n = 5), physical activity (n = 3), activities of daily living
4 (n = 3) and other (n = 5). Concepts linked to 'personal factors' included living arrangements,
5 self-sufficiency and medication adherence.⁴ The commonly reported health conditions
6 according to organ systems were diseases of the skin and subcutaneous tissue, psychiatric
7 disorders, neurological diseases, infectious diseases, diseases of the digestive system,
8 sensory disorders, diseases of the musculoskeletal system, and cancer.
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15 16 **5 Discussion**

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19 As part of the project to develop an ICF-CS for community-dwelling adults ≥ 75 years old for
20 use in primary care, this scoping review was performed to identify aspects of functioning that
21 are considered relevant in frequently used assessment instruments published in the scientific
22 literature. From the research perspective, the component 'activities and participation' has
23 shown to be the most relevant among all ICF components with regard to functioning of older
24 patients. Almost half of all assigned categories are in this component. ICF categories that
25 belong to the components 'body functions' and 'environmental factors', were less frequently
26 assigned. With only two ICF categories, 'body structures' seems to be the least relevant
27 component of the four. However, this might be due to the fact that studies which solely focused
28 on body structures without considering any other features of functioning were excluded. Such
29 studies were excluded to help ensure that the resulting ICF-CS goes beyond the biological
30 aspects of health provision and promotes those components of the ICF that might not yet
31 receive enough attention in primary care. It is noteworthy that the ICF-CS for primary care and
32 for the geriatric population developed by the research groups in the Netherlands also did not
33 include body structures(12-14).
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51 The ICF chapters with the most frequently assigned categories were: b1 'mental functions', d4
52 'mobility', d5 'self-care', and d6 'domestic life'. These areas are of special interest as they are
53 prerequisites for being able to live independently at home. In a meta-analysis, indicators of
54 functional and cognitive impairments were identified as the strongest predictors for
55 necessitating admission to a nursing home(34). Cognitive impairment has also been identified
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3 as the strongest predictor for necessitating nursing home placement in a study investigating
4 caregivers reasons for nursing home placement(35). Frequently identified categories referring
5 to d5 'self-care' were *dressing (d540)*, *washing oneself (d510)*, *eating (d550)*, and *toileting*
6 *(d530)*. These are all activities of daily living. Literature indicates, that older adults with
7 problems in three or more activities of daily living had a higher risk of being admitted to a
8 nursing home than adults without problems(34). Household activities, like *doing housework*
9 *(d640)* or *preparing meals (d630)*, have frequently been identified in this review, but have not
10 been found to be a major predictor for nursing home placement(34). This might be due to the
11 fact that impairments in these areas can easily be compensated e.g. with household aids or
12 assistance from family members.

13
14 No concepts were identified referring to the chapter b4 'functions of the cardiovascular,
15 hematological, immunological and respiratory systems'. This might be due to the fact, that
16 health conditions are coded with 'nc-hc' and not with the ICF category representing the
17 underlying functions affected by a certain disease. Another explanation might be that, although
18 the prevalence of diseases in these systems, especially of cardiovascular diseases, has
19 increased since the 1980s, inability to perform activities of daily living as well as mortality
20 induced by these diseases has decreased in the same period(2). This might be an explanation
21 why recent research that focuses on functioning of the elderly, as reflected by the publications
22 from 2007-2017, is less concerned with functions of the cardiovascular, hematological,
23 immunological and respiratory systems. Moreover, no concepts were identified in the chapter
24 e4 'attitudes'. Attitudes may be more in the focus of qualitative research, which, due to the
25 focus on assessment instruments in this study, did barely show up within this data set.
26 However, as several studies and systematic reviews suggest that negative attitudes towards
27 old age negatively affect the health of the elderly, attitudes might be a relevant aspect to also
28 include in instruments used for assessing functioning(36-38).

29
30 Concepts referring to environmental factors with an impact on an individual's life were
31 minimally addressed in the assessment instruments reported in the included articles. The most
32 frequently identified category in this section was *products or substances for personal*

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

21 **5.1 Strengths and limitations**

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

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

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

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3 *sensation of falling (b2402)*, and *emotional functions (b152)*. Other concepts could only be
4
5 linked to the very general first-level ICF categories, not allowing a detailed representation of
6
7 the concept; e.g. isolation was linked to *support and relationships (e3)*. Sometimes, the same
8
9 concept could be linked to different categories. This was especially the case for concepts
10
11 regarding the change of body positions. For example the concept “get into bed” can be linked
12
13 to:

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- 16 - *lying down (d4100)*; defined as “Getting into and out of a lying down position or
17 *changing body position from horizontal to any other position, such as standing up or*
18 *sitting down”(33) or to*
 - 19
20 - *standing (d4104)*; defined as “Getting into and out of a standing position or changing
21 *body position from standing to any other position, such as lying down or sitting*
22 *down”(33).*
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28 This was one reason why we decided to link all concepts to second-level categories only. Being
29
30 aware of these issues, WHO created a mechanism of updating ICF categories to further
31
32 enhance the use of this classification(42). We will report the linking problems we faced to WHO
33
34 after publication of this study.

35 36 37 **5.2 Implications for practice**

38
39 Within a consensus conference a comprehensive ICF-CS based on the results of this scoping
40
41 review and the three other preparatory studies, and also considering the already existing ICF-
42
43 CS for this target group mentioned in the introduction, will be developed.

44
45
46 As discussed, several aspects of functioning that were identified in this review are closely
47
48 linked to independent living. There is some evidence that older patients tend to consider
49
50 problems in functioning that threaten their independent living as most important, whereas their
51
52 physicians focus more on somatic problems and risk factors(43). Thus, in order to better
53
54 balance medical interventions according to the older patients' needs, it might be warranted to
55
56 include more psychosocial and environmental information in the consultation process(44).
57
58 Providing physicians with our comprehensive, but easy to handle ICF-CS might be a first step
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3 towards achieving this. Considering information on functioning might support general
4 practitioners to better estimate the relevance of medical interventions, and thus avoid
5 unnecessary medical interventions.
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10 **6 Conclusions**

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13 In conclusion, this scoping review demonstrates that frequently used instruments for assessing
14 functioning in older adults focus mainly on activities of daily living and mental functions,
15 whereas environmental factors are only minimally addressed. Despite some limitations
16 experienced in the linking process, the ICF provides a useful reference to identify and cluster
17 the concepts used in instruments for assessing functioning of older adults.
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25
26
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29 search strategy.
30
31
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33

34
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36 degree 'Dr. rer. biol. hum.' for Johanna Tomandl.
37
38
39

40 **8 Footnotes**

41 **8.1 Contributors**

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44
45 JT was involved in the development of the search strategy; performed the literature search;
46 took part in the screening of the papers, the data extraction and the linking process; performed
47 the data analysis; was involved in the interpretation of the data; drafted parts of the manuscript
48 and collated all sections from the co-authors. SHe was involved in the development of the
49 search strategy, the screening of the papers, the data extraction, the linking process and the
50 interpretation of the data. MS advised the research team on the ICF Core Set methodology
51 and revised the draft. EF was involved in the conception of the study, the development of the
52 search strategy and the abstract screening; provided supervision and revised the draft.
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2
3 EG/TK/SHu were involved in the conception of the study and in the development of the search
4 strategy; provided supervision and revised the draft. SB/SG were involved in the development
5 of the search strategy, the screening of the papers, the data extraction, the linking process and
6 the interpretation of the data; drafted parts of the manuscript. All authors read and approved
7 the final version of the manuscript. SB and SG contributed equally to this work.
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20 21 **8.3 Disclaimer**

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23 The funders had no role in the study design, data collection and analysis, decision to publish,
24 or preparation of the manuscript.
25
26

27 28 **8.4 Competing interests**

29
30 None declared.
31

32 33 **8.5 Patient consent for publication**

34
35 Not required.
36

37 38 **8.6 Ethics approval**

39
40 Not required.
41

42 43 **8.7 Data availability statement**

44
45 The datasets used and analyzed during the current study are available from the corresponding
46 author upon reasonable request.
47
48

49 50 **8.8 Notes**

51
52 ¹ A list of accredited ICF-CS can be found here: <https://www.icf-core-sets.org/en/page1.php>.²
53
54 The ICF Research Branch is a cooperation partner within the WHO collaborating center for
55 the Family of International Classifications (WHO-FIC) in Germany, which aims to promote
56 health by implementing ICF based tools and models.³ The categories of the ICF are divided
57 into different levels. First-level categories are coded using the component letter (b, s, d, or e)
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3 followed by the chapter number (one digit). Second-level categories are coded using the
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5 letter and three digits; the third- and fourth-level categories using the letter and four or five
6
7 digits. ⁴In the International Classification of Functioning, Disability and Health personal
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9 factors are defined as factors related to the individual (e.g. age, gender, life experiences)
10
11 whereas environmental factors cover all aspects of the external world that have an impact on
12
13 functioning (e.g. social systems or laws).
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16 9 References

- 17 1. Christensen K, Doblhammer G, Rau R, et al. Ageing populations: the challenges
18 ahead. *Lancet*. 2009;374(9696):1196-208.10.1016/S0140-6736(09)61460-4.
- 19 2. Crimmins EM. Trends in the health of the elderly. *Annu Rev Public Health*.
20 2004;25:79-98.
- 21 3. Klawiter M. Risk, prevention and the breast cancer continuum: the NCI, the FDA,
22 health activism and the pharmaceutical industry. *History and Technology*.
23 2002;18(4):309-53.
- 24 4. Aronowitz RA. The converged experience of risk and disease. *The Milbank Quarterly*.
25 2009;87(2):417-42.
- 26 5. Kostev K, Jacob L. Multimorbidity and polypharmacy among elderly people followed
27 in general practices in Germany. *European journal of internal medicine*. 2018;55:66-
28 8.10.1016/j.ejim.2018.07.014.
- 29 6. Frazier SC. Health outcomes and polypharmacy in elderly individuals. *J Gerontol*
30 *Nurs*. 2005;31(9):4-9.
- 31 7. Calderón-Larrañaga A, Poblador-Plou B, González-Rubio F, et al. Multimorbidity,
32 polypharmacy, referrals, and adverse drug events: are we doing things well? *Br J*
33 *Gen Pract*. 2012;62(605):e821-e6.10.3399/bjgp12X659295.
- 34 8. Chatterji S, Byles J, Cutler D, et al. Health, functioning, and disability in older adults -
35 present status and future implications. *Lancet*. 2015;385(9967):563-75.
- 36 9. Lee SJ, Go AS, Lindquist K, et al. Chronic conditions and mortality among the oldest
37 old. *Am J Public Health*. 2008;98(7):1209-14.10.2105/Ajph.2007.130955.
- 38 10. Selb M, Escorpizo R, Kostanjsek N, et al. A guide on how to develop an International
39 Classification of Functioning, Disability and Health Core Set. *European Journal of*
40 *Physical and Rehabilitation Medicine*. 2015;51(1):105-17.
- 41 11. Grill E, Hermes R, Swoboda W, et al. ICF Core Set for geriatric patients in early post-
42 acute rehabilitation facilities. *Disabil Rehabil*. 2005;27(7-8):411-
43 7.10.1080/09638280400013966.
- 44 12. Emmen B, van Boven K, ten Napel H. Exploration of the desired content of an
45 'International Classification of Functioning' (ICF) item set for multimorbid patients in
46 general practice. *Newsletter WHO-FIC Annual Network Meeting*. 2014;12(1):9-11.
- 47 13. Postma S, van Boven K, Ten Napel H, et al. The development of an ICF-based
48 questionnaire for patients with chronic conditions in primary care. *J Clin Epidemiol*.
49 2018;103:92-100.
- 50 14. Spoorenberg SLW, Reijneveld SA, Middel B, et al. The Geriatric ICF Core Set
51 reflecting health-related problems in community-living older adults aged 75 years and
52 older without dementia: development and validation. *Disabil Rehabil*.
53 2015;37(25):2337-43.10.3109/09638288.2015.1024337.
- 54 15. Tomandl J, Book S, Hoefle A, et al. Laying the foundation for an ICF core set for
55 community-dwelling elderly adults in primary care: the patient-perspective identified in
56 a qualitative study. 2020. Manuscript submitted for publication.
- 57
58
59
60

16. Book S, Ulbrecht G, Tomandl J, et al. Laying the foundation for an ICF Core Set for community-dwelling elderly adults in primary care: The clinical perspective identified in a cross-sectional study. 2020. Manuscript submitted for publication.
17. Tomandl J, Book S, Gotthardt S, et al. Laying the foundation for a core set of the International Classification of Functioning, Disability and Health for community-dwelling adults aged 75 years and above in general practice: a study protocol. *BMJ Open*. 2018;8(8):e024274.10.1136/bmjopen-2018-024274.
18. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. 2018;169(7):467-73.
19. Tacconelli E. Systematic reviews: CRD's guidance for undertaking reviews in health care. *The Lancet Infectious Diseases*. 2010;10(4):226.
20. Geyh S, Cieza A, Schouten J, et al. ICF Core Sets for stroke. *J Rehabil Med*. 2004;36(0):135-41.
21. de Schipper E, Lundequist A, Coghill D, et al. Ability and disability in autism spectrum disorder: A systematic literature review employing the international classification of functioning, disability and health-children and youth version. *Autism Res*. 2015;8(6):782-94.
22. Granberg S, Dahlström J, Möller C, et al. The ICF core sets for hearing loss—researcher perspective. Part I: Systematic review of outcome measures identified in audiological research. *Int J Audio*. 2014;53(2):65-76.
23. Gorostiaga A, Balluerka N, Guilera G, et al. Functioning in patients with schizophrenia: a systematic review of the literature using the International Classification of Functioning, Disability and Health (ICF) as a reference. *Qual Life Res*. 2017;26(3):531-43.
24. Random Integer Set Generator 2018. Available from: <https://www.random.org/integer-sets/>. (Accessed 20 Dec 2018).
25. Offenbächer M, Cieza A, Brockow T, et al. Are the contents of treatment outcomes in fibromyalgia trials represented in the international classification of functioning, disability, and health? *Clin J Pain*. 2007;23(8):691-701.
26. Wolff B, Cieza A, Parentin A, et al. Identifying the concepts contained in outcome measures of clinical trials on four internal disorders using the International Classification of Functioning, Disability and Health as a reference. *J Rehabil Med*. 2004(44 Suppl):37-42.10.1080/16501960410015407.
27. Wasiak J, McMahon M, Danilla S, et al. Measuring common outcome measures and their concepts using the International Classification of Functioning, Disability and Health (ICF) in adults with burn injury: a systematic review. *Burns*. 2011;37(6):913-24.
28. Brockow T, Cieza A, Kuhlow H, et al. Identifying the concepts contained in outcome measures of clinical trials on musculoskeletal disorders and chronic widespread pain using the International Classification of Functioning, Disability and Health as a reference. *J Rehabil Med*. 2004;36(0):30-6.
29. Geyh S, Kurt T, Brockow T, et al. Identifying the concepts contained in outcome measures of clinical trials on stroke using the International Classification of Functioning, Disability and Health as a reference. *J Rehabil Med*. 2004;36(0):56-62.
30. Scheuringer M, Grill E, Boldt C, et al. Systematic review of measures and their concepts used in published studies focusing on rehabilitation in the acute hospital and in early post-acute rehabilitation facilities. *Disabil Rehabil*. 2005;27(7-8):419-29.
31. Bartoszek G, Fischer U, Müller M, et al. Outcome measures in older persons with acquired joint contractures: a systematic review and content analysis using the ICF (International Classification of Functioning, Disability and Health) as a reference. *BMC Geriatr*. 2016;16(1):40.
32. Cieza A, Fayed N, Bickenbach J, et al. Refinements of the ICF Linking Rules to strengthen their potential for establishing comparability of health information. *Disabil Rehabil*. 2016;41(5):574-83.10.3109/09638288.2016.1145258.
33. World Health Organization. International Classification of Functioning, Disability and Health: ICF: World Health Organization 2001.

- 1
2
3 34. Gaugler JE, Duval S, Anderson KA, et al. Predicting nursing home admission in the
4 US: a meta-analysis. *BMC Geriatr*. 2007;7(1):13.10.1186/1471-2318-7-13.
5 35. Buhr GT, Kuchibhatla M, Clipp EC. Caregivers' reasons for nursing home placement:
6 clues for improving discussions with families prior to the transition. *Gerontologist*.
7 2006;46(1):52-61.
8 36. Horton S, Baker J, Pearce G, et al. On the malleability of performance: Implications
9 for seniors. *J Appl Gerontol*. 2008;27(4):446-65.
10 37. Meisner BA. A meta-analysis of positive and negative age stereotype priming effects
11 on behavior among older adults. *Journals of Gerontology Series B: Psychological*
12 *Sciences and Social Sciences*. 2011;67(1):13-7.
13 38. Levy BR, Slade MD, Chang ES, et al. Ageism Amplifies Cost and Prevalence of
14 Health Conditions. *Gerontologist*. 2018:gny131-gny.10.1093/geront/gny131.
15 39. Lawton MP. Residential environment and self-directedness among older people. *Am*
16 *Psychol*. 1990;45(5):638.
17 40. Lien WC, Chang JH, Guo NW, et al. Determinants of perceived physical environment
18 barriers among community-dwelling elderly in Taiwan. *J Nutr Health Aging*.
19 2015;19(5):575-82.10.1007/s12603-015-0473-4.
20 41. Wahl H-W, Iwarsson S, Oswald F. Aging well and the environment: Toward an
21 integrative model and research agenda for the future. *Gerontologist*. 2012;52(3):306-
22 16.
23 42. WHO-FIC Update and Revision Committee. ICF Update Platform. User Guide. 2013.
24 43. Theile G, Mueller C. [Multimorbid General Practice Patients - What's really
25 important?]. *Praxis*. 2012;101:1621-6.10.1024/1661-8157/a001145.
26 44. Nationale Akademie der Wissenschaften Leopoldina aDAdT, Union der deutschen
27 Akademien der Wissenschaften. Medizinische Versorgung im Alter – Welche Evidenz
28 brauchen wir? 2015.
29
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31 10 List of abbreviations

32
33
34 ICF: International Classification of Functioning, Disability and Health

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

36
37 PRISMA-Sc: Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension
38 for scoping reviews

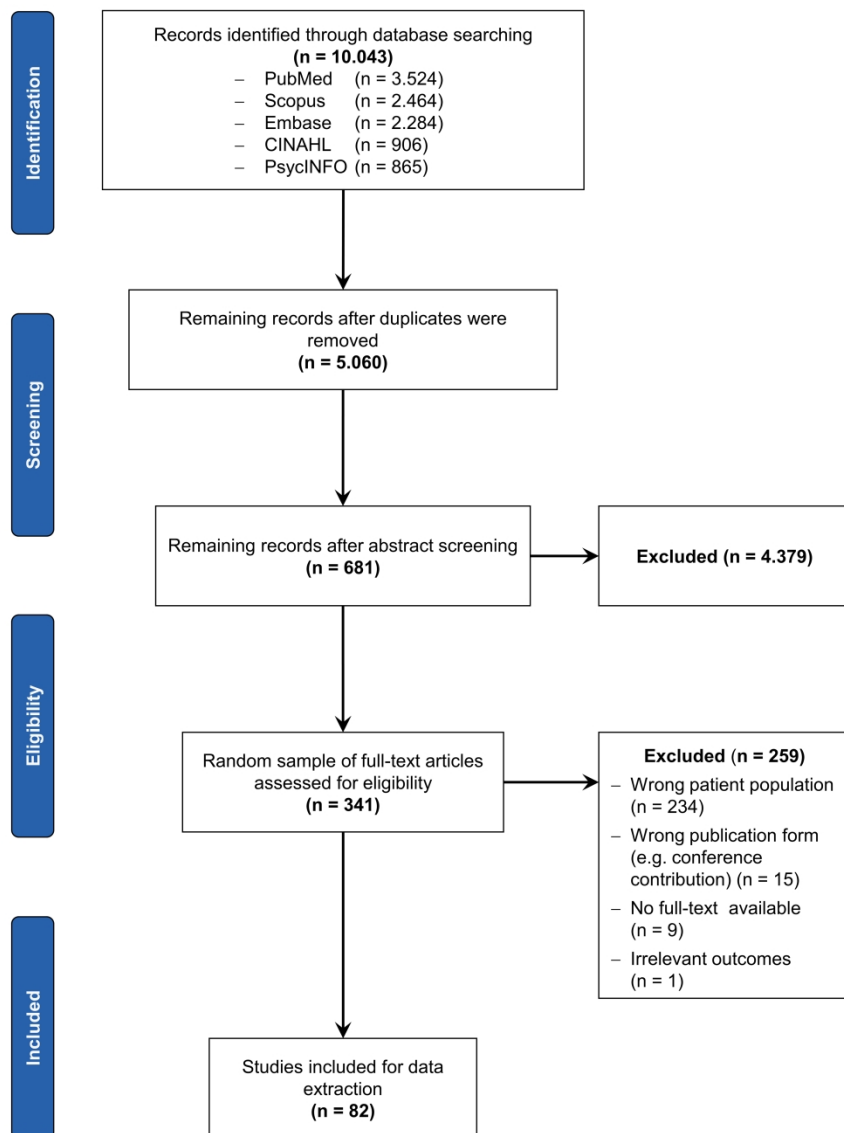
39
40
41 PICOS: Patients, Intervention, Comparison, Outcomes, Study design
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46 11 List of figures

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49 *Figure 1.* Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
50 flow chart.
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For peer review only



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

46 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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- 3 28. "psychologic assessment"/
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- 5 29. "self care"/
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- 7 30. "social environment"/
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- 9 31. "social interaction"/
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- 11 32. "social life"/
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- 13 33. "social problem"/
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- 15 34. "wellbeing"/
- 16
- 17 35. "abilit*" .ab,ti.
- 18
- 19 36. mobility.ab,ti.
- 20
- 21 37. "daily routine" .ab,ti.
- 22
- 23 38. "social life" .ab,ti.
- 24
- 25 39. performance.ab,ti.
- 26
- 27 40. self-care.ab,ti.
- 28
- 29 41. selfcare.ab,ti.
- 30
- 31 42. "social interaction" .ab,ti.
- 32
- 33 43. "interpersonal interaction" .ab,ti.
- 34
- 35 44. "coping strategy" .ab,ti.
- 36
- 37 45. "coping strategies" .ab,ti.
- 38
- 39 46. communitydwelling.ab,ti.
- 40
- 41 47. "community dwelling" .ab,ti.
- 42
- 43 48. "independent living" .ab,ti.
- 44
- 45 49. "independently living" .ab,ti.
- 46
- 47 50. "contextual factor*" .ab,ti.
- 48
- 49 51. "protective factor*" .ab,ti.
- 50
- 51 52. "risk factor*" .ab,ti.
- 52
- 53 53. "personal factor*" .ab,ti.
- 54
- 55 54. "environmental factor*" .ab,ti.
- 56
- 57 55. "living alone" .ab,ti.
- 58
- 59 56. "sociocultural factor*" .ab,ti.
- 60

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- 2
- 3 57. "psychosocial factor*".ab,ti.
- 4
- 5 58. "social environment".ab,ti.
- 6
- 7 59. "quality of life".ab,ti.
- 8
- 9 60. well-being.ab,ti.
- 10
- 11 61. wellbeing.ab,ti.
- 12
- 13 62. wellness.ab,ti.
- 14
- 15 63. ICF.ab,ti.
- 16
- 17 64. "International Classification of Functioning".ab,ti.
- 18
- 19 65. health.ab,ti.
- 20
- 21 66. "medical problem*".ab,ti.
- 22
- 23 67. "psychological problem*".ab,ti.
- 24
- 25 68. "social problem*".ab,ti.
- 26
- 27 69. "physical change*".ab,ti.
- 28
- 29 70. "physical illness".ab,ti.
- 30
- 31 71. "psychological change*".ab,ti.
- 32
- 33 72. impairment.ab,ti.
- 34
- 35 73. "mental change*".ab,ti.
- 36
- 37 74. "psychological assessment".ab,ti.
- 38
- 39 75. "cognitive assessment".ab,ti.
- 40
- 41 76. "needs assessment".ab,ti.
- 42
- 43 77. "neuropsychological assessment".ab,ti.
- 44
- 45 78. "behavioural assessment".ab,ti.
- 46
- 47 79. "behavioral assessment".ab,ti.
- 48
- 49 80. "social participation".ab,ti.
- 50
- 51 81. "activities of daily living".ab,ti.
- 52
- 53 82. "daily living activities".ab,ti.
- 54
- 55 83. "body function".ab,ti.
- 56
- 57 84. "body functions".ab,ti.
- 58
- 59 85. "body structures".ab,ti.
- 60

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2
3 86. "body structure".ab,ti.
4
5 87. "social participation"/
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7 88. "daily life activity"/
8
9 89. 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88
10
11 90. (English or German).lg.
12
13 91. article.pt.
14
15 92. ("2007" or "2008" or "2009" or "2010" or "2011" or "2012" or "2013" or "2014" or "2015" or
16 "2016" or "2017").yr.
17
18 93. "home environment".ab,ti.
19
20 94. "urban environment".ab,ti.
21
22 95. disability.ab,ti.
23
24 96. disabilities.ab,ti.
25
26 97. disable.ab,ti.
27
28 98. disabled.ab,ti.
29
30 99. disablement.ab,ti.
31
32 100. function.ab,ti.
33
34 101. functions.ab,ti.
35
36 102. functioning.ab,ti.
37
38 103. functional.ab,ti.
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40 104. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
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42 105. 13 or 46 or 47 or 48 or 49 or 93 or 94
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44 106. 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
45 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
46 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
47 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
48 or 78 or 79 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103
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50 107. 89 and 104 and 105 and 106
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52 108. 90 and 92 and 107
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Appendix B

References for included articles

1. Aartolahti E, Hakkinen A, Lonroos E, et al. Relationship between functional vision and balance and mobility performance in community-dwelling older adults. *Aging Clin Exp Res*. 2013;25(5):545-52.10.1007/s40520-013-0120-z.
2. Abellan van Kan G, Cesari M, Gillette-Guyonnet S, et al. Sarcopenia and cognitive impairment in elderly women: results from the EPIDOS cohort. *Age Ageing*. 2013;42(2):196-202.10.1093/ageing/afs173.
3. Ahluwalia SC, Gill TM, Baker DI, et al. Perspectives of older persons on bathing and bathing disability: A qualitative study. *J Am Geriatr Soc*. 2010;58(3):450-6.
4. Almeida OP, Yeap BB, Hankey GJ, et al. Association of depression with sexual and daily activities: A community study of octogenarian men. *Am J Geriatr Psychiatry*. 2015;23(3):234-42.10.1016/j.jagp.2013.09.007.
5. Behm L, Eklund K, Wilhelmson K, et al. Health Promotion Can Postpone Frailty: Results from the RCT Elderly Persons in the Risk Zone. *Public Health Nurs*. 2016;33(4):303-15.10.1111/phn.12240.
6. Berkemeyer S, Schumacher J, Thiem U, et al. Bone T-scores and functional status: A cross-sectional study on german elderly. *PLoS ONE*. 2009;4(12).10.1371/journal.pone.0008216.
7. Blain H, Carriere I, Sourial N, et al. Balance and walking speed predict subsequent 8-year mortality independently of current and intermediate events in well-functioning women aged 75 years and older. *J Nutr Health Aging*. 2010;14(7):595-600.10.1007/s12603-010-0111-0.
8. Bollwein J, Diekmann R, Kaiser MJ, et al. Dietary quality is related to frailty in community-dwelling older adults. *J Gerontol A Biol Sci Med Sci*. 2013;68(4):483-9.10.1093/gerona/gls204.
9. Brännström H, Bäckman M, Fischer RS. Walking on the edge: Meanings of living in an ageing body and using a walker in everyday life - A phenomenological hermeneutic study. *International Journal of Older People Nursing*. 2013;8(2):116-22.10.1111/j.1748-3743.2012.00334.x.
10. Brown CJ, Kennedy RE, Lo AX, et al. Impact of Emergency Department Visits and Hospitalization on Mobility Among Community-Dwelling Older Adults. *Am J Med*. 2016;129(10):1124.e9-.e15.10.1016/j.amjmed.2016.05.016.
11. Byles JE, Leigh L, Vo K, et al. Life space and mental health: a study of older community-dwelling persons in Australia. *Aging & Mental Health*. 2015;19(2):98-106.10.1080/13607863.2014.917607.
12. Calvert JF, Kaye J, Leahy M, et al. Technology use by rural and urban oldest old. *Technol Health Care*. 2009;17(1):1-11.10.3233/THC-2009-0527.
13. Chipperfield JG, Newall NE, Chuchmach LP, et al. Differential determinants of men's and women's everyday physical activity in later life. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences*. 2008;63(4):S211-S8.
14. Dahlin-Ivanoff S, Haak M, Fange A, et al. The multiple meaning of home as experienced by very old Swedish people. *Scandinavian journal of occupational therapy*. 2007;14(1):25-32.10.1080/11038120601151714.
15. Diez-Ruiz A, Bueno-Errandonea A, Nunez-Barrio J, et al. Factors associated with frailty in primary care: a prospective cohort study. *BMC Geriatr*. 2016;16:91.10.1186/s12877-016-0263-9.
16. Eckerblad J, Theander K, Ekdahl A, et al. To adjust and endure: a qualitative study of symptom burden in older people with multimorbidity. *Appl Nurs Res*. 2015;28(4):322-7.10.1016/j.apnr.2015.03.008.

17. El-Khoury F, Cassou B, Latouche A, et al. Effectiveness of two year balance training programme on prevention of fall induced injuries in at risk women aged 75-85 living in community: Ossébo randomised controlled trial. *BMJ (Online)*. 2015;351.10.1136/bmj.h3830.
18. Eronen J, von Bonsdorff M, Rantakokko M, et al. Socioeconomic Status and Life-Space Mobility in Old Age. *Journal of aging and physical activity*. 2016;24(4):617-23.10.1123/japa.2015-0196.
19. Fabre JM, Wood RH, Cherry KE, et al. Age-related deterioration in flexibility is associated with health-related quality of life in nonagenarians. *J Geriatr Phys Ther*. 2007;30(1):16-22.
20. Fänge A, Ivanoff SD. The home is the hub of health in very old age: Findings from the ENABLE-AGE Project. *Arch Gerontol Geriatr*. 2009;48(3):340-5.10.1016/j.archger.2008.02.015.
21. Formiga F, Ferrer A, Padrós G, et al. Diabetes Mellitus as a Risk Factor for Functional and Cognitive Decline in Very Old People: The Octabaix Study. *Journal of the American Medical Directors Association*. 2014;15(12):924-8.10.1016/j.jamda.2014.07.019.
22. Formiga F, Ferrer A, Padros G, et al. Evidence of functional declining and global comorbidity measured at baseline proved to be the strongest predictors for long-term death in elderly community residents aged 85 years: A 5-year follow-up evaluation, the OCTABAIX study. *Clin Interv Aging*. 2016;11:437-44.10.2147/CIA.S101447.
23. Fritel X, Lachal L, Cassou B, et al. Mobility impairment is associated with urge but not stress urinary incontinence in community-dwelling older women: results from the Ossebo study. *BJOG*. 2013;120(12):1566-72.10.1111/1471-0528.12316.
24. Gustafsson S, Eklund K, Wilhelmson K, et al. Long-term outcome for ADL following the health-promoting RCT - elderly persons in the risk zone. *Gerontologist*. 2013;53(4):654-63.10.1093/geront/gns121.
25. Gustafsson S, Wilhelmson K, Eklund K, et al. Health-promoting interventions for persons aged 80 and older are successful in the short term - results from the randomized and three-armed Elderly Persons in the Risk Zone study. *J Am Geriatr Soc*. 2012;60(3):447-54.10.1111/j.1532-5415.2011.03861.x.
26. Haak M, Fänge A, Iwarsson S, et al. Home as a signification of independence and autonomy: Experiences among old Swedish people. *Scandinavian Journal of Occupational Therapy*. 2007;14(1):16-24.10.1080/11038120601024929.
27. Hammar IO, Dahlin-Ivanoff S, Wilhelmson K, et al. Shifting between self-governing and being governed: A qualitative study of older persons' self-determination. *BMC Geriatr*. 2014;14(1).10.1186/1471-2318-14-126.
28. Hegendörfer E, Vaes B, Andreeva E, et al. Predictive Value of Different Expressions of Forced Expiratory Volume in 1 Second (FEV1) for Adverse Outcomes in a Cohort of Adults Aged 80 and Older. *Journal of the American Medical Directors Association*. 2017;18(2):123-30.10.1016/j.jamda.2016.08.012.
29. Heyl V, Wahl H. Cognitive ability as a resource for everyday functioning among older adults who are visually impaired. *Journal of Visual Impairment & Blindness*. 2010;104(7):391-403.
30. Hoeksema AR, Spoorenberg S, Peters LL, et al. Elderly with remaining teeth report less frailty and better quality of life than edentulous elderly: a cross-sectional study. *Oral Dis*. 2017;23(4):526-36.10.1111/odi.12644.
31. Horgen G, Eilertsen G, Falkenberg H. Lighting old age - how lighting impacts the ability to grow old in own housing, part one. *Work*. 2012;41 Suppl 1:3385-7.10.3233/wor-2012-0612-3385.
32. Houston DK, Tooze JA, Davis CC, et al. Serum 25-hydroxyvitamin D and physical function in older adults: the Cardiovascular Health Study All Stars. *J Am Geriatr Soc*. 2011;59(10):1793-801.10.1111/j.1532-5415.2011.03601.x.

- 1
2
3 33. Idland G, Rydwick E, Smastuen MC, et al. Predictors of mobility in community-dwelling
4 women aged 85 and older. *Disabil Rehabil*. 2013;35(11):881-
5 7.10.3109/09638288.2012.712195.
- 6
7 34. Iwarsson S, Horstmann V, Carlsson G, et al. Person-environment fit predicts falls in older
8 adults better than the consideration of environmental hazards only. *Clin Rehabil*.
9 2009;23(6):558-67.10.1177/0269215508101740.
- 10
11 35. Landi F, Russo A, Liperoti R, et al. Anorexia, physical function, and incident disability among
12 the frail elderly population: Results from the iLSIRENTE study. *Journal of the American*
13 *Medical Directors Association*. 2010;11(4):268-74.10.1016/j.jamda.2009.12.088.
- 14
15 36. Landi F, Russo A, Liperoti R, et al. Midarm muscle circumference, physical performance and
16 mortality: Results from the aging and longevity study in the Sirente geographic area
17 (iLSIRENTE study). *Clin Nutr*. 2010;29(4):441-7.10.1016/j.clnu.2009.12.006.
- 18
19 37. Larsson A, Haglund L, Hagberg J. Doing everyday life-experiences of the oldest old.
20 *Scandinavian Journal of Occupational Therapy*. 2009;16(2):99-
21 109.10.1080/11038120802409762.
- 22
23 38. Laudisio A, Marzetti E, Antonica L, et al. Metabolic syndrome and quality of life in the elderly:
24 Age and gender differences. *Eur J Nutr*. 2013;52(1):307-16.
- 25
26 39. Laudisio A, Marzetti E, Franceschi F, et al. Disability is associated with emergency room
27 visits in the elderly: a population-based study. *Aging Clin Exp Res*. 2015;27(5):663-
28 71.10.1007/s40520-015-0324-5.
- 29
30 40. Laudisio A, Marzetti E, Pagano F, et al. Masticatory dysfunction is associated with worse
31 functional ability: a population-based study. *J Clin Periodontol*. 2010;37(2):113-
32 9.10.1111/j.1600-051X.2009.01518.x.
- 33
34 41. Lofqvist C, Tomsone S, Iwarsson S, et al. Changes in Home and Health over Nine Years
35 among very Old People in Latvia - Results from the ENABLE-AGE Project. *Journal of cross-*
36 *cultural gerontology*. 2017;32(1):17-29.
- 37
38 42. Mahler M, Sarvimäki A. Fear of falling from a daily life perspective; narratives from later life.
39 *Scand J Caring Sci*. 2012;26(1):38-44.10.1111/j.1471-6712.2011.00901.x.
- 40
41 43. Mangani I, Cesari M, Russo A, et al. Physical function, physical activity and recent falls.
42 Results from the 'Invecchiamento e Longevità nel Sirente (iLSIRENTE)' Study. *Aging Clinical*
43 *& Experimental Research*. 2008;20(3):234-41.
- 44
45 44. Manty M, Rantanen T, Era P, et al. Fatigue and depressive symptoms in older people. *J Appl*
46 *Gerontol*. 2014;33(4):505-14.10.1177/0733464812454011.
- 47
48 45. Mikkola TM, Polku H, Portegijs E, et al. Self-reported hearing is associated with time spent
49 out-of-home and withdrawal from leisure activities in older community-dwelling adults. *Aging*
50 *Clin Exp Res*. 2016;28(2):297-302.10.1007/s40520-015-0389-1.
- 51
52 46. Mikkola TM, Portegijs E, Rantakokko M, et al. Association of self-reported hearing difficulty to
53 objective and perceived participation outside the home in older community-dwelling adults. *J*
54 *Aging Health*. 2015;27(1):103-22.10.1177/0898264314538662.
- 55
56 47. Murabito JM, Pencina MJ, Kelly-Hayes M, et al. Temporal trends in self-reported functional
57 limitations and physical disability among the community-dwelling elderly population: the
58 Framingham Heart Study. *Am J Public Health*. 2008;98(7):1256-
59 62.10.2105/AJPH.2007.128132.
- 60
61 48. Muscari A, Bianchi G, Forti P, et al. Physical Activity and Other Determinants of Survival in
62 the Oldest Adults. *J Am Geriatr Soc*. 2017;65(2):402-6.10.1111/jgs.14569.
- 63
64 49. Nitsch D, Mann AG, Bulpitt C, et al. Impairment of kidney function and reduced quality-of-life
65 in older people: A cross-sectional study. *Age Ageing*. 2011;40(3):381-
66 7.10.1093/ageing/afr024.

- 1
2
3 50. Nykänen I, Lönnroos E, Kautiainen H, et al. Nutritional screening in a population-based
4 cohort of community-dwelling older people. *European Journal of Public Health*.
5 2013;23(3):405-9.10.1093/eurpub/cks026.
- 6
7 51. Polku H, Mikkola TM, Rantakokko M, et al. Self-reported hearing difficulties and changes in
8 life-space mobility among community-dwelling older adults: a Two-year follow-Up study.
9 *BMC Geriatr*. 2015;15:121.10.1186/s12877-015-0119-8.
- 10
11 52. Portegijs E, Rantakokko M, Viljanen A, et al. Is frailty associated with life-space mobility and
12 perceived autonomy in participation outdoors? A longitudinal study. *Age & Ageing*.
13 2016;45(4):550-3.10.1093/ageing/afw072.
- 14
15 53. Quail JM, Addona V, Wolfson C, et al. Association of unmet need with self-rated health in a
16 community dwelling cohort of disabled seniors 75 years of age and over. *European Journal
17 of Ageing*. 2007;4(1):45-55.10.1007/s10433-007-0042-8.
- 18
19 54. Rantakokko M, Iwarsson S, Vahaluoto S, et al. Perceived environmental barriers to outdoor
20 mobility and feelings of loneliness among community-dwelling older people. *Journals of
21 Gerontology - Series A Biological Sciences and Medical Sciences*. 2014;69(12):1562-
22 8.10.1093/gerona/glu069.
- 23
24 55. Rantakokko M, Portegijs E, Viljanen A, et al. Mobility Modification Alleviates Environmental
25 Influence on Incident Mobility Difficulty among Community-Dwelling Older People: A Two-
26 Year Follow-Up Study. *PLoS ONE*. 2016;11(4):e0154396.10.1371/journal.pone.0154396.
- 27
28 56. Rantz M, Lane K, Phillips LJ, et al. Enhanced registered nurse care coordination with sensor
29 technology: Impact on length of stay and cost in aging in place housing. *Nurs Outlook*.
30 2015;63(6):650-5.10.1016/j.outlook.2015.08.004.
- 31
32 57. Rao SK, Wallace LMK, Theou O, et al. Is it better to be happy or not depressed? Depression
33 mediates the effect of psychological well-being on adverse health outcomes in older adults.
34 *Int J Geriatr Psychiatry*. 2016.10.1002/gps.4559.
- 35
36 58. Rapo-Pylkko S, Haanpaa M, Liira H. Chronic pain among community-dwelling elderly: a
37 population-based clinical study. *Scand J Prim Health Care*. 2016;34(2):159-
38 64.10.3109/02813432.2016.1160628.
- 39
40 59. Rasinaho M, Hirvensalo M, Leinonen R, et al. Motives for and barriers to physical activity
41 among older adults with mobility limitations. *Journal of Aging and Physical Activity*.
42 2007;15(1):90-102.
- 43
44 60. Richards J, Rankaduwa W. Housing Canada's oldest-old: correlates of their residential
45 status. *Journal of Housing for the Elderly*. 2008;22(4):376-403.
- 46
47 61. Rydwick E, Frändin K, Akner G. Effects of a physical training and nutritional intervention
48 program in frail elderly people regarding habitual physical activity level and activities of daily
49 living-A randomized controlled pilot study. *Arch Gerontol Geriatr*. 2010;51(3):283-
50 9.10.1016/j.archger.2009.12.001.
- 51
52 62. Rydwick E, Lammes E, Frändin K, et al. Effects of a physical and nutritional intervention
53 program for frail elderly people over age 75. A randomized controlled pilot treatment trial.
54 *Aging Clinical and Experimental Research*. 2008;20(2):159-70.
- 55
56 63. Sabayan B, Oleksik AM, Maier AB, et al. High blood pressure and resilience to physical and
57 cognitive decline in the oldest old: The Leiden 85-Plus Study. *J Am Geriatr Soc*.
58 2012;60(11):2014-9.
- 59
60 64. Sallinen M, Hentonen O, Karki A. Technology and active agency of older adults living in
61 service house environment. *Disability and Rehabilitation Assistive technology*. 2015;10(1):27-
62 31.10.3109/17483107.2013.836685.
- 63
64 65. Sampson EL, Bulpitt CJ, Fletcher AE. Survival of Community-dwelling older people: The
65 effect of cognitive impairment and social engagement. *J Am Geriatr Soc*. 2009;57(6):985-91.
- 66
67 66. Savikko N, Routasalo P, Tilvis R, et al. Psychosocial group rehabilitation for lonely older
68 people: Favourable processes and mediating factors of the intervention leading to alleviated

- 1
2
3 loneliness. *International Journal of Older People Nursing*. 2010;5(1):16-24.10.1111/j.1748-
4 3743.2009.00191.x.
- 5
6 67. Sixsmith J, Sixsmith A, Fange AM, et al. Healthy ageing and home: The perspectives of very
7 old people in five european countries. *Soc Sci Med*. 2014;106:1-9.
- 8
9 68. Thompson HJ, Demiris G, Rue T, et al. A Holistic approach to assess older adults' wellness
10 using e-health technologies. *Telemedicine journal and e-health : the official journal of the*
11 *American Telemedicine Association*. 2011;17(10):794-800.
- 12
13 69. Tsai LT, Portegijs E, Rantakokko M, et al. The association between objectively measured
14 physical activity and life-space mobility among older people. *Scand J Med Sci Sports*.
15 2015;25(4):e368-73.10.1111/sms.12337.
- 16
17 70. Tsai LT, Rantakokko M, Portegijs E, et al. Environmental mobility barriers and walking for
18 errands among older people who live alone vs. with others. *BMC Public Health*.
19 2013;13(1).10.1186/1471-2458-13-1054.
- 20
21 71. van Bommel T, Delgado V, Bax JJ, et al. Impact of valvular heart disease on activities of
22 daily living of nonagenarians: the Leiden 85-plus study a population based study. *BMC*
23 *Geriatr*. 2010;10:17.10.1186/1471-2318-10-17.
- 24
25 72. van Houwelingen AH, den Elzen WP, le Cessie S, et al. Consequences of interaction of
26 functional, somatic, mental and social problems in community-dwelling older people. *PLoS*
27 *ONE*. 2015;10(4):e0121013.10.1371/journal.pone.0121013.
- 28
29 73. Vasara P. Not ageing in place: Negotiating meanings of residency in age-related housing.
30 *Journal of aging studies*. 2015;35:55-64.10.1016/j.jaging.2015.07.004.
- 31
32 74. Vestergaard S, Kronborg C, Puggaard L. Home-based video exercise intervention for
33 community-dwelling frail older women: A randomized controlled trial. *Aging Clin Exp Res*.
34 2008;20(5):479-86.
- 35
36 75. Von Humboldt S, Leal I. The Old and the Oldest-old: Do They Have Different Perspectives
37 on Adjustment to Aging? *International Journal of Gerontology*. 2015;9(3):156-60.
- 38
39 76. Wang K, Delbaere K, Brodie M, et al. Differences between Gait on Stairs and Flat Surfaces
40 in Relation to Fall Risk and Future Falls. *IEEE journal of biomedical and health informatics*.
41 2017.10.1109/jbhi.2017.2677901.
- 42
43 77. Werth BL, Williams KA, Pont LG. Laxative Use and Self-Reported Constipation in a
44 Community-Dwelling Elderly Population: A Community-Based Survey From Australia.
45 *Gastroenterol Nurs*. 2017;40(2):134-41.10.1097/sga.000000000000144.
- 46
47 78. Williams ID, O'Doherty LJ, Mitchell GK, et al. Identifying unmet needs in older patients:
48 Nurse-GP collaboration in general practice. *Aust Fam Physician*. 2007;36(9):772-6.
- 49
50 79. Wilson K, Mottram P, Sixsmith A. Depressive symptoms in the very old living alone:
51 Prevalence, incidence and risk factors. *Int J Geriatr Psychiatry*. 2007;22(4):361-
52 6.10.1002/gps.1682.
- 53
54 80. Wong CH, Weiss D, Sourial N, et al. Frailty and its association with disability and comorbidity
55 in a community-dwelling sample of seniors in Montreal: A cross-sectional study. *Aging Clin*
56 *Exp Res*. 2010;22(1):54-62.10.3275/6675.
- 57
58 81. Young Y. Factors Associated With Permanent Transition From Independent Living to
59 Nursing Home in a Continuing Care Retirement Community. *Journal of the American Medical*
60 *Directors Association*. 2009;10(7):491-7.10.1016/j.jamda.2009.03.019.
82. Zingmond DS, Ettner SL, Wilber KH, et al. Association of claims-based quality of care
measures with outcomes among community-dwelling vulnerable elders. *Med Care*.
2011;49(6):553-9.10.1097/MLR.0b013e31820e5aab.

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 1 st 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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3	Eckerblad	Sweden	qualitative study using semi-structured interviews and content analysis	n/a	n/a	20	community-dwelling	79-89	80.0	
4	et al.									
5	(2015)									
6										
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9										
10										
11	El-Khoury	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
12	et al.									
13	(2015)									
14										
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19	Eronen et	Finland	cross-sectional study	n/a	n/a	848	community-dwelling	75-90	62.0	X
20	al. (2016)									
21										
22										
23	Fabre et al.	USA	population-based cohort study	n/a	n/a	74	community-dwelling	≥90	51.3	X
24	(2007)									
25										
26	Fänge et	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	40	community-dwelling	80-89	57.5	
27	al. (2009)									
28										
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32	Formiga et	Spain	longitudinal study	n/a	n/a	167	community-dwelling	≥85	60.5	X
33	al. (2014)									
34										
35	Formiga et	Spain	RCT with 5-year follow-up	falls and malnutrition prevention	general primary care assessment	328	community-dwelling	≥85	61.6	X
36	al. (2016)									
37										
38	Fritel et al.	France	observational cross-	n/a	n/a	1,942	community-dwelling	75-85	100.0	X
39	(2013)									
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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	
Ottensvald 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-dwelling	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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2										
3	Horgen et	Norway	mixed	n/a	n/a	165	community-	75	n/a	X
4	al. (2012)		methods				dwelling			
5			study							
6										
7	Houston et	USA	secondary	n/a	n/a	988	community-	77-	64.5	X
8	al. (2011)		analysis of a				dwelling	100		
9			longitudinal							
10			study with 3							
11			years of							
12			follow-up							
13										
14	Idland et	Norway	prospective ,	n/a	n/a	307 (baseline)	community-	75-92	100.0	X
15	al. (2013)		observational			113 (follow-	dwelling			
16			cohort study			up)				
17			with 9 years							
18			follow-up							
19										
20	Warsson et	Sweden,	secondary	n/a	n/a	834	community-	75-89	79.7	X
21	al. (2009)	Germany,	analysis of a				dwelling			
22		Latvia	longitudinal							
23			survey study							
24			with 1 year							
25			follow-up							
26										
27	Landi et al.	Italy	secondary	n/a	n/a	357	community-	≥80	67.0	X
28	(2010a)		analysis of a				dwelling			
29			prospective							
30			cohort study							
31			(baseline)							
32										
33	Landi et al.	Italy	secondary	n/a	n/a	364 (baseline)	community-	≥80	67.0	X
34	(2010b)		analysis of a			205 (follow-	dwelling			
35			prospective			up)				
36			cohort study							
37			with 2 years							
38			follow-up							
39										
40	Parsson et	Sweden	qualitative	n/a	n/a	18	community-	86-93	55.6	
41	al. (2009)		study using				dwelling			
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46interviews,
observations
and
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gical method
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sectional
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356

community-
dwelling

≥75

54.5

X

longitudinal,
population-
based study
with 1-year
follow-up

n/a

n/a

342

community-
dwelling

≥75

56.0

X

cross-
sectional
study

n/a

n/a

350

community-
dwelling

≥75

54.3

X

secondary
analysis of a
longitudinal
study with 9
years follow-
up

n/a

n/a

59

community-
dwelling

77-90

90.0

X

qualitative
study using
narrative
interviews and
thematic
analysis

n/a

n/a

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community-
dwelling

81-94

100.0

secondary
analysis of a
prospective
cohort study

n/a

n/a

364

community-
dwelling

≥80

67.0

X

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3	Mänty et	Denmark,	secondary	n/a	n/a	561	community-	75	55.0	X
4	al. (2014)	Finland	analysis of a				dwelling			
5			longitudinal							
6			study							
7										
8	Mikkola et	Finland	secondary	n/a	n/a	766	community-	75-90	62.7	X
9	al. (2016)		analysis of a				dwelling			
10			cross							
11			sectional and							
12			longitudinal							
13			study							
14										
15	Mikkola et	Finland	cross-	n/a	n/a	848	community-	75-90	62.0	X
16	al. (2015)		sectional				dwelling			
17			study							
18										
19	Murabito et	USA	secondary	n/a	n/a	830	community-	79-88	61.4	X
20	al. (2008)		analysis of a				dwelling			
21			prospective							
22			cohort study							
23										
24	Muscari et	Italy	prospective,	n/a	n/a	500	community-	85-	65.8	X
25	al. (2017)		longitudinal				dwelling	102		
26			population-							
27			based study							
28			with 7 years							
29			follow-up							
30										
31	Nitsch et	UK	cross-	n/a	n/a	2,967	community-	≥75	59.7	
32	al. (2011)		sectional				dwelling			
33			study							
34										
35	Nykänen et	Finland	population	n/a	n/a	696	community-	≥75	69.4	X
36	al. (2013)		based				dwelling			
37			randomized							
38			comparative							
39			study							
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3	Polku et al.	Finland	prospective cohort study	n/a	n/a	848	community-dwelling	75-90	62.0	X
4	(2015)									
5	Portegijs et	Finland	secondary analysis of a cross-sectional study (baseline data & follow-up)	n/a	n/a	753	community-dwelling	75-90	64.0	X
6	al. (2016)									
7										
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13	Quail et al.	Canada	secondary analysis of a population-based cohort study	n/a	n/a	508	community-dwelling	75-96	66.9	
14	(2007)									
15										
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19	Rantakokk	Finland	secondary analysis of a cross-sectional study (baseline data)	n/a	n/a	847	community-dwelling	75-90	62.0	X
20	o et al.									
21	(2014)									
22										
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27	Rantakokk	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
28	o et al.									
29	(2016)									
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36	Rantz et al.	USA	secondary analysis of a cross-	living with sensors	living without sensors	133	residents of independent living facility	mean age: 83	64.7	X
37	(2015)									
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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 & Rankaduwera (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)

14	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
24	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	
32	Sampson et al. (2009)	UK	prospective cohort study	n/a	n/a	10,720	community-dwelling	≥75	59.6	X
35	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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4								independent		
5								living facility		
6	Sixsmith et	Hungary,	qualitative	n/a	n/a	190	community-	75-89	61.6	X
7	al. (2014)	Latvia,	study using in-				dwelling			
8		United	depth, semi-							
9		Kingdom,	structured							
10		Germany,	interviews and							
11		and	grounded							
12		Sweden	theory							
13	Thompson	USA	cross-	n/a	n/a	27	inhabitants of	78-94	67.0	X
14	et al.		sectional				an			
15	(2011)		study				independent			
16							retirement			
17							community			
18										
19	Tsai et al.	Finland	cross-	n/a	n/a	174	community-	75-90	64.0	X
20	(2015)		sectional				dwelling			
21			study							
22										
23	Tsai et al.	Finland	cross-	n/a	n/a	657	community-	75-81	75.0	X
24	(2013)		sectional				dwelling			
25			study							
26										
27	Van	Netherlan	prospective	n/a	n/a	277	community-	≥85	72.6	X
28	Bemmel et	ds	population-				dwelling			
29	al. (2010)		based study							
30										
31	van	Netherlan	cluster RCT	care plan for people with a	usual care	2,681	community-	≥75	68.3	X
32	Houweling	ds		combination of problems at		(baseline)	dwelling			
33	et al.			the functional, somatic,		2,172 (follow-				
34	(2015)			mental, or social level		up)				
35										
36	Vasara	Finland	qualitative	n/a	n/a	14	community	78-88	64.3	
37	(2015)		study using				dwelling			
38			semi-							
39			structured							
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6	Vestergaard et al.	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
7										
8	(2008)									
9										
10	Von Humboldt & Leal	Portugal	qualitative study using interviews and qualitative content analysis	n/a	n/a	152	community-dwelling	75-102	61.2	
11										
12	(2015)									
13										
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16										
17	Wang et al.	Australia	cross-sectional study	n/a	n/a	81	community-dwelling	mean age: 83.8 (SD 3.83)	44.4	
18	(2017)									
19										
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23	Werth et al.	Australia	retrospective cross-sectional survey study	n/a	n/a	239	community-dwelling	≥76	60.7	
24	(2017)									
25										
26										
27	Williams et al.	Australia	cross-sectional study	n/a	n/a	546	community-dwelling	75-96	68.0	X
28	(2007)									
29										
30										
31	Wilson et al.	UK	cross-sectional study	n/a	n/a	242	community-dwelling	80-90	69.9	X
32	(2007)									
33										
34										
35	Wong et al.	Canada	cross-sectional study	n/a	n/a	740	community-dwelling	75-96	68.0	
36	(2010)									
37										
38	Young	USA	prospective cohort study	n/a	n/a	298	people living in the	75-94	69.1	X
39	(2009)									
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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



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 (PRISMA-ScR): 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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3 **Laying the foundation for a Core Set of the International Classification of Functioning,**
4 **Disability and Health for community-dwelling older adults in primary care: Relevant**
5 **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*', '*dressings*', 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.
- 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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3 for community-dwelling patients, they could play an important role in advancing the paradigm
4 change from a disease-based to a biopsychosocial view.
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8 *Functioning* can be defined as the outcome of interactions between a person's health
9 conditions and contextual factors(10). It can be described using the international standard and
10 classification system for describing functioning and health, the International Classification of
11 Functioning, Disability and Health (ICF). With more than 1,400 categories, it is, however, too
12 extensive to be used in daily practice. Thus, shorter lists of categories, so-called ICF Core Sets
13 (ICF-CS), have been developed for several health conditions.¹ They comprise categories
14 relevant to persons living with a specific condition(11). An ICF-CS for geriatric patients in early
15 post-acute rehabilitation was developed in 2005(12). As target group and aims of rehabilitation
16 can differ from that of general medicine, the categories included in this ICF-CS may likewise
17 be different from an ICF-CS for geriatric patients in primary care. Two other ICF-CS, one for
18 primary care and one for geriatric patients, have been developed in the Netherlands(13-15).
19 Though they might turn out to be applicable to our study population, they were developed using
20 methods other than the established multi-perspective methodology for developing ICF-CS,
21 leaving out either the perspective of the target group or the researchers. For this reason, we
22 aimed to develop an ICF-CS for community-dwelling adults (≥ 75 years) for use in primary
23 care, following the standardized process of the ICF Research Branch(11). This process
24 includes a preparatory phase followed by a consensus conference. During the preparatory
25 phase, four studies are conducted to identify relevant ICF categories: a systematic or scoping
26 review (research perspective), a qualitative study (perspective of the target population)(16), an
27 expert survey (experts' perspective), and an empirical study (clinical perspective)(17). To gain
28 a comprehensive understanding of functioning, it is important to capture all four perspectives.
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52 The scoping review reflects the research perspective in that it aims to identify aspects of
53 functioning that are described or evaluated in the scientific literature related to the health
54 condition of interest(11). In this paper, methods and results of the scoping review are
55 presented. The objective was to identify concepts of functioning in community-dwelling older
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3 adults considered relevant in frequently used assessment instruments published in the
4 scientific literature.
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8 **3 Methods**

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11 This scoping review was conducted following the methodology proposed by the ICF Research
12 Branch(11).² This methodology is composed of five steps: 1) literature search, 2) study
13 selection, 3) extraction of relevant concepts, 4) linkage of the concepts to the ICF and 5)
14 frequency analysis. We did not aim to answer clinical questions by reviewing existing evidence,
15 but to systematically extract the concepts used by the scientific community to operationalize
16 functioning related to community-dwelling older adults. A study protocol has been published
17 elsewhere(18). This review was registered in PROSPERO (CRD42017067784) on 07/10/2017
18 and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-
19 Analyses extension for scoping reviews (PRISMA-ScR) guideline(19).
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30 **3.1 Eligibility Criteria**

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33 The selection of the eligibility criteria was guided by the PICOS (Population, Intervention,
34 Comparison, Outcomes, Study design) framework(20). Due to the special focus of this review,
35 only the 'P', 'O', and 'S' were relevant for our search.
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39 Population: For a publication to be included in this review, all the participants included in the
40 published study had to be community-dwelling and at least 75 years old. Studies that included
41 institutionalized participants (e.g. nursing home), participants recruited in a hospital or
42 rehabilitation center, or participants with dementia were excluded. As the intended ICF-CS is
43 meant to be used in primary care practices in Germany, only studies conducted in high-
44 resources countries with a similar socio-economic and cultural background were considered.
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3 represent the needs of other community-dwelling older adults not suffering from the particular
4 disease.
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7 Outcomes: The publications had to be related to functioning as defined by the ICF (e.g.
8 activities of daily living, social interaction, physical mobility). Publications reporting on studies
9 that solely focused on body structures without considering any other features of functioning
10 were excluded. Since physicians tend to focus on physical aspects of health anyway, and the
11 final ICF-CS is meant to complement this traditional emphasis on physical structures and
12 processes with few categories as necessary (for reasons of feasibility), we decided to forego
13 body structures to ensure that the resulting ICF-CS reflects those components of the ICF that
14 are not yet in the focus of general physicians.
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17 Study design: As suggested in the ICF-CS development guidelines, randomized controlled
18 trials, clinical controlled trials, cross-sectional studies, observational studies and qualitative
19 studies were included(11). Study protocols, case studies, economic evaluation studies,
20 conference papers, psychometric studies, prevention studies, studies of phase-II clinical trials,
21 studies exclusively showing laboratory parameters, animal experiments, letters, comments
22 and editorials were excluded, as those publications usually do not include relevant information
23 on functioning(11). Furthermore, systematic reviews and meta-analyses were not included in
24 this review.
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41 **3.2 Literature search**

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43 Electronic searches were carried out in PubMed, PsycINFO, EMBASE, CINAHL und Scopus
44 to identify potentially relevant publications. The search terms were organized into population
45 (e.g. aged, elderly, older adults), living condition (e.g. community-dwelling, independently
46 living) and outcome variables according to the ICF-related terms (e.g. social life, self-care,
47 home environment) using the thesaurus of the respective database (e.g. Medical subject
48 headings in PubMed) as well as free text words. Only studies published between 2007 and
49 2017 in peer-reviewed journals in English or German were considered for inclusion. The search
50 strategy was reviewed by an experienced librarian. The whole search strategy is available in
51 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)

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

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

3.7 Patient and public involvement

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41 Patients and the public were not involved in this study.

4 Results

4.1 Study Selection

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

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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3	Activities of Daily Living staircase	6						
4	(20, 21, 22, 29, 35, 66)					x		
5								
6	Short Form Health 36	5						
7	(9, 14, 16, 19, 26)					x		
8	Geriatric Depression Scale - 30 items	5						
9	(5, 23, 33, 34, 67)							x
10								
11	Barthel Index of Activities of Daily Living	5						
12	(5, 12, 17, 18, 43)					x		
13								
14	Center for Epidemiologic Studies Depression Scale	5						
15	(15, 27, 37, 40, 60)							x
16	The University of Alabama at Birmingham Study of	4						
17	Aging Life-Space Assessment							x
18	(8, 15, 44, 59)							
19	EuroQoL-5 dimension	4						
20	(25, 41, 62, 63)					x		
21								
22	Berg Balance Scale	3						
23	(1, 4, 21)					x		
24								
25	Groningen Activity Restrictions Scale	3						
26	(54, 61, 62)							x
27								
28	Abbreviated Mental Test Score	3						
29	(32, 33, 34)					x		
30								
31	Minimum Data Set - Home Care	3						
32	(30, 31, 36)					x	x	x
33								
34	Mobility-Tiredness-Scale	3						
35	(384, 37, 63)							
36								
37	Usability in my Home Questionnaire	3						
38	(29, 35, 66)							x
39								
40	Perceived environmental barriers to outdoor mobility	2						
41	(47, 48)							x
42								
43	Cognitive Performance Scale	2						
44	(30, 36)					x		
45								
46	Functional Independence Measure	2						
47	(52, 53)					x	x	x
48								
49	Gait Speed	2						
50	(2, 12)					x		
51								
52	Gijón Social Scale	2						
53	(12, 18)							x
54								
55	Housing Enabler Screening Tool	2						
56	(29, 35)							x
57								
58	Housing Options for Older People	2						
59	(35, 66)							x
60								
61	Impact on Participation and Autonomy Questionnaire	2						
62	(39, 47)					x	x	x
63								
64	Instrumental Activity Measure	2						
65	(52, 53)							x
66								
67	Mini Nutritional Assessment	2						
68	(17, 18)					x	x	x
69								
70	Neuropsychological Aging Inventory	2						
71	(29, 57)							x
72								

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 (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 *dressings (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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3	b152	Emotional functions	35
4			
5	b167	Mental functions of language	30
6			
7	b130	Energy and drive functions	28
8			
9	b126	Temperament and personality functions	23
10			
11	b110	Consciousness functions	5
12			
13	b134	Sleep functions	5
14			
15	b160	Thought functions	5
16			
17	b147	Psychomotor functions	3
18			
19	b172	Calculation functions	3
20			
21	b280	Sensation of pain	12
22			
23	b210	Seeing functions	3
24			
25	b230	Hearing functions	3
26			
27	b330	Fluency and rhythm of speech functions	5
28			
29	b525	Defecation functions	19
30			
31	b510	Ingestion functions	3
32			
33	b530	Weight maintenance functions	3
34			
35	b620	Urination functions	25
36			
37	b755	Involuntary movement reaction functions	13
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39	b730	Muscle power functions	7
40			
41	b810	Protective functions of the skin	3
42			
43	b820	Repair functions of the skin	3
44			
45	Body structures		4
46	s750	Structure of lower extremity	2
47			
48	s730	Structure of upper extremity	2
49			
50	Environmental factors		91
51	e110	Products or substances for personal consumption	17
52			
53	e155	Design, construction and building products and technology of buildings for private use	12
54			
55	e115	Products and technology for personal use in daily living	5
56			
57	e120	Products and technology for personal indoor and outdoor mobility and transportation	4
58			
59	e125	Products and technology for communication	2
60			
	e160	Products and technology of land development	2
	e165	Assets	2
	e210	Physical geography	2
	e225	Climate	2

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3	e240	Light	2
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5	e250	Sound	2
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7	e310	Immediate family	5
8	e315	Extended family	5
9			
10	e320	Friends	5
11			
12	e325	Acquaintances, peers colleagues, neighbors and community members	5
13			
14	e355	Health professionals	3
15	e575	General social support services, systems and policies	5
16			
17	e580	Health services, systems and policies	5
18			
19	e530	Utilities services, systems and policies	4
20			
21	e520	Open space planning services, systems and policies	2
22			
23	e530	Utilities services, systems and policies	4
24			
25	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.

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

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

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

11
12 Concepts referring to environmental factors with an impact on an individual's life were
13 minimally addressed in the assessment instruments reported in the included articles. The most
14 frequently identified category in this section was *products or substances for personal*
15 *consumption (e110)*, mainly assigned for the concept of medication. However, environmental
16 factors like housing design (e.g. lighting conditions, uneven surfaces), neighborhood planning
17 (e.g. public transportation, walkable community services), and social support (e.g. family,
18 friends, or health professionals) play a crucial role in old age. Considering these environmental
19 factors can contribute to the prevention of falls, nursing home placement as well as to the
20 compensation of other negative effects of age-related declines(35, 40-42). Thus, developing
21 instruments that addresses these essential environmental factors or revising current
22 assessment instruments to include more environmental factors items may be warranted.

23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 **5.1 Strengths and limitations**

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

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52 Another limitation of this literature review is the restriction to articles published in English or.
53 Thus, relevant studies conducted in the selected countries, but published in the authors' native
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3 language were possibly missed. Also drawing a random sample for full text screening carries
4 the risk of losing potentially relevant publications. Finally, excluding studies that focus solely
5 on body structures may have introduced some bias in the results. The reason for excluding
6 these studies was mentioned above.
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11 Some potentially relevant information may have been lost in the linking process, as single ICF
12 categories are often not precise enough to represent some relevant concepts for older adults.
13 For example, fatigue, falls or fear of falling could not easily be linked to one specific ICF
14 category. Sometimes more than one category was necessary and still the concept might not
15 be adequately described; e.g. fear of falling was linked using *involuntary movement reaction*
16 *functions (b755)*, *sensation of falling (b2402)*, and *emotional functions (b152)*. Other concepts
17 could only be linked to the very general first-level ICF categories, not allowing a detailed
18 representation of the concept; e.g. isolation was linked to *support and relationships (e3)*.
19 Sometimes, the same concept could be linked to different categories. This was especially the
20 case for concepts regarding the change of body positions. For example, the concept “get into
21 bed” can be linked to:
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- 34 - *lying down (d4100)*; defined as “Getting into and out of a lying down position or
35 *changing body position from horizontal to any other position, such as standing up or*
36 *sitting down”(10) or to*
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- 39 - *standing (d4104)*; defined as “Getting into and out of a standing position or changing
40 *body position from standing to any other position, such as lying down or sitting*
41 *down”(10).*
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47 This was one reason why we decided to link all concepts to second-level categories only. Being
48 aware of these issues, WHO created a mechanism of updating ICF categories to further
49 enhance the use of this classification(43). We will report the linking problems we faced to WHO
50 after publication of this study.
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55 **5.2 Implications for practice**

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3 Within a consensus conference a comprehensive ICF-CS based on the results of this scoping
4 review and the three other preparatory studies, and also considering the already existing ICF-
5 CS for this target group mentioned in the introduction, will be developed.
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10 As discussed, several aspects of functioning that were identified in this review are closely
11 linked to independent living. There is some evidence that older patients tend to consider
12 problems in functioning that threaten their independent living as most important, whereas their
13 physicians focus more on somatic problems and risk factors(44). Thus, in order to better
14 balance medical interventions according to the older patients' needs, it might be warranted to
15 include more psychosocial and environmental information in the consultation process(45).
16 Defining those aspects of functioning that are relevant from the research perspective seems
17 important to us, because assessment instruments that are frequently used influence whether
18 an intervention is seen to be effective or not. The concepts found therefore will have a strong
19 influence on the final ICF-CS to be developed.
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31 **6 Conclusions**

32 In conclusion, this scoping review demonstrates that frequently used instruments for assessing
33 functioning in older adults focus mainly on activities of daily living and mental functions,
34 whereas environmental factors are only minimally addressed. Despite some limitations
35 experienced in the linking process, the ICF provides a useful reference to identify and cluster
36 the concepts used in assessment instruments focusing on functioning in community-dwelling
37 older adults.
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50 Universität Erlangen Nürnberg for his support and advice in the development of the electronic
51 search strategy.
52
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59 degree 'Dr. rer. biol. hum.' for Johanna Tomandl.
60

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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3 Not required.
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6 **8.7 Data availability statement**

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8 The datasets used and analyzed during the current study are available from the corresponding
9 author upon reasonable request.
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12 **8.8 Notes**

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15 ¹ A list of accredited ICF-CS can be found here: <https://www.icf-core-sets.org/en/page1.php>.²

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17 The ICF Research Branch is a cooperation partner within the WHO collaborating center for
18 the Family of International Classifications (WHO-FIC) in Germany, which aims to promote
19 health by implementing ICF based tools and models.³ In the International Classification of
20 Functioning, Disability and Health personal factors are defined as factors related to the
21 individual (e.g. age, gender, life experiences) whereas environmental factors cover all
22 aspects of the external world that have an impact on functioning (e.g. social systems or
23 laws).⁴ The categories of the ICF are divided into different levels. First-level categories are
24 coded using the component letter (b, s, d, or e) followed by the chapter number (one digit).
25 Second-level categories are coded using the letter and three digits; the third- and fourth-level
26 categories using the letter and four or five digits.
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39 **9 References**

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43 1. Christensen K, Doblhammer G, Rau R, et al. Ageing populations: the challenges
44 ahead. *Lancet*. 2009;374(9696):1196-208.10.1016/S0140-6736(09)61460-4.
45 2. Crimmins EM. Trends in the health of the elderly. *Annu Rev Public Health*.
46 2004;25:79-98.
47 3. Klawiter M. Risk, prevention and the breast cancer continuum: the NCI, the FDA,
48 health activism and the pharmaceutical industry. *History and Technology*. 2002;18(4):309-53.
49 4. Aronowitz RA. The converged experience of risk and disease. *The Milbank Quarterly*.
50 2009;87(2):417-42.
51 5. Kostev K, Jacob L. Multimorbidity and polypharmacy among elderly people followed
52 in general practices in Germany. *European journal of internal medicine*. 2018;55:66-
53 8.10.1016/j.ejim.2018.07.014.
54 6. Frazier SC. Health outcomes and polypharmacy in elderly individuals. *J Gerontol*
55 *Nurs*. 2005;31(9):4-9.
56 7. Calderón-Larrañaga A, Poblador-Plou B, González-Rubio F, et al. Multimorbidity,
57 polypharmacy, referrals, and adverse drug events: are we doing things well? *Br J Gen Pract*.
58 2012;62(605):e821-e6.10.3399/bjgp12X659295.
59 8. Chatterji S, Byles J, Cutler D, et al. Health, functioning, and disability in older adults -
60 present status and future implications. *Lancet*. 2015;385(9967):563-75.

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 - 60
9. Lee SJ, Go AS, Lindquist K, et al. Chronic conditions and mortality among the oldest old. *Am J Public Health*. 2008;98(7):1209-14.10.2105/Ajph.2007.130955.
10. World Health Organization. International Classification of Functioning, Disability and Health: ICF: World Health Organization 2001.
11. Selb M, Escorpizo R, Kostanjsek N, et al. A guide on how to develop an International Classification of Functioning, Disability and Health Core Set. *European Journal of Physical and Rehabilitation Medicine*. 2015;51(1):105-17.
12. Grill E, Hermes R, Swoboda W, et al. ICF Core Set for geriatric patients in early post-acute rehabilitation facilities. *Disabil Rehabil*. 2005;27(7-8):411-7.10.1080/09638280400013966.
13. Emmen B, van Boven K, ten Napel H. Exploration of the desired content of an 'International Classification of Functioning' (ICF) item set for multimorbid patients in general practice. *Newsletter WHO-FIC Annual Network Meeting*. 2014;12(1):9-11.
14. Postma S, van Boven K, Ten Napel H, et al. The development of an ICF-based questionnaire for patients with chronic conditions in primary care. *J Clin Epidemiol*. 2018;103:92-100.
15. Spoorenberg SLW, Reijneveld SA, Middel B, et al. The Geriatric ICF Core Set reflecting health-related problems in community-living older adults aged 75 years and older without dementia: development and validation. *Disabil Rehabil*. 2015;37(25):2337-43.10.3109/09638288.2015.1024337.
16. Tomandl J, Book S, Hoefle A, et al. Laying the foundation for an ICF core set for community-dwelling elderly adults in primary care: the patient-perspective identified in a qualitative study. 2020.
17. Book S, Ulbrecht G, Tomandl J, et al. Laying the foundation for an ICF Core Set for community-dwelling elderly adults in primary care: The clinical perspective identified in a cross-sectional study 2020.
18. Tomandl J, Book S, Gotthardt S, et al. Laying the foundation for a core set of the International Classification of Functioning, Disability and Health for community-dwelling adults aged 75 years and above in general practice: a study protocol. *BMJ Open*. 2018;8(8):e024274.10.1136/bmjopen-2018-024274.
19. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. 2018;169(7):467-73.
20. Tacconelli E. Systematic reviews: CRD's guidance for undertaking reviews in health care. *The Lancet Infectious Diseases*. 2010;10(4):226.
21. Geyh S, Cieza A, Schouten J, et al. ICF Core Sets for stroke. *J Rehabil Med*. 2004;36(0):135-41.
22. de Schipper E, Lundquist A, Coghill D, et al. Ability and disability in autism spectrum disorder: A systematic literature review employing the international classification of functioning, disability and health-children and youth version. *Autism Res*. 2015;8(6):782-94.
23. Granberg S, Dahlström J, Möller C, et al. The ICF core sets for hearing loss—researcher perspective. Part I: Systematic review of outcome measures identified in audiological research. *Int J Audio*. 2014;53(2):65-76.
24. Gorostiaga A, Balluerka N, Guilera G, et al. Functioning in patients with schizophrenia: a systematic review of the literature using the International Classification of Functioning, Disability and Health (ICF) as a reference. *Qual Life Res*. 2017;26(3):531-43.
25. Random Integer Set Generator 2018. Available from: <https://www.random.org/integer-sets/>. (Accessed 20 Dec 2018).
26. Wolff B, Cieza A, Parentin A, et al. Identifying the concepts contained in outcome measures of clinical trials on four internal disorders using the International Classification of Functioning, Disability and Health as a reference. *J Rehabil Med*. 2004(44 Suppl):37-42.10.1080/16501960410015407.
27. Wasiak J, McMahan M, Danilla S, et al. Measuring common outcome measures and their concepts using the International Classification of Functioning, Disability and Health (ICF) in adults with burn injury: a systematic review. *Burns*. 2011;37(6):913-24.

- 1
2
3 28. Brockow T, Cieza A, Kuhlow H, et al. Identifying the concepts contained in outcome
4 measures of clinical trials on musculoskeletal disorders and chronic widespread pain using
5 the International Classification of Functioning, Disability and Health as a reference. *J Rehabil*
6 *Med.* 2004;36(0):30-6.
- 7 29. Geyh S, Kurt T, Brockow T, et al. Identifying the concepts contained in outcome
8 measures of clinical trials on stroke using the International Classification of Functioning,
9 Disability and Health as a reference. *J Rehabil Med.* 2004;36(0):56-62.
- 10 30. Offenbächer M, Cieza A, Brockow T, et al. Are the contents of treatment outcomes in
11 fibromyalgia trials represented in the international classification of functioning, disability, and
12 health? *Clin J Pain.* 2007;23(8):691-701.
- 13 31. Scheuringer M, Grill E, Boldt C, et al. Systematic review of measures and their
14 concepts used in published studies focusing on rehabilitation in the acute hospital and in
15 early post-acute rehabilitation facilities. *Disabil Rehabil.* 2005;27(7-8):419-29.
- 16 32. Bartoszek G, Fischer U, Müller M, et al. Outcome measures in older persons with
17 acquired joint contractures: a systematic review and content analysis using the ICF
18 (International Classification of Functioning, Disability and Health) as a reference. *BMC*
19 *Geriatr.* 2016;16(1):40.
- 20 33. Cieza A, Fayed N, Bickenbach J, et al. Refinements of the ICF Linking Rules to
21 strengthen their potential for establishing comparability of health information. *Disabil Rehabil.*
22 2016;41(5):574-83. 10.3109/09638288.2016.1145258.
- 23 34. World Health O. ICD-10 : international statistical classification of diseases and related
24 health problems : tenth revision. 2nd ed ed. Geneva: World Health Organization; 2004.
- 25 35. Gaugler JE, Duval S, Anderson KA, et al. Predicting nursing home admission in the
26 US: a meta-analysis. *BMC Geriatr.* 2007;7(1):13. 10.1186/1471-2318-7-13.
- 27 36. Buhr GT, Kuchibhatla M, Clipp EC. Caregivers' reasons for nursing home placement:
28 clues for improving discussions with families prior to the transition. *Gerontologist.*
29 2006;46(1):52-61.
- 30 37. Horton S, Baker J, Pearce G, et al. On the malleability of performance: Implications
31 for seniors. *J Appl Gerontol.* 2008;27(4):446-65.
- 32 38. Meisner BA. A meta-analysis of positive and negative age stereotype priming effects
33 on behavior among older adults. *Journals of Gerontology Series B: Psychological Sciences*
34 *and Social Sciences.* 2011;67(1):13-7.
- 35 39. Levy BR, Slade MD, Chang ES, et al. Ageism Amplifies Cost and Prevalence of
36 Health Conditions. *Gerontologist.* 2018:gny131-gny. 10.1093/geront/gny131.
- 37 40. Lawton MP. Residential environment and self-directedness among older people. *Am*
38 *Psychol.* 1990;45(5):638.
- 39 41. Lien WC, Chang JH, Guo NW, et al. Determinants of perceived physical environment
40 barriers among community-dwelling elderly in Taiwan. *J Nutr Health Aging.* 2015;19(5):575-
41 82. 10.1007/s12603-015-0473-4.
- 42 42. Wahl H-W, Iwarsson S, Oswald F. Aging well and the environment: Toward an
43 integrative model and research agenda for the future. *Gerontologist.* 2012;52(3):306-16.
- 44 43. WHO-FIC Update and Revision Committee. ICF Update Platform. User Guide. 2013.
- 45 44. Theile G, Mueller C. [Multimorbid General Practice Patients - What's really
46 important?]. *Praxis.* 2012;101:1621-6. 10.1024/1661-8157/a001145.
- 47 45. Nationale Akademie der Wissenschaften Leopoldina aDAdT, Union der deutschen
48 Akademien der Wissenschaften. Medizinische Versorgung im Alter – Welche Evidenz
49 brauchen wir? 2015.

10 List of abbreviations

ICF: International Classification of Functioning, Disability and Health

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

1
2
3 PRISMA-Sc: Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension
4
5 for scoping reviews
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7 PICOS: Patients, Intervention, Comparison, Outcomes, Study design
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10 **11 List of figures**

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13 *Figure 1.* Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
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15 flow chart.
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For peer review only

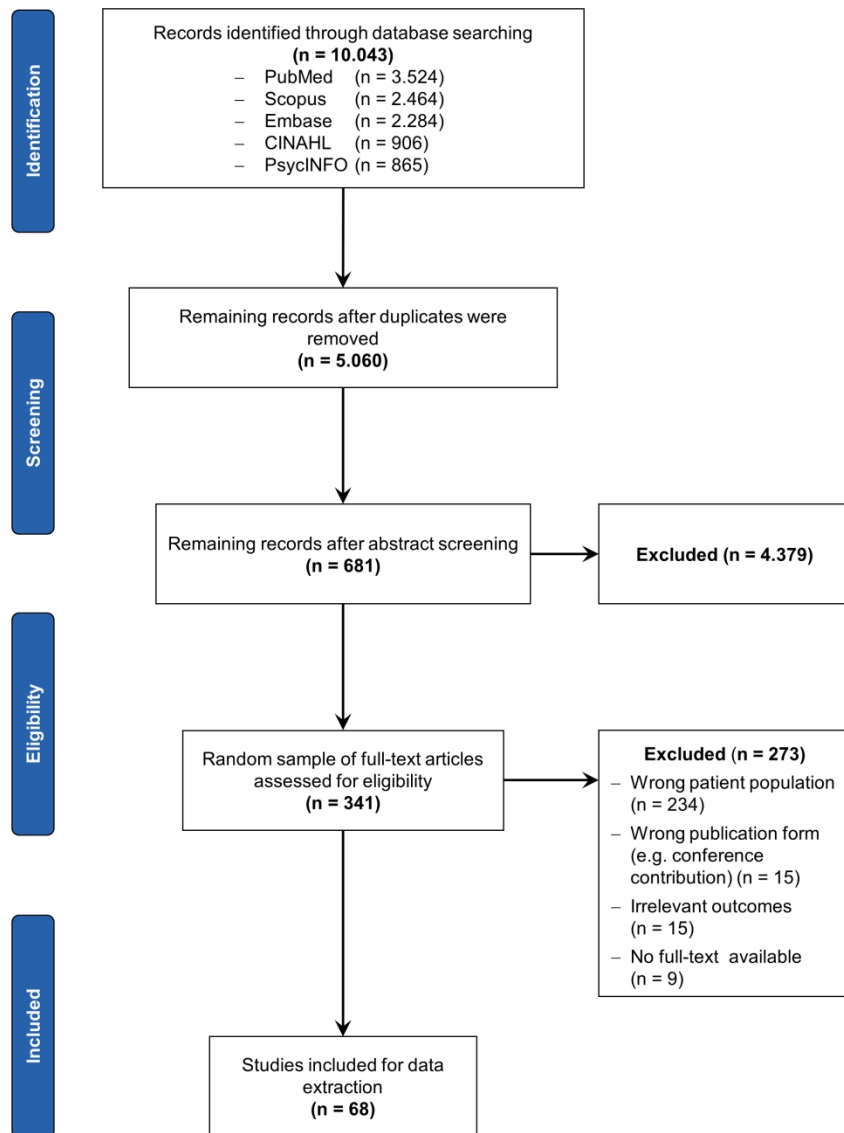


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

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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- 3 28. "psychologic assessment"/
- 4
- 5 29. "self care"/
- 6
- 7 30. "social environment"/
- 8
- 9 31. "social interaction"/
- 10
- 11 32. "social life"/
- 12
- 13 33. "social problem"/
- 14
- 15 34. "wellbeing"/
- 16
- 17 35. "abilit*" .ab,ti.
- 18
- 19 36. mobility.ab,ti.
- 20
- 21 37. "daily routine" .ab,ti.
- 22
- 23 38. "social life" .ab,ti.
- 24
- 25 39. performance.ab,ti.
- 26
- 27 40. self-care.ab,ti.
- 28
- 29 41. selfcare.ab,ti.
- 30
- 31 42. "social interaction" .ab,ti.
- 32
- 33 43. "interpersonal interaction" .ab,ti.
- 34
- 35 44. "coping strategy" .ab,ti.
- 36
- 37 45. "coping strategies" .ab,ti.
- 38
- 39 46. communitydwelling.ab,ti.
- 40
- 41 47. "community dwelling" .ab,ti.
- 42
- 43 48. "independent living" .ab,ti.
- 44
- 45 49. "independently living" .ab,ti.
- 46
- 47 50. "contextual factor*" .ab,ti.
- 48
- 49 51. "protective factor*" .ab,ti.
- 50
- 51 52. "risk factor*" .ab,ti.
- 52
- 53 53. "personal factor*" .ab,ti.
- 54
- 55 54. "environmental factor*" .ab,ti.
- 56
- 57 55. "living alone" .ab,ti.
- 58
- 59 56. "sociocultural factor*" .ab,ti.
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- 3 57. "psychosocial factor*".ab,ti.
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- 5 58. "social environment".ab,ti.
- 6
- 7 59. "quality of life".ab,ti.
- 8
- 9 60. well-being.ab,ti.
- 10
- 11 61. wellbeing.ab,ti.
- 12
- 13 62. wellness.ab,ti.
- 14
- 15 63. ICF.ab,ti.
- 16
- 17 64. "International Classification of Functioning".ab,ti.
- 18
- 19 65. health.ab,ti.
- 20
- 21 66. "medical problem*".ab,ti.
- 22
- 23 67. "psychological problem*".ab,ti.
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- 25 68. "social problem*".ab,ti.
- 26
- 27 69. "physical change*".ab,ti.
- 28
- 29 70. "physical illness".ab,ti.
- 30
- 31 71. "psychological change*".ab,ti.
- 32
- 33 72. impairment.ab,ti.
- 34
- 35 73. "mental change*".ab,ti.
- 36
- 37 74. "psychological assessment".ab,ti.
- 38
- 39 75. "cognitive assessment".ab,ti.
- 40
- 41 76. "needs assessment".ab,ti.
- 42
- 43 77. "neuropsychological assessment".ab,ti.
- 44
- 45 78. "behavioural assessment".ab,ti.
- 46
- 47 79. "behavioral assessment".ab,ti.
- 48
- 49 80. "social participation".ab,ti.
- 50
- 51 81. "activities of daily living".ab,ti.
- 52
- 53 82. "daily living activities".ab,ti.
- 54
- 55 83. "body function".ab,ti.
- 56
- 57 84. "body functions".ab,ti.
- 58
- 59 85. "body structures".ab,ti.
- 60

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2
3 86. "body structure".ab,ti.
4
5 87. "social participation"/
6
7 88. "daily life activity"/
8
9 89. 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88
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11 90. (English or German).lg.
12
13 91. article.pt.
14
15 92. ("2007" or "2008" or "2009" or "2010" or "2011" or "2012" or "2013" or "2014" or "2015" or
16 "2016" or "2017").yr.
17
18 93. "home environment".ab,ti.
19
20 94. "urban environment".ab,ti.
21
22 95. disability.ab,ti.
23
24 96. disabilities.ab,ti.
25
26 97. disable.ab,ti.
27
28 98. disabled.ab,ti.
29
30 99. disablement.ab,ti.
31
32 100. function.ab,ti.
33
34 101. functions.ab,ti.
35
36 102. functioning.ab,ti.
37
38 103. functional.ab,ti.
39
40 104. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
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42 105. 13 or 46 or 47 or 48 or 49 or 93 or 94
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44 106. 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
45 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
46 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
47 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
48 or 78 or 79 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103
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50 107. 89 and 104 and 105 and 106
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52 108. 90 and 92 and 107
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Appendix B

References for included articles

1. Aartolahti E, Hakkinen A, Lonroos E, et al. Relationship between functional vision and balance and mobility performance in community-dwelling older adults. *Aging Clin Exp Res*. 2013;25(5):545-52.10.1007/s40520-013-0120-z.
2. Abellan van Kan G, Cesari M, Gillette-Guyonnet S, et al. Sarcopenia and cognitive impairment in elderly women: results from the EPIDOS cohort. *Age Ageing*. 2013;42(2):196-202.10.1093/ageing/afs173.
3. Ahluwalia SC, Gill TM, Baker DI, et al. Perspectives of older persons on bathing and bathing disability: A qualitative study. *J Am Geriatr Soc*. 2010;58(3):450-6.
4. Behm L, Eklund K, Wilhelmson K, et al. Health Promotion Can Postpone Frailty: Results from the RCT Elderly Persons in the Risk Zone. *Public Health Nurs*. 2016;33(4):303-15.10.1111/phn.12240.
5. Berkemeyer S, Schumacher J, Thiem U, et al. Bone T-scores and functional status: A cross-sectional study on german elderly. *PLoS ONE*. 2009;4(12).10.1371/journal.pone.0008216.
6. Blain H, Carriere I, Sourial N, et al. Balance and walking speed predict subsequent 8-year mortality independently of current and intermediate events in well-functioning women aged 75 years and older. *J Nutr Health Aging*. 2010;14(7):595-600.10.1007/s12603-010-0111-0.
7. Bollwein J, Diekmann R, Kaiser MJ, et al. Dietary quality is related to frailty in community-dwelling older adults. *J Gerontol A Biol Sci Med Sci*. 2013;68(4):483-9.10.1093/gerona/gls204.
8. Brown CJ, Kennedy RE, Lo AX, et al. Impact of Emergency Department Visits and Hospitalization on Mobility Among Community-Dwelling Older Adults. *Am J Med*. 2016;129(10):1124.e9-.e15.10.1016/j.amjmed.2016.05.016.
9. Byles JE, Leigh L, Vo K, et al. Life space and mental health: a study of older community-dwelling persons in Australia. *Aging & Mental Health*. 2015;19(2):98-106.10.1080/13607863.2014.917607.
10. Calvert JF, Kaye J, Leahy M, et al. Technology use by rural and urban oldest old. *Technol Health Care*. 2009;17(1):1-11.10.3233/THC-2009-0527.
11. Chipperfield JG, Newall NE, Chuchmach LP, et al. Differential determinants of men's and women's everyday physical activity in later life. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences*. 2008;63(4):S211-S8.
12. Diez-Ruiz A, Bueno-Errandonea A, Nunez-Barrio J, et al. Factors associated with frailty in primary care: a prospective cohort study. *BMC Geriatr*. 2016;16:91.10.1186/s12877-016-0263-9.
13. Eckerblad J, Theander K, Ekdahl A, et al. To adjust and endure: a qualitative study of symptom burden in older people with multimorbidity. *Appl Nurs Res*. 2015;28(4):322-7.10.1016/j.apnr.2015.03.008.
14. El-Khoury F, Cassou B, Latouche A, et al. Effectiveness of two year balance training programme on prevention of fall induced injuries in at risk women aged 75-85 living in community: Ossébo randomised controlled trial. *BMJ (Online)*. 2015;351.10.1136/bmj.h3830.
15. Eronen J, von Bonsdorff M, Rantakokko M, et al. Socioeconomic Status and Life-Space Mobility in Old Age. *Journal of aging and physical activity*. 2016;24(4):617-23.10.1123/japa.2015-0196.
16. Fabre JM, Wood RH, Cherry KE, et al. Age-related deterioration in flexibility is associated with health-related quality of life in nonagenarians. *J Geriatr Phys Ther*. 2007;30(1):16-22.

17. Formiga F, Ferrer A, Padrós G, et al. Diabetes Mellitus as a Risk Factor for Functional and Cognitive Decline in Very Old People: The Octabaix Study. *Journal of the American Medical Directors Association*. 2014;15(12):924-8.10.1016/j.jamda.2014.07.019.
18. Formiga F, Ferrer A, Padros G, et al. Evidence of functional declining and global comorbidity measured at baseline proved to be the strongest predictors for long-term death in elderly community residents aged 85 years: A 5-year follow-up evaluation, the OCTABAIX study. *Clin Interv Aging*. 2016;11:437-44.10.2147/CIA.S101447.
19. Fritel X, Lachal L, Cassou B, et al. Mobility impairment is associated with urge but not stress urinary incontinence in community-dwelling older women: results from the Ossebo study. *BJOG*. 2013;120(12):1566-72.10.1111/1471-0528.12316.
20. Gustafsson S, Eklund K, Wilhelmson K, et al. Long-term outcome for ADL following the health-promoting RCT - elderly persons in the risk zone. *Gerontologist*. 2013;53(4):654-63.10.1093/geront/gns121.
21. Gustafsson S, Wilhelmson K, Eklund K, et al. Health-promoting interventions for persons aged 80 and older are successful in the short term - results from the randomized and three-armed Elderly Persons in the Risk Zone study. *J Am Geriatr Soc*. 2012;60(3):447-54.10.1111/j.1532-5415.2011.03861.x.
22. Hammar IO, Dahlin-Ivanoff S, Wilhelmson K, et al. Shifting between self-governing and being governed: A qualitative study of older persons' self-determination. *BMC Geriatr*. 2014;14(1).10.1186/1471-2318-14-126.
23. Hegendörfer E, Vaes B, Andreeva E, et al. Predictive Value of Different Expressions of Forced Expiratory Volume in 1 Second (FEV1) for Adverse Outcomes in a Cohort of Adults Aged 80 and Older. *Journal of the American Medical Directors Association*. 2017;18(2):123-30.10.1016/j.jamda.2016.08.012.
24. Heyl V, Wahl H. Cognitive ability as a resource for everyday functioning among older adults who are visually impaired. *Journal of Visual Impairment & Blindness*. 2010;104(7):391-403.
25. Hoeksema AR, Spoorenberg S, Peters LL, et al. Elderly with remaining teeth report less frailty and better quality of life than edentulous elderly: a cross-sectional study. *Oral Dis*. 2017;23(4):526-36.10.1111/odi.12644.
26. Horgen G, Eilertsen G, Falkenberg H. Lighting old age - how lighting impacts the ability to grow old in own housing, part one. *Work*. 2012;41 Suppl 1:3385-7.10.3233/wor-2012-0612-3385.
27. Houston DK, Tooze JA, Davis CC, et al. Serum 25-hydroxyvitamin D and physical function in older adults: the Cardiovascular Health Study All Stars. *J Am Geriatr Soc*. 2011;59(10):1793-801.10.1111/j.1532-5415.2011.03601.x.
28. Idland G, Rydwick E, Smastuen MC, et al. Predictors of mobility in community-dwelling women aged 85 and older. *Disabil Rehabil*. 2013;35(11):881-7.10.3109/09638288.2012.712195.
29. Iwarsson S, Horstmann V, Carlsson G, et al. Person-environment fit predicts falls in older adults better than the consideration of environmental hazards only. *Clin Rehabil*. 2009;23(6):558-67.10.1177/0269215508101740.
30. Landi F, Russo A, Liperoti R, et al. Anorexia, physical function, and incident disability among the frail elderly population: Results from the iLSIRENTE study. *Journal of the American Medical Directors Association*. 2010;11(4):268-74.10.1016/j.jamda.2009.12.088.
31. Landi F, Russo A, Liperoti R, et al. Midarm muscle circumference, physical performance and mortality: Results from the aging and longevity study in the Sirente geographic area (iLSIRENTE study). *Clin Nutr*. 2010;29(4):441-7.10.1016/j.clnu.2009.12.006.
32. Laudisio A, Marzetti E, Antonica L, et al. Metabolic syndrome and quality of life in the elderly: Age and gender differences. *Eur J Nutr*. 2013;52(1):307-16.

- 1
2
3 33. Laudisio A, Marzetti E, Franceschi F, et al. Disability is associated with emergency room
4 visits in the elderly: a population-based study. *Aging Clin Exp Res*. 2015;27(5):663-
5 71.10.1007/s40520-015-0324-5.
- 6
7 34. Laudisio A, Marzetti E, Pagano F, et al. Masticatory dysfunction is associated with worse
8 functional ability: a population-based study. *J Clin Periodontol*. 2010;37(2):113-
9 9.10.1111/j.1600-051X.2009.01518.x.
- 10
11 35. Lofqvist C, Tomsone S, Iwarsson S, et al. Changes in Home and Health over Nine Years
12 among very Old People in Latvia - Results from the ENABLE-AGE Project. *Journal of cross-*
13 *cultural gerontology*. 2017;32(1):17-29.
- 14
15 36. Mangani I, Cesari M, Russo A, et al. Physical function, physical activity and recent falls.
16 Results from the 'Invecchiamento e Longevità nel Sirente (ilSIRENTE)' Study. *Aging Clinical*
17 *& Experimental Research*. 2008;20(3):234-41.
- 18
19 37. Mänty M, Rantanen T, Era P, et al. Fatigue and depressive symptoms in older people. *J Appl*
20 *Gerontol*. 2014;33(4):505-14.10.1177/0733464812454011.
- 21
22 38. Mikkola TM, Polku H, Portegijs E, et al. Self-reported hearing is associated with time spent
23 out-of-home and withdrawal from leisure activities in older community-dwelling adults. *Aging*
24 *Clin Exp Res*. 2016;28(2):297-302.10.1007/s40520-015-0389-1.
- 25
26 39. Mikkola TM, Portegijs E, Rantakokko M, et al. Association of self-reported hearing difficulty to
27 objective and perceived participation outside the home in older community-dwelling adults. *J*
28 *Aging Health*. 2015;27(1):103-22.10.1177/0898264314538662.
- 29
30 40. Murabito JM, Pencina MJ, Kelly-Hayes M, et al. Temporal trends in self-reported functional
31 limitations and physical disability among the community-dwelling elderly population: the
32 Framingham Heart Study. *Am J Public Health*. 2008;98(7):1256-
33 62.10.2105/AJPH.2007.128132.
- 34
35 41. Muscari A, Bianchi G, Forti P, et al. Physical Activity and Other Determinants of Survival in
36 the Oldest Adults. *J Am Geriatr Soc*. 2017;65(2):402-6.10.1111/jgs.14569.
- 37
38 42. Nitsch D, Mann AG, Bulpitt C, et al. Impairment of kidney function and reduced quality-of-life
39 in older people: A cross-sectional study. *Age Ageing*. 2011;40(3):381-
40 7.10.1093/ageing/afr024.
- 41
42 43. Nykänen I, Lönnroos E, Kautiainen H, et al. Nutritional screening in a population-based
43 cohort of community-dwelling older people. *European Journal of Public Health*.
44 2013;23(3):405-9.10.1093/eurpub/cks026.
- 45
46 44. Polku H, Mikkola TM, Rantakokko M, et al. Self-reported hearing difficulties and changes in
47 life-space mobility among community-dwelling older adults: a Two-year follow-Up study.
48 *BMC Geriatr*. 2015;15:121.10.1186/s12877-015-0119-8.
- 49
50 45. Portegijs E, Rantakokko M, Viljanen A, et al. Is frailty associated with life-space mobility and
51 perceived autonomy in participation outdoors? A longitudinal study. *Age & Ageing*.
52 2016;45(4):550-3.10.1093/ageing/afw072.
- 53
54 46. Quail JM, Addona V, Wolfson C, et al. Association of unmet need with self-rated health in a
55 community dwelling cohort of disabled seniors 75 years of age and over. *European Journal*
56 *of Ageing*. 2007;4(1):45-55.10.1007/s10433-007-0042-8.
- 57
58 47. Rantakokko M, Iwarsson S, Vahaluoto S, et al. Perceived environmental barriers to outdoor
59 mobility and feelings of loneliness among community-dwelling older people. *Journals of*
60 *Gerontology - Series A Biological Sciences and Medical Sciences*. 2014;69(12):1562-
8.10.1093/gerona/glu069.
48. Rantakokko M, Portegijs E, Viljanen A, et al. Mobility Modification Alleviates Environmental
Influence on Incident Mobility Difficulty among Community-Dwelling Older People: A Two-
Year Follow-Up Study. *PLoS ONE*. 2016;11(4):e0154396.10.1371/journal.pone.0154396.

- 1
- 2
- 3 49. Rantz M, Lane K, Phillips LJ, et al. Enhanced registered nurse care coordination with sensor
4 technology: Impact on length of stay and cost in aging in place housing. *Nurs Outlook*.
5 2015;63(6):650-5.10.1016/j.outlook.2015.08.004.
- 6
- 7 50. Rao SK, Wallace LMK, Theou O, et al. Is it better to be happy or not depressed? Depression
8 mediates the effect of psychological well-being on adverse health outcomes in older adults.
9 *Int J Geriatr Psychiatry*. 2016.10.1002/gps.4559.
- 10
- 11 51. Rapo-Pylkko S, Haanpaa M, Liira H. Chronic pain among community-dwelling elderly: a
12 population-based clinical study. *Scand J Prim Health Care*. 2016;34(2):159-
13 64.10.3109/02813432.2016.1160628.
- 14
- 15 52. Rydwick E, Frändin K, Akner G. Effects of a physical training and nutritional intervention
16 program in frail elderly people regarding habitual physical activity level and activities of daily
17 living-A randomized controlled pilot study. *Arch Gerontol Geriatr*. 2010;51(3):283-
18 9.10.1016/j.archger.2009.12.001.
- 19
- 20 53. Rydwick E, Lammes E, Frändin K, et al. Effects of a physical and nutritional intervention
21 program for frail elderly people over age 75. A randomized controlled pilot treatment trial.
22 *Aging Clinical and Experimental Research*. 2008;20(2):159-70.
- 23
- 24 54. Sabayan B, Oleksik AM, Maier AB, et al. High blood pressure and resilience to physical and
25 cognitive decline in the oldest old: The Leiden 85-Plus Study. *J Am Geriatr Soc*.
26 2012;60(11):2014-9.
- 27
- 28 55. Sampson EL, Bulpitt CJ, Fletcher AE. Survival of Community-dwelling older people: The
29 effect of cognitive impairment and social engagement. *J Am Geriatr Soc*. 2009;57(6):985-91.
- 30
- 31 56. Savikko N, Routasalo P, Tilvis R, et al. Psychosocial group rehabilitation for lonely older
32 people: Favourable processes and mediating factors of the intervention leading to alleviated
33 loneliness. *International Journal of Older People Nursing*. 2010;5(1):16-24.10.1111/j.1748-
34 3743.2009.00191.x.
- 35
- 36 57. Sixsmith J, Sixsmith A, Fange AM, et al. Healthy ageing and home: The perspectives of very
37 old people in five european countries. *Soc Sci Med*. 2014;106:1-9.
- 38
- 39 58. Thompson HJ, Demiris G, Rue T, et al. A Holistic approach to assess older adults' wellness
40 using e-health technologies. *Telemedicine journal and e-health : the official journal of the*
41 *American Telemedicine Association*. 2011;17(10):794-800.
- 42
- 43 59. Tsai LT, Portegijs E, Rantakokko M, et al. The association between objectively measured
44 physical activity and life-space mobility among older people. *Scand J Med Sci Sports*.
45 2015;25(4):e368-73.10.1111/sms.12337.
- 46
- 47 60. Tsai LT, Rantakokko M, Portegijs E, et al. Environmental mobility barriers and walking for
48 errands among older people who live alone vs. with others. *BMC Public Health*.
49 2013;13(1).10.1186/1471-2458-13-1054.
- 50
- 51 61. van Bommel T, Delgado V, Bax JJ, et al. Impact of valvular heart disease on activities of
52 daily living of nonagenarians: the Leiden 85-plus study a population based study. *BMC*
53 *Geriatr*. 2010;10:17.10.1186/1471-2318-10-17.
- 54
- 55 62. van Houwelingen AH, den Elzen WP, le Cessie S, et al. Consequences of interaction of
56 functional, somatic, mental and social problems in community-dwelling older people. *PLoS*
57 *ONE*. 2015;10(4):e0121013.10.1371/journal.pone.0121013.
- 58
- 59 63. Vestergaard S, Kronborg C, Puggaard L. Home-based video exercise intervention for
60 community-dwelling frail older women: A randomized controlled trial. *Aging Clin Exp Res*.
61 2008;20(5):479-86.
- 62
- 63 64. Wang K, Delbaere K, Brodie M, et al. Differences between Gait on Stairs and Flat Surfaces
64 in Relation to Fall Risk and Future Falls. *IEEE journal of biomedical and health informatics*.
65 2017.10.1109/jbhi.2017.2677901.
- 66
- 67 65. Williams ID, O'Doherty LJ, Mitchell GK, et al. Identifying unmet needs in older patients:
68 Nurse-GP collaboration in general practice. *Aust Fam Physician*. 2007;36(9):772-6.

- 1
2
3 66. Wilson K, Mottram P, Sixsmith A. Depressive symptoms in the very old living alone:
4 Prevalence, incidence and risk factors. *Int J Geriatr Psychiatry*. 2007;22(4):361-
5 6.10.1002/gps.1682.
6
7 67. Young Y. Factors Associated With Permanent Transition From Independent Living to
8 Nursing Home in a Continuing Care Retirement Community. *Journal of the American Medical*
9 *Directors Association*. 2009;10(7):491-7.10.1016/j.jamda.2009.03.019.
10
11 68. Zingmond DS, Ettner SL, Wilber KH, et al. Association of claims-based quality of care
12 measures with outcomes among community-dwelling vulnerable elders. *Med Care*.
13 2011;49(6):553-9.10.1097/MLR.0b013e31820e5aab.
14
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For peer review only

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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3	Byles et al.	Australia	cross-sectional study	n/a	n/a	260	community-dwelling	75-80	50.4	
4	(2015)									
5										
6	Calvert et al.	USA	cross-sectional study	n/a	n/a	306	community-dwelling	≥85	62.0	
7	(2009)									
8										
9	Chipperfield et al.	Canada	prospective cohort study	n/a	n/a	198	community-dwelling	80-98	63.1	
10	(2008)									
11										
12	Diez-Ruiz et al.	Spain	prospective cohort study with 2 years follow-up	n/a	n/a	215	community dwelling	≥75	63.0	
13	(2016)									
14										
15	Eckerblad et al.	Sweden	qualitative study using semi-structured interviews and content analysis	n/a	n/a	20	community-dwelling	79-89	80.0	
16	(2015)									
17										
18	El-Khoury et al.	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	
19	(2015)									
20										
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26	Eronen et al.	Finland	cross-sectional study	n/a	n/a	848	community-dwelling	75-90	62.0	
27	(2016)									
28										
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33	Fabre et al.	USA	population-based cohort study	n/a	n/a	74	community-dwelling	≥90	51.3	
34	(2007)									
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3	Formiga et al. (2014)	Spain	longitudinal study	n/a	n/a	167	community-dwelling	≥85	60.5
4									
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
6									
7	Fritel et al. (2013)	France	observational cross-sectional study	n/a	n/a	1,942	community-dwelling	75-85	100.0
8									
9									
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11									
12	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
13									
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15									
16									
17	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
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23	Hammar et al. (2014)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	11	community-dwelling	84-95	54.5
24									
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29	Hegendörfer et al. (2017)	Belgium	prospective, observational, population based cohort study	n/a	n/a	501	community-dwelling	≥80	63.0
30									
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33									
34	Heyl & Wahl (2010)	Germany	cross-sectional study	n/a	n/a	271	community-dwelling	75-94	54
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3	Hoeksema	Netherlan	cross-	n/a	n/a	1026	community-	≥75	59.0	
4	et al.	ds	sectional				dwelling			
5	(2017)		study							
6										
7	Horgen et	Norway	mixed	n/a	n/a	165	community-	75	n/a	
8	al. (2012)		methods				dwelling			
9			study							
10	Houston et	USA	secondary	n/a	n/a	988	community-	77-100	64.5	
11	al. (2011)		analysis of a				dwelling			
12			longitudinal							
13			study with 3							
14			years of							
15			follow-up							
16										
17	Idland et	Norway	prospective ,	n/a	n/a	307 (baseline)	community-	75-92	100.0	
18	al. (2013)		observational			113 (follow-	dwelling			
19			cohort study			up)				
20			with 9 years							
21			follow-up							
22										
23	Iwarsson et	Sweden,	secondary	n/a	n/a	834	community-	75-89	79.7	
24	al. (2009)	Germany,	analysis of a				dwelling			
25		Latvia	longitudinal							
26			survey study							
27			with 1 year							
28			follow-up							
29	Landi et al.	Italy	secondary	n/a	n/a	357	community-	≥80	67.0	
30	(2010a)		analysis of a				dwelling			
31			prospective							
32			cohort study							
33			(baseline)							
34										
35	Landi et al.	Italy	secondary	n/a	n/a	364 (baseline)	community-	≥80	67.0	
36	(2010b)		analysis of a			205 (follow-	dwelling			
37			prospective			up)				
38			cohort study							
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3			with 2 years						
4			follow-up						
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6	Laudisio et	Italy	cross-	n/a	n/a	356	community-	≥75	54.5
7	al. (2013)		sectional				dwelling		
8			study						
9	Laudisio et	Italy	longitudinal,	n/a	n/a	342	community-	≥75	56.0
10	al. (2015)		population-				dwelling		
11			based study						
12			with 1-year						
13			follow-up						
14									
15	Laudisio et	Italy	cross-	n/a	n/a	350	community-	≥75	54.3
16	al. (2010)		sectional				dwelling		
17			study						
18	Lofqvist et	Latvia	secondary	n/a	n/a	59	community-	77-90	90.0
19	al. (2017)		analysis of a				dwelling		
20			longitudinal						
21			study with 9						
22			years follow-						
23			up						
24									
25	Mangani et	Italy	secondary	n/a	n/a	364	community-	≥80	67.0
26	al. (2008)		analysis of a				dwelling		
27			prospective						
28			cohort study						
29									
30	Mänty et	Denmark,	secondary	n/a	n/a	561	community-	75	55.0
31	al. (2014)	Finland	analysis of a				dwelling		
32			longitudinal						
33			study						
34									
35	Mikkola et	Finland	secondary	n/a	n/a	766	community-	75-90	62.7
36	al. (2016)		analysis of a				dwelling		
37			cross						
38			sectional and						
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3	Quail et al.	Canada	secondary	n/a	n/a	508	community-	75-96	66.9	
4	(2007)		analysis of a				dwelling			
5			population-							
6			based cohort							
7			study							
8										
9	Rantakokk	Finland	secondary	n/a	n/a	847	community-	75-90	62.0	
10	o et al.		analysis of a				dwelling			
11	(2014)		cross-							
12			sectional							
13			study							
14			(baseline							
15			data)							
16										
17	Rantakokk	Finland	secondary	n/a	n/a	848	community-	75-90	62.0	
18	o et al.		analysis of a			(baseline),	dwelling			
19	(2016)		cross-			816 (1				
20			sectional			year follow-				
21			study			up),				
22			(baseline data			761 (2				
23			& follow-up)			years follow -				
24						up)				
25	Rantz et al.	USA	secondary	living with sensors	living without sensors	133	residents of	mean	64.7	
26	(2015)		analysis of a				independent	age: 83		
27			cross-				living facility			
28			sectional							
29			study							
30										
31	Rao et al.	Canada	secondary	n/a	n/a	1,668	community-	mean	58.0	
32	(2016)		analysis of a				dwelling	age: 82.9		
33			cross-					(SD 6.9)		
34			sectional							
35			study							
36										
37	Rapo-	Finland	cross-	n/a	n/a	106	community-	75-85	74.0	
38	Pylkko et		sectional				dwelling			
39	al. (2016)		study							
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3	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
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16	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
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27	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
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37	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 Bommel 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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3	Vestergaar	Denmark	RCT	home-based video exercises;	bi-weekly telephone call	53	community-	75-91	100.0	
4	d et al.			26min/day; 3 times/week; 5			dwelling			
5	(2008)			months; bi-weekly telephone call						
6										
7	Wang et al.	Australia	cross-	n/a	n/a	81	community-	mean	44.4	
8	(2017)		sectional				dwelling	age: 83.8		
9			study					(SD 3.83)		
10	Williams et	Australia	cross-	n/a	n/a	546	community-	75-96	68.0	
11	al. (2007)		sectional				dwelling			
12			study							
13										
14	Wilson et	UK	cross-	n/a	n/a	242	community-	80-90	69.9	
15	al. (2007)		sectional				dwelling			
16			study							
17	Young	USA	prospective	n/a	n/a	298	people living	75-94	69.1	
18	(2009)		cohort study				in the			
19							independent			
20							living unit of a			
21							continuing			
22							care			
23							retirement			
24							community			
25										
26	Zingmond	USA	retrospective	n/a	n/a	21,310	community-	≥75	78.0	
27	et al.		cohort study				dwelling			
28	(2011)									
29										

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

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



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 (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: 10.7326/M18-0850.



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