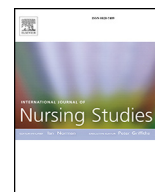


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Physical, social, and symbolic environment related to physical activity of older individuals in long-term care: A mixed-method systematic review

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ABSTRACT

Background: Being active in old age is vital for health and well-being. Inactivity decreases functional ability, mobility, and increases care dependence and risk of falling. Worryingly, older individuals in long-term care settings spend most of their waking day sitting or lying down. The environment should be of special interest considering active life in long-term care. This review aimed to synthesize evidence and provide a comprehensive understanding of the environmental aspects related to the physical activity of older individuals in long-term care settings. **Methods:** A mixed-method systematic review, registered in PROSPERO (CRD42021251899; May 30th, 2021) was conducted using four international scientific databases (CINAHL, PubMed, Cochrane, PsychInfo). The searches were conducted from the earliest possible date till Dec 31st, 2020. All empirical peer-reviewed studies published in the English language in scientific journals were included if they had investigated environmental aspects (physical, social, and/or symbolic) in relation to the physical activity of older individuals in long-term care facilities providing full-time care. Critical appraisal was conducted using Joanna Briggs Institute's Critical Appraisal tools, and the Mixed Method Appraisal Tool. Abductive thematic analysis and a conceptual map were used to synthesize the evidence.

Results: Altogether 838 original articles were assessed for eligibility, resulting in 30 included studies. No studies were excluded based on quality. The mean age of residents was over 75 when reported. Their cognitive and physical functioning varied. The most frequent setting was nursing home. Three themes and corresponding descriptive themes were formulated, including 1) Physical environment: accessible and safe living environment, activating physical environment, 2) Social environment: supportive professionals, the role of other people, adequate activities to socialize and be active, and 3) Symbolic environment: policy at multiple levels, values of organizations and professionals. Different environmental aspects within and between the dimensions of the physical, social, and symbolic environment were related to each other.

Conclusions: A comprehensive synthesis of current evidence was provided and may be used for the assessment and development of long-term care settings. However, some aspects may have been missed because they have been addressed with terminology not identified with the word environment or similar concepts. As increasing activity may require actions in multiple dimensions, experimental research should be conducted to develop and test the effects of widescale modifications to existing environments from the needs of residents and fitting for each context. The evidence should be used for the design of new facilities.

Tweetable abstract: Environmental aspects at multiple levels should be addressed to increase the activity of older long-term care residents.

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What is already known

- Older individuals in long-term care settings live inactive lives despite the importance of activity to their health and functioning.
- Environmental aspects should be of special interest as the adaptability to the environment decreases by age, and some aspects have been identified in research to relate to the physical activity of older individuals in long-term care.

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- No prior systematic review of enablers and barriers in the physical, social, and symbolic dimensions of the environment related to the physical activity of older individuals in long-term care settings has been conducted, and is of vital importance to develop activity-supporting environments.

What this paper adds

- This review provides a systematic synthesis of the many environmental aspects related to the physical activity of older individuals in long-term care in the physical, social, and symbolic dimensions of the care environment.
- The findings show that environmental aspects related to physical activity are also related to each other within and between dimensions, thus, assessment of the environmental aspects and actions to modify them should be taken comprehensively and in all the dimensions of the care environment to increase the physical activity of older individuals in long-term care.
- In the future, experimental research, engaging stakeholders in the intervention development process, should be conducted to develop and test the effects of widescale modifications to existing environments from the needs of residents and fitting for each context, and new facilities should be designed considering the recognized aspects impeding and enabling activity.

1. Background

To meet the needs of aging populations, the long-term care environment should be harnessed to the maximum extent to support residents' active living. As worldwide populations are aging (Eurostat, 2021), the health and social systems in all countries are faced with challenges (World Health Organization, 2020). Concurrently, the demand for long-term care increases. In the past decades, older individuals have been observed to increasingly experience more complex health issues and disabilities in long-term care (Barker et al., 2020; Palese et al., 2016). In these settings, individuals are often multi-morbid (Sverdrup et al., 2018), require assistance to accomplish activities of daily living, and experience mobility limitations, thus, requiring personal assistance or use aids to walk and transfer (Palese et al., 2016). As the functioning of an individual decreases so does their adaptability to their environment (Lawton and Nahemow, 1973). The long-term care environment should, therefore, promote independence, autonomy, and a healthy and fulfilling life for its residents by supporting their functioning. Unfortunately, long-term care environments have been criticized as being hospital-like (Wahl et al., 2012) and may support dependency rather than independence and autonomy (Moilanen et al., 2021). At present, older individuals in long-term care spend most of their waking day ($\geq 85\%$) sitting or lying down (den Ouden et al., 2015; Parry et al., 2019). Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy consumption (Caspersen et al., 1985). It is vital for the health, well-being, and functional ability of older individuals (World Health Organization, 2010). A decline in physical activity leads to a decline in physical fitness resulting in worsening mobility (Ferrucci et al., 2016), and an increased risk of falling (Ho et al., 2021) and care dependency (den Ouden et al., 2015). In addition, decreased functioning lowers the quality of life (Sander et al., 2015), and self-worth of older individuals (Pentecost et al., 2020).

The intensity of physical activities is measured by their energy consumption, as metabolic equivalents. One metabolic equivalent is consumed sitting. (Norton et al., 2010) Recommended weekly levels of physical activity for older adults include moderate-intensity physical activity ($3 < 6$ metabolic equivalents) of at least 150 min, or vigorous-intensity physical activity ($6 < 9$ metabolic equivalents) of at least 75 min. In addition, muscle-strengthening activities at least twice a week, and balance training to prevent falls should be conducted (Norton et al., 2010; World Health Organization, 2010). Being active in older age at

these levels reduces the risk of all-cause and cardiovascular mortality, breast and prostate cancer, dementia, depression, recurrent falls, fractures, disability in activities of daily living, and decline in physical performance (Cunningham et al., 2020). However, for older individuals in long-term care meeting the recommended levels of physical activity is often unrealistic, and they participate mostly in low or light-intensity physical activity (1.6–3 metabolic equivalents), such as walking slowly or doing self-care activities (Mc Ardle et al., 2021; Norton et al., 2010). Nonetheless, activity well below the recommended levels has protective effects for health outcomes (Cunningham et al., 2020). For older long-term care residents being active even at low-intensity levels may improve physical functioning, quality-of-life, balance, postural stability, performance in activities of daily living, and life satisfaction, and decrease fear of falling (Baldelli et al., 2021). It is recommended that older individuals not capable of meeting the recommended weekly levels of physical activity would be as active as they can (World Health Organization, 2010).

Environment supporting functioning is adequately stimulating but does not pose too much environmental stress on an individual's competence level (Lawton, 1989). In nursing theory, the care environment has been depicted as including 1) spatial, 2) temporal, and 3) qualitative characteristics that create the impact of the environment on individuals (Kim, 2010). The spatiality of the environment describes the proximity of environmental elements to a person, determining the directedness of their effects. Temporality describes the continuity and frequency of the presence of these elements, determining the extent of their influence. The quality of the elements affects the degree of the influence. The qualitative dimensions of the environment are 1) physical, 2) social, and 3) symbolic. The physical environment consists of matter-based aspects of the environment, the social environment consists of individuals and groups an individual is in contact with, and the symbolic environment includes ideational, normative, and institutional elements, that exist only in the minds of people. (Kim, 2010) The importance of the environment for the physical activity of older individuals in long-term care has been identified in the research (Anderiesen et al., 2014; Benjamin et al., 2014; Douma et al., 2017). In earlier reviews, environmental aspects have been reported to affect both organized and facilitated activity, such as physical activities in the facilities, and self-initiated activity, such as having walks on one's own, of long-term care residents (Benjamin et al., 2014; Douma et al., 2017). These include factors, such as spaciousness, accessibility, safety, suitable equipment and areas for activities, the number and time of staff, type of care given, and having things to do (Benjamin et al., 2014; Douma et al., 2017). Furthermore, according to the review by Anderiesen et al. (2014), a home-like environment and functional modifications, such as color cues and labelling have shown positive results for the physical activity of residents with dementia (Anderiesen et al., 2014).

Despite the environmental aspects reported in the reviews mentioned before (Anderiesen et al., 2014; Benjamin et al., 2014; Douma et al., 2017), to the best of our knowledge, no systematic review considering enablers and barriers in all the physical, social, and symbolic dimensions of the environment to the physical activity of older individuals in the long-term care setting has been conducted. Promoting the physical activity of older individuals in long-term care is of vital importance. This requires targeting several aspects of the environment at multiple dimensions (Benjamin et al., 2014). Thus, a comprehensive understanding of the environmental aspects related to the physical activity of older individuals in all the qualitative dimensions of the long-term care environment is essential.

1.1. Aim

The present review aims to explore and synthesize evidence and create a comprehensive understanding of aspects in the physical, social, and symbolic dimensions of the environment related to the physical activity of older individuals in long-term care.

2. Methods

2.1. Review methodology

The review protocol was registered with PROSPERO, an International Prospective Register of Systematic Reviews on May 30th, 2021 before data extraction (CRD42021251899). The ESRC Guidance for Narrative Synthesis in Systematic Reviews (Popay et al., 2006) guided the review process and selection of methods. An integrated convergent approach was used. The review process included 1) developing a theoretical model, 2) developing a preliminary synthesis, 3) exploring relationships in the data, and 4) assessing the robustness of the synthesis product. Lawton's theory (Lawton and Nahemow, 1973; Lawton, 1989) of the interdependence of the older individual and their environment was used as a theoretical basis as a guide to formulating the review aim and research questions. Kim's typology (Kim, 2010) of the health care environment as physical, social, and symbolic dimensions was used to further guide the data extraction and synthesis.

2.2. Search strategy

A systematic literature search was conducted by two researchers in four international scientific databases: MEDLINE (PubMed), CINAHL (Ebsco), APA PsychInfo (Ebsco), and the Cochrane Library from the earliest possible date till December 31st 2020. The search terms were chosen based on the inclusion criteria and a broad review of reported keywords in previous literature. The combination of the used keywords was (walk* OR mobility OR move OR movement OR moving OR exercis* OR ambulat* OR physical activ* AND environment* OR life space OR architect AND older adult* OR older people OR elderly OR elder OR resident* OR aging population* AND AB nursing home* OR inhouse OR residential care OR long-term) checked and confirmed to comport with each database by a library information specialist. The searches were focused on title and abstract level and limited to the English language. Reference lists of included studies were screened to supplement the search.

2.3. Eligibility criteria and inclusion of articles

The eligibility criteria for the included studies were defined using the SPIDER terms. The studies were included if they: 1) focused on aging individuals (60 years and older) in long-term care settings (nursing homes, assisted living communities, residential communities, retirement communities) providing full-time care, 2) investigated environmental aspects (physical, social, or symbolic as defined by Kim (2010)) in relation to the physical activity of older individuals in long-term care settings, 3) were empirical studies, 4) provided evidence of residents' physical activity defined as any activity (e.g., activities of daily living, walking, household chores, recreational activities, walking, exercise) resulting in energy consumption produced by skeletal muscles (Caspersen et al., 1985), and 5) were published as research articles in scientific peer-reviewed journals in the English language. The studies were excluded if they 1) focused on community-dwelling older individuals or full-time care was not provided 2) were focused solely on individual factors, 3) were reviews or PhD dissertations, 4) were focused on the ability for physical activity, such as the ability to be mobile or to perform activities of daily living, or investigated the effects of exercise interventions with professional-led training as the main component.

Study selection was conducted in stages by applying the eligibility criteria. The selection was conducted by four researchers at each stage, with the first author assessing all of the articles, and three researchers assessing one-third of the articles each. In unclear cases, inclusion was discussed and agreed upon within the research team. First, titles and abstracts were screened to include relevant studies for full-text assessment. If eligibility was unclear, studies were included to avoid excluding

potentially relevant studies. Second, full texts of included articles were read with the eligibility criteria in mind. All decisions were tracked using a spreadsheet developed for the purpose.

2.4. Quality appraisal

Critical appraisal of included studies was conducted by four researchers, with the first author evaluating all studies and three researchers evaluating one-third each. When the researchers were not in full agreement, a stricter approach to quality assessment was taken and reported. The appraisals were conducted using the Joanna Briggs Institute's Critical Appraisal Checklists according to the study designs (Joanna Briggs Institute, 2020a, 2020b, 2020c, 2020d, 2020e, 2020f). For mixed-method studies, the Mixed Method Appraisal Tool was used (Hong et al., 2018), as no Joanna Briggs Institute's checklist existed. All appraisal tools included questions to be answered with "yes", "no", and "unclear", "not applicable", or "can't tell".

2.5. Data extraction

Data from the included studies were extracted by the first author and presented in tables developed for the purpose, including author, year, country, the aim of the study, study population and sample size (residents, family members, staff, managers, and other stakeholders), characteristics of participants (age, sex, and for older individuals cognition, mobility), facility type and facility size, facility characteristics (public/private/other, physical activity offered, activity personnel employed), study design, data collection and analysis methods, and results. Data extraction of the results was conducted by one researcher reading the results and discussions on the included articles and extracting all empirical data concerning the relationship between the environment and physical activity. The data extraction was discussed with and confirmed by the research team.

2.6. Data synthesis

Data synthesis with an integrated approach was conducted by the first author, discussed with, and confirmed by the research team. Originally planned three analyses of 1) perceptions, 2) observed associations of environment and physical activity, and 3) the effects of interventions were not conducted; this was because a large portion of studies reported the aggregated results as regards participant perceptions and observations, and only two studies investigated the effects of interventions with different exposures and outcomes. As the approach to data synthesis was configuration rather than aggregation (Sandelowski et al., 2012), this decision was justified.

An abductive thematic analysis (Thomas and Harden, 2008) was conducted. The results of the studies were read and familiarized with and coded using NVivo (version 12.6.0.959). This included qualitzing quantitative data by forming narrative interpretations of the quantitative results with codes. For example, in de Boer et al. (2016) residents of green care farms were observed to be significantly more physically active than residents of traditional nursing homes. This was coded as the positive effect of green care. Next, coding was deductively organized under physical, social, and symbolic themes (Kim, 2010). Codes under each theme were familiarized with and descriptive themes were formulated inductively. To explore relationships in the data, a concept map (Cañas and Novak, 2010) was used to illustrate the relationships of different environmental aspects within and between the dimensions of the physical, social, and symbolic environment. Considering the aim of the review, key concepts relating to each dimension were identified and ranked from the most general, inclusive ones (presented on the left) to the more specific, least general concepts (presented on the right). The results of analyses are presented in tables, figures, and narratively.

3. Results

3.1. Search results

The search resulted in 1104 retrieved records from the databases, of which 283 were duplicates. After the screening of titles and abstracts, 48 articles were assessed for eligibility as full-texts, resulting in 24 studies included in the review. Screening the reference lists of included articles, 17 studies were retrieved, of which, 6 articles met the inclusion criteria. Thus, the total number of included studies was 30, and a flow chart of the inclusion of articles is presented in Fig. 1.

3.2. Quality appraisal of included studies

Articles were not excluded from the review based on methodological quality. Methodological issues in qualitative studies were mostly concerning the lack of situating the researcher culturally or theoretically, and the lack of stating the researcher's influence on the research. In cross-sectional studies, the most common methodological issues concerned the lack of considering for confounding factors. In randomized-controlled trials, methodological issues mostly concerned the similarity of groups at baseline and blinding. One out of two randomized-controlled trials did not report the similarity of groups at baseline, and in the other, the groups were not similar. Blinding of treatment assignment had not been conducted in the studies. Of five mixed-method studies, only one had issues in methodological quality, showing some obscurity in the qualitative analysis of the study. Issues in methodological quality are reported in Table 1. Detailed judgments for the critical appraisal items for each study according to the used tool are presented in Supplemental material Table 1.

3.3. Study characteristics

Study characteristics are reported in Table 1. Most of the studies were published in 2010 and after. Seven studies had been published

between 2000 and 2009 and two studies before the 1990s. The studies had been conducted in Australia (n = 1), Belgium (n = 2), Canada (n = 4), Finland (n = 1), Germany (n = 1), Norway (n = 1), the Netherlands (n = 3), Slovenia (n = 1), Sweden (n = 2), Taiwan (n = 2), the UK (n = 3), and the USA (n = 8). One study had been conducted in Spain and the UK (n = 1).

The sample sizes of studies ranged from 2 to 171 participants. Participants had been included by purposive, convenience, and random sampling. Ten studies reported the mean age of residents, which was over 75 years in all studies. Cognitive and physical functioning of older individuals varied within and between studies, when reported. For example, in Kalinowski et al. (2012) the mean score in the Mini-Mental State Examination of participants was 26 (SD 3), whereas in de Boer et al. (2016) the mean score was 8 (SD 6.9). Both studies included participants living in nursing homes. The settings were described in the studies as nursing homes (n = 10), residential care facilities (n = 4), assisted living facilities (n = 5), care homes (n = 2), dementia care units (n = 1), elderly care units (n = 1), psychogeriatric nursing homes (n = 1), and long-term care facilities (n = 4). One study defined the setting as assisted-living/residential care, and one study compared green care, small-scale living facilities, and traditional nursing homes. The size of the units varied within and between studies. For example, in Kalinowski et al. (2012), the number of beds in the participating units ranged from 20 to 230 beds. However, most of the studies did not report this.

3.4. Thematic synthesis

The main themes (Physical, Social, and Symbolic environment) and their corresponding descriptive themes, and example codes and illustrative quotations of the original results are presented in Table 2.

3.4.1. Physical environment

The identified descriptive themes for the theme of the physical environment were: Accessible and Safe living environment, and Activating physical environment.

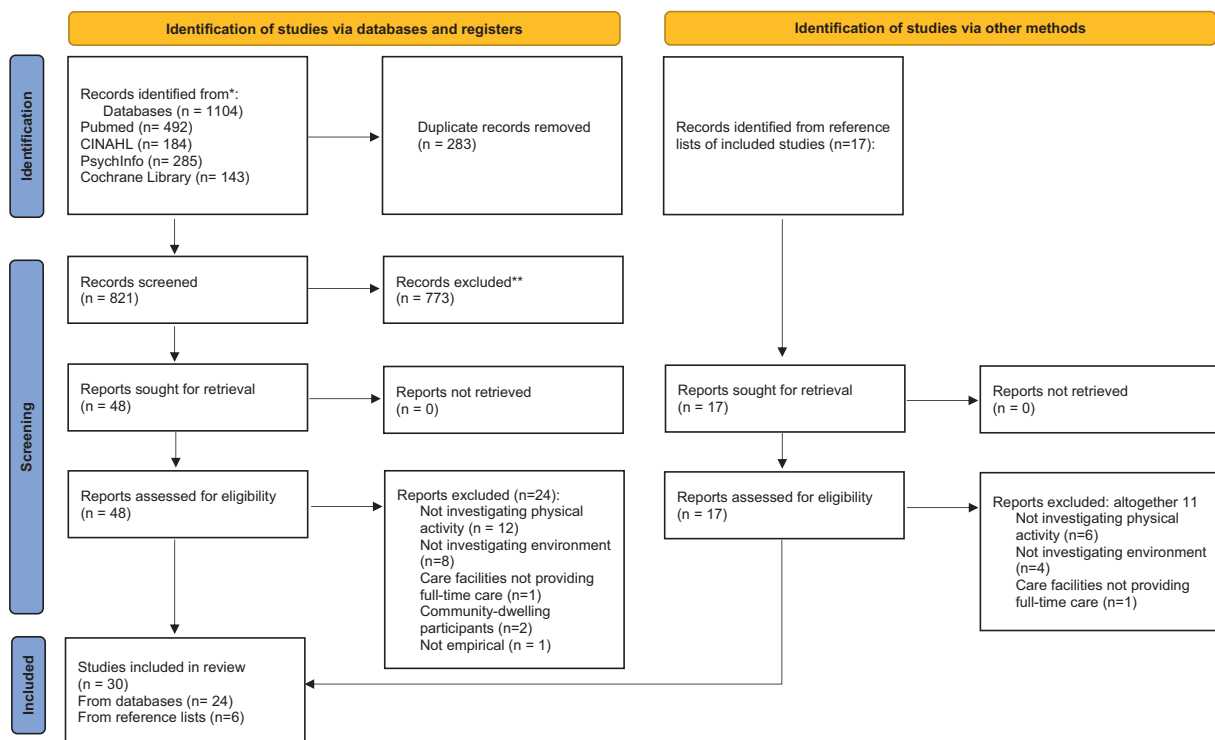


Fig. 1. Flow chart of inclusion of articles (Page et al., 2021).

Table 1

Full descriptive information and results of all studies included in the review.

First author Year Country	Study aim	Methods (qual/quant/ mixed) Data collection Data analysis	Participants (n) Age [†] Gender [†] Mobility (residents) [†] Cognition (residents) [†] Employed at the facility/work experience (staff, managers) [†]	Setting (n) Public/private/other [†] Facility size [†] Physical activity offered [†] Therapists and activity personnel at the unit [†]	Main findings for the relationship of environment and physical activity of older individuals	Issues in methodological quality according to quality appraisal
Qualitative studies ^a						
Benjamin 2011 Canada	Perspectives of residents, staff, and significant others about physical activity.	Qual Focus groups Content analysis	Residents (n = 48): Age: ≥65 Staff (n = 62): Employee ≥6 months, registered nurses, registered practical nurses, health care aides or personal care attendants, nursing supervisors, physiotherapists, and staff or managers from recreation/activity, restorative care, volunteer, and housekeeping services	For-profit (n = 3) and non-profit (n = 6) long-term care facilities Number of beds: for-profit mean 121, non-profit mean 203 Formal activity programs and exercise offered: most facilities 2–3 times/week Physiotherapists in all facilities, occupational therapist in 6 units Volunteers in all facilities	Factors that mitigate the provision of physical activity: inadequate support, pervasive institutional routines, physical environment constraints.	Not stating the researcher's influence on the research or the philosophical perspective
Benjamin 2009 Canada	Examine administrators' perspectives on the meaning of the terms exercise and physical activity, the value of physical activity, and how physical activity is or is not encouraged in their settings.	Qual Interviews Descriptive statistics, content analysis	Significant others (n = 42): ≥18 yo, 3 relatives, 3 friends Administrators (n = 9): Employed at facility ≥3 months	For-profit (n = 3) and non-profit (n = 6) long-term care facilities Number of beds: for-profit mean 121, non-profit mean 203 Formal activity programs and exercise offered: most facilities 2–3 times/week Physiotherapists in all facilities, occupational therapist in 6 units Volunteers in all facilities	Barriers to organizing physical activity: funding, human resources, built physical environment.	Not situating the researcher culturally or theoretically, not stating the researcher's influence on the research or the philosophical perspective
Burke 2020 UK	Reports a study of a physical activity programme in a residential care setting, and on the process used to develop good practice guidance from it, which included input from a range of stakeholders.	Qual Observations, stakeholder consultations Inductive theme development	Residents (n = 33): Living with dementia Consultative group: Health professionals, academics, council representative, program staff, two researchers who conducted the observation study	Nursing homes (n = 6) Dementia care unit (n = 1) Volunteers in all facilities	Important for disseminating best practice for physical activity: promoting the right atmosphere, appropriate environment, good communication, and necessary adaptations.	Not situating the researcher culturally or theoretically, not stating philosophical perspective
Chen 2010 Taiwan	Explore barriers that older adults residing in LTC institutions experience in regular physical activity participation.	Qual Interviews Content analysis	Residents (n = 90): Age: mean 78.5 (SD 6.2) Female 65.6%	Nursing homes (n = 6)	Barriers to physical activity: environmental restrictions as lack of space and equipment, restrictions on activity choices.	Not situating the researcher culturally or theoretically, not stating the researcher's influence on the research
Giné-Garriga	Using service learning and co-creation:	Qual	No known cognitive impairments Residents (n = 22):	Care homes (n = 4):	Barriers to physical activity: knowledge	Not situating the

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Table 1 (continued)

First author Year Country	Study aim	Methods (qual/quant/ mixed) Data collection Data analysis	Participants (n) Age [†] Gender [†] Mobility (residents) [†] Cognition (residents) [†] Employed at the facility/work experience (staff, managers) [†]	Setting (n) Public/private/other [†] Facility size [†] Physical activity offered [†] Therapists and activity personnel at the unit [†]	Main findings for the relationship of environment and physical activity of older individuals	Issues in methodological quality according to quality appraisal
2019 UK, Spain	(a) How are sedentary behavior and movement in care homes perceived and experienced among care home residents, staff members, relatives and policymakers?, and (b) How can we work together to decrease sedentary behavior and increase movement in care home residents?	Workshops Inductive thematic analysis	Age: mean 83.2 (SD 11.6) Women: 59% Students (n = 26) Care staff (n = 14): senior care assistants, 3 physical therapists, 2 geriatricians, 1 occupational therapist, 1 nurse Family members (n = 4): 1 brother, 1 sister, 2 daughters	2 care homes in the UK 2 care homes in Spain	and attitudes, such as overprotection and culture of the care staff. Promoting physical activity: using regular reminders for residents to be active, engaging residents, family, and staff members, involving residents in household chores, and opening up to the neighborhood.	researcher culturally or theoretically, not stating the researcher's influence on the research
Hawkins 2018 UK	Explore residents' routine patterns of movement in two care homes, and the organizational values, structures, mechanisms and processes that shaped these patterns.	Qual Observations, informal conversations, interviews Not reported	Policy makers (n = 4) Residents (n = 6) [‡] : Unit 1 Age: majority of residents ≥ 80 yo, female, diagnosis of dementia Unit 2 varying physical abilities, small number of residents living with dementia	Care homes (n = 2) Care home of 35 residents, activity coordinator absent during research Care home of 30 residents: recently appointed activities coordinator	Affecting residents' movement: organizational values, care practices, systems of management, staff training and development, and the use of care planning.	Not stating the researcher's influence on the research
Luyten 2017 Netherlands	Determine whether and how nursing home residents with dementia respond to the interactive art installation in general and to identify whether responses change when the content, type, and nature of interaction with the artwork changes.	Mixed Observations Deductive coding of video material	Staff (n = 8) [‡] Residents (n = 11): Living with dementia Staff (n = 4)	Nursing home (n = 1)	Resident responses to the artwork included: Interaction with the artwork 36.6% of responses, of which 69% physical responses Residents interacted with other people: 52.8% of responses, of which 21% physical responses Lost focus or unclear response: 10.6% responses Physical responses required encouragement by the care provider. Most activating content: designed to trigger counter-reaction and recognizable content.	Not situating the researcher culturally or theoretically, not stating the researcher's influence on the research
MacDonald 2006	Investigate how the institutional environment impacts leisure opportunities and choices of individuals with Alzheimer's disease in a long-term	Qual Focus groups	Family members (n = 5): Staff (n = 5): Personal care	Long-term care facility (n = 1): 120-bed unit, two large wings	Family members reported to restrict opportunity for leisure: lack of staff, routine care, lack of family involvement, physical environment constraints.	Not situating the researcher culturally or theoretically, not stating the researcher's influence

Canada	care facility, from the perspectives of staff members and family caregivers.	Thematic analysis	workers, housekeeping staff, or therapeutic recreation staff Work experience (years): range 9–31, average 10.8		Staff reported to restrict opportunity for leisure: lack of staff, routine care, insufficient knowledge of residents, Staff-related issues, environmental issues, discrimination of individuals with Alzheimer's disease, and lack of family support and education.	on the research or the philosophical perspective, no ethical approval
Mahrs Träff 2020 Sweden	Increase the understanding of the importance of the physical environment to enable physical activities in assisted living facilities.	Qual Observations, interviews Content analysis	Residents (n = 13): Age: average 87, range 70–95 Women: 62% Different levels of physical and cognitive impairment Staff (n = 17): 4 physiotherapists, 4 occupational therapists, 5 care professionals, 4 head of units	Assisted-living facilities (n = 4): Units in one large and one small municipality	Multipurpose rooms, exercise rooms, and adapted outdoor environment facilitated physical activity, whereas small apartment size, locked doors, and not adapted or managed outdoor environment impeded physical activity of the residents. Long corridors may either facilitate or impede physical activity depending on the corridor shape and arrangement of aids and places to sit and rest.	Not situating the researcher culturally or theoretically, not stating the researcher's influence on the research, or the philosophical perspective
Øye 2020 Norway	Investigate what kind of informal restraint is used in the four nursing homes, while the secondary aim is to investigate how staff use informal restraint under which institutional circumstances.	Qual Observations, interviews with staff Thematic coding, theoretical informed coding	Staff (n = 43): 5 leaders, 1 social educator, 1 assistant occupational therapist, 8 nurses, 23 auxiliary nurses and 5 assistant nurses	Nursing homes (n = 4): 3 units middle sized, 1 unit small-sized nursing	Restricting freedom of movement: informal use of restraint, such as diversion of residents' attention, white lies, persuasion and interpersonal pressure, offers, and threats.	Not stating the researcher's influence on the research or the philosophical perspective
Phillips 2013 USA	Investigate individual and situational factors influencing physical activity practices of elders in residential-care/assisted communities.	Qual Focus groups Thematic analysis	Residents (n = 47): Age: mean 85.4 (SD 7.2) Women: 89%	Residential care/assisted-living facilities (n = 6): Size: Residents mean 51 (SD 25.7) 5 for-profit unit, 1 non-profit Offered exercise: Chair-exercise programs in all six units, walking programs in two units	Staying active meant walking indoors and out, attending chair-exercise programs, performing professionally prescribed home exercises, and using available exercise equipment. Lack of dedicated exercise space and short corridors hampered efforts to stay active. Participants wished for individualized home exercise programs and supervised exercise sessions.	Not stating the researcher's influence on the research, not locating the researcher culturally or theoretically
Saarnio 2009 Finland	Describe the use of physical restraint and the perspectives of elderly patients and their family members on the use of physical restraint in long-term institutional care.	Qual Observations, interviews Inductive content analysis	Resident (n = 7) [‡] : Age: ≥75 Moving around independently or aided by a nurse, some patients having dementia Family members (n = 7) [‡] : Age: range 55–78 Residents (n = 14): Age: range 86–99 Women: 86%	Elderly care units (n = 3) 1 municipal nursing home, 1 municipal hospice ward, 1 private nursing home Number of beds in units: range 19–30	Residents' activity was impeded by removing the patient's mobility aid and keeping the patient inadequately clothed. This was done because of an unsafe environment, the lack of staff, safety concerns, and unfavorable resident behavior.	Not situating the researcher culturally or theoretically, not stating the researcher's influence on the research
Stathi 2007 UK	Explore the exercise experiences of nursing home residents age 86–99 years who participated in a 6-month exercise intervention.	Qual Interviews Interpretive phenomenological analysis	Age: range 55–78 Residents (n = 14): Age: range 86–99 Women: 86%	Nursing home (n = 1): Activity organizer in the unit	Some residents reported daily life to be passive, and independence restricted. Important for physical activity: socializing through exercise, available activities, sessions with trustworthy exercise professionals, and professionals' opinions.	Not locating the researcher culturally or theoretically, no ethical approval

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Table 1 (continued)

First author Year Country	Study aim	Methods (qual/quant/ mixed) Data collection Data analysis	Participants (n) Age [†] Gender [†] Mobility (residents) [†] Cognition (residents) [†] Employed at the facility/work experience (staff, managers) [†]	Setting (n) Public/private/other [†] Facility size [†] Physical activity offered [†] Therapists and activity personnel at the unit [†]	Main findings for the relationship of environment and physical activity of older individuals	Issues in methodological quality according to quality appraisal
Tak 2015 USA	Describe types of current activity involvement and barriers to activities as perceived by nursing home residents with dementia.	Qual Short open-ended and in-depth interviews	Residents (n = 37): Age: mean 84.6 (SD 5.8) Women: 67%	Nursing homes (n = not reported)	Participants primarily depended on activities organized by the facilities and felt they had limited opportunities for activities. Environmental factors, along with a fixed activity schedule, prevented them from engaging in activities.	Not locating the researcher culturally or theoretically, not stating the researcher's influence on the research
Van Steenwinkel 2017 Belgium	Gain insight into residents' and caregivers' experiences of living and working in the facilities, and the role of architectural features in these experiences.	Qual Observations, interviews Narrative analysis according to QUAGOL guide	Mini-Mental State Examination: 16.4 (SD 4.9) Residents (n = 7) [‡] : Age: range 63–84 Women: 43% Variety of physical impairments, psychosocial problems, dementia Staff (n = 7) [‡] : Age: range 25–55 Women: 75% Work experience: range 2–37 years	Residential care facility (n = 1): Four dwelling units of 8 residents each	Small-scaleness, spatial generosity and accessibility afforded residents freedom of movement both indoors and outdoors. The limited number of residents and compactness of the units made it easier for the care staff to manage the unit, thus being able to avoid strict rules and time schedules.	Not locating the researcher culturally or theoretically, not stating the researcher's influence on the research
Mixed-method studies ^b						
Baert 2016 Belgium	Identify barriers as well as motivators for organizing physical activity in long-term care facilities according to administrators. A secondary goal was examining their knowledge of the WHO guidelines regarding physical activity and to reveal potential motivators and barriers for the implementation of these guidelines.	Mixed Interviews, online survey Content analysis	Administrators (n = 24 interviews, n = 127 survey): Interviews: Age: mean 46 (SD 9), Years of experience as administrator mean 26 (SD 8) Surveys: Age range 27–64, Men 53% Both: Employed ≥50% of a full-time equivalent during previous 6 months as administrator Administrative staff (n = 26) [‡] : Administrator or activity coordinator	Long-term care facilities (n = 24 interviews, n = 127 survey) Interviews: Public and private not-for-profit facilities Surveys: Public (49%) and private (44%) not-for-profit, and private for-profit units (7%) Organizing physical activity: 98% of units, more than once a week 24% Physiotherapist available in all units Assisted-living facilities (n = 26)	Motivators to organize physical activity: initiating social contact, preventing loneliness, infrastructure of the facility, and adequate and sufficient materials. Having a garden with walking lanes stimulates physical activity. Physiotherapists, occupational therapists, and animators are the most appropriate professionals to organize physical activity. Nurses and nursing aides are less appropriate.	
Lu 2010 USA	Explore walking environments for assisted-living facility residents to reveal current situations (e.g., indoor and outdoor walking environments) and help develop hypotheses and research instruments for future research, and to provide recommendations for walkable assisted-living facility design and renovation.	Mixed Observations, interviews with administrative staff Qual data: descriptive statistics	Residents: Using walkers 46.2%, wheelchairs 23.8%	Unit size: <50 beds 19.2%, 50–99 beds 69.2%, >99 beds 11.6%	Walking was an important activity for residents both indoors and outdoors. May influence walking behavior: facility site selection, neighborhood sidewalk conditions, availability of seating, walking path configuration (e.g., looped/nonlooped path), and existence of shading, handrails, and signage.	

Mihalko 2003 USA	Partner with executive directors in order to conduct an analysis of the social and physical characteristics of assisted living associated with physical activity.	Quan data: content analysis Mixed Interviews Descriptive statistics	Executive directors (n = 21)	Assisted-living facilities (n = 21): Mean size: 65.5 residents (SD 27.0) General activity directors employed in all facilities	Staff issues affected resident activity. 25% of the facilities provided any type of exercise equipment. Although all facilities were equipped with hallways and common areas, few regularly promoted the use of these areas for physical activity purposes. The environmental quality was high in general but resident activities were restricted by size of communal spaces and locked doors.
Nordin 2017 Sweden	Explore how the physical environment influences resident activities and interactions at two RCFs by using a mixed-method approach.	Mixed Medical records, observations, field notes, walkalong interviews Descriptive statistics Content analysis	Residents (n = 54): Age: facility 1 range 74–96, mean 87, facility 2 range 71–100, mean 88 Mobility: facility 1 poor 26.93%, good 73.07%; Facility 2 poor 23.08%, good 76.92% Staff (n = 25) Relatives (n = 4) Staff:	Residential care facilities (n = 2): Two units divergent in terms of their physical environments (one newly renovated, one nonrenovated) but similar in terms of resident and staffing profiles and care organization.	
Schwarz 2004 USA	Assessed the influence of design interventions on an existing long-term care facility for residents with dementia and the staff members.	Mixed Environmental assessment, behavior mapping, focus groups with staff members Individual and aggregate levels of analyses for qual and quan data Scores, frequency counts Qual data analysis not reported	Two focus groups (n = not reported)	Nursing home (n = 1): Occupying physically and cognitively impaired elderly Renovations made to create a more responsive physical, therapeutic, and homey environment: Decentralized dining and bathing facilities for smaller groups of residents Smaller nurses' stations Improved interior design, appropriate lightning and carpeting Single-occupancy rooms instead of double-occupancy rooms, private bathrooms in rooms	After the renovation of the facilities, they were assessed to be of better quality, and residents participated more in programmed activities. Due to lack of appropriate activities, high staff turnover, and family members' resistance to the relocation of their loved ones the design did not meet all the behavioral expectations. Qualitative analysis unclear
Case series ^c de Boer 2016 Netherlands	Examine whether residents of green care farms are more engaged in (physical) activities and social interaction than are residents of traditional nursing homes and regular small-scale living facilities.	Quan Observations 1-way analysis of variance (ANOVA) for baseline characteristics Descriptive analyses	Residents (n = 118): Age: mean 84 (SD 7.8) Women: 75% Mini Mental State Examination: mean 8 (SD 6.9) Barthel Index: mean 10 (SD 5.9)	Nursing homes (n = 18) Green care farms (n = 5): small-scale living facilities that combine agricultural with care activities, emphasize participation in activities of daily living, physical environment offers opportunities for activities and free movement Traditional nursing homes (n = 4) Regular small-scale living facilities (n = 9)	Residents of green care farms were: significantly more physically active (P = .013, SE = 0.8) than residents of regular small-scale living facilities, significantly less often engaged in passive/purposeless activities (P < .001, SE = 1.7) compared with residents of traditional nursing homes, and had significantly more active engagement (P = .014, SE = 0.9), and came outside significantly more (P = .010, SE = 1.1) than residents of traditional nursing homes.

Table 1 (continued)

First author Year Country	Study aim	Methods (qual/quant/ mixed) Data collection Data analysis	Participants (n) Age [†] Gender [†] Mobility (residents) [†] Cognition (residents) [†] Employed at the facility/work experience (staff, managers) [†]	Setting (n) Public/private/other [†] Facility size [†] Physical activity offered [†] Therapists and activity personnel at the unit [†]	Main findings for the relationship of environment and physical activity of older individuals	Issues in methodological quality according to quality appraisal
Case reports ^d						
MacDonald 1974 USA	Reverse the culturally expected behavior pattern of (not) walking using behavior modification techniques.	Quan Observations Descriptive statistics	Residents (n = 2): Age: 85–92 yo Women: 100% Transporting by wheelchair	Nursing home (n = 1)	Using praise and social prompts resulted in walking, whereas without these intervention conditions the study subjects reverted to not walking as before.	Patients' history not clearly described, adverse events not reported
Cross-sectional studies ^e						
Holmes 2017 USA	Examine factors that influence physical activity among residents in assisted living.	Quan Baseline data of intervention study Descriptive statistics Structural equation modeling	Residents (n = 171): Age: mean 87.7 (SD 5.7) Female 80% Mini-Mental State Examination: mean 23.2 (SD 4.9)	Assisted-living facilities (n = 4) Number of beds in units: range 99–265 All units had in-house rehabilitation services and various activity programs	Satisfaction with activities (0.18, p < .05), and social support for exercise (0.22, p < .05) were directly associated with time spent in physical activity.	
Kalinowski 2012 Germany	Explore different institutional barriers to and facilitator of physical activity in nursing homes.	Quan Cross-sectional survey Descriptive statistics: means, frequencies, percentages	Residents (n = 217): Age: mean 80 (SD 10.2) Women: 55% Mini Mental State Examination: mean 26 (SD 3) Able to walk: 62% Able to sit: 35% Confined in bed: 3%	Nursing homes (n = 40): 17 private-owned, 22 operated by social services or charities, 1 public facility Size of facilities: range 20 to 230 beds ¾ of facilities offered possibilities for activity participation outside facilities ¼ no exercise rooms Half employed occupational or physical therapists	Residents were not adequately informed about activity options. Participation to activities was higher for those residents that had informed relatives. Exercise offered was rarely tailored to the residents' needs. 22% of residents wished for more individual promotion of their functional abilities.	Confounding not considered
Lemke 1984 USA	Explain the impact of an intra-institutional relocation on the behavior of residents who varied in mobility and mental status.	Quan Observations Tabulation of observations, calculating percentages for time spent in each location and activity	Residents (n = 20): Age: median 71 years Women: 4% Using a walker or wheelchair 40%	Nursing home (n = 1) that moved from an older building to a newer building Older building: two-story building with H-structure, long central corridor connecting with two shorter wing corridors, each floor with nurses' station, own dining room and lounge space, not designed to accommodate older and disabled residents, variety of social-recreational aids, a relatively spacious physical environment, and easy orientation, lacked prosthetic aids and safety features often valued by older people	After the relocation wheelchair-mobile residents were more active in the new facilities, whereas immobile residents experienced a restriction of their spatial range. Low mental status residents spent less time in social areas and more in the halls near the nurses' stations, where they could maintain contact with the staff.	Confounding not considered

Prevc 2009 Slovenia	Explore age identity, the perception of old age, the role of physical activity in the socialization of elderly people and social influences on physical activity in elderly people living in a nursing home.	Quan Cross-sectional survey Descriptive statistics	Residents (n = 75): Age: 78.9 (SD 7.9) Women: 75%	Newer building: Single story building with three distinct 50-bed wards, landscaped patio between wards, communal areas at one corner, increased provision of prosthetic aids, including wider hallways and automatic doors, call buttons and smoke detectors in residents' rooms, more physical amenities, larger scale and complexity of the building Nursing homes (n = 4)	Interaction with other residents was an important component of physical activity. Beliefs and ideas about the environment influence activity.	No clear criteria for inclusion in the sample, problems with internal consistency of used questionnaire
Quasi-experimental studies ^f						
Braun 2014 Netherlands	Determine whether and how psychogeriatric nursing home residents would respond to the interactive surfaces on the floor without receiving instructions and to determine how long residents would be physically active.	Mixed Observations Timing and categorizing of responses from video recordings	Residents (n = 98): Women: 55% Psychogeriatric residents	Psychogeriatric nursing home ward (n = 1)	Individual times that residents were active ranged from 3 to 415 s. Physical responses: 30% of responses Looking at/watching projections: 40% of responses	No control group, not conducting multiple measurements
Yang 2020 Taiwan	Develop an intervention programme for promoting self-efficacy of older adults living in long-term care facilities, and examine the perceived helpfulness of the intervention programme for encouraging walking behaviors.	Quan Questionnaires Descriptive statistics Paired sample t-tests	Residents (n = 30): Age: average 80.93 (SD 6.89) Women: 73.3% Using assistive tools: 40%	Residential care facility (n = 1)	Resident did not notice surface: 30% of responses. Safe environment was perceived to be the most helpful factor for encouraging walking behaviors 1–5 Likert Scale 4.93 (SD 0.25), followed by public compliments 4.50 (SD 1.01), verbal encouragement 4.17 (1.21), walking accompaniment 3.73 (SD 1.26).	No control group, lack of clarity of measurements
Randomized controlled trials ^g						
D'Cunha 2020 Australia	To evaluate whether virtual group cycling (VCE) was physically safe and feasible and if it provided benefits over usual exercise activities on mood, apathy and engagement; Explore the perceptions of VCE users and facilitators to identify perceived benefits and concerns associated with the VCE and to determine whether the VCE was comparable to cycling alone or provided any perceived benefits over usual activities (daily exercises).	Mixed Observations, interviews Video analysis Quan data: means, SDs, frequencies, t-tests, Mann–Whitney tests, Qual data: content analysis/ thematic analysis	Residents (n = 10): Age: mean 86.1 (SD 8.06) Women: 80% Montreal Cognitive Assessment score: mean 12.2 (SD 4.69) Katz Index of Independence in Activities of Daily Living: mean 3.40 (SD 2.12) Activity manager (n = 1)	Residential aged-care facility (n = 1)	The intervention group had a lower response for environmental stimulation than the control condition (p = .032), mainly due to lower scores in physical accessibility (p = .012) for the intervention condition compared to the control condition. Participants experienced the virtual cycling experience to be immersive and challenging. The activity manager observed the virtual cycling to be an overall positive experience for participants.	No blinding of treatment assignment, not reporting similarity of groups at baseline

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Table 1 (continued)

First author Year Country	Study aim	Methods (qual/quant/ mixed) Data collection Data analysis	Participants (n) Age [†] Gender [†] Mobility (residents) [†] Cognition (residents) [†] Employed at the facility/work experience (staff, managers) [†]	Setting (n) Public/private/other [†] Facility size [†] Physical activity offered [†] Therapists and activity personnel at the unit [†]	Main findings for the relationship of environment and physical activity of older individuals	Issues in methodological quality according to quality appraisal
Lauzé 2017 Canada	Assess the feasibility, the acceptability, and the effects of physical activity intervention using gerontechnology in assisted living communities.	Quan Baseline, post intervention at 12 weeks after baseline, follow-up at 24 weeks after baseline Questionnaires, surveys, performance tests, anthropometric measurements Descriptive statistics Mann-Whitney tests	Residents (n = 42): Age: intervention group mean 80.1. (SD 7.5), control group 83.2 (SD 6.7) Women: Intervention group 71%, control group 91%	Assisted-living facilities (n = 4)	The experimental group completed 67% (SD 13%) of the exercise sessions in autonomy. Changes between baseline and follow-up were statistically different between groups for walking speed (EX: +0.10 ± 0.20 vs CON: -0.04 ± 0.16 m/s; P = .04) and the Short Physical Performance Battery score (EX: +1.1 ± 2.0 vs CON: -0.4 ± 1.6; P = .03).	Treatment groups not similar at baseline, no blinding of treatment assignment, per-protocol analysis

[†] = Reported when information available in the original studies.

[‡] = Participants in interviews.

CON = control group.

EX = experimental group.

SD = standard deviation.

SE = standard error.

^a Critical appraisal: Joanna Briggs Institute Critical Appraisal Checklist for Qualitative Research.

^b Critical appraisal: Mixed Method Appraisal Tool.

^c Critical appraisal: Joanna Briggs Institute Critical Appraisal Checklist for Case Series.

^d Critical appraisal: Joanna Briggs Institute Critical Appraisal Checklist for Case Reports.

^e Critical appraisal: Joanna Briggs Institute Critical Appraisal Checklist for Analytical Cross-Sectional Studies.

^f Critical appraisal: Joanna Briggs Institute Critical Appraisal Checklist for Quasi-Experimental Studies.

^g Critical appraisal: Joanna Briggs Institute Critical Appraisal Checklist for Randomized Controlled Trials.

Table 2
Main themes and descriptive themes with example codes and quotations from included studies.

Theme	Descriptive theme	Example code	Illustrative quotation (study)
Physical environment	Accessible and safe living environment	Floor material	Additionally, caregivers mentioned that color differences in floor materials had caused some residents with dementia hesitating to cross the different colored floor parts, as if there were a level difference. (van Steenwinkel et al., 2017)
	Activating physical environment	Interactive art	Participants were activated by content that was designed to trigger counter-reaction, such as a child waving. They reacted mostly to content that they could recognize, abstract content did not facilitate interaction. Physical responses to the art work occurred mostly together with encouragement by the care provider. (Benjamin et al., 2011)
Social environment	Supportive professionals	Mobility support	During routine activities such as moving to the dining room for meals, residents tended to be either wheeled there or, for those who did walk independently, observed by care staff from a distance. (Hawkins et al., 2018)
	The role of other people	Role of family members	And I walk her [resident] to the end of the hall and back, and she's quite capable of doing it, but I know that the few days that I've missed doing that, I can see a decline in her ability to do it. (Benjamin et al., 2011)
	Adequate activities to socialize and be active	Socialization	Interaction with other residents seems to be an important component of physical activity, as participants grade the importance of socializing during exercise quite highly (4.0 ± 1.3). We also noticed high level of agreement with the preference for group exercise instead of individual activity (4.1 ± 1.4). (Prevc and Doupona Topic, 2009)
Symbolic environment	Policy at multiple levels	Policy for physical activity	Others had dedicated physical space for exercise but also had policies that may have deterred interest, such as requiring physician permission and staff supervision to use the equipment. (Phillips and Flesner, 2013)
	Values of organizations and professionals	Valuing physical activity	...refusal of some physicians to sign a physiotherapy referral because they did not see "the value of range-of-motion exercises for a resident who is bedridden" (Benjamin et al., 2011).

3.4.1.1. Accessible and safe living environment. In the long-term care facilities, a variety of aspects in relation to accessibility and safety of the physical environment were considered important for the physical activity of the residents. The spaciousness of the facilities supported activity when there was enough space to move, turn, and pass other residents using mobility aids, and was an impediment when the space was limited and cramped (Baert et al., 2016; Benjamin et al., 2011; MacDonald, 2006; van Steenwinkel et al., 2017). This was related to the common areas as well as resident rooms. Locked (Mahrs Träff et al., 2020; Nordin et al., 2017; Øye et al., 2017) and heavy or difficult doors (Benjamin et al., 2009, 2011; Mahrs Träff et al., 2020; Nordin et al., 2017; van Steenwinkel et al., 2017) limited residents' freedom to move. Sufficiently wide doorways and automatic doors (Benjamin et al., 2009), as well as, well-functioning or automatic elevators (Lu, 2010; Nordin et al., 2017; van Steenwinkel et al., 2017) were considered important for residents to be able to be active.

Aspects in the physical environment, such as doorsteps (Nordin et al., 2017; van Steenwinkel et al., 2017), stairs (Baert et al., 2016), and steep pathways and ramps impeded activity (Benjamin et al., 2009, 2011; Mahrs Träff et al., 2020; Nordin et al., 2017; van Steenwinkel et al., 2017). Characteristics of floor materials, such as shininess of floors (MacDonald, 2006) and color differences (van Steenwinkel et al., 2017) were reported to limit residents' activity due to sensory distractions. In general, well-lit areas, good lighting, and brightness (Kalinowski et al., 2012) facilitated residents' walking. Appropriate mobility aids (Benjamin et al., 2009; Hawkins et al., 2018), places to sit and rest (Benjamin et al., 2011; Kalinowski et al., 2012; Lu, 2010; MacDonald, 2006; Mahrs Träff et al., 2020), shade (Lu, 2010), handrails (Benjamin et al., 2009; Lu, 2010; Mahrs Träff et al., 2020), and proper signage to help navigate (Kalinowski et al., 2012; Lu, 2010) were important accessibility and safety aspects in the environment for facilitating activity. In addition, visual access for nurses to monitor residents was important for safe activity. This was facilitated by staff areas close to rooms where residents spent their time (Lemke and Moos, 1984), visual access to hallways (Hawkins et al., 2018; Schwarz et al., 2004), and open plans and glazed patios (van Steenwinkel et al., 2017). Monitoring devices, such as wireless alarm systems were reported to facilitate the same purpose (Lu, 2010; Schwarz et al., 2004).

3.4.1.2. Activating physical environment. The natural and built environment surrounding the facilities were of importance to resident activity. The landscape was reported to influence activity, as characteristics that were too challenging as hills impeded residents' activity in the area

(Mahrs Träff et al., 2020). For the built environment, integration in a regular residential street, having safe walkways outside the facilities, and proximity to public facilities and gardens were facilitators for resident activity (Benjamin et al., 2011; Kalinowski et al., 2012; Lu, 2010; van Steenwinkel et al., 2017). Busy roads next to the facilities hindered opportunities to spend time outdoors (Nordin et al., 2017; Øye et al., 2017). Outdoor areas, such as gardens, courtyards, patios, terraces, as well as greenhouses and balconies, were reported as important for physical activity (Baert et al., 2016; Benjamin et al., 2009, 2011; Giné-Garriga et al., 2019; Mahrs Träff et al., 2020; Tak et al., 2015; van Steenwinkel et al., 2017). Independent access outdoors was considered to facilitate physical activity (Mahrs Träff et al., 2020; Nordin et al., 2017; Øye et al., 2017; van Steenwinkel et al., 2017). Residents in green care farms having more access to outdoor spaces and having more activities outdoors were observed to be significantly more physically active than residents in traditional nursing homes (de Boer et al., 2016).

Walking paths outdoors and indoors facilitated walking, which was considered an important activity for residents (Baert et al., 2016; Benjamin et al., 2009, 2011; Lu, 2010; Nordin et al., 2017; Phillips and Flesner, 2013). Indoors, repetitive, or open floor plans (Nordin et al., 2017; van Steenwinkel et al., 2017), circular designs, and u-shape corridors increased resident activity (Benjamin et al., 2009; Nordin et al., 2017). Dead end hallways (Benjamin et al., 2009; MacDonald, 2006) and short corridors (Phillips and Flesner, 2013) were reported as barriers. Varying visual experiences as different wall colors, furniture, and carpets were reported to facilitate activity (Lu, 2010).

For organizing activities, rooms dedicated to exercise were found to be beneficial or were desired in the case of not having one (Benjamin et al., 2009, 2011; Mihalko and Wickley, 2003; Phillips and Flesner, 2013). Lack of space impeded organizing activities or hindered participation in group activities but also self-initiated activity (Benjamin et al., 2011; Chen, 2010; Phillips and Flesner, 2013). When rooms had to be used for another purpose due to a lack of space, such as using the dining room for exercise, this was found to be inconvenient (Benjamin et al., 2009). Lack of equipment and appropriate material hindered exercising and organizing activities (Baert et al., 2016; Benjamin et al., 2011; Kalinowski et al., 2012; Mihalko and Wickley, 2003) and was related sometimes to the lack of space to store the equipment (Benjamin et al., 2009, 2011).

Technological solutions were found to be feasible for activating psychogeriatric residents and residents having dementia. Interactive artwork induced physical responses in residents, especially when

being recognizable, such as projections of a football field or windmills, or was designed to trigger counter-reactions, such as seeing a child waving (Braun et al., 2015; Luyten et al., 2018). Abstract projections did not engage the residents in physical activity as much (Braun et al., 2015; Luyten et al., 2018). Exergaming facilitated physical activity and was feasible to some extent to be used independently by the residents in assisted-living facilities after practicing with a professional (Lauzé et al., 2017). Virtual group cycling as watching a pre-recorded video of a cycling trip outdoors and using pedal exercisers concurrently facilitated the physical activity of residential aged-care residents and was experienced as engaging by them (D'Cunha et al., 2020).

3.4.2. Social environment

The identified descriptive themes for the theme Social environment were: Supportive professionals, The role of other people, and Adequate activities to socialize and be active.

3.4.2.1. Supportive professionals. The care staff's actions were related to the residents' activity. Strict schedules and mechanistic approaches to care were reported to impede activity (Benjamin et al., 2011; Giné-Garriga et al., 2019; Hawkins et al., 2018; MacDonald, 2006; Stathi and Simey, 2007; van Steenwinkel et al., 2017). Care duties were prioritized at the expense of the facilitation of physical activity, for example, by taking shortcuts to meet care demands (Benjamin et al., 2011; Hawkins et al., 2018; MacDonald, 2006). This was related to the lack of resources, such as staff and financial resources (Baert et al., 2016; Benjamin et al., 2009, 2011; MacDonald, 2006; Mahrs Träff et al., 2020), and the care culture of the facilities (Hawkins et al., 2018). Residents were even immobilized by removing mobility aids, keeping the residents undressed so they would not leave their room (Saarnio and Isola, 2009), or by lying, diversion of attention, threats, and offers (Øye et al., 2017). The use of substitute staff (Benjamin et al., 2011) and the staff not knowing the residents well enough (MacDonald, 2006); these factors hindered physical activity support. The staff was not always motivated to organize physical activities for residents (Baert et al., 2016; Mihalko and Wickley, 2003) or were even perceived as inappropriate professionals for doing so (Baert et al., 2016).

It was acknowledged that increasing physical activity in daily tasks and transfers could be attained by simple actions, such as facilitating more independence in care duties (Benjamin et al., 2011; Giné-Garriga et al., 2019; Hawkins et al., 2018). The reflective and flexible practice of constantly assessing residents' needs and managing the potential risks was seen to enable providing appropriate support and implementation of necessary plans (Hawkins et al., 2018). Formal training was perceived as important to increase competence in physical activity support (Baert et al., 2016; Hawkins et al., 2018). The opinions of health professionals and residents' trust in them were important for residents (Stathi and Simey, 2007) and encouragement and social support facilitated physical activity (Burke et al., 2021; Giné-Garriga et al., 2019; Hawkins et al., 2018; Holmes et al., 2017; MacDonald and Butler, 1974; Yang et al., 2021).

3.4.2.2. The role of other people. Isolation of the long-term care facilities from the surrounding community was considered harmful for physical activity (Giné-Garriga et al., 2019). Being in contact with the community, such as visiting public areas and public facilities, interacting with community members in the outdoor areas of the facilities, and having visits from the community facilitated activity (Baert et al., 2016; van Steenwinkel et al., 2017). Family involvement influenced residents' activity level (Kalinowski et al., 2012) and participation in activities (MacDonald, 2006; Schwarz et al., 2004). Opinions of family members were important for the residents, and family members encouraged them for physical activity but also wished the residents to limit independent activity when they were worried about the potential risks (Giné-Garriga et al., 2019). Family members helped residents to walk both indoors and outdoors during their visits (Benjamin et al., 2011;

Giné-Garriga et al., 2019; Lu, 2010) and kept them informed about possibilities for activities (Kalinowski et al., 2012). Family members' contributions (Baert et al., 2016) and educating them about residents' functioning (MacDonald, 2006) were perceived as important to facilitate the activity of residents. In addition, volunteers helped in supporting the activity of residents (Benjamin et al., 2011).

3.4.2.3. Adequate activities to socialize and be active. Residents were reported to be dependent primarily on activities organized by the facilities. Satisfaction with the available activities was positively associated with physical activity (Holmes et al., 2017). However, the organization of activities was often thought to be insufficient. There was a lack of organized activities, they did not match the preferences or needs of the residents, they were organized too rarely or they were organized at inconvenient times for the residents (Benjamin et al., 2011; Kalinowski et al., 2012; MacDonald, 2006; Phillips and Flesner, 2013; Stathi and Simey, 2007; Tak et al., 2015; van Steenwinkel et al., 2017). Activities were not always adjusted to residents' functional ability (Tak et al., 2015) and residents were even discriminated against based on their functioning (MacDonald, 2006). When there was a shortage of staff, care was prioritized (Benjamin et al., 2009) and staff availability affected residents' opportunities to go outdoors (Mahrs Träff et al., 2020). The social component of physical activities was perceived important by and for residents (Baert et al., 2016; Phillips and Flesner, 2013; Prevc and Doupona Topic, 2009; Stathi and Simey, 2007; Tak et al., 2015; van Steenwinkel et al., 2017). In addition, residents wished for individualized home-exercise programs (Phillips and Flesner, 2013). The heterogeneity of individuals according to cognitive and physical functioning was found to increase the difficulty for organizing activities (Baert et al., 2016).

3.4.3. Symbolic environment

The descriptive themes identified for the theme Symbolic environment were: Policy at multiple levels, and Values of organizations and professionals.

3.4.3.1. Policy at multiple levels. Laws (Baert et al., 2016) and regulations for safety and hygiene were reported to sometimes restrict opportunities for resident participation in household chores (Giné-Garriga et al., 2019). Organizational policies, such as norms and rules in the facilities, affected the actions of staff members in activity promotion, such as the initiative to organize activities (van Steenwinkel et al., 2017). Residents were denied opportunities to go outdoors or a locked doors policy limited residents' freedom to be active in the facilities (Mahrs Träff et al., 2020; Nordin et al., 2017; Øye et al., 2017; van Steenwinkel et al., 2017). Policies, such as only being allowed to use the exercise equipment under supervision were reported to possibly impede resident activity (Phillips and Flesner, 2013).

3.4.3.2. Values of organizations and professionals. Organizational values about physical activity affected actions taken throughout the organization. Valuing the maintaining of residents' functioning by being physically active was perceived as important for implementing care practices (Benjamin et al., 2009), and organizing physical activities (Baert et al., 2016). Support from the facility's board (Baert et al., 2016) and the managerial process were considered important mechanisms in implementing the organizational values of care into practice (Hawkins et al., 2018). The care staff perceived maintaining residents' mobility as a part of their role, especially when they were more experienced and had been working longer in the long-term care context (Hawkins et al., 2018). However, physical activity, restorative care, and rehabilitation were reported not to be always valued by health care professionals (Benjamin et al., 2009; Giné-Garriga et al., 2019; Stathi and Simey, 2007). They were seen as unnecessary for residents after a certain point of decline in functioning (Benjamin et al., 2009). Physicians were reported to refuse referrals to physiotherapy

(Benjamin et al., 2009) or even tell residents to stop trying to be mobile as it would not be necessary for them anymore (Giné-Garriga et al., 2019; Stathi and Simey, 2007).

3.5. Concept map of environmental factors and their related relationships with physical activity

Several broader and more specific concepts were identified for each of the dimensions physical, social, and symbolic environment. These concepts were related to each other within and between the dimensions. The conceptual map is presented in Fig. 2.

4. Discussion

This review aimed to explore and synthesize evidence and create a comprehensive understanding of aspects in the physical, social, and symbolic dimensions of the environment related to the physical activity of older individuals in long-term care. Even though some earlier reviews (Anderiesen et al., 2014; Benjamin et al., 2014; Douma et al., 2017) have synthesized evidence of some of these aspects, this review adds to this knowledge by systematic synthesis of evidence of enablers and barriers

in all the qualitative dimensions of the care environment related to the physical activity of older individuals in long-term care settings. The long-term care environment should support individuals incapable of independent living to live their life to the fullest. Therefore, these environments should be designed and adapted to the needs of the individuals living there, supporting functioning and enabling activity and participation. Fortunately, several aspects have been identified that can be modified to activate long-term care residents. The results show that all the qualitative dimensions physical, social, and symbolic are important when considering the physical activity of long-term care residents. Further, several descriptive themes were identified for the dimensions.

Considering the physical environment, two descriptive themes: Accessible and safe living environment, and Activating physical environment were identified. Safety and accessibility are core elements of the right to adequate housing as a human right (United Nations, 1991). The importance of the physical environment to the safety of residents in long-term care has been well-identified (Joseph et al., 2016). Nonetheless, the evidence suggests that currently there exist aspects that impede activity in this respect in long-term care; they have also been reported earlier (Benjamin et al., 2014; Douma et al., 2017). As being physically active, i.e. moving, is a fundamental human need

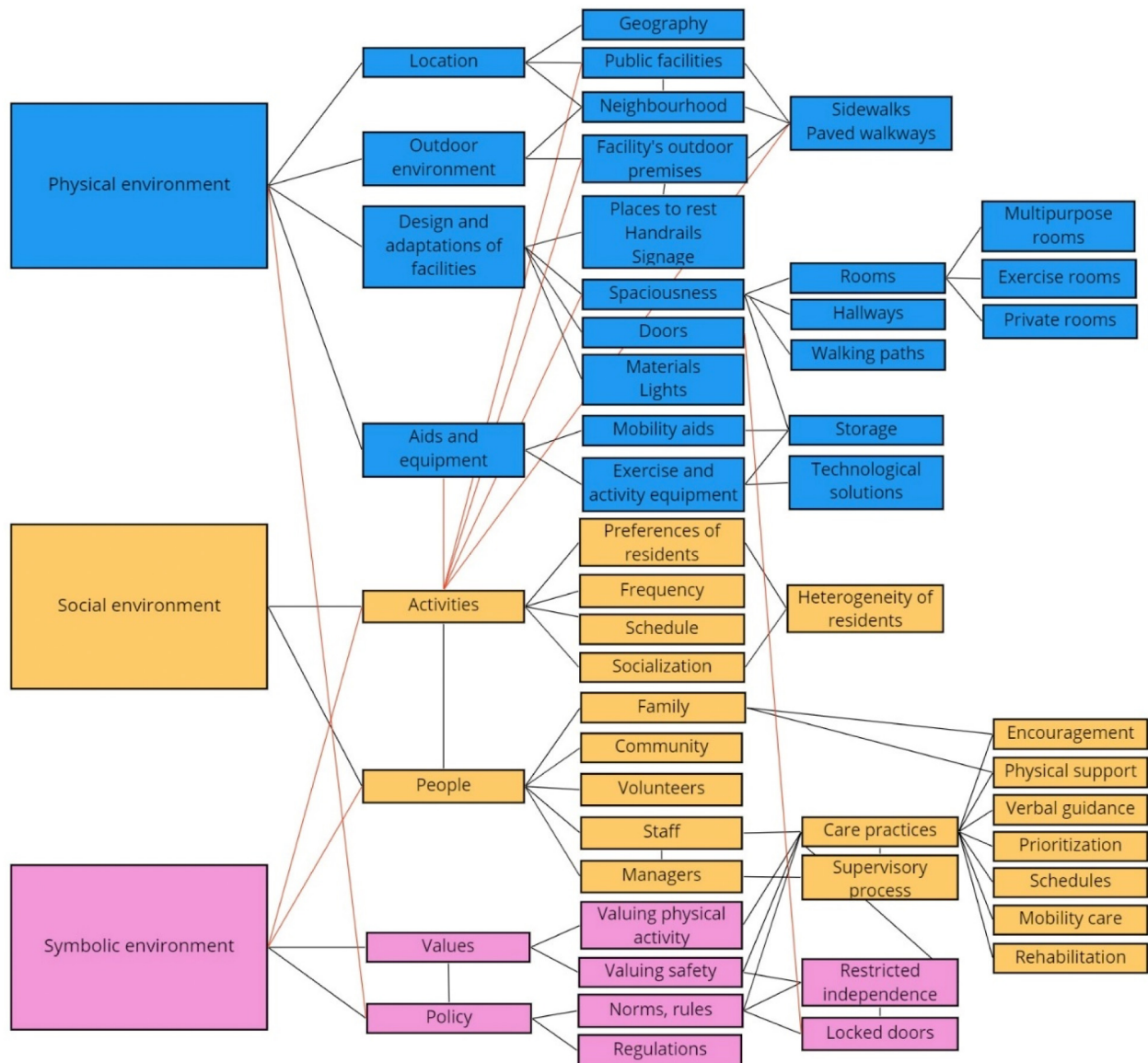


Fig. 2. Concept map of environmental aspects and their relationships influencing the physical activity of older individuals in long-term care. Red lines present relationships between dimensions and black lines within dimensions. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

(Moulton et al., 2019), it is worrying if the long-term care environment is not adequately safe and accessible for its residents to do this. These problems could be partly because residents increasingly experience more complex health problems and more severe disability in long-term care (Barker et al., 2020; Palese et al., 2016). Older facilities designed for better functioning residents do not always meet the needs of current residents with worse functional ability (Benjamin et al., 2009). On the other hand, many long-term care environments are very institutional-like, and as such are not providing adequate support to the residents (Wahlroos et al., 2021).

Furthermore, considering that the long-term care environment is the permanent living and being environment of the residents, it should be designed for active living, having facilities and equipment for exercise, recreational activities, and walking. Considering the evidence, there seems to be impediments in this respect, which have also been noted elsewhere (Benjamin et al., 2014; Douma et al., 2017). Considering the outdoor environment in relation to physical activity, earlier reviews have mainly reported aspects in the facility premises (Benjamin et al., 2014; Douma et al., 2017). In addition, built and natural environmental aspects in addition to the facilities were raised in the present review. The effects of these to the physical activity of community-dwelling older individuals have been identified. For example, safety, walkability, and pleasing esthetics of the neighborhood, and proximity to public spaces have been observed to positively affect the physical activity level of older community-dwelling individuals (Barnett et al., 2017), whereas aspects, such as hilliness have been observed to have negative effects (Keskinen et al., 2020). These should not be overlooked when designing long-term care facilities, and it is also important when considering the social inclusion of long-term care residents. Furthermore, as outdoor environments have implicit health benefits (Frumkin et al., 2017), outdoor spaces should be available for all residents despite their functional ability and capability to leave the long-term care premises.

The descriptive themes for the social dimension of the environment were Supportive professionals, the role of other people, and adequate activities to socialize and be active. Factors especially those related to the resources of staff, staffing levels, and staff's time been noted earlier to be related to the physical activity of older individuals in long-term care (Benjamin et al., 2014; Douma et al., 2017). This is not surprising as staff shortages and time constraints have been identified as important aspects relating to the quality of care (Boltz et al., 2020) and the lack of health workforce is a global issue (World Health Organization, 2016). In the future, it is expected that technology will relieve some of the pressure on resources and shortage of staff (Siren et al., 2021). At present, considering the evidence of the facilitation of physical activity with technology, it seems that without resources in the social dimension this may be difficult for the frailest elderly population, as they need support or encouragement by the care staff. Nonetheless, technology possesses opportunities to create a more stimulating environment in long-term care (Franke et al., 2021). Whether in the future, for example, social robots could be used safely with minimal human supervision remains to be seen (Tan et al., 2021).

It is noteworthy that promoting physical activity is not always considered to be the nurses' responsibility or a suitable part of their role in the long-term care environment based on the evidence. This has been observed in the hospital setting as well (Constantin and Dahlke, 2018). As low and light intensity activity comprises most of the activity of long-term care residents (Mc Ardle et al., 2021), actions taken throughout daily life are important for the total activity of long-term care residents. Therefore, activating the residents and pausing sedentary activity, in addition to mobility care in daily life, is important (de Souto Barreto et al., 2016), and should be an integral part of nursing care. On the other hand, activity is related to the activities that are available for residents in the long-term care setting. Worryingly, having nothing to do has been reported to hinder the physical activity of older individuals in long-term care (Benjamin et al., 2014; Douma et

al., 2017) and was raised in the present review as well. In addition to inactivity, adjusting to an institutionalized life increases the experience of the loss of autonomy and independence of older individuals in long-term care (Reis et al., 2019).

The typology of Kim (2010) was used to found the review on nursing theory. Some aspects depicted with the dimension of the symbolic environment are discussed in other reviews from the perspective of the organizational aspects (Benjamin et al., 2014; Douma et al., 2017). With the used typology, however, ideational and normative elements are considered as well. For this dimension, values and policies were identified in the present review as aspects related to the physical activity of long-term care residents. The evidence suggests that even ageism may be related to the activity of older long-term care residents, which has been identified to affect the quality of care in long-term care institutions (São José and Amado, 2017). The aspects of the symbolic environment are truly noteworthy as values and policies affect behaviors (Hitlin and Piliavin, 2004), such as actions taken in the social dimension like mobility care, or even constructing the physical environment, such as locking doors. Furthermore, the values of the organization shape professionals' ethical standards (Sastrawan et al., 2021). The conceptual map outlines the interrelatedness of the environmental aspects within and between the dimensions of the physical, social, and symbolic environment. This interrelatedness underlies the fact, as already stated in earlier research (Benjamin et al., 2014), that increasing physical activity most likely requires actions in multiple dimensions. Which aspects are relevant in each long-term care setting is dependent on the existing characteristics of the long-term care environment. Therefore, assessment should be comprehensive and taken in all dimensions.

It should be noted, that this review focused on the environment. Individual factors, such as health status, fear of falling, medications, past activity enjoyment, attitudes, beliefs, and motivation are related to the physical activity of long-term care residents (Benjamin et al., 2014; van Alphen et al., 2016). Therefore, not all actions are relevant and suitable for all populations or individuals in long-term care. Moreover, the extent of the effect of the environmental aspects on each individual's physical activity varies between residents, as their functioning is different (Lawton and Nahemow, 1973). This poses a challenge for the long-term care setting, as it should accommodate the activity of a heterogeneous population.

In the review, a systematic search of four international scientific databases was conducted, and 30 eligible studies were assessed and their results synthesized. Only two studies had conducted randomized experimental research (D'Cunha et al., 2020; Lauzé et al., 2017). These studies had more methodological issues than most other included studies. Half of the studies were qualitative. Even though they have a lower level of evidence (OCEBM Table of Evidence Working Group, 2011), they have high value in identifying aspects that have not been and can be subsequently investigated with quantitative methods (Keeley et al., 2016). The characteristics of the settings and participants varied between studies, which is a distinctive feature of long-term care settings. As the aim was to synthesize all possible aspects in the physical, social, and symbolic dimensions of the environment related to the physical activity of older long-term care residents receiving full-time care, more restrictive inclusion criteria would not have been advantageous. The synthesis, though comprehensive, is most likely not exhaustive, as some aspects might still be missing from this evidence. In addition, research has focused so far only on some aspects of the environment, and further research should be conducted, for example, on the effect of colors, sounds, noise, wayfinding, spatial orientation, visual and tactual stimuli, smell and fragrance, furnishing, and decorations and patterns on the physical activity of long-term care residents (van Alphen et al., 2016). Furthermore, with causality investigations of specific environmental aspects and physical activity outcomes, setting and population characteristics may be further considered for their confounding effects.

In future research, the feasibility and effects of identified environmental aspects and changes to them should be tested with

multicomponent interventions addressing the aspects in multiple dimensions. This kind of research is still lacking (Narsakka et al., 2021). As each long-term care setting is individual, residents, staff, and other stakeholders should be included in the formation of this kind of intervention. This is emphasized by the evidence of the importance of the social and symbolic dimensions of the environment for older individuals' physical activity in long-term care raised by this as well as earlier reviews (Anderiesen et al., 2014; Benjamin et al., 2014; Douma et al., 2017). Furthermore, considering the engagement of the residents, the solutions created should be internally motivating for the residents rather than decided for them (van Alphen et al., 2016). By incorporating the staff in the process they are more likely to be open and committed to the care culture and organizational change (Pentecost et al., 2020). In addition to research and practice, policies should be used to guide the organization of long-term care considering these settings as environments for active living. Policies should guide the future design of long-term care facilities and the standards required for existing facilities and care.

5. Limitations

There are some limitations in the review. Having the broad scope of investigating the environment, including the dimensions of the physical, social, and symbolic, some relevant studies may have been missed in the searches. As this definition of environment includes a large variety of aspects, relevant studies may have addressed these aspects with terminology not identified in the search strategy. Naming all these aspects in the search strategy separately was not feasible. Thus, the term *environment* together with other similar concepts were used as umbrella terms to conduct searches for the review, resulting in a reasonable number of search results. The search terms were based on earlier research and confirmed by a university librarian. Reference lists of included studies were screened to strengthen the inclusion of articles.

Second, originally, the purpose was to analyze separately 1) perceptions of the participants, 2) observed associations of environmental aspects and physical activity, and 3) effects of experimental studies. As a large portion of studies had used a variety of data collection methods and reported aggregated results for associations and perceptions, separate analyses could not be conducted reliably. Therefore, a decision to conduct a joint analysis was made and was justified considering the aim of the review. Additionally, as only two studies investigated the effects of interventions that differed by study design, exposures, and outcomes, they were included in the analysis with the rest of the data, and justified to produce a synthesis by configuration rather than aggregation (Sandelowski et al., 2012). The same methods for data analysis were used as planned originally.

Finally, the data extraction and synthesis were conducted by one researcher which may be considered a limitation for the review. However, the data extraction and synthesis were discussed with and confirmed by the research team. Furthermore, the inclusion of articles and quality appraisal were conducted by two independent reviewers, and searches were conducted in four international scientific databases. To strengthen the credibility of the thematic synthesis, the theme development was conducted twice, two months apart, and the synthesis was refined based on this process. In addition, to establish trustworthiness, the research process was reported in detail. To enable transparency and to preserve the context for the evaluation of the reader, each study was reported in detail, according to the aim, methods, methodological quality, and characteristics of the setting and sample, and their main results concerning the relationship between environment and physical activity.

6. Conclusions

This systematic review explored and synthesized evidence to provide a comprehensive understanding of environmental aspects related to the physical activity of older individuals in long-term care. A

synthesis by thematic analysis and a conceptual map was conducted based on nursing theory. Three themes and corresponding descriptive themes were formulated, including 1) Physical environment: accessible and safe living environment, activating physical environment, 2) Social environment: supportive professionals, the role of other people, adequate activities to socialize and be active, and 3) Symbolic environment: policy at multiple levels, values of organizations and professionals. The synthesis provided evidence of the relatedness of these aspects to each other within and between dimensions concerning the physical activity of older individuals in long-term care. The findings provide evidence of environmental aspects that should be comprehensively evaluated and targeted in long-term care to support older individuals' activity. Creating activity-supporting environments is of vital importance to reduce the health-related risks of inactivity and to enable active living. Furthermore, the promotion of physical activity should be an integral part of long-term care considering the environment as a substantial component. In the future, the effects of the identified environmental aspects on physical activity should be further researched. Moreover, experimental research should be conducted to address the identified environmental aspects and engage the stakeholders in the process, so as to test the effects of widescale modifications to existing environments, in addition to building new ones.

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Noora Narsakka: Conceptualization, Methodology, Investigation, Formal analysis, Writing - Original Draft, Writing - Review & Editing, Visualization. **Riitta Suhonen:** Conceptualization, Investigation, Validation, Writing - Review & Editing, Supervision. **Emilia Kiello-Viljamaa:** Investigation, Validation, Writing - Review & Editing. **Minna Stolt:** Conceptualization, Investigation, Validation, Writing - Review & Editing, Supervision.

Declaration of Competing Interest

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