



# BMJ Open What long-term care interventions have been published between 2010 and 2020? Results of a WHO scoping review identifying long-term care interventions for older people around the world

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## ABSTRACT

**Objective** The global population is rapidly ageing. To tackle the increasing prevalence of older adults' chronic conditions, loss of intrinsic capacity and functional ability, long-term care interventions are required. The study aim was to identify long-term care interventions reported in scientific literature from 2010 to 2020 and categorise them in relation to WHO's public health framework of healthy ageing.

**Design** Scoping review conducted on PubMed, CINHAL, Cochrane and Google Advanced targeting studies reporting on long-term care interventions for older and frail adults. An internal validated Excel matrix was used for charting.

Setting nursing homes, assisted care homes, long-term care facilities, home, residential houses for the elderly and at the community.

**Inclusion criteria** Studies published in peer-reviewed journals between 1 January 2010 to 1 February 2020 on implemented interventions with outcome measures provided in the settings mentioned above for subjects older than 60 years old in English, Spanish, German, Portuguese or French.

**Results** 305 studies were included. Fifty clustered interventions were identified and organised into four WHO Healthy Ageing domains and 20 subdomains. All interventions delved from high-income settings; no interventions from low-resource settings were identified. The most frequently reported interventions were multimodal exercise (n=68 reports, person-centred assessment and care plan development (n=22), case management for continuum care (n=16), multicomponent interventions (n=15), psychoeducational interventions for caregivers (n=13) and interventions mitigating cognitive decline (n=13).

**Conclusion** The identified interventions are diverse overarching multiple settings and areas seeking to prevent, treat and improve loss of functional ability and intrinsic capacity. Interventions from low-resource settings were not identified.

## Strengths and limitations of this study

- This study used a scoping review methodology to identify long-term care interventions in the scientific literature in the last 10 years.
- This study categorised the retrieved interventions into the domains of WHO articulated definition of Healthy Ageing.
- This study focused its search on international-overarching databases and did not conduct search on regional databases where local interventions might be published.
- This study did not focus on the effectiveness of the individual interventions.

## BACKGROUND

At a time of multiple and changing public health challenges, one issue remains certain: the world population is ageing rapidly.<sup>1</sup> From 2015 to 2050, the proportion of the world's population aged 60 years or older will more than double.<sup>1</sup> Longer lives and an older population age structure, without a reduction in the incidence of disease burden, is expected to result in a higher prevalence of non-communicable diseases at the population level, and increasing comorbidity at the individual level. These trends will increase the demand for effective services and require prompt responses from health systems and more enabling environments. Increasing burden of chronic conditions will result in a decline in intrinsic capacity and functioning of the global population, creating enormous challenges in all aspects of society and most importantly health and social care.<sup>1</sup>

In 2015, WHO articulated a definition for Healthy Ageing as 'the process of developing and maintaining the functional ability that

enables well-being in older age.’<sup>2</sup> Through functional ability, WHO has prioritised achieving meaningful living despite moderate to significant declines in physical or mental capacity.<sup>2</sup> The provision of long-term care services aims at: ‘ensuring that people with or at risk of significant loss of physical and mental capacity can maintain a level of functional ability consistent with their basic rights, fundamental freedoms and human dignity’.<sup>2</sup> These services, typically non-hospital based, are provided in various settings, involve care and assistance with everyday tasks, support with social participation, and management of advanced chronic conditions through community nursing, rehabilitation and palliative and end-of-life care.<sup>2,3</sup>

As the number of older persons continues to grow so will the need for long-term care. In countries from the Organisation for Economic Cooperation and Development, older adults above 80 years are driving the increased demand and supply of long-term care. An estimate average of 52% of people above 80 years require some kind of long-term care support but remain without access.<sup>4</sup> The unmet need for long-term care is particularly pronounced in low-middle income countries (LMICs),<sup>1,2,4</sup> many of which are experiencing an epidemiological transition and where the majority of older people live. It is projected that more than 80% of older people will be living in LMICs in 2050.<sup>1,2,4</sup> As a result, an increase in prevalence of need for long-term care is expected.<sup>5</sup> The WHO strives to close this gap. To do so, the appraisal of long-term care provision globally is deemed a necessary first step.

While there has been a boom in publications reporting on long-term care provision in the last 10 years,<sup>6</sup> scarce systematic assessment has been conducted exploring long-term care interventions and services. Only few studies have targeted this matter focusing on specific thematic areas such as oral health,<sup>7</sup> caregivers,<sup>8</sup> comprehensive geriatric assessment,<sup>9</sup> delirium and dementia,<sup>10–14</sup> telemedicine and videogames,<sup>15</sup> health promotion,<sup>16,17</sup> fall prevention and injury reduction,<sup>18,19</sup> multicomponent interventions,<sup>20,21</sup> nutrition,<sup>22</sup> occupational therapy,<sup>23</sup> physical activity,<sup>24–32</sup> and models of care.<sup>33,34</sup>

The provision and access to long term care for older people who need it, is one of the four key action areas endorsed by all WHO and UN Member States, within the UN Decade of Healthy Ageing, endorsed in 2020. The importance to identify and evaluate interventions that mitigate declines in capacities and maintain dignity and older person’s ability sets the stage for this study.

Following a scoping review methodology, this study answered the question: What long-term care interventions have been published between 2010 and 2020? and aimed to systematically assess the scientific literature reporting on long-term care interventions and services for older adults available globally within the mentioned period of time. Its main objective is to provide an overview of the currently reported interventions and to propose a categorisation for its better appraisal. This study has been

conducted in preparation of a WHO process to enable a long-term care package of services.

## METHODS

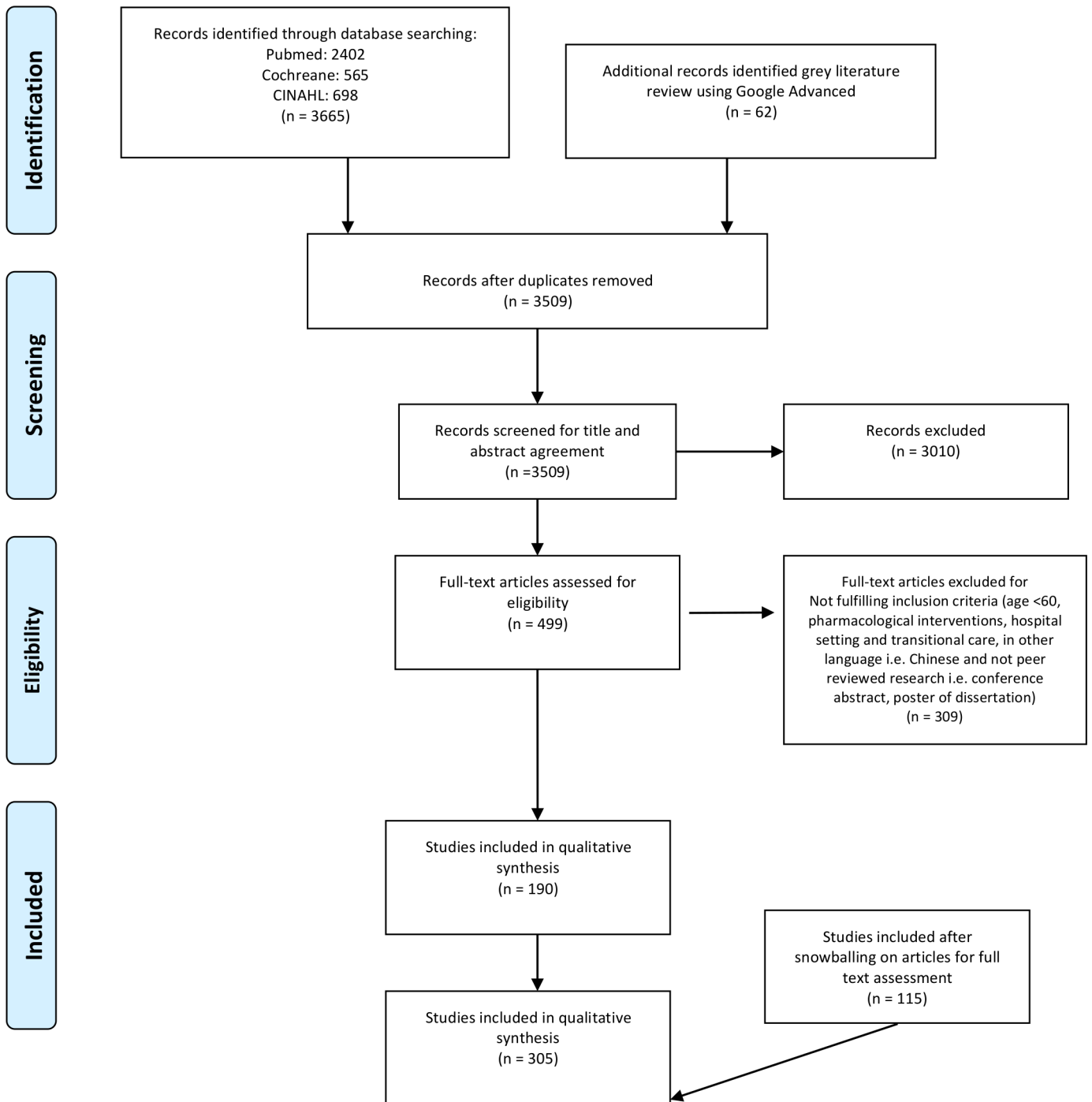
A scoping review is considered to be the most appropriate method to address the aim of this study as this method has been traditionally used to scan large and unexplored bodies of evidence with the aim of better understanding its content and gaps.<sup>35,36</sup> To the best of our knowledge, this study is one of the first efforts to systematically exploring long-term care interventions provided around the world. A research protocol was drafted and internally approved by the research team. The scoping review was conducted between February and June 2020 following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) reporting guidance<sup>35,37</sup> and is reported following the PRISMA-ScR checklist and diagram (figure 1).<sup>35,38</sup>

## Inclusion criteria

The following inclusion criteria were established: (1) Studies published in peer-reviewed journals, (2) published between 1 January 2010 to 1 February 2020; we have chosen this time frame based on the scientometric review by Fu *et al*<sup>6,39</sup> in which a burst of publications from 2010 onwards was reported (3) Provided in one of the following settings: nursing homes, assisted care homes, long-term care facilities, home, residential houses for the elderly and at the community; (4) reporting on subjects older than 60 years old; (5) providing a detailed description of the interventions’ components (including a description on materials, personnel and its implementation); (6) the reported intervention had to be already implemented either in research or real life context (ie, only studies reporting on the results of an implemented intervention were included, protocols or plans were excluded); (7) studies had to report on at least one outcome measure assessing the implementation of the intervention; (8) reporting on non-pharmacological (ie, we included interventions relying on behavioural modifications and support of intrinsic capacity without requiring medical prescriptions: ie, pharmacological intervention like anticoagulants were excluded) interventions except those related to preventative public health measures such as vaccination and (9) addressing older adults at risk of or living with frailty and intrinsic capacity loss.

## Exclusion criteria

Studies were excluded if: (1) they were published out of the defined dates; (2) did not provide a description of the component(s) of the interventions; (3) were delivered at the hospital setting in the context of acute care (ie, emergency room) or hospitalisation; (4) occurred in the context of transitional care (ie, from the orthopaedic ward to home after hip surgery); (5) reported on acute, subacute or postacute episode; (6) long-term care for any other population (ie, children); (7) dissertations,



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**Figure 1** Shows the process followed to select the articles included in this study. Repeated articles were deleted. Two researchers (NA-C and BW) independently reviewed all articles by title and abstract. On title and abstract agreement, articles were selected for full text assessment. Discrepancies were discussed to reach agreement (NA-C, BW and Z-AH). Articles selected for full-text assessment were downloaded and managed using the MENDELEY reference manager software. An additional 'snow-balling'<sup>43</sup> approach was conducted on the reference section of selected articles to identify other relevant studies. Adapted from Moher *et al.*<sup>38</sup>

doctoral thesis, conference communications, posters, abstracts, protocols, courses and training material; (8) studies reporting only outcome measures for economic evaluation; (9) pharmacological interventions; (10) Long-term effects of medications, surgeries or other acute or

hospital-based interventions and (11) we excluded articles reported in languages other than English, Spanish, German, Portuguese and French. These languages were targeted based on the research team proficiency and with the aim of broadening the search over English articles.

**Table 1** Search terms

|                     | Concept                           | MeSH   |   |
|---------------------|-----------------------------------|--|---|
| Population          | Older adult                       | ▶ “Aged”[Mesh]   |   |
|                     | Frail elderly                     | ▶ “Frail elderly”[Mesh]  |   |
|                     | Older people                      |  |   |
|                     | Elderly                           |  |   |
| Context             | Long-term care facilities         | ▶ “Long-term care”[Mesh]<br>▶ “Nursing homes”[Mesh]                  |   |
|                     | Nursing homes                     | ▶ “Homes for the aged [Mesh]   |   |
|                     | Home and community based services | ▶ Long term care facilities<br>▶ “Assisted living facilities” [Mesh] |   |
|                     | Community health services         | ▶ “Community health services [Mesh]                                  |   |
|                     | Caregivers                        | ▶ Home care  |   |
|                     | Social services                   | ▶ “Caregivers”[Mesh]<br>▶ “Social services” [Mesh]<br>▶ Social care  |   |
|                     | Concept                           | Long-term care services OR interventions                             | ▶ Long-term care<br>▶ Health services for the aged [Mesh] |
|                     |                                   | Provision  | ▶ Intervention [Mesh]                                     |
| Package of services |                                   | ▶ Services   |   |

### Search engines and strategy

Peer-review studies were searched in PubMed, CINAHL (EBSCO Host) and in Cochrane database. An additional search was conducted in Google Advanced to assess grey literature, allowing the identification of evidence-based reports that are normally excluded from indexed journals. No regional databases were searched. A combination of the following terms (table 1) was used and specifically adapted to the characteristics of each search engine under the supervision of the Library Service at the University of Navarra (online supplemental boxes 2–5): Long-term care OR/AND, health services for the aged, AND/OR social services, AND/OR, social care, AND, interventions, OR services, AND long-term care facilities, OR assisted living facilities, OR nursing homes, OR homes for the aged, OR home care, OR community health services, OR Caregivers, AND older adult, AND frail elderly.

### Article selection and article categorisation

#### Data charting

The interventions were extracted from the articles included in the study (NA-C and RS). From each intervention data were gathered using an internally validated charting form drafted in Excel MS Office 2019 that targeted: type of study, demographic characteristics of the study population, country, intervention description, delivery setting, provider, delivery frequency, duration, outcome measures and conclusions. Specific information regarding these fields is not provided.

Repeated interventions were deleted. That is, in the case a same intervention was reported twice in two different studies (ie, a research group reported an intervention first in an randomised control trial and later in a cost-effectiveness secondary analysis) the intervention was counted only once. In this case, the study presenting more data to complete the charting form was used as reference. This general method was used for studies included in systematic reviews. Following the inclusion criteria, studies prior to 2010 were excluded even if they were being reported in a systematic review from 2010 and onward.

#### Data analysis

The identified interventions were approached using non-software based cluster analysis (NA-C, RS and Z-AH). The aim of this qualitative approach was finding similarities between the interventions and grouping them accordingly. First, interventions were organised into thematic areas following WHO’s Healthy Ageing domains, namely: intrinsic capacity, functional ability, and environment (specifically support provided by caregivers). (2) The interventions within each thematic area were clustered according to similarity and coded. On them, cluster analysis was conducted to identify a common underlying concepts and associations. Associated interventions were included in a cluster. The interventions contained in a same cluster received a heading. This name aimed at synthesising the cluster content. Naming was aligned with WHO’s official wording used in guidelines and official reports (MRP). Two researches conducted independently the clusterisation (NA-C and MRP), decisions and disagreements were discussed. A third researcher (Z-AH) reviewed the decisions.

Frequency of appearance was calculated as the number of interventions contained within one cluster. The frequency of appearance was placed next to the cluster denomination, indicating how often the intervention was reported.

The scope of this study aimed at scanning the scientific literature to gain an overview of the long-term care interventions provided around the world and approach its appraisal in a descriptive manner. Given the exploratory scope and the scoping review nature of this study, no assessment of the quality of included studies or identified interventions was conducted.

## RESULTS

### Identified studies and characteristics

A total of 3727 articles were identified; after duplicates were removed, 3509 were assessed for title and abstract agreement. A total of 499 articles were selected for full-text assessment, from which only 190 were included in qualitative synthesis. Additional 150 articles were identified through snowballing and included in qualitative synthesis, leaving a total of 305 articles assessed (figure 1).

**Table 2** Typology of the identified studies

| Study design                   | No of studies identified | % of identified studies |
|--------------------------------|--------------------------|-------------------------|
| Randomised control trial       | 181                      | 59.3                    |
| Systematic review              | 28                       | 9.2                     |
| Quasi-experimental             | 25                       | 8.2                     |
| Pre/post                       | 14                       | 4.6                     |
| Descriptive                    | 10                       | 3.3                     |
| Cohort                         | 8                        | 2.6                     |
| Cross sectional                | 7                        | 2.3                     |
| Observational                  | 6                        | 2.0                     |
| Case and control               | 3                        | 1.0                     |
| Case reports                   | 2                        | 0.7                     |
| Controlled trial               | 2                        | 0.7                     |
| Experimental                   | 2                        | 0.7                     |
| Experimental cross over        | 2                        | 0.7                     |
| Mix methods                    | 2                        | 0.7                     |
| Non-randomised trials          | 2                        | 0.7                     |
| Randomised intervention study  | 2                        | 0.7                     |
| Scoping review                 | 2                        | 0.7                     |
| Cost-effectiveness             | 1                        | 0.3                     |
| Designed-delay                 | 1                        | 0.3                     |
| Integrative review             | 1                        | 0.3                     |
| Matched control group          | 1                        | 0.3                     |
| Prospective intervention study | 1                        | 0.3                     |
| Not specified                  | 2                        | 0.7                     |
| Total                          | 305                      | 100.0                   |

The majority of the identified studies were randomised controlled trials (n=181, 59.3%), followed by systematic reviews (n=28, 9.2%), and quasi-experimental studies (n=25, 8.2%) (table 2). The top three publishing journals were the Journal of American Medical Directors Association (n=17), Journal of American Geriatric Society (n=13) and BMC Geriatrics (n=11) (table 3). A total of 38 studies were identified in 2010, followed by 34 in 2011 and 36 in 2012. A trend to decrease the number of publications followed the year 2014.

An under-representation of interventions from LMIC was identified (please see online supplemental table 8). All of the included studies corresponded to interventions identified in high-income (HIC) or upper-middle-income countries (UMC) according to the latest classification of the World Bank.<sup>40</sup> The majority of the studies were conducted and published within the United States of America (n=56; 18%), followed by China, Taiwan (n=39; 13%), The Netherlands (n=19; 6%), Japan (n=18; 6%), Australia (n=15; 5%), Sweden (n=14, 5%), United Kingdom (n=14, 5%), Canada (n=11; 4%) and Spain (n=10, 3%). Articles from UMCs reporting interventions were: Brazil (n=4; 1%), Argentina (n=2; 0.7%),

**Table 3** Top 10 journals publishing on LTC interventions

| Journal  | No of articles identified |
|--|---------------------------|
| <i>Journal of American Medical Directors Association</i> | 17                        |
| <i>Journal of American Geriatric Society</i>             | 13                        |
| <i>BMC Geriatrics</i>                                    | 11                        |
| <i>Clinical Interventions in Aging</i>                   | 9                         |
| <i>Archives of Gerontology and Geriatrics</i>            | 7                         |
| <i>International Journal of Nursing Studies</i>          | 7                         |
| <i>International Psychogeriatric</i>                     | 7                         |
| <i>Ageing Clinical and Experimental Research</i>         | 6                         |
| <i>Geriatrics &amp; Gerontology International</i>        | 6                         |
| <i>Journal of Clinical Nursing</i>                       | 6                         |

Colombia (n=1; 0.3%), Mexico (n=1; 0.3%), and Turkey (n=1; 0.3%). No interventions based in low-income or low-middle-income countries were identified in this study.

### Identified interventions

Table 4 shows a summary of the findings. A total of 273 interventions using different formulations were identified. By ‘different formulations’ we refer to the different nomenclatures used in the source study. For example, one intervention could be named as ‘Stretching exercise’ in study A, while study B would call it ‘exercise to improve stretching’ and study C ‘silver yoga to improve stretching’. During the cluster analysis, these interventions were grouped under stretching exercises.

Analysis delved a total of 49 clusters, which were organised in four domains: (1) Interventions to support caregivers and enable care-planning based on person-centred assessment, (2) Interventions for the maintenance of intrinsic capacity, (3) Interventions for the optimisation of functional ability and (4) Additional environmental and structural interventions. Tables 4–7 provide an overview of the identified interventions organised per domains and subdomains.

In terms of delivery setting, long-term care facilities predominated (n=85), followed by home (n=73), and community (n=46). No specific definitions regarding the settings were provided within the studies.

The most frequently reported interventions were: multimodal exercise programme (n=68 reports), person-centred assessment and care plan development (n=22), case management, coordination and timely referral to ensure patient-centred continuum care (n=16), multi-component interventions (n=15), interventions aimed at mitigating/preventing cognitive decline (n=13), psycho-educational interventions for caregivers (n=13), screen and management of polypharmacy (n=7), use of telemedicine to provide long-term care services (n=7) and interventions to foster continued opportunities for learning, growing and decision making (n=6),

**Table 4** Summary table

| WHO healthy ageing domain   | Subdomain                                   | Total no of clusters | Total frequency of appearance |
|---|---|----------------------|-------------------------------|
| Interventions to support caregivers and enable care-planning based on person-centred assessment | Caregiver support                           | 13                   | 34                            |
|   | Person-centred assessment and care planning | 3                    | 46                            |
| Interventions for the maintenance of intrinsic capacity   | Vitality (nutrition and hydration)          | 4                    | 15                            |
|   | Oral health                                 | 1                    | 7                             |
|   | Skin health                                 | 2                    | 3                             |
|   | Cognitive capacity                          | 3                    | 19                            |
|   | Psychological capacity                      | 2                    | 7                             |
|   | Sleep hygiene                               | 1                    | 4                             |
|   | Locomotor capacity                          | 2                    | 71                            |
|   | Bladder and bowel capacity                  | 2                    | 3                             |
| Interventions for the optimisation of functional ability  | Multicomponent                              | 1                    | 15                            |
|   | Moving around                               | 1                    | 2                             |
|   | Build and maintain relationships            | 2                    | 5                             |
| Additional environmental and structural interventions   | Learn, grow and make decisions              | 1                    | 6                             |
|   | Modification to the built environment       | 2                    | 6                             |
|   | Fall prevention                             | 3                    | 11                            |
|   | Pain management                             | 1                    | 1                             |
|   | Polypharmacy                                | 1                    | 7                             |
|   | Palliative care and end of life care        | 1                    | 1                             |
|   | Digital Health                              | 2                    | 8                             |
| Management of communicable disease  | 1   | 2                    |                               |
|   | Total                                       | 49                   | 273                           |

### Interventions to support caregivers and enable care-planning based on person-centred assessment

Within the subdomain for caregiver support (table 5), the most frequently appearing interventions were psychoeducational interventions to foster self-care, psychological hygiene, stress management and coping strategies for informal caregivers. The majority of the interventions corresponded to the provision of support for caregivers of people with dementia (PWD) or Alzheimer. Additionally, the need for training was made evident; several studies addressed this issue by reporting on different training interventions mainly targeting paid caregivers.

Interestingly, a total of 22 studies reported interventions stressing person-centred assessment for care planning. A comprehensive geriatric assessment to identify older people's needs was majorly conducted to design adjusted care plans and inform decision-making regarding care management, delivery and referral. This elevated frequency of appearance made it the second most reported intervention within this study. Also particularly relevant were the interventions addressing care management. These interventions proposed a figure specially designed to manage and coordinate care for older adults, mostly in the form of a trained nurse. The

common objective was the timely referral to social and clinical services and pursue of a continuum of care.

### Interventions for the maintenance of intrinsic capacity

This domain accounts for the greatest number of studies included (table 6). The interventions addressed several areas for the maintenance of intrinsic capacity. Those to prevent malnutrition and dehydration focused on scheduled mealtimes and increase of caloric intake by providing between meals snacks and beverages. Approaches based on food modification were also reported, especially to prevent dysphagia and to facilitate intake by providing finger food.

The promotion of oral care and the timely identification of related problems were frequently reported in the literature. Most of these interventions stressed screening programmes. The prevention of pressure ulcers was mainly addressed through interventions addressing skin care routines and the use of cushions.

The prevention of cognitive decline seems to be a common interest in the provision of long-term care especially for PWD. Studies reported interventions promoting the social integration of older people by means of occupational therapy, reminiscence exercises, well-being

**Table 5** Interventions to support caregivers and enable care-planning based on person-centred assessment (n=16)

| Subdomain                | Clustered interventions   | Frequency of appearance | Reference   | Examples of included interventions*  |
|--------------------------|---|-------------------------|---|--|
| Caregiver support (n=13) | Psychoeducational interventions   | 13                      | Jalali and Wohlin, <sup>43</sup> Cheng <i>et al</i> , <sup>44</sup> Chu <i>et al</i> , <sup>45</sup> Wang <i>et al</i> , <sup>46</sup> Au <i>et al</i> , <sup>47</sup> Kwok <i>et al</i> , <sup>48</sup> Chen <i>et al</i> , <sup>49</sup> Au, <sup>50</sup> Kwok <i>et al</i> , <sup>51</sup> Velásquez <i>et al</i> , <sup>52</sup> Au, <sup>53</sup> Cooper <i>et al</i> , <sup>54</sup> Logsdon <i>et al</i> 2010 <sup>55</sup> | Psychoeducation for PWD caregivers, <sup>43</sup> <sup>44</sup> <sup>48</sup> Support group for PWD caregivers, <sup>45</sup> <sup>46</sup> Support group for PWA caregivers, <sup>47</sup> <sup>49</sup> Coping strategies for PWD caregivers, <sup>49</sup> Behavioural activation for PWD caregivers, <sup>50</sup> Behavioural therapy for PWD family caregivers, <sup>51</sup> Psychoeducation for older adults caregivers, <sup>52</sup> Self-care for PWD caregivers, <sup>53</sup> Abuse prevention for PWD family caregivers, <sup>54</sup> Psychoeducation on memory loss for caregivers and older adults. <sup>55</sup> |
|                          | Training on specific geriatric syndromes, health conditions and skills-based care   | 3                       | Huang <i>et al</i> , <sup>56</sup> Simmons <i>et al</i> , <sup>57</sup> Ford <i>et al</i> <sup>58</sup>   | Training on aggressive behaviour of people with dementia, <sup>56</sup> Nutritional care delivery for nonnursing staff, <sup>57</sup> Training on chronic disease self-management. <sup>58</sup>   |
|                          | Training for management of people with dementia   | 3                       | Verkaik <i>et al</i> , <sup>59</sup> Testad <i>et al</i> , <sup>60</sup> Siddiqi <i>et al</i> <sup>61</sup>   | Depression guidelines for PWD, <sup>59</sup> Training on agitation and restraint use for PWD, <sup>60</sup> Staff training on delirium risk factors. <sup>61</sup>   |
|                          | Interventions aimed at creating social support networks   | 2                       | Wang <i>et al</i> , <sup>62</sup> Chien <i>et al</i> <sup>63</sup>  | Family-led mutual support group for PWD, <sup>62</sup> Care programme for families of PWD. <sup>63</sup>   |
|                          | Training on medication review   | 2                       | García-Gollarte <i>et al</i> , <sup>64</sup> Pitkälä <i>et al</i> <sup>65</sup>   | Nursing home physician training on inappropriate prescription, <sup>64</sup> Nurse training on harmful medication. <sup>65</sup>   |
|                          | Training for infection prevention and control measures  | 2                       | Yeung <i>et al</i> <sup>66</sup> Ho <i>et al</i> <sup>67</sup>  | Hand hygiene intervention. <sup>66</sup> <sup>67</sup>   |
|                          | Training for on preventing malnutrition   | 1                       | Lorefält and Wilhelmsson <sup>68</sup>  | Staff training to increase energy intake of residential older adults. <sup>68</sup>  |
|                          | Training on preventing pressure injury  | 1                       | Stern <i>et al</i> <sup>69</sup>  | Pressure ulcer treatment through multidisciplinary teams via telemedicine. <sup>69</sup>   |
|                          | Training for promoting oral health  | 1                       | Poisson <i>et al</i> <sup>70</sup>  | Nutritional and oral care training for nursing home staff. <sup>70</sup>   |
|                          | Training to identifying deterioration signs in functioning (cognition, mood, vitality, mobility, vision, hearing, etc.) and its management and referral | 1                       | Little <i>et al</i> <sup>71</sup>   | Training on identification and management of deterioration in care home residents. <sup>71</sup>   |
|                          | Training on violence prevention and detection   | 1                       | Teresi <i>et al</i> <sup>72</sup>   | Staff training targeting resident-to-resident elder mistreatment. <sup>72</sup>  |
|                          | Training on palliative care assessment  | 2                       | Bökberg <i>et al</i> <sup>73</sup><br>Hanson <i>et al</i> <sup>74</sup>   | Training on palliative care need identification and symptom management for staff in nursing home, <sup>73</sup> Goals of care to improve decision making and palliative care for PWAD. <sup>74</sup>   |
|                          | Training to manage pain   | 1                       | Rostad <i>et al</i> <sup>75</sup>   | Training on pain assessment and analgesic use on residents with severe dementia. <sup>75</sup>   |

Continued

Table 5 Continued

| Subdomain   | Clustered interventions  | Frequency of appearance | Reference  | Examples of included interventions*  |
|---|--|-------------------------|--|--|
| Person-centred assessment and care plan development and care planning (n=3) | Person-centred assessment and care plan development  | 21                      | Tikkanen <i>et al</i> , <sup>76</sup> Franse <i>et al</i> , <sup>77</sup> Parsons <i>et al</i> , <sup>78</sup> Leung <i>et al</i> , <sup>79</sup> Daniels <i>et al</i> , <sup>80</sup> De Vriendt <i>et al</i> , <sup>81</sup> de Kerimel <i>et al</i> , <sup>82</sup> Featherstone, <sup>83</sup> Li <i>et al</i> , <sup>84</sup> Tikkanen <i>et al</i> , <sup>85</sup> Ploeg <i>et al</i> , <sup>86</sup> Bleijenberg <i>et al</i> , <sup>87</sup> Hoogendijk <i>et al</i> , <sup>88</sup> Monteserin <i>et al</i> , <sup>89</sup> Godwin <i>et al</i> , <sup>90</sup> Fairhall <i>et al</i> , <sup>91</sup> Fairhall <i>et al</i> , <sup>92</sup> Fairhall <i>et al</i> , <sup>93</sup> Cameron <i>et al</i> , <sup>94</sup> Lindquist <i>et al</i> , <sup>95</sup> Chan and Pang <sup>96</sup> | Comprehensive geriatric assessment-based individually targeted interventions on mobility, <sup>76</sup> Referral to social and health services based on a comprehensive geriatric assessment, <sup>77 78 80-94</sup> Persons centred assessment followed by care management service for the prevention of falls, <sup>79</sup> Screening of needs for personal decisions regarding health support, home needs and care planning. <sup>95 96</sup>  |
|   | Case management, coordination and timely referral to ensure patient-centred continuum care | 16                      | Dolovich <i>et al</i> , <sup>97</sup> Wilson and Bachman, <sup>98</sup> Fleisher <i>et al</i> , <sup>99</sup> Fristedt <i>et al</i> , <sup>100</sup> Granbom <i>et al</i> , <sup>101</sup> Szanton <i>et al</i> , <sup>102</sup> Di Pollina <i>et al</i> , <sup>103</sup> Melnick <i>et al</i> , <sup>104</sup> Imhof <i>et al</i> , <sup>105</sup> Kono <i>et al</i> , <sup>106</sup> van Hout <i>et al</i> , <sup>107</sup> Favela <i>et al</i> , <sup>108</sup> Frese <i>et al</i> , <sup>109</sup> Metzethin <i>et al</i> , <sup>110</sup> Bökberg <i>et al</i> , <sup>111</sup> Jansen <i>et al</i> , <sup>112</sup> Looman <i>et al</i> <sup>113</sup> .   | Achieving health goals and covering older adults needs through volunteers and primary care support, <sup>97</sup> House calls to support home-based care of PWD and PWA, <sup>98</sup> Home visits for individuals with advanced Parkinson's Disease, <sup>99</sup> Mobile geriatric teams, <sup>100</sup> Case management to improve social participation and leisure activities, <sup>101</sup> Behavioural and home repair interventions, <sup>102</sup> Integrated care for older adults with chronic conditions, <sup>103</sup> Home calls for home bound older adults, <sup>104</sup> Advanced practice nurse in-home health consultation programme for community-dwelling older adults, <sup>105</sup> Preventive home visit programme based on a systematic assessment of care needs, <sup>106</sup> Nurse home visits, <sup>107 108</sup> In-home preventive comprehensive geriatric assessment, <sup>109</sup> Multidimensional assessment and care based on a tailor made treatment plan, <sup>110</sup> Home visits for PWD, <sup>111</sup> Case management for older adults with early symptoms of dementia, <sup>112</sup> Integrated care model. <sup>113</sup> |
|   | Assessment of caregiver needs included in the person-centred assessment                    | 8                       | Janse <i>et al</i> , <sup>112</sup> Yu, <sup>114</sup> Tanner <i>et al</i> , <sup>115</sup> Radwany <i>et al</i> , <sup>116</sup> Montgomery <i>et al</i> , <sup>117</sup> Lam <i>et al</i> , <sup>118</sup> Kwok <i>et al</i> , <sup>119</sup> Tuntland H <i>et al</i> <sup>120</sup>   | Integrated and multidisciplinary care for older frail adults, <sup>112</sup> Health and social collaborative case management to optimise the support given to caregivers of frail elderly adults, <sup>114</sup> Community-based dementia care coordination, <sup>115</sup> Advance care planning for older adults including caregivers needs, <sup>116</sup> Assessment of caregivers need and management of burden and depressive symptoms, <sup>117</sup> Case management for people with mild dementia with optimisation of family resources and community mobilisation, <sup>118</sup> Case management for older people with early dementia and to reduce caregiver burden, <sup>119</sup> Reablement for community-dwelling older adults. <sup>120</sup>   |

\*For details please see online supplemental annex 1 'Detailed interventions'.

PWD, People with dementia; PWA, People with Alzheimer; PWAD, People with advanced dementia.



**Table 6** Interventions for the maintenance of intrinsic capacity (n=18)

| Subdomain                                | Clustered interventions                                    | Frequency of appearance | Reference   | Examples of included interventions*  |
|--|--|-------------------------|---|--|
| Vitality (nutrition and hydration) (n=4) | Interventions to prevent malnutrition and dehydration      | 8                       | Black <i>et al.</i> , <sup>121</sup> Kwok <i>et al.</i> , <sup>122</sup> Steven <i>et al.</i> , <sup>123</sup> Simmons <i>et al.</i> , <sup>124</sup> Stange <i>et al.</i> , <sup>125</sup> Carlsson <i>et al.</i> , <sup>126</sup> Simmons <i>et al.</i> , <sup>127</sup> Krikorian <i>et al.</i> <sup>128</sup> | Therapeutic diets for long-term care residents, <sup>121</sup> Dietary interventions promote intakes of fruit, vegetable, fish and lower salt, <sup>122</sup> Hydration monitoring app, <sup>123</sup> Nutrition interventions on food, beverage, and supplement intake, <sup>124</sup> Low volume, nutrient- and energy-dense oral nutritional supplement, <sup>125</sup> High-intensity exercise and protein supplement, <sup>126</sup> Oral liquid nutrition supplementation and snack foods and fluids between meals, <sup>127</sup> Blueberry supplementation. <sup>128</sup> |
|  | Food modification  | 4                       | Pouyet <i>et al.</i> , <sup>129</sup> Lin <i>et al.</i> , <sup>130</sup> Zanini <i>et al.</i> , <sup>131</sup> Beck <i>et al.</i> <sup>132</sup>  | Finger foods for PWA, <sup>129</sup> Montessori method to increase eating ability for institutionalised PWD, <sup>130</sup> Texture-modified food programme for older adults with dysphagia, <sup>131</sup> combination of homemade oral supplements, group exercise and oral care. <sup>132</sup>   |
|  | Mealtime interventions                                     | 2                       | Charras and Fremontier, <sup>133</sup> Kenkmann <i>et al.</i> <sup>134</sup>  | Shared meal times between residents and caregivers, <sup>133</sup> Restaurant-style dining in residential homes. <sup>134</sup>  |
|  | Nutritional counselling                                    | 1                       | Schilp <i>et al.</i> <sup>135</sup>   | Dietetic treatment for undernourished older adults <sup>135</sup>  |
| Oral health (n=1)                        | Interventions to promote oral health                       | 7                       | Coker <i>et al.</i> , <sup>7</sup> Marchini <i>et al.</i> , <sup>136</sup> Juthani-Mehta <i>et al.</i> , <sup>137</sup> De Visschere <i>et al.</i> , <sup>138</sup> Lewis <i>et al.</i> , <sup>139</sup> Sumi <i>et al.</i> , <sup>140</sup> Tomata <i>et al.</i> <sup>141</sup>                                  | Bucco-dental healthcare, <sup>7</sup> Oral hygiene protocol, <sup>136</sup> Oral healthcare guideline, <sup>138</sup> Provision of professional oral care, <sup>139</sup> Educational programme and dietitian consultation. <sup>141</sup>   |
| Skin Health (n=1)                        | Interventions for skin care and pressure injury prevention | 2                       | Brienza <i>et al.</i> , <sup>142</sup> Hahnel <i>et al.</i> , <sup>143</sup>  | Skin protection wheelchair seat cushions, <sup>142</sup> Standardised skin care regimens on skin dryness. <sup>143</sup>   |
| Visual capacity (n=1)                    | Screening for vision loss                                  | 1                       | Sánchez <i>et al.</i> <sup>144</sup>  | Functional vision screening. <sup>144</sup>  |

Continued

Table 6 Continued

| Subdomain                    | Clustered interventions   | Frequency of appearance | Reference  | Examples of included interventions*   |
|------------------------------|---|-------------------------|--|---|
| Cognitive capacity (n=3)     | Interventions aimed at mitigating cognitive decline   | 13                      | Cohen-Mansfield <i>et al.</i> , <sup>145</sup> Janata, <sup>146</sup> Aslaksen, <sup>147</sup> Azcurra, <sup>148</sup> Wenborn <i>et al.</i> , <sup>149</sup> Buettner <i>et al.</i> , <sup>150</sup> van der Ploeg <i>et al.</i> , <sup>151</sup> van Haitsma <i>et al.</i> , <sup>152</sup> Cho, <sup>153</sup> van Haefften-van Dijk <i>et al.</i> , <sup>154</sup> Morgan, <sup>155</sup> Haslam <i>et al.</i> , <sup>156</sup> Galik <i>et al.</i> <sup>157</sup> | Non-pharmacological agitation management on PWD, <sup>145</sup> Agitation management on PWA using music, <sup>146</sup> Reminiscence for PWD, <sup>148</sup> Occupational therapy to increase activity levels on older adults, <sup>149</sup> Individually prescribed recreation therapy, <sup>150</sup> interaction activities based on Montessori principles for PWD, <sup>151</sup> Music therapy-singing group for PWD, <sup>153</sup> Day care with socially integrated, community-based support programme for PWD, <sup>154</sup> Reminiscence for older adults, <sup>156</sup> Function-focused care for PWD. <sup>157</sup> |
|                              | Interventions aimed at decreasing behavioural, psychological symptoms of people with dementia | 5                       | Kolanowski <i>et al.</i> , <sup>158</sup> Cohen-Mansfield <i>et al.</i> , <sup>159</sup> Fu <i>et al.</i> , <sup>160</sup> Moyle <i>et al.</i> , <sup>161</sup> Gitlin <i>et al.</i> <sup>162</sup>  | Activity programme based on the Need-Driven Dementia-Compromised Behaviour model, <sup>158</sup> Non-pharmacologic interventions for agitation PWD, <sup>159–161</sup> Modifiable environmental stressors to increase functionality. <sup>162</sup>   |
|                              | Virtual reality usage for cognitive stimulation   | 1                       | dos Santos Mendes <i>et al.</i> <sup>163</sup>   | Virtual-reality-based cognitive training in Parkinson's. <sup>163</sup>   |
| Psychological capacity (n=2) | Psychosocial/non-pharmacological interventions to address anxiety and depression              | 5                       | Sung <i>et al.</i> , <sup>164</sup> Davidson <i>et al.</i> , <sup>165</sup> Dozeman <i>et al.</i> , <sup>166</sup> Chuang <i>et al.</i> , <sup>167</sup> Moretti <i>et al.</i> <sup>168</sup>  | Music for anxiety reduction, <sup>164</sup> acceptance and commitment therapy for symptoms of depression and anxiety in older adults, <sup>165</sup> Psychotherapeutic intervention of depression and anxiety, <sup>166</sup> Pet therapy. <sup>168</sup>   |
|                              | Screening assessing for depressive symptoms and suicide prevention                            | 2                       | Lohman <i>et al.</i> , <sup>169</sup> Kim and Yang <sup>170</sup>  | Home visits including suicide risk assessment. <sup>169</sup> Group therapy to provide peer support and to enhance social integration. <sup>170</sup>   |
| Sleep hygiene (n=1)          | Interventions to improve sleep hygiene  | 4                       | Figueiro <i>et al.</i> , <sup>171</sup> Royer <i>et al.</i> , <sup>172</sup> Wu <i>et al.</i> , <sup>173</sup> McCurry <i>et al.</i> <sup>174</sup>  | Light therapy, <sup>171–173</sup> Light therapy and increased physical activity. <sup>174</sup>   |

Continued

Table 6 Continued

| Subdomain   | Clustered interventions  | Frequency of appearance | Reference   | Examples of included interventions*   |
|---|--|-------------------------|---|---|
| Locomotor capacity (n=2)                                  | Multimodal exercise programme  | 68                      | Boström <i>et al.</i> , <sup>175</sup> Stolee <i>et al.</i> , <sup>176</sup> Schreiber <i>et al.</i> , <sup>177</sup> Lustosa <i>et al.</i> , <sup>178</sup> Kanda <i>et al.</i> , <sup>179</sup> Barthalos <i>et al.</i> , <sup>180</sup> Zech <i>et al.</i> , <sup>181</sup> Henwood <i>et al.</i> , <sup>182</sup> Langlois <i>et al.</i> , <sup>183</sup> Ontake <i>et al.</i> , <sup>184</sup> Wu <i>et al.</i> , <sup>185</sup> Makizako <i>et al.</i> , <sup>186</sup> Foley <i>et al.</i> , <sup>187</sup> Cesari <i>et al.</i> , <sup>188</sup> Freiburger <i>et al.</i> , <sup>189</sup> Clemson <i>et al.</i> , <sup>190</sup> Grönstedt <i>et al.</i> , <sup>191</sup> Villareal, <sup>192</sup> Pollock, <sup>193</sup> Tounignant, <sup>194</sup> Miller <i>et al.</i> , <sup>195</sup> Danilovich <i>et al.</i> , <sup>196</sup> Giné-Garriga <i>et al.</i> , <sup>197</sup> Edgren <i>et al.</i> , <sup>198</sup> Kamegaya <i>et al.</i> , <sup>199</sup> Clegg <i>et al.</i> , <sup>200</sup> Venturelli <i>et al.</i> , <sup>201</sup> Sievänen <i>et al.</i> , <sup>202</sup> Cadore <i>et al.</i> , <sup>203</sup> Bösjner <i>et al.</i> , <sup>204</sup> Brustio <i>et al.</i> , <sup>205</sup> Kovács <i>et al.</i> , <sup>206</sup> Comans <i>et al.</i> , <sup>207</sup> Krampe <i>et al.</i> , <sup>208</sup> da Silva Borges <i>et al.</i> , <sup>209</sup> Jeon <i>et al.</i> , <sup>210</sup> Ožić <i>et al.</i> , <sup>211</sup> Broadbent <i>et al.</i> , <sup>212</sup> Bainbridge <i>et al.</i> , <sup>213</sup> Esculler <i>et al.</i> , <sup>214</sup> Mhatre <i>et al.</i> , <sup>215</sup> Pompeu <i>et al.</i> , <sup>216</sup> Mugueta-Aguinaga and Garcia-Zapirain, <sup>217</sup> Hakim <i>et al.</i> , <sup>218</sup> Daniel, <sup>219</sup> Agmon <i>et al.</i> , <sup>220</sup> van den Berg <i>et al.</i> , <sup>221</sup> Shih <i>et al.</i> , <sup>222</sup> Ariati <i>et al.</i> , <sup>223</sup> Fu <i>et al.</i> , <sup>224</sup> Chen <i>et al.</i> , <sup>225</sup> Watt <i>et al.</i> , <sup>226</sup> Chen <i>et al.</i> , <sup>227</sup> Sato <i>et al.</i> , <sup>228</sup> Yamada <i>et al.</i> , <sup>229</sup> Tarazona-Santabalbina <i>et al.</i> , <sup>230</sup> Roach <i>et al.</i> , <sup>231</sup> Edgren <i>et al.</i> , <sup>232</sup> Rodriguez-Diaz <i>et al.</i> , <sup>233</sup> Serra-Rexach <i>et al.</i> , <sup>234</sup> Underwood <i>et al.</i> , <sup>235</sup> Liu <i>et al.</i> , <sup>236</sup> Hagedorn and Holm, <sup>237</sup> Hsu <i>et al.</i> , <sup>238</sup> Nomura <i>et al.</i> , <sup>239</sup> Taylor <i>et al.</i> , <sup>240</sup> Yao <i>et al.</i> , <sup>241</sup> Buckinx <i>et al.</i> <sup>242</sup> | High-intensity functional exercise, <sup>175</sup> 186 Volunteer-led in-home exercise programme, <sup>176</sup> Fitness training, <sup>177</sup> Resistance exercise, <sup>178</sup> 179 Low-intensity training, <sup>179</sup> 180 Muscle strenght, <sup>181</sup> 203 In home exercise, <sup>182</sup> 186 199 234 Exercise training and physical activity, <sup>183</sup> 184 187 188 191 192 197 201 204 206 228 231 233 235-237 Exergaming and physical therapy, <sup>190</sup> 212-224 Strength and balance exercise, <sup>189</sup> 190 210 211 225 229 232 235 Whole-body vibration in addition to strength and balance, <sup>193</sup> 202 242 Tai Chi exercises, <sup>190,234,235,236,237</sup> Neuromotor training, <sup>205</sup> Dance-based physical therapy, <sup>208</sup> 209 Stretching exercises, <sup>225-227</sup> |
| Exercise programme for those with limitations in mobility |  | 3                       | Ito <i>et al.</i> , <sup>243</sup> Slaughter <i>et al.</i> , <sup>244</sup> Muramatsu <i>et al.</i> <sup>245</sup>  | Home visit locomotion training, <sup>243</sup> 244 Chair-bound movements. <sup>245</sup>  |
| Bladder and bowel capacity (n=2)                          | Interventions to improve bowel function  | 2                       | Huang <i>et al.</i> , <sup>246</sup> van den Nieuwboer <i>et al.</i> <sup>247</sup>   | Pamphlets including strategies for reducing constipation, <sup>246</sup> Probiotic fermented milk. <sup>247</sup>   |
|   | Interventions to improve bladder function including management of urinary incontinence | 1                       | Talley <i>et al.</i> <sup>248</sup>   | Pelvic floor training and physical activity. <sup>248</sup>   |

Continued

Table 6 Continued

| Subdomain            | Clustered interventions  | Frequency of appearance | Reference   | Examples of included interventions*  |
|----------------------|--|-------------------------|---|--|
| Multicomponent (n=1) | Combination of two or more of the above interventions (ie, Multimodal exercise +nutrition) | 15                      | Gené Huguet <i>et al</i> , <sup>249</sup> Lewin <i>et al</i> , <sup>250</sup> Serra-Prat <i>et al</i> , <sup>251</sup> Kimura <i>et al</i> , <sup>252</sup> Rydwik <i>et al</i> , <sup>253</sup> Abizanda <i>et al</i> , <sup>254</sup> Haider <i>et al</i> , <sup>255</sup> Winzer <i>et al</i> , <sup>256</sup> Kwon <i>et al</i> , <sup>257</sup> Lu <i>et al</i> , <sup>258</sup> Ng <i>et al</i> , <sup>259</sup> Yuri <i>et al</i> , <sup>260</sup> Apóstolo <i>et al</i> , <sup>261</sup> Jang <i>et al</i> , <sup>262</sup> Ruiques <i>et al</i> . <sup>263</sup> | Combination of exercise, nutrition, polypharmacy and social assessment, <sup>249</sup> Combination of case management, nutrition, exercise, depression assessment and prevention and addressing loneliness, <sup>250</sup> Physical activity and a nutrition, <sup>251–255</sup> Physical activity, nutrition and social support, <sup>256</sup> Physical activity, nutrition and cognitive component, <sup>258</sup> Physical activity, nutrition and cognitive component, <sup>259</sup> Physical activity and cognition, <sup>261</sup> Physical activity, nutrition, hazard assessment, polypharmacy and depression, <sup>262</sup> Care planning, case management, medication reviews and multidisciplinary team meetings. <sup>263</sup> |

\*For details please see online supplemental annex 1 'Detailed interventions'. PWD, People with dementia; PWA, People with Alzheimer;

exercises to tackle loneliness and strive for a search of meaning and belonging. Specific non-pharmacological interventions targeting PWD were identified, these aimed at decreasing psychological and behavioural symptoms such as agitation, aggressiveness and depression. Another set of non-pharmacological interventions to promote mental health among older people was reported and included screening and appraisal of depression and anxiety, while only one aimed at preventing suicide. Sleep hygiene was reported in four studies, which aimed at improving the circadian rhythm by adding light therapy and structured day routines.

The multimodal exercise programme was recorded as the most frequently appearing intervention in this study (n=68). These interventions mainly focused on giving older adults the possibility of engaging in physical activity and exercising with the aim of improving muscle power, strength, resistance and balance alone or in combination and on improving stretching. Interestingly, an increasing relevant role of exergames on older people's exercising was detected. Several studies reported on specific multimodal exercise interventions conducted through exergames. Similarly relevant were the multicomponent interventions, which mainly reported on combinations of multimodal exercises and nutritional interventions or those to improve cognition.

#### Interventions for the optimisation of functional ability

These interventions focused on the interactions between older people and their environment (table 7). Two studies targeted the mobility of older people in their community and proposed buddy-based programmes and volunteer based models to promote mobility. Other interventions within this domain aimed at maintaining older people's capacity of building and maintaining relationships by engaging in letter writing activities or reminiscence exercises on the search for meaning of their lives. Lastly, other studies targeted interventions to foster continued opportunities for learning, growing and decision-making. These were related workshops for the better understanding of ageing and disease, or interventions to strengthening older adult's capacity to move in an environment that they perceive as dangerous. Lastly, we identified one intervention using artificial intelligence in form of robots to address loneliness.

#### Additional environmental and structural interventions

Table 8 summarises the results for this thematic area. The environmental modifications of housing settings were reported. These targeted the modification of bathing facilities, changing flooring surfaces and lighting hallways. Only one study reported an older-young people combined housing model.

Fall preventions were often mentioned in the scientific literature. Interventions included a person-centred risk assessment to screen older people's risk and identify modifiable settings. Another set of interventions targeted

**Table 7** Interventions for the optimisation of functional ability (n=4)

| Subdomain                              | Clustered interventions  | Frequency of appearance | Reference   | Examples of included interventions*   |
|--|--|-------------------------|---|---|
| Moving around (n=1)                    | Interventions to promote mobility in the community   | 2                       | Clark <i>et al</i> , <sup>264</sup> Rantanen <i>et al</i> <sup>265</sup>  | Lifestyle modification and strategies to overcome everyday obstacles, <sup>264</sup> Outdoor activities to promote mobility and social participation. <sup>265</sup>  |
| Build and maintain relationships (n=2) | Interventions to build and maintain relationships  | 4                       | Duyan <i>et al</i> , <sup>266</sup> Imai <i>et al</i> , <sup>267</sup> Chochinov <i>et al</i> , <sup>268</sup> Tsai and Tsai <sup>269</sup>   | Support group therapy, <sup>266</sup> Reception of postcards from members of the community, <sup>267</sup> Dignity therapy, <sup>268</sup> Videoconferences with family members. <sup>268</sup>   |
|  | Artificial intelligence in form of robots aimed at addressing loneliness and providing companionship | 1                       | Moyle <i>et al</i> <sup>270</sup>   | Robotic Seal as a therapeutic tool to tackle loneliness <sup>270</sup>  |
| Learn, grow and make decisions (n=1)   | Interventions to foster continued opportunities for learning, growing and decision making            | 6                       | Behm <i>et al</i> , <sup>271</sup> Gustafsson <i>et al</i> , <sup>272</sup> Spoorenberg <i>et al</i> , <sup>273</sup> Barrios <i>et al</i> , <sup>274</sup> Yao and Chen, <sup>275</sup> Masuya <i>et al</i> <sup>276</sup> | Psychoeducation on topics related to ageing and strategies to face symptoms, <sup>271</sup> Meetings for older community-dwelling persons on loneliness, social network, healthy ageing and social support, <sup>272–274</sup> Horticulture, <sup>275</sup><br><sup>276</sup> |

\*For details please see online supplemental annex 1 'Detailed interventions'.

cognitive interventions to manage older adults' fear of falling.

Interventions to prevent and control multiple, unnecessary medicine prescriptions seemed to be a field of interest within the scientific literature. Authors proposed various interventions to monitor polypharmacy at long-term care facilities, by including external pharmacist review on residents' prescriptions and enhancing interdisciplinary cooperation between physicians, nurses and pharmacists. One study proposed a primary care, at a home setting, approach to this issue by suggesting the external revision of older adults' prescriptions from a pharmacist. Vaccination interventions were reported in long-term care facilities, particularly against influenza and pneumonia.

Perhaps reflecting the search teams, only two studies addressed pain management and palliative and end-of-life care. To address pain in older adults one study proposed hand-massage as an alternative therapy to alter pain perception. To provide timely palliative and end-of-life care one study reported on home visits providing primary medical care from time of the enrolment in the programme with 24 hours availability and maintenance of close working relationships with community-based nursing and social service agencies, patients and their caregivers.

Lastly, several interventions involving technology or the use of technology as means to provide long-term care were reported. Although these interventions appeared in several subdomains, we decided to cluster all these interventions under one subdomain named digital health.

Rather than the type of support that they were using or the aimed they had, the common factor leading to clusterisation was the use of technology. These interventions aimed to provide cognitive stimulation and to store health information. As mentioned before, technology has also found its niche in multimodal exercise through exergames.

## DISCUSSION

This study provides an overview of the identified interventions that have been evaluated and published in the scientific literature in the last 10 years. A total of 49 clusters using 273 formulations were identified, classified in relation to WHO's public health framework of healthy ageing in 20 subdomains. The interventions varied greatly between each other and represented different thematic areas, this resonates with the complex landscape of long-term care provision and the challenge of covering older adults multiple needs at various levels and settings. The categorisation following healthy ageing domains is a first attempt to understanding the field of research. As long-term care is a continuum of care rather than a categorical matter, the domains we propose at some points overlap.

Regarding the top reported interventions, they show a trend towards offering physical activity and exercise to older adults seeking to maintain functional ability, towards implementing person-centred care programmes and interventions, coordinating care, training caregivers and combining interventions such as physical activity and nutritional advice. As a matter of fact, the implementation

**Table 8** Additional environmental and structural interventions (n=11)

| Subdomain                                   | Clustered interventions                            | Frequency of appearance | Reference  | Examples of included interventions*   |
|---|--|-------------------------|--|---|
| Modification to the built environment (n=2) | Environmental modifications                        | 5                       | Mitoku and Shimanouchi, <sup>277</sup> Whitehead <i>et al</i> , <sup>278</sup> Gustavsson <i>et al</i> , <sup>279</sup> de Almeida Mello <i>et al</i> , <sup>280</sup> Borrows and Holland <sup>281</sup>  | Home modifications to increase accessibility and reduce risks, <sup>277</sup> Bathing adaptations, <sup>278</sup> Impact absorbing flooring, <sup>279</sup> Home adaptations and training with a new assistive device. <sup>280,281</sup>   |
|   | Housing models                                     | 1                       | Arentshorst <i>et al</i> <sup>282</sup>  | Intergenerational Housing. <sup>282</sup>   |
| Fall prevention (n=3)                       | Person centred fall risks screening and assessment | 7                       | Gitlin, <sup>283</sup> Möller <i>et al</i> , <sup>284</sup> Fahliström <i>et al</i> , <sup>285</sup> Vind <i>et al</i> , <sup>286</sup> Otaka <i>et al</i> , <sup>287</sup> Casteel <i>et al</i> , <sup>288</sup> Markle-Reid <i>et al</i> <sup>289</sup>              | Fall risk assessment and prevention, <sup>283,286,289</sup> Case management with fall risk assessment, polypharmacy evaluation, psychoeducation and house visits, <sup>284</sup> Training nurses for home visits and individually designed home exercise programmes aimed at balance, leg strength and walking ability, <sup>287</sup> Falls risk assessment and psychoeducation, <sup>287</sup> A falls and fire prevention and assessment and educational workshops. <sup>288</sup> |
|   | Interventions to manage fear of falling            | 3                       | Dorresteijn <i>et al</i> , <sup>290</sup> Faes <i>et al</i> , <sup>291</sup> Huang <i>et al</i> <sup>292</sup>   | Psychoeducation and behavioural modification to assess, address and manage fear of falling. <sup>290-292</sup>  |
|   | Environmental modifications to prevent falls       | 1                       | Tchalla <i>et al</i> <sup>293</sup>  | Falls risk assessment plus nightlight path to improve awareness and teleassistance to coordinate help in case of a fall. <sup>293</sup>   |
| Pain management (n=1)                       | Interventions to manage pain                       | 1                       | Cino <sup>294</sup>  | Aromatherapy hand massage for older adults with chronic pain. <sup>294</sup>  |
| Polypharmacy (n=1)                          | Screen and management of polypharmacy              | 7                       | Olsson <i>et al</i> , <sup>295</sup> Milos <i>et al</i> , <sup>296</sup> Bruhant and Wermeille, <sup>297</sup> Garfinkel and Mangin, <sup>298</sup> Patterson <i>et al</i> , <sup>299</sup> Lapane <i>et al</i> , <sup>300</sup> Halvorsen <i>et al</i> <sup>301</sup> | Programme for the systematic review of medications by physicians, <sup>295,300</sup> Programme for the systematic review of medications by pharmacist, <sup>296</sup> Programme for the systematic review of medications by nurses and physicians, <sup>299</sup> Computerised system to identify medications that may contribute to delirium risk, <sup>298</sup>  |
|   | Palliative care and end of life care (n=1)         | 1                       | Ornstein <i>et al</i> <sup>302</sup>   | Home palliative care team visits. <sup>302</sup>  |

Continued

Table 8 Continued

| Subdomain                                | Clustered interventions  | Frequency of appearance | Reference   | Examples of included interventions*  |
|--|--|-------------------------|---|--|
| Digital health (n=2)                     | Use of Telemedicine to provide long-term care services                               | 7                       | Orlandoni et al, <sup>303</sup> Dham et al, <sup>304</sup> Dy et al, <sup>305</sup> Queyroux et al, <sup>306</sup> Upatisinget al, <sup>307</sup> Gellis et al, <sup>308</sup> Lewis et al <sup>309</sup> | Video consultation for enteral nutrition, <sup>303</sup> Telepsychiatry consultation, <sup>304</sup> Teleconsultation for glycaemic control of patients with DM2, <sup>305</sup> Teleconsultation with a dentist for oral health assessment, <sup>306</sup> Telemonitoring of frailty status, <sup>307</sup> Telemonitoring of patients with heart or chronic respiratory failure, <sup>308</sup> Community virtual ward to support patients with chronic conditions and deterioration at home. <sup>309</sup> |
|  | Digital tracking and decision support system to capture and store health information | 1                       | Makai et al <sup>310</sup>  | Technologies incorporating patients information to ease case management. <sup>310</sup>  |
| Management of communicable disease (n=1) | Vaccination for older adults   | 2                       | Poscia et al, <sup>311</sup> Chan et al <sup>142</sup>  | Influenza and pneumococcal vaccination. <sup>143 144</sup>   |

\*For details please see online supplemental annex 1 'Detailed interventions'.

of comprehensive geriatric assessment appeared as overarching topic across the domains. This approach could be considered a preparatory step for long-term care service provision based on need. Our search strategy might have not been able to capture other long-term care interventions like food-on-wheels, management of incontinence and chronic disease management among others, thus such interventions are missing. In a next consultation step we will expose the interventions to long-term care and ageing experts to add missing interventions.

All the studies and interventions detected through our search strategy corresponded to those provided in HIC and UMCs. No interventions provided in lower-middle-income or low-income countries were identified. This under-representation can result from lack of resources to conduct research on these topics but definitely does not mean a lack of long-term care interventions in low-resource settings. Also important to consider is the fact that our search focused on international-overarching databases, we did not search regional databases were relevant local information might be stored. Therefore, the outcomes of this study represent the findings on global databases. Further research can target interventions published on regional databases.

According to the findings of this study, home, community and long-term care facilities account for the most frequent settings where this type of care is provided. Although interventions were more reported at institutional settings, long-term care transcends the barriers of facility and facility-like settings to the community and home. Communities should, therefore, be considered as a key setting for long-term care provision. Promoting greater access and sustainable costs, can be particularly helpful to expand coverage of services within a country's benefit packages implementing Universal Health Coverage and ensuring close proximity to primary care.<sup>41</sup> However, a common or agreed definition for 'settings' was not provided. This study's scope focused only on collecting the settings as reported in the studies and did not strive to harmonise the definition of settings.

WHO's programme on integrated care for older people (ICOPE)<sup>35</sup> has done extensive work to move away from disease based approaches and look into interventions that optimise intrinsic capacity. The retrieved interventions from the scoping review for long-term care have shown to be inclusive of those interventions for the ICOPE guidelines,<sup>35</sup> highlighting the relevance of integrated care within long-term care services.

However, this study revealed gaps in potential important long-term care interventions. Out of the six important domains of intrinsic capacity (vitality, locomotor capacity, psychological capacity, cognitive capacity, visual capacity, hearing capacity),<sup>35</sup> no specific interventions for hearing capacity was identified. Furthermore, functional ability is about having the capabilities that enable all people to be and do what they have reason to value. This includes a person's ability to meet their basic needs; learn, grow and make decisions; be mobile; build and maintain

relationships; and contribute to society.<sup>2</sup> After a categorisation of the interventions retrieved, we found that still there was a substantial gap of interventions addressing basic needs, including social care and support services, and interventions that enhance societal contribution.

### Weaknesses

This study followed a scoping review design to provide an overview of the existing evidence on the topic and did not include risk bias assessment or formal assessment of methodological quality. Risk bias assessment is usually not conducted on scoping reviews.<sup>35 36</sup>

Additionally, the scope of this study did not include a quality appraisal or analysis of their outcomes. Therefore, results only depict the domains and subdomains where the interventions could be categorised. The numerous outcome parameters, various settings and different populations reduced the comparability of studies. Additionally, data disaggregation by sex and age groups was not possible since many studies missed this information. Better disaggregation would broaden the understanding of the population receiving long-term care.

### Further research

This study attempted a categorising of long-term care interventions in relation to WHO's public health framework of healthy ageing. Further research needs to be conducted to design an improved categorisation and should ideally need to include the voices of academic and policy experts on the field, and older adults.<sup>42</sup> The low-resource setting under-representation needs to be tackled by including specific interventions from this settings. This finding highlights the need to support research efforts and capacity building strategies in under-represented settings to translate long-term care traditional provision into scientific literature. It also demands the attention from research groups, decision-makers and other stakeholders to thoroughly consider long-term care interventions locally provided, and not reported, as sources of crucial information on long-term care provision and coverage.

Further research is required to incorporate the vision and practices of various settings regarding the provision of long-term care interventions (eg, at the community level). In the case of using this list for informed decision making, consensus processes or as a repository of interventions, special attention has to be given to the cultural, regional applicability of the here included interventions in specific contexts.

Further research should address equity issues more broadly to include focus on addressing specific long-term care needs to optimise functional ability and achieve healthy ageing in specific under-represented populations.

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