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Review Article

Organizational Capacity Building in Nursing Facilities to Promote Resident Mobility: A Systematic Review

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A B S T R A C T

Objectives: The objective of the present systematic review was to investigate the effects of organizational capacity building interventions on the environment, nursing staff capacity, and mobility of residents in nursing facilities.
Design: Systematic review.
Setting and Participants: Nursing facilities, staff, and residents.
Methods: We conducted a systematic review according to the methods of the Cochrane Collaboration. The systematic review was prospectively registered in the PROSPERO database of systematic reviews (registration number CRD42020202996). We searched for studies in MEDLINE (via PubMed), CINAHL (via EBSCO), the Physiotherapy Evidence Database (PEDro), and the Cochrane Library (07/20). A narrative synthesis was conducted because of the high heterogeneity of the included studies.
Results: We identified 6747 records and included 14 studies in our review. We clustered the 14 interventions into 3 different categories (environmental modification, nursing staff capacity, and multifactorial interventions). Three studies assessed outcomes at the nursing staff level, and all studies reported outcomes at the resident level. We found highly heterogeneous and inconsistent effects of organizational capacity building on increasing nursing staff capacity and/or resident mobility.
Conclusions and Implications: The findings emphasize the need for further research focusing on an international understanding and definition of organizational capacity building. Additionally, research and intervention development for organizational capacity building interventions to promote resident mobility are needed while applying the framework of the Medical Research Council. Furthermore, studies should assess outcomes regarding the environment and nursing staff to better understand if and how environmental structures and nursing staff capacity effect resident mobility.

Limitations in mobility are one of the main reasons why people become care dependent nowadays.[1] In general, function decline is a frequent predictor for older people to be admitted to a nursing facility.[2] Specifically, between July 1, 2007, and July 30, 2008, approximately 53% of the newly admitted older persons in the United States of America, who moved from their home to a nursing facility, showed an increased dependency in activities of daily living.[3] Nevertheless, even with relocation to a nursing facility, residents' mobility often decreases,[4] resulting in various health risks (eg, falls, incontinence, pressure ulcers, pneumonia, and reduced quality of life),[5,6] which then often are followed by an avoidable

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hospitalization.[7,8] To address these challenges, different interventions to maintain and promote mobility in residents have been investigated.[9] Recent research has mainly focused on direct interventions for improving residents' mobility, such as exercise programs and physical movement interventions.[10,11] Yet, interventions focusing on improving mobility have shown limited effects and offer room for improvement.[12] In addition, especially, for vulnerable groups such as residents living in nursing facilities and who are unable to improve the mobility on their own, the implementation of indirect interventions is of high relevance.[13] This assumption is supported by the Lawton environmental press model,[14,15] showing that older people's functioning is not only dependent on their own competencies, but rather is a dynamic combination between environmental factors, the older people's competencies, and the older person's coping strategies for changes within the environment (the interaction between both).[16,17] Rosenbock and Claus[18] and De Bock et al[13] incorporated this idea by stating that indirect interventions focus on changing the ecological, social, cultural, and technical-material environment in the institutional and social context, rather than focusing exclusively on the improvement of function. Indirect interventions therefore aim at capacity building on institutional level and social context.[13,19] Based on this, we define indirect interventions as organizational capacity building (OCB) interventions.

Even though the environment seems to have an impact on aging and mobility,[14,17] no systematic review addressed the effects of OCB interventions on the promotion or maintenance of mobility in nursing facility residents. The objectives of the present systematic review are therefore to investigate the effects of OCB interventions with the aim to promote or maintain mobility of the residents on (1) the environment of nursing facilities and/or the capacity of nursing staff and (2) on residents' mobility.

Methods

The systematic review was prospectively registered in the PROSPERO database of systematic reviews (registration number CRD42020202996).[20] To conduct the review, we followed the methodologic descriptions from the Cochrane Collaboration Handbook for Systematic Reviews.[21] We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement[22] to report the review (Supplementary material).

Literature Search

For operationalizing the term OCB, a preliminary search in MEDLINE (via PubMed) and Google Scholar by 2 members of the research team (M.R.M., J.B.) was carried out. As a result, we focused on a combination of index search terms and keywords for improving environmental aspects of nursing facilities and nursing staff capacity.[13,23] The search string was developed by the first 2 authors of this review (M.R.M., J.B.); both have a professional background in health care (nurse and psychologist). The search string was checked by all coauthors (T.Q., C.M., S.R., C.R., S.A., and M.R.) using the Peer Review of Electronic Search Strategies (PRESS) recommendations.[24] Our initial search was conducted for MEDLINE (via PubMed) and adapted for other databases by a single team member (M.R.M.) according to the descriptions in RefHunter, version 5.0.[25] Our search strategy for MEDLINE (via PubMed) is included in Supplementary Table 1. Between July and August 2020, an electronic search was conducted in the following databases: MEDLINE (via PubMed), CINAHL (via EBSCO), the Physiotherapy Evidence Database (PEDro), and the Cochrane Library (07/20). Additionally, we searched trial registrations (ClinicalTrials.gov) and performed backward and forward citation tracking via reference lists and Google Scholar.

Study Selection

To identify potentially relevant studies, titles and abstracts from identified records were independently screened against inclusion and exclusion criteria (Table 1) by 2 reviewers (M.R.M., J.B.) using the software Covidence.[26] Discrepancies in opinions during the process were discussed in regular video meetings between the 2 reviewers, and in case of no consensus, disagreements were resolved in a video meeting with selected coauthors (T.Q., C.M., M.R.). The same strategy was applied for full-text screening.

Data Extraction and Management

We created a data extraction form in Covidence[26] and included the intervention characteristics recommended for reporting (multicomponent) interventions by TIDier and CReDECI 2.[27,28] Data extraction was performed independently by 2 reviewers (M.R.M., J.B.). After finishing the data extraction process, every item of the 2 independent extractions was double checked for consistency by the same 2 reviewers. If there were differences in the extracted data, they were discussed in regular video meetings, and consensus was achieved. The results of the data extractions were then discussed in a video meeting with and peer-reviewed by coauthors (T.Q., C.M., M.R.).

Quality Assessment

We used the Risk of Bias Tool 1 (RoB 1)[29] to judge the quality of all included (cluster) randomized controlled trials. For the included nonrandomized controlled trials, we used the Risk of Bias In Non-randomised Studies—of Interventions (ROBINS-I).[30] In a first step, the RoB 1 and ROBINS-I were performed independently by 2 reviewers (M.R.M., J.B.). The second step consisted of comparing the results and discussing differing opinions between the reviewers (M.R.M., J.B.) in regular video meetings. If a discrepancy could not be resolved, it was discussed in a video meeting with the coauthors (T.Q., C.M., M.R.), and a consensus was achieved. For the detection of selective reporting in the included studies, we checked the trial register information if it was available. All figures of the results from the RoB 1 were created with Review Manager, version 5.4,[31] and results from ROBINS-I were created with Risk-Of-Bias VISualization (robvis).[32]

Data Synthesis

Due to the heterogeneity of the individual interventions and outcomes, a meta-analysis could not be performed. Instead, we performed a narrative synthesis, and the individual study results are reported descriptively at the respective study level. For this purpose, we report the means and standard deviations (SDs) or standard errors (SEs) and confidence intervals (CIs) at baseline and final follow-up for the individual studies. Additionally, if possible, we calculated the mean difference (MD) with 95% CI. For studies where no means, SD/SE, or n were reported, we report the available data. Effects are reported as positive if our calculated MD with 95% CI showed a statistically significant effect in favor of the intervention group, or the study reported a statistically significant advantage for the intervention group. All statistical analyses were performed using R, version 4.0.3 (R Foundation for Statistical Computing, Vienna, Austria).

Results

A total of 6747 articles were initially identified through the electronic database search. After removing duplicates, 4530 records were screened for relevance, and ultimately, 14 studies[33–46] and

Table 1
Inclusion and Exclusion Criteria for the Review

Criteria	Definition
Population	We focused on studies with interventions that were provided in nursing facilities and aimed at the nursing facility environment and/or nursing staff capacity and at promoting or maintaining the mobility of the residents. As nursing facilities, we considered nursing homes that provide long-term and/or short-term health related care and services for people (residents) with various care needs (eg, activities of daily living) and medical (eg, wound care) needs. The population of interest for this systematic review was as follows: • the nursing facility environment or • the nursing staff and • the residents who indirectly benefited from the intervention We excluded all studies that focused on settings other than nursing facilities and consequently did not consider the nursing facility environment or the nursing staff and the resident.
Intervention	We included all studies with interventions focusing on OCB or a combination of OCB and direct interventions in nursing facilities to promote the mobility of residents. We understand interventions for OCB as interventions for changing the • ecological, • social, • cultural, and • technical-material living conditions in the institutional and social context with the aim of maintaining or improving various health determinants of the people living in these settings.[13,19] We excluded all studies that tested • OCB interventions that were not conducted in the context of promoting or maintaining resident mobility or • only direct interventions for residents (eg, exercise groups).
Compare	We considered studies including control groups that received the following: Environment level: • minor components of the OCB intervention from the intervention group or • no intervention and/or nursing staff level: • minor components of the OCB intervention from the intervention group or • no intervention and/or resident level: • usual care or • an intervention aimed directly at resident behaviors related to mobility (eg, exercise groups). We excluded all studies in which the control group received interventions other than those described above.
Outcomes (primary and secondary)	The primary outcomes for the review were environmental changes/modifications in nursing facilities and/or nursing staff capacity changes aimed at promoting or maintaining the mobility of the residents (eg, optimizing the environment or competence, knowledge, or behavior of nursing staff). The secondary outcome was the mobility of nursing facility residents (eg, performance of activities, activities of daily living, physical activities, physical function, walking or gait speed and locomotion). We considered studies that measured our primary and secondary outcomes or only primary or only secondary outcomes. We excluded all studies that measured outcomes other than our primary and/or secondary.
Study Design	Because the review focused on interventions for OCB,[23] we included studies with and without randomization such as the following: • randomized/clinical controlled trials, • cluster randomized/controlled trials and • randomized/nonrandomized crossover design studies. We excluded all study designs that could not be used to measure effects of interventions (eg, qualitative study designs)
Other	We only included studies in English and German language. We only included peer-reviewed studies and gray literature in the form of study reports. There were no restrictions on publication status. We excluded all studies that have not been published in English or German and were not peer-reviewed or gray literature in the form of study reports.

additional 16 reports corresponding to these studies were included in the review[36,43,47–60] (Figure 1).

Study Characteristics

The studies were mainly from Europe (n = 8).[33,35,37,40,44,46,61] The remaining studies were from Asia (n = 2),[34,42] North America (n = 3),[38,39,41] and New Zealand (n = 1).[45] Four studies reported the participation of nursing staff members (n = 691), with a mean age ranging from 38.1 to 59.7 years.[41,45,54,56] Three of these 4 studies reported the proportion of female nursing staff ranging from 92.5% to 96.0%.[41,54,56] In all 14 studies, a total of 2614 residents participated. The mean age of the residents in the 14 studies ranged from 75.0 to 87.4 years. For all included studies, the overall proportion of female residents ranged from 63.5% to 86.3%. The study characteristics of all included studies are provided in Table 2.

Description of the Organizational Capacity Building Interventions

Based on the 14 included studies, we clustered the interventions by content or type into 3 different categories (environmental modification, nursing staff capacity, and multifactorial interventions). Four interventions were classified in the category environmental modification.[34,35,45,46] Eight interventions with an educational focus were classified in the category nursing staff capacity.[33,36–42] In 2 studies, we identified a combination of direct and indirect interventions. These interventions are included in the category multifactorial interventions.[43,44] The characteristics of all included interventions are reported according to the recommended items from TIDier and CReDECI 2[27,28] in Supplementary Table 2.

Outcomes and Data Collection Methods of the Included Studies

No study assessed outcomes related to the environment of nursing facility. Outcomes for nursing staff capacity were assessed and reported in 3 studies.[41,54,56] In all 14 studies, outcomes for resident mobility were assessed and reported. Detailed information about data collection methods and outcomes are reported for each study in Table 2.

Quality of the Included Studies

We judged the methodological quality of the 11 included (cluster) randomized controlled trials[33,35,37,41,44,46,61] by using the Cochrane RoB 1[29] and for the 3 nonrandomized controlled trials[34,42,45] we used

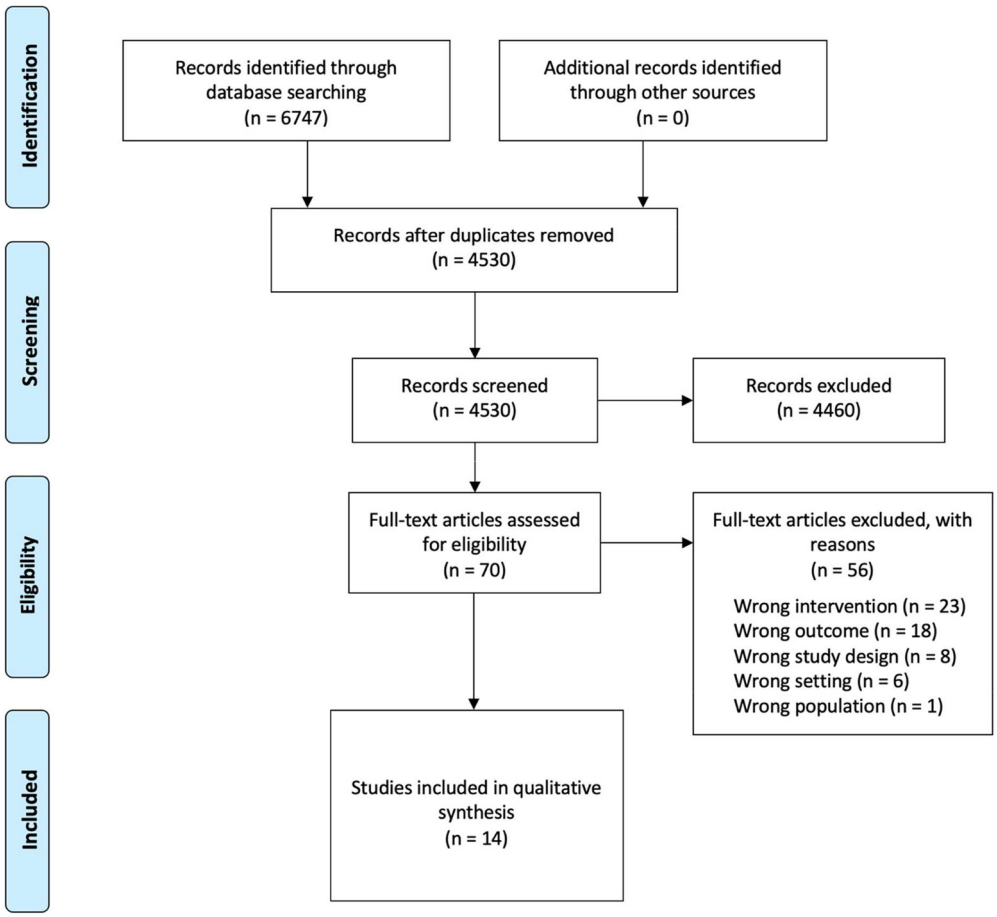

Fig. 1. PRISMA flow diagram[22] demonstrating the identification and screening and eligibility assessments of studies preceding review inclusion.

the ROBINS-I.[30] The methodological quality of the included studies varied, and for most, we rated the risk of bias for the different domains as low and unclear or low and moderate (Figures 2 and 3, respectively). The reasons for judging a high risk of bias or serious bias are reported in Supplementary Table 3.

Effects of Organizational Capacity-Building Interventions

The studies with environmental modification interventions (n = 4) reported outcomes on the mobility of residents and showed heterogeneous effects.[34,35,45,46] First, there was a positive stabilizing effect on functional capacity (Nursing Home Physical Performance Test) for the family style mealtimes intervention[35] and a positive increase in functional activity (mean activity score—Actiwatch L) for the blue-enriched white lightning intervention.[46] The other 2 interventions pharmacist visits[34] and robotic[45] yielded nearly no effects (FIM: MD = 1.56, 95% CI −2.74 to 5.86[34]; ADL: MD = 1.3, 95% CI −1.00 to 3.60, and mobility subscales: MD = 0.4, 95% CI −0.55 to 1.35[45]) in the physical activity and mobility of residents.

Three studies in the category nursing staff capacity reported outcomes on nursing staff capacity.[41,54,56] All 8 included studies in this category reported outcomes on the mobility of residents.[33,36–42]

Three interventions, which addressed one of our primary outcomes (nursing staff capacity), offered an educational and motivational program for nursing staff on providing function-focused care (FFC) for nursing home residents.[41,54,56] Two of these studies identified a positive increase in knowledge (Theoretical Knowledge of Restorative Care Activities Test) about FFC in the intervention groups (MD = 1.3, 95% CI 1.16 to 1.34,[54] and MD = 1.32, 95% CI 0.52 to 2.12[56]). The other study identified no effect in knowledge about FFC in the intervention group.[41] For the outcome behavior (Nursing Assistants Restorative Care Behavior Checklist) for providing FFC, one study identified a positive increase in the intervention group[41] and the other study found no effect in the intervention group (MD = 0.02, 95% CI −0.04 to 0.08[54]).

The same 3 studies also reported effects for physical activity and physical functioning in residents.[38,41,42] In 2 of these studies, it was found that the interventions led to a positive improvement[41] or positive stabilizing (MD = −3.89, 95% CI −6.35 to −1.43[42]) in physical function (Long-Term Care Survey[41]) and activity (ActiGraph[41] and K-ADL[42]) among nursing home residents. In addition, no effects in the intervention groups were shown for Barthel Index,[41] Grip-D S101 (MD = 0.35, 95% CI −2.96 to 3.67[42]) and PCS (MD = 0.86, 95% CI −1.89 to 3.61[42]) outcomes. The other study[38] identified no effects for physical functioning (Barthel Index) and mobility (Tinetti Mobility Scale) comparing the intervention and control groups.

The other 5 studies, which focused on other educational interventions for nursing staff as FFC, also found heterogeneous and inconsistent effects on resident mobility.[33,36,37,39,40] For the following 3 interventions, no positive effects on the mobility, physical activity, and function of residents in the intervention groups were found: an education workshop for implementation of the German national mobility expert standard,[33] the Guide to Action for Falls Prevention Tool—Care Homes (GtACH),[37] and the Skilful Care Training Package.[36] A positive stabilizing effect in physical activity was found for the COSMOS intervention (Physical Self-Maintenance Scale for ADL: MD = −1.4, 95% CI −2.7 to −0.1)[40] and for the study with the focus on the Self-Care for Seniors (SCS) intervention (ADL and time to stand normally with 5 different foot placements).[39]

Table 2
Study Characteristics for the 14 Included Studies

Reference and Funding	Country, Design and Final Follow-up	Study Population	Intervention and Control	Outcome Measures	Results
Environmental modifications • Broadbent et al (2016)[45,*] • Peri et al (2016)[60,†] • Robot Pilot Project program of the Korea Ministry of Knowledge and Economy, the Korea Institute for Robot Industry Advancement and the New Zealand Ministry of Business, Innovation and Employment's International Investment Opportunities Fund (13635)	• New Zealand • Nonrandomized controlled trial • 12 wk after	Overall (Residents) • Age: 85.8 ± 8.1 y • Sex: female n = 40 (76.9%) • Cognitive status: AMTS 6.6 ± 3.0 Overall (Nursing staff) • Age: 47.2 ± 11.5 y • Sex: female n = 49 (92.5%) • Education: 3 y secondary school: n = 16; 4-5 y secondary education: n = 11; postsecondary school education: n = 26 IG (Residents) • Participants: n = 27 (at final follow-up) • Care dependency: ADL 21.7 ± 2.9 IG (Nursing staff) • Participants: n = 29 (at final follow-up) CG (Residents) • Participants: n = 25 (at final follow-up) • Care dependency: ADL score: 19.4 ± 4.9 CG (Nursing staff) • Participants: 24 (at final follow-up)	• IG received a robotic intervention. • CG received usual care with no robots, or no robots were deployed in the staff room.	Residents' mobility: Activities of Daily Living (ADL) subscale: self-care mobility, dressing, feeding, bathing, and toileting[‡]; Mobility subscale: transfers, mobility within the home, and ability on stairs[‡]	No statistically significant benefits for residents in the intervention group: ADL • Baseline: IG: M = 21.7 (SD = 2.9), 95% CI 20.60, 22.79; CG: M = 19.4 (SD = 4.9), 95% CI 17.48, 21.32 • Final follow-up: IG: M = 21 (SD = 3.3), 95% CI 19.75, 22.24; CG: M = 19.7 (SD = 4.8), 95% CI 17.81, 21.58 • Difference in means: MD = 1.3, 95% CI −1.00, 3.60 Mobility subscale • Baseline: IG: M = 4.4 (SD = 1.3), 95% CI 3.91, 4.89; CG: M = 4.2 (SD = 1.9), 95% CI 3.45, 4.94 • Final follow-up: IG: M = 4.4 (SD = 1.5), 95% CI 3.83, 4.96; CG: M = 4.0 (SD = 1.9), 95% CI 3.25, 4.74 • Difference in means: MD = 0.4, 95% CI −0.55, 1.35
• Hopkins et al (2017)[46,*] • Cross-Council New Dynamics of Ageing (NDA) initiative (Grant number RES-339- 25-0009)	• United Kingdom • Randomized crossover design • After 4 wk; 3-wk washout period	Overall (Residents) • Participants: 69 (at final follow-up) • Age: 85.8 ± 7.5 y • Sex: female n = 69 (86.3%) • Care dependency: not reported • Cognitive status: MMSE score 19 ± 6	• IG received blue-enriched white lighting. • CG received white lighting.	Residents' mobility: Mean activity score—Actiwatch L[‡]	Statistically significant[‖] benefit for residents in the intervention group: Mean activity score—Actiwatch L • Crossover design: IG: M = 39.2 (SD = 42.4); CG: M = 34.5 (SD = 32.1)
• Nijs et al (2006)[35,*] • Nijs et al (2006)[59,†] • Nijs (2006)[58,†] • Nijs et al (2003)[57,†] • Netherlands Organisation for Health Research and Development (project no. 2420.0021)	• Netherlands • Cluster-randomized controlled trial • 6 mo after	Overall (Residents) • Clusters: 10 IG (Residents) • Clusters: not reported • Participants: 95 (at final follow-up) • Age: 78.0 ± 11.1 y • Sex: female n = 67 (70.0%) • Care dependency: number of diseases 3 ± 1.4; in wheelchair n = 74 (78.0%) • Cognitive status: not reported CG (Residents) • Clusters: not reported • Participants: 83 (at final follow-up)	• IG had family-style mealtimes. • CG received individually preplated meals.	Residents' mobility: Nursing Home Physical Performance Test[‡]	Statistically significant[‖] benefit for residents in the intervention group: Nursing Home Physical Performance Test • Baseline: IG: M = 25 (SD = 12.3), 95% CI 22.53, 27.47; CG: M = 24 (SD = 12.3), 95% CI 21.35, 26.64 • Final follow-up: IG: β = 0.2, 95% CI −2.3, 2.7; CG: β = −2.2, 95% CI −4.1, 0.4; • Differences in change (IG-CG) β = 3.2 CI 0.9, 5.5

		• Age: 75.0 ± 9.9 y • Sex: female n = 46 (55.0%) • Care dependency: number of diseases 3 ± 1.6; in wheelchair n = 71 (78.0%) • Cognitive status: not reported			
• Hashimoto et al (2020)[34,*] • AMED Japan Agency for Medical Research and Development	• Japan • Nonrandomized controlled trial • 6 mo after	IG (Residents) • Participants: 28 (at final follow-up) • Age: 86.8 ± 7.1 y • Sex: female 78.55% • Care dependency: required care level 3.5 ± 1.0 • Cognitive status: dementia diagnosis 46.4 % CG (Residents) • Participants: 27 (at final follow-up) • Age: 84.9 ± 7.4 y • Sex: female 77.78% • Care dependency: required care level 3.4 ± 1.2 • Cognitive status: dementia diagnosed 70.4%	• IG received pharmacist visits. • CG received usual care.	Residents' mobility: Activities of Daily Living - all 5 items of the Functional Independence Measure (FIM)[‡]	No statistically significant benefit for residents in the intervention group: FIM • Baseline: IG: M = 17.93 (SD = 8.52), 95% CI 14.77, 21.08; CG: M = 17.00 (SD = 7.36), 95% CI 14.22, 19.78 • Final follow-up: IG: M = 17.82 (SD = 8.50), 95% CI 14.67, 20.97; CG: M = 16.26 (SD = 7.36), 95% CI 13.48, 19.04 • Difference in means: MD = 1.56, 95% CI −2.74, 5.86
Nursing staff capacity • Galik et al (2014)[41,*] • Alzheimer's Association New Investigator Research Grant NIRG-09-131261	• United States of America • Cluster-randomized controlled trial • 6 mo after	Overall (Nursing staff) • Clusters: 4 • Participants: 77 • Age: 41.60 ± 12.80 y • Sex: female n = 71 (96%) Overall (Residents) • Clusters: 4 • Participants: 103 • Age: 83.7 ± 9.9 y • Sex: female n = 79 (77.0%) • Care dependency: not reported • Cognitive status: MMSE 8.7 ± 4.0 IG (Residents) • Care dependency: Barthel Index mean 45.56 CG (Residents) • Care dependency: Barthel Index mean 35.62	• IG received the Function-Focused Care program for the Cognitively Impaired (FFC-CI). • CG received only the education of the FFC-CI related to the nursing staff.	• Nursing staff capacity: Theoretical Knowledge of Restorative Care Activities Test[‡]; Nursing Assistants Restorative Care Behavior Checklist[‡] • Residents' mobility: Barthel Index[‡]; Physical activity—ActiGraph[‡]; Physical activity on the Long-Term Care Survey[‡]	Statistically significant[‖] benefit for nursing staff in the intervention group: Nursing staff—Nursing Assistants Restorative Care Behavior Checklist • Baseline: IG: M = 0.63 (SE = 0.04); CG: M = 0.55 (SE = 0.04) • Final follow-up: IG: M = 0.66 (SE = 0.05); CG: M = 0.40 (SE = 0.06) No statistically significant benefit for nursing staff in the intervention group: Nursing staff—Theoretical Knowledge of Restorative Care Activities Test • Baseline: IG: M = 7.85 (SE = 0.32); CG: M = 7.58 (SE = 0.37) • Final follow-up: IG: M = 8.5 (SE = 0.26); CG: M = 8.09 (SE = 0.3) Statistically significant[‖] benefits for residents in the intervention group: Residents—Physical activity on the Long-Term Care Survey • Baseline: IG: M = 115.96 (SE = 14.75); CG: M = 130.18 (SE = 16.39) • Final follow-up: IG: M = 126.05 (SE = 14.75); CG: M = 74.33 (SE = 13.25)

(*continued on next page*)

Table 2 (*continued*)

Reference and Funding	Country, Design and Final Follow-up	Study Population	Intervention and Control	Outcome Measures	Results
					Residents: Physical activity - ActiGraph • Baseline: IG: M = 20.31 (SE = 3.34); CG: M = 18.81 (SE = 3.07) • Final follow-up: IG: M = 86.28 (SE = 26.68); CG: M = 32.85 (SE = 7.22) No statistically significant benefit for residents in the intervention group: Residents: Barthel Index • Baseline: IG: M = 45.56 (SE = 4.11); CG: M = 35.62 (SE = 3.94) • Final follow-up: IG: M = 51.27 (SE = 3.43); CG: M = 45.35 (SE = 2.95)
• Jung et al (2020)[42,*] • Jung et al (2020)[56,†] • Basic Science Research Program through the National Research Foundation of Korea (NRF); Ministry of Science, ICT and Future Planning (No. 2013R1A1A1010718); Ministry of Education (No. 201713030011)	• South Korea • Nonrandomized controlled trial • 12 wk after	IG (Nursing staff) • Participants: 24 (at final follow-up) • Age: 54.13 ± 5.68 y • Sex: not reported • Education: Elementary School: 4.2 %; Middle School: 0.0 %; High School: 79.2 %; >College: 16.7 % • Career in months: 46.13 ± 87.74 IG (Residents) • Participants: 21 (at final follow-up) • Age: 84.71 ± 7.47 y • Sex: female n = 17 (81.0%) • Care dependency: care level 1: 4.8%; 2: 38.1%; 3: 42.9%; 4: 14.3% • Cognitive status: K-MMSE 13.81 ± 5.96 CG (Nursing staff) • Participants: 26 (at final follow-up) • Age: 59.77 ± 3.81 y • Sex: not reported • Education: Elementary school: 3.8%; Middle school: 30.8%; High school: 53.8%; >College: 3.8% Career in months: 61.42 ± 37.18 CG (Residents) • Participants: 20 (at final follow-up) • Age: 80.30 ± 8.06 y • Sex: female n = 16 (80.0%) • Care dependency: care level; 1: 0%; 2: 45.0%; 3: 45.0%; 4: 10.0% • Cognitive status: K-MMSE 16.60 ± 7.12	• IG received the Korean-Function-Focus-Care Program (K-FFCP). • CG received no education.	• Nursing staff capacity: Theoretical Knowledge of Restorative Care Activities Test[‡] • Residents' mobility: Korean Activities of Daily Living − K-ADL[‡]; Korean Version of the Physical Capability Scale − PCS[‡]; Grip strength dynamometer − Grip-D S101[‡]	Statistically significant[‖] benefit for nursing staff in the intervention group: Nursing staff—Theoretical Knowledge of Restorative Care Activities Test • Baseline: IG: M = 7.16 (SD = 1.53), 95% CI 6.54, 7.77; CG: M = 5.37 (SD = 1.67), 95% CI 4.73, 6.01 • Final follow-up: IG: M = 6.92 (SD = 1.19), 95% CI 6.44, 7.40; CG: M = 5.6 (SD = 1.58), 95% CI 4.99, 6.21 • Difference in means: MD = 1.32, 95% CI 0.52, 2.12 Statistically significant[‖] benefit for residents in the intervention group: Residents − K-ADL • Baseline: IG: M = 12.95 (SD = 4.71), 95% CI 10.93, 14.96; CG: M = 15.75 (SD = 3.25), 95% CI 14.32, 17.17 • Final follow-up: IG: M = 11.81 (SD = 4.58), 95% CI 9.85, 13.77; CG: M = 15.7 (SD = 3.04), 95% CI 14.37, 17.03 • Difference in means: MD = −3.89, 95% CI −6.35, −1.43 No statistically significant benefits for residents in the intervention group:

• Resnick et al (2009)[38,*] • Resnick et al (2009)[52,†] • Resnick et al (2009)[53,†] • Resnick et al (2009)[54,†] • Resnick et al (2008)[55,†] • Agency for Healthcare Research and Quality (AHRQ) Grant R01 HS/MH 13372-01	• United States of America • Randomized controlled trial • 12 mo after	Overall (Nursing staff) • Age: 38.1 ± 12.0 • Sex: female n = 486 (93.0%) • Years of education: 14.7 ± 3.8 • Years of work experience: 11.5 ± 8.6 IG (Nursing staff) • Participants: 179 (at final follow-up) IG (Residents) • Participants: 168 (at final follow-up) • Age: 83.7 ± 8.1 y • Sex: female n = 197 (77.0%) • Care dependency: Barthel Index 58.70 ± 1.86 • Cognitive status: MMSE 20.8 ± 5.4 CG (Nursing staff) Participants: 178 (at final follow-up) CG (Residents) • Participants: 158 (at final follow-up) • Sex: female n = 192 (83.1%) • Care dependency: Barthel Index 59.06 ± 1.93 • Cognitive status: MMSE 19.9 ± 5.1	• IG received the Res-Care in-service educational component. • CG received a single in-service program on managing difficult behaviors.	• Nursing staff capacity: Theoretical Knowledge of Restorative Care Activities Test[‡]; Nursing Assistants Restorative Care Behavior Checklist[‡] • Residents' mobility: Barthel Index[‡]; Tinetti Mobility scale[‡]	Residents − PCS • Baseline: IG: M = 11.81 (SD = 3.9), 95% CI 10.34, 13.47; CG: M = 12.4 (SD = 2.32), 95% CI 11.38, 13.42 • Final follow-up: IG: M = 10.71 (SD = 4.31), 95% CI 8.87, 12.55; CG: M = 9.85 (SD = 4.4), 95% CI 7.92, 11.78 • Difference in means: MD = 0.86, 95% CI −1.89, 3.61 Residents: Grip strength dynamometer, Grip-D S101 • Baseline: IG: M = 8.04 (SD = 5.36), 95% CI 5.75, 10.33; CG: M = 9.23 (SD = 5.8), 95% CI 6.69, 11.77 • Final follow-up: IG: M = 9.24 (SD = 5.1), 95% CI 7.06, 11.42; CG: M = 8.89 (SD = 5.39), 95% CI 6.53, 11.25 • Difference in means: MD = 0.35, 95% CI −2.96, 3.67 Statistically significant[¶] benefit for nursing staff in the intervention group: Nursing staff—Theoretical Knowledge of Restorative Care Activities Test • Baseline: IG: M = 8.21 (SE = 0.15), 95% CI 7.92, 8.50; CG: M = 8.21 (SE = 0.14), 95% CI 7.93, 8.48 • Final follow-up: IG: M = 9.76 (SE = 0.18), 95% CI 9.41, 10.11; CG: M = 8.46 (SE = 0.19), 95% CI 8.09, 8.83 • Difference in means: MD = 1.3, 95% CI 1.16, 1.34 No statistically significant benefit for nursing staff in the intervention group: Nursing staff—Nursing Assistants Restorative Care Behavior Checklist • Baseline: IG: M = 0.64 (SE = 0.01), 95% CI 0.62, 0.66; CG: M = 0.63 (SE = 0.01), 95% CI 0.61, 0.65 • Final follow-up: IG: M = 0.65 (SE = 0.02), 95% CI 0.61, 0.69; CG: M = 0.63 (SE = 0.02), 95% CI 0.59, 0.67

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Table 2 (*continued*)

Reference and Funding	Country, Design and Final Follow-up	Study Population	Intervention and Control	Outcome Measures	Results
					• Difference in means: MD = 0.02, 95% CI −0.04, 0.08 No statistically significant benefits for residents in the intervention group: Residents—Barthel Index • Baseline: IG: M = 58.7 (SE = 1.86); CG: M = 59.06 (SE = 1.93) • Final follow-up: IG: M = 55.29 (SE = 2.37); CG: M = 53.1 (SE = 2.34) Residents—Tinetti Mobility scale • Baseline: IG: M = 4.74 (SE = 0.49); CG: M = 6.71 (SE = 0.56) • Final follow-up: IG: M = 4.9 (SE = 0.63); CG: M = 5.27 (SE = 0.68) No statistically significant benefits for residents in the intervention group: Residents—Timed up-and-go test • Baseline: IG A: M = 31.9 (SD = 19.5), 95% CI 29.59, 34.21; IG B: M = 33.8 (SD = 27), 95% CI 30.53, 37.07; CG: M = 33.7 (SD = 24.4), 95% CI 30.60, 36.80 • Final follow-up: IG A: M = 27.7 (SD = 14.4), 95% CI 25.79, 29.61; IG B: M = 32.4 (SD = 22.3), 95% CI 23.32, 35.47; CG: M = 30.9 (SD = 17.8), 95% CI 28.30, 33.50 • Difference in means IG A/CG: MD = −3.2, 95% CI −6.40, 0.01 • Difference in means IG B/CG: MD = 1.5, 95% CI −2.59, 5.59 Residents able to walk—EboMo • Baseline: IG A: M = 37.54 (SD = 4.05), 95% CI 37.07, 38.01; IG B: M = 36.69 (SD = 4.73), 95% CI 36.13, 37.24; CG: M = 37.4 (SD = 4.05), 95% CI 36.93, 37.87 • Final follow-up: IG A: M = 36.42 (SD = 5.13), 95% CI 35.79, 37.04; IG B: M = 36.78 (SD = 4.5), 95% CI 36.20, 37.35; CG: M = 36.72 (SD = 5.61), 95% CI 35.98, 37.45
• Görres et al (2016)[33,*] • The National Association of Statutory Health Insurance Funds Germany	• Germany • Cluster-randomized controlled trial • 6 mo after	IG (Residents) • Clusters: 9 (at follow-up) • Participants: 337 (at final follow-up) • Age: 83.8 ± 9.0 y • Sex: female n = 290 (76.3%) • Care dependence; Care level • 0.5%; 0: 0.3%; 1: 48.9%; 2: 42.1%; 3: 6.8%; 3+: 1.3% • Cognitive status: MMSE 20.2 ± 7.8 CG (Residents) • Clusters: 11 (at final follow-up) • Participants: 297 (at final follow-up) • Age: 83.7 ± 9.8 y • Sex: female n = 245 (72.7%) • Care dependency; care level: 0.6%; 0: 4.7%; 1: 46.0%; 2: 39.5%; 3: 7.7%; 3+: 1.5% • Cognitive status: MMSE 21.3 ± 6.3	• IG A received an education session on implementing the German national mobility expert standard. • IG B received the same intervention as group A in addition to an explicit mobility training for promoting the mobility of the residents. • CG received usual care.	Residents' mobility: Timed up-and-go test[§]; Erfassungsbogen Mobilität—EboMo[‡] (only available in the German language)	

• Graham et al (2018)[62,†] Graham et al (2020)[36,*] • • Chartered Society of Physiotherapy (CSP) Charitable Trust (grant no. OPA/14/03)	• United Kingdom • Cluster-randomized controlled feasibility study • 6 mo after	IG (Residents) • Clusters: 4 (at final follow-up) • Participants: 54 (at final follow-up) • Age: 87.4 ± 7.22 y • Sex: female n = 59 (78.7%) • Care dependency: Barthel Index 4.1 ± 4.9 • Cognitive status: not reported CG (Residents) • Clusters: 5 (at final follow-up) • Participants: 50 • Age: 84.5 ± 8.34 y • Sex: female n = 47 (66.2%) • Care dependency: Barthel Index 3.9 ± 3.92 • Cognitive status: not reported	• IG received the Skilful Care Training Package (SCTP). • CG received usual care.	Residents' mobility: Barthel Index of Activities of Daily Living[‡]; Physical Activity and Mobility in Residential Care scale (PAM-RC)[‡]; Continuing Care Activity Measure (CCAM)[‡]	• Difference in means IG A/CG: MD = −0.3, 95% CI −1.27, 0.67 • Difference in means IG B/CG: MD = 0.06, 95% CI −0.87, 0.99 Residents not able to walk—EboMo • Baseline: IG A: M = 26.34 (SD = 6.35), 95% CI 25.05, 27.63; IG B: M = 23.14 (SD = 6.82), 95% CI 21.77, 24.50; CG: M = 23.58 (SD = 7.18), 95% CI 22.10, 25.05 • Final follow-up: IG A: M = 25.08 (SD = 6.6), 95% CI 19.55, 30.60; IG B: M = 24.9 (SD = 6.19), 95% CI 21.86, 24.79; CG: M = 23.33 (SD = 7.34), 95% CI 4.53, 7.85 • Difference in means IG A/CG: MD = 1.75, 95% CI −0.48, 3.98 • Difference in means IG B/CG: MD = 1,57, 95% CI −0.60, 3.74 No statistically significant benefits for residents in the intervention group: Barthel Index • Baseline: IG: M = 4.6 (SD = 2.69), 95% CI 3.98, 5.21; CG: M = 4 (SD = 1.71), 95% CI 3.76, 4.23 • Final follow-up: IG: M = 3.4 (SD = 2.49), 95% CI 2.83, 4.16; CG: M = 3.4 (SD = 0.61), 95% CI 3.23, 3.57 • Difference in means: MD = 0.1, 95% CI −0.61, 0.81 PAM-RC • Baseline: IG: M = 4.8 (SD = 2.65), 95% CI 4.20, 5.40; CG: M = 4.7 (SD = 1.71), 95% CI 4.30, 5.10 • Final follow-up: IG: M = 4.2 (SD = 1.96), 95% CI 3.68, 4.72; CG: M = 3.6 (SD = 1.45), 95% CI 3.20, 4.00 • Difference in means: MD = 0.6, 95% CI −0.07, 1.27 CCAM • Baseline: IG: M = 58 (SD = 13.34), 95% CI 54.94, 61.06; CG: M = 53.7 (SD = 10.45), 95% CI 51.20, 56.20

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Table 2 (*continued*)

Reference and Funding	Country, Design and Final Follow-up	Study Population	Intervention and Control	Outcome Measures	Results
					• Final follow-up: IG: M = 49.4 (SD = 7.66), 95% CI 47.32, 51.58; CG: M = 44.7 (SD = 7.33), 95% CI 42.65, 46.75 • Difference in means: MD = 4.7, 95% CI 1.74, 7,66
• Husebø et al (2019)[40,*] • Habiger et al (2019)[51,†] • Aasmul et al (2018)[48,†] • Blytt et al (2017)[50,†] • Aasmul et al (2018)[49,†] • Research Council of Norway (sponsor's protocol code 222113/H10); The Rebekka Ege Hegermann's foundation	• Norway • Cluster-randomized controlled trial • 9 mo after	IG (Residents) • Clusters: 36 (at final follow-up) • Participants: 214 (at final follow-up) • Age: 86.5 ± 7.7 y • Sex: female n = 216 (73.0%) • Care dependency: ADL 17.7 ± 5.1 • Cognition status: MMSE 11 (4-16) CG (Residents) • Clusters: 31 (at final follow-up) • Participants: 183 (at final follow-up) • Age: 87.0 ± 7.2 y • Sex: female n = 186 (75.0%) • Care dependency: ADL 16.9 ± 5.6 • Cognition status: MMSE 12 (4-17)	• IG received the COSMOS intervention. • CG received usual care.	Residents' mobility: Physical self-maintenance scale for activities of daily living[§]	Statistically significant[‖] benefit for residents in the intervention group: Physical self-maintenance scale for activities of daily living • Baseline: IG: M = 16.9 (SD = 5.6), 95% CI 16.20, 17.60; CG: M = 17.3 (SD = 5.4), 95% CI 19.68, 17.91 • Final follow-up: Between-group effect between baseline and 9 mo: MD = −1.4, 95% CI −2.7, −0.1
• Morris et al (1999)[39,*] • Grant AG11719 − National Institute of Health, National Institute on Aging, HRCA Roybal Center of Research on Applied Gerontology	• United States of America • Cluster-randomized controlled trial • 10 mo after	Overall (Residents) • Participants: 392 (at final follow-up) • Age: 84.7 y • Sex: female 79.0 % • Cognitive status: severely impaired cognitive skills 38%; Alzheimer's disease 24%; dementia other than Alzheimer's disease 27% IG A (Residents) • Participants: 144 (at final follow-up) • Care dependency: ADL mean score 21.37 IG B (Residents) • Participants: 124 (at final follow-up) • Care dependency: ADL mean score 20.48 CG (Residents) • Participants: 124 (at final follow-up) • Care dependency: ADL mean score 19.96	• IG A received the "Self-Care for Seniors" education program. • IG B received an exercise program. • CG received usual care.	Residents' mobility: Activities of Daily Living − MDS indicators of bed mobility, transfer, walk in room, walk in corridor, self-walking or self-propelled wheelchair mobility on and off the unit, dressing, personal hygiene, toilet use and eating[§]; Time required to stand up 5 times in a row[‖]; Time able to stand normally with 5 different foot placements[‡]; Number of feet walked[‡]	Statistically significant[¶] benefit for residents in the intervention group: ADL • Baseline: IG: M = 21.37; CG: M = 19.96 • Final follow-up: IG: M = 21.76; CG: M = 23.43; • Time to stand normally with 5 different foot placements Baseline[‖]: IG: M = 2.63; CG: M = 2.41; Final follow-up: IG: M = 1.84; CG: M = 2.09 No statistically significant benefits for residents in the intervention group: Time required to stand up 5 times in a row • Baseline: IG: M = 2.52; CG: M = 2.44 • Final follow-up: IG: 2.52; CG: 2.51 Distance (in feet) walked • Baseline: IG: M = 1.80; CG: M = 1.82 • Final follow-up:

• Walker et al (2016)[37,*] • National Institute of Health Research (NIHR) Research for Patient Benefit grant funding stream [PB-PG-1010-23053]; The Collaboration for Leadership in Applied Health Research and Care East Midlands (CLAHRC EM) [P0511172]	• United Kingdom • Cluster-randomized controlled trial • 6 mo after	IG (Residents) • Clusters: 3 (at final follow-up) • Participants: 22 (at final follow-up) • Age: 84.0 ± 14.8 y • Sex: female n = 18 (72.0%) • Care dependency: Barthel Index 11.9 ± 4.9 • Cognitive status: not reported CG (Residents) • Clusters: 3 (at final follow-up) • Participants: 20 (at final follow-up) • Age: 82.0 ± 13.4 y • Sex: female n = 17 (63.0%) • Care dependency: Barthel Index 11.0 ± 4.7 • Cognitive status: not reported	• IG received a training for the Guide to Action Care Home manual. • CG received usual care.	Residents' mobility: Barthel Index[‡]	IG: M = 1.40; CG: M = 1.58 No statistically significant benefit for residents in the intervention group: Barthel Index • Baseline: IG: M = 11.9 (SD = 4.9), 95% CI 9.98, 13.82; CG: M = 11 (SD = 4.7), 95% CI 9.23, 12.78 • Final follow-up: IG: M = 11.3 (SD = 5.1), 95% CI 9.17, 13.43; CG: M = 10.1 (SD = 4.1), 95% CI 8.30, 11.90 • Difference in means: MD = 1.2, 95% CI −1.69, 4.09
Multifactorial intervention • Dyer et al (2004)[44,*] • Department of Health's Public Health Development fund (South West)	• United Kingdom • Randomized controlled trial • 3 mo after	IG (Residents) • Participants: 89 (at final follow-up) • Age: 87.2 ± 6.9 y • Sex: female n = 81 (79.4%) • Care dependency: Barthel Index median 16 (Q1-Q3 13.7-17) • Cognitive status: AMTS 6.20 ± 3.1 CG (Residents) • Participants: 83 • Age: 87.4 ± 6.9 y • Sex: female n = 72 (76.59%) • Care dependency: Barthel Index median 16 (Q1-Q3 14-17) • Cognitive status: AMTS 7.4 ± 2.6	• IG received a multifactorial risk modification program. • CG received usual care.	Residents' mobility: Timed up-and-go test[§]; Time in unsupported standing[†]; Tinetti Mobility Scale[‡]	Statistically significant[‖] benefit for residents in the intervention group: Time unsupported stand (Median, Q1-Q3) • Baseline: IG: Median = 60 [60, 60]; CG: Median = 60 [60, 60] • Final follow-up: IG: Median = 60 [60, 60]; CG: Median = 60 [53, 60] No statistically significant benefits for residents in the intervention group: Timed up-and-go test (Median, Q1-Q3) • Baseline: IG: Median = 31.0 [20.7, 54.9]; CG: Median = 28.7 [20.2, 48.1] • Final follow-up: IG: Median = 28.9 [17.5, 53.1]; CG: Median = 29.9 [18.3, 3.1] Tinetti Mobility Scale (Median, Q1-Q3) • Baseline: IG: Median = 16 [11, 20]; CG: Median = 15 [11.25, 21.75] • Final follow-up: IG: Median = 18 [13, 23]; CG: Median = 15 [12, 21]
• Jensen et al (2002)[61,*] • Jensen et al (2003)[47,†] • Jensen et al (2004)[43,†] • Federation of County Councils in Sweden, Vardal Foundation, Gun	• Sweden • Cluster-randomized controlled trial • 11 wk/9 mo after	IG (Residents) • Clusters: 4 (at final follow-up) • Participants: 77 (at final follow-up) • Age: 84 y (IQR 81-88)	• IG received multifactorial risk modification program. • CG received usual care.	Residents' mobility: Step height > 5 cm[‡]; Step height > 10 cm[‡]; Berg Balance Scale[†]; Functional Ambulation Categories[‡]; Fast gait speed[§]	Statistically significant benefits for residents in the intervention group: Step height > 5 cm[¶] • Baseline:

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Table 2 (*continued*)

Reference and Funding	Country, Design and Final Follow-up	Study Population	Intervention and Control	Outcome Measures	Results
and Bertil Stohne Foundation, and Erik and Anne-Marie Detlof's Foundation		• Sex: female n = 66 (74.0%) • Care dependency: Barthel Index mean 14 (IQR 10-17) • Cognitive status: MMSE score mean = 19 (IQR 12-22) CG (Residents) • Clusters: 5 (at final follow-up) • Participants: 75 (at final follow-up) • Age: 84 y (IQR 80-87) • Sex: female n = 74 (76.0%) • Care dependency: Barthel Index mean 13 (IQR 9-16) • Cognitive status: MMSE mean score = 15 (IQR 12-20)			IG (n = 87): n = 21 (24%); CG (n = 96): n = 19 (20%) • Final follow-up: IG (n = 77): n = 30 (39%); CG (n = 85): n = 17 (20%) Step height > 10 cm‖ • Baseline: IG (n = 87): n = 11 (13%); CG (n = 96): n = 13 (14%)§ Final follow-up: IG (n = 77): n = 24 (34%); CG (n = 85): n = 14 (17%) Functional Ambulation Categories >4¶ • Baseline: IG (n = 89): n = 62 (70%); CG (n = 98): n = 63 (64%) • Final follow-up: IG (n = 71): n = 53 (75%); CG (n = 73): n = 33 (45%) Fast Gait speed‖ • Baseline: IG: Median/quartile 10th-90th = 0.67 [0.31-1.09]; CG: Median/quartile 10th-90th = 0.62 [0.31-1.08] • Final follow-up: IG: Median/quartile 10th-90th = 0.65 [0.24-1.05]; CG: Median/quartile 10th-90th = 0.37 [0.01-0.98] No statistically significant benefits for residents in the intervention group: Berg Balance Scale • Baseline: IG: Median/quartile 10th-90th = 23 [7-46]; CG: Median/quartile 10th-90th = 19 [4-42] • Final follow-up: IG: Median/quartile 10th-90th = 33 [6-48]; CG: Median/quartile 10th-90th = 21 [4-46]

ADL, activities of daily living; AMTS, The Abbreviated Mental Test Score; β, beta coefficient; CG, control group; CI, confidence interval; IG, intervention group; IQR, interquartile-range; (K-) MMSE, (Korean-) Mini-Mental State Examination; M, mean; n, number of participants; NA, not available; Q1-Q3, quartile1-quartile 3; SD, standard deviation; SE, standard error.

*Primary publication.

†Additional publication.

‡Higher score indicates better outcome.

§Lower score indicates better outcome.

‖Statistically significant ($P < .05$).

¶Statistically significant ($P < .001$).

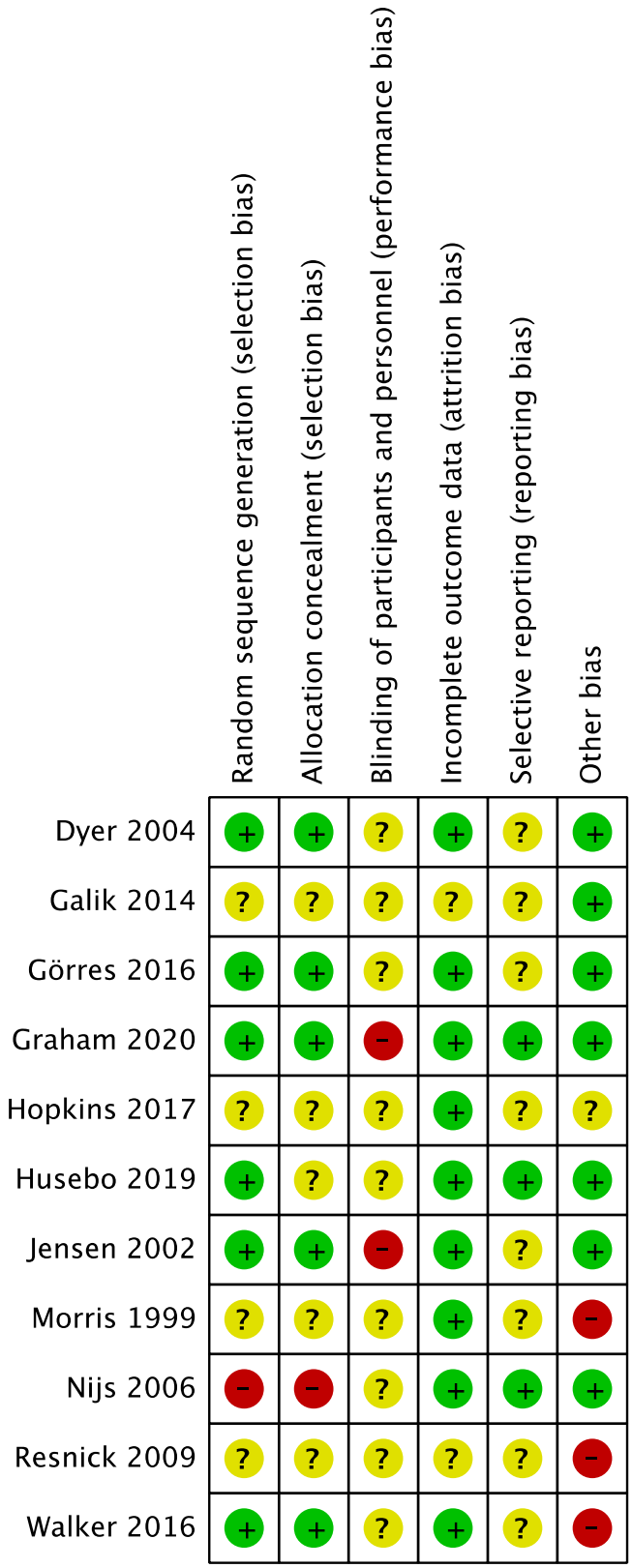

Fig. 2. Risk of Bias 1 (RoB 1) summary for each included (cluster) randomized controlled trial.

The effects of multifactorial interventions on mobility for residents were investigated in 2 studies.[43,44] These interventions focused on a multifactorial risk modification program (eg, a combination of resident exercise classes, education programs for nursing staff and environmental modifications in nursing homes). In both studies, a positive stabilizing effect was identified for some mobility outcomes (time unsupported stand,[44] step height > 5 cm, step height > 10 cm, Functional Ambulation Categories > 4, fast gait speed[43]) in the intervention groups. For the other outcome measures timed up-and-go test and Tinetti Mobility Scale,[44] and Berg Balance Scale,[43] no effects on residents' mobility were found in the intervention groups.

Discussion

To our knowledge, this study is the first to systematically review the effects of OCB interventions with the aim to promote or maintain mobility of the residents. The strength of our review is its methodological quality, the systematic and broad approach to identify various OCB interventions, and their effects on environment, nursing staff capacity, and resident mobility. We included 14 studies and additional 16 reports of these studies, with a total number of 691 nursing staff and 2614 residents. We clustered these interventions into 3 categories: environmental modification, nursing staff capacity, and multifactorial interventions. In summary, the designs, quality, interventions, outcomes, and measurements of the included studies were very heterogeneous. Unfortunately, this leads us to conclude that it is not possible to draw a clear overall conclusion on the effects of the included interventions on our primary and secondary outcomes.

In terms of our research objective 1, no study measured environmental outcomes, and 3 studies measured outcomes at the nursing staff level. In summary, the 3 interventions are inconsistent in their effects with a tendency for a positive increase in knowledge about FFC[54,56] in 2 studies and in behavior for providing FFC[41] in another study. It needs to be considered that one of the 2 studies that reported a positive increase in knowledge was a nonrandomized trial.[56] However, we judged the study quality as moderate and, therefore, sound evidence for a nonrandomized trial but cannot be compared with a randomized trial.[30] As a result, the positive effect of this study needs to be interpreted with caution.

In general, it seems that at present, outcomes at the environmental and nursing staff levels can be considered poorly explored.

All studies reported outcomes for our research objective 2. For the interventions in the category environmental modification, it can be summarized that family mealtimes[35] could prevent the loss of functional capacity in nursing facility residents. For the blue-enriched lightning intervention,[46] it should be mentioned that the positive increase in physical activity also included physical activity during the night and should be critically evaluated at this point.

Furthermore, it seems that the 2 of 3 interventions[41,42] with a focus on FFC in the category nursing staff capacity can partially positively stabilize and can have a positive effect on mobility in residents, which cannot be clearly explained by the knowledge and behavior outcomes in nursing staff reported previously. The other 5 interventions in the category nursing staff capacity may have had no or a positive effect on residents' mobility. The effects of these interventions on mobility vary within and across the studies and depend on the outcomes and measurement tools used.

For the category multifactorial interventions, it seems that the 2 interventions had no effects or positive effects on residents' mobility. The results appear heterogeneous and inconsistent. In addition, we could not determine whether the effect of the intervention was due to the direct or indirect intervention or to a combination of the 2 interventions.

The heterogeneous and inconsistent results of the studies included in our review could be due to the fact that assessing outcomes at the environmental or nursing staff level was mainly not part of the original study or was not reported. As a result, it remains unclear whether environmental modifications or educational programs had a

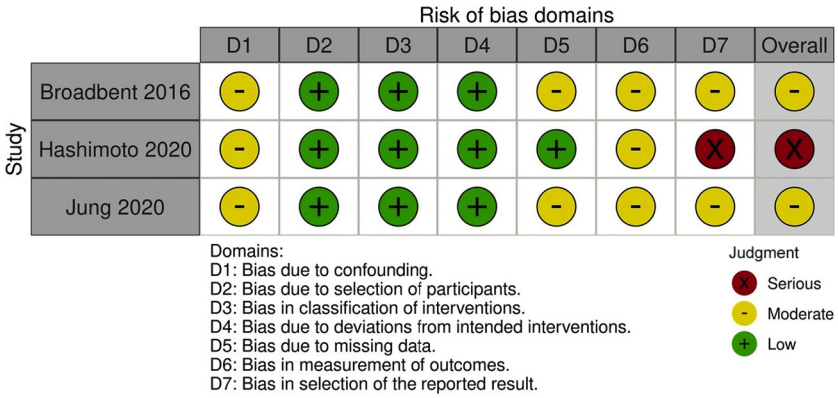

Fig. 3. Risk of Bias In Non-randomised Studies—of Interventions (ROBINS-I) summary for each included nonrandomized controlled trial.

positive effect on the environment in the nursing facility or on the nursing staff capacity. Furthermore, it remains unclear whether the identified improvements in these outcomes led to the improvements in residents' mobility. The missing outcome assessments of the environment and nursing staff led us to the conclusion that OCB interventions are probably blur with implementation approaches. Therefore, the question arises whether OCB interventions are considered key elements of interventions promoting mobility or whether outcomes, such as increases in nursing staff capacity, are considered to be a key element of the implementation. We assume that all identified OCB interventions can be understood as interventions whose outcomes can be measured; therefore, how and in which way they can be integrated into the daily routine of the nursing staff to be effective can be investigated.

Following this, the lack of research on the organizational preconditions for the implementation of these interventions could be an additional reason why we found heterogeneous and inconsistent results.[63,64] In the included studies, it seems unknown whether the respective intervention was implemented successfully and how success was determined. As a result, it remains unclear whether an intervention had no effect or whether implementation of the intervention was unsuccessful.[65] Examples of implementation outcome measures are acceptability, feasibility, and implementation cost. These and other outcomes could be used to measure whether implementation was successful or not.[66] Furthermore, the use of frameworks for implementation could help to improve implementation and, as a result, increase the effectiveness of an intervention.[67] Only 2 of 14 studies reported the underlying theory and mechanics of how the intervention was expected to work.[38,41] In this case, structured intervention development following the framework of the Medical Research Council (MRC) could lead to a more theoretical foundation and understanding of how and why interventions work and may, as a result, improve their effectiveness.[63] Finally, regarding reporting of the items recommended by TIDier and CReDECI 2, our study revealed that there was insufficient reporting of the different intervention components (eg, material) in most of the included studies. However, this appears to be essential for successful implementation of the interventions in other care contexts.

The systematic review we conducted has some limitations. The lack of an international standard for defining OCB and related interventions in the context of nursing facility and its impact on resident mobility limits the understanding of indirect intervention approaches. An internationally accepted definition of OCB interventions may have led to other aspects that were not considered in our review. Furthermore, because of the focus on OCB interventions for modifying environmental aspects of nursing facilities and increasing nursing staff capacity and the wide variety of study designs used to test these interventions,[23] we included not only randomized controlled trials but also nonrandomized controlled trials. This must be taken into account when making comparisons between the different studies. However, only 1 of the 3 included nonrandomized controlled trials identified a positive effect for nursing staff (knowledge) and residents (K-ADL).[56] Consequently, the impact of the included nonrandomized controlled trials on the result of our review seems to be rather small and in line with the findings of the included (cluster) randomized trials. Finally, we considered only English and German language publications and no librarian was involved in the development of the search strategy. However, the search strategy was conducted by researchers with a professional background in health care, expertise in conducting reviews, and reviewed by the team using a systematic process.[24]

Conclusion and Implications

The present systematic review identified various OCB interventions aimed at promoting or maintaining mobility in residents living in a nursing facility. The results of our systematic review did not reveal a clear pattern of findings. First, an international definition and understanding of OCB could lead to a clear distinction of interventions and implementation approaches resulting in specific outcome assessments for the environment and nursing staff.[67,68] Second, research and the development of interventions for OCB with a focus on resident mobility in accordance with the MRC framework is needed.[63] Third, interventions should consider organizational preconditions and ought to be implemented and evaluated with effective approaches and outcome measures, respectively. In summary, international awareness of this type of intervention could result in a more specific research focus, new approaches to interventions and a better understanding of how and why an intervention may work and the effect of OCB on the environment, nursing staff, and resident mobility.

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Supplementary Data

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Supplementary Table 1
Search Strategy for MEDLINE (via PubMed)

Population	#1 long term care [MeSH Terms]
	#2 residential facilities [MeSH Terms]
	#3 skilled nursing facilities [MeSH Terms]
	#4 residential facilit*[Title/Abstract]
	#5 skilled nursing facilit*[Title/Abstract]
	#6 nursing home*[Title/Abstract]
	#7 homes for the aged [Title/Abstract]
	#8 care home*[Title/Abstract]
	#9 long term care [Title/Abstract]
	#10 short term care [Title/Abstract]
	#11 OR/#1-10
Intervention	#12 architecture [MeSH Terms]
	#13 architecture [Title/Abstract]
	#14 environment [MeSH Terms]
	#15 environment*[Title/Abstract]
	#16 education [Title/Abstract]
	#17 education [MeSH Terms]
	#18 teaching [MeSH Terms]
	#19 teaching [Title/Abstract]
	#20 training [Title/Abstract]
	#21 capability [Title/Abstract]
	#22 capacity building [Title/Abstract]
	#23 light*[Title/Abstract]
	#24 daylight [Title/Abstract]
	#25 workflow [Title/Abstract]
	#26 system [Title/Abstract]
	#27 change process [Title/Abstract]
	#28 work structure [Title/Abstract]
	#29 policy [Title/Abstract]
	#30 regulation [Title/Abstract]
	#31 staff*[Title/Abstract]
	#32 nursing staff [MeSH Terms]
	#33 walking way [Title/Abstract]
	#34 parkour [Title/Abstract]
	#35 garden [Title/Abstract]
	#36 floor*[Title/Abstract]
	#37 assistive technology [Title/Abstract]
	#38 assistive aids [Title/Abstract]
	#39 person-centred care [Title/Abstract]
	#40 person-centered care [Title/Abstract]
	#41 medication [Title/Abstract]
	#42 intervention [Title/Abstract]
	#43 prevention [Title/Abstract]
	#44 OR/#12-43
	#45 #11 AND #44
Outcome	#46 physical activities [MeSH Terms]
	#47 physical activities [Title/Abstract]
	#48 walk*[Title/Abstract]
	#49 walking [MeSH Terms]
	#50 activity [Title/Abstract]
	#51 ambulat*[Title/Abstract]
	#52 mobil*[Title/Abstract]
	#53 moving [Title/Abstract]
	#54 gait [Title/Abstract]
	#55 function [Title/Abstract]
	#56 physical function [Title/Abstract]
	#57 physical fitness [Title/Abstract]
	#58 physical fitness [MeSH Terms]
	#59 motor activities [MeSH Terms]
	#60 motor activities [Title/Abstract]
	#61 movability [Title/Abstract]
	#62 locomotion [MeSH Terms]
	#63 locomotion [Title/Abstract]
	#64 OR/#46-63
	#65 #45 AND #64
Study design	#66 randomized controlled trial [Publication Type]
	#67 controlled clinical trial [Publication Type]
	#68 groups [Title/Abstract]
	#69 trial [Title/Abstract]
	#70 random*[Title/Abstract]
	#71 OR/#66-70
	#72 #65 AND #71

Supplementary Table 2
Intervention Characteristics for the 14 Included Studies

Source	What? Procedures	Why? Development, Rationale and Theory	What? Materials	How? Modes of Delivery	Who? Intervention Provider	When and How Much? Number of Sessions, etc
Environmental modifications						
■ Broadbent et al (2016)[45] ■ Peri et al (2016)[60]	Robotic intervention: • Two different robots (Cafero and/or guide robot). • Robots provided different functions, eg, measured vital signs or provided entertainment and Internet access. • In addition, the Cafero robots provided exercises for brain fitness. • Using the robots included initial greeting and a personalized interface. • The robots recognized the person by initials as either resident, staff, or visitor and reacted verbally.	Development: • Based on empirical exploratory research Rationale: • Evidence shows that assistive-type robots can be accepted by and are useful for residents in nursing facilities Theory: • Not reported	Robots: • 3 Cafero robots • 3 guide robots	• Cafero robots placed in residents' lounges in the rest home (n = 1) and in 2 staff rooms: 1 in the rest home and 1 in the nursing facility • Guide robots placed in residents' lounges in the rest home (n = 1) and in the residents' lounges in the nursing facility (n = 2)	—	• Robots left in the residents' lounges and staff rooms for 6 wk, 24 h/d, 7 d/wk • The robots in the lounges were switched on at 6 AM and off at 8 PM
Hopkins et al (2017)[46]	Blue-enriched white lighting: • The intervention included installment of blue-enriched lighting lamps.	Development: • Intervention was developed by integrating recent research about light and light exposure and age-related ocular changes Rationale: • Evidence shows effects of light levels on people with dementia (eg, increasing rest-activity rhythm) • There is an absence of research on light for older people without dementia Theory: • Not reported	Lamps: • 17000 K blue-enriched light lamps and freestanding dexian frames	Lamps were installed in communal lounges and dining rooms overhead from free standing dexian frames	—	The residents in the nursing facilities could choose independently whether they wanted to spend time in the communal lounges and dining rooms
■ Nijs et al (2006)[35] ■ Nijs et al (2006)[59] ■ Nijs (2006)[58] ■ Nijs et al (2003)[57]	Family-style mealtimes: • Family-style mealtimes involve 5 different aspects. • Table dressing: different materials were used to create a family-style ambience. • Food services: meal was served in dishes; resident could choose between different foods.	Development: • Based on previous research and a literature summary Rationale: • Evidence shows that family-style mealtimes are associated with positive outcomes for residents (eg, physical function, quality of life)	Materials for family-style mealtimes: • Tablecloth, nonplastic cups, normal plates, full cutlery, napkins, subtle flower arrangements	The intervention was provided in the dining room with an average of 6 residents per table for the group	Nursing facility staff	Not reported

	• Staff: nursing staff sits down and chats with residents. Change in staff during mealtime was prohibited. Medication was provided before the meal. Dining room was tidied up after eating finished. • Resident's protocol: number of residents per table. Residents given the option of serving themselves. Mealtimes began when everybody was seated. Before a meal, everyone was asked to reflect or pray by themselves. • Mealtime protocol: no other were done while eating, and the dining room was closed for visitors. The entire dining room environment was modified so that it was not possible to see typical nursing facility items (eg, nursing records or medication packages).	Theory: • Not reported				
Hashimoto et al (2020)[34]	Pharmacist visits: • Pharmacist visits contained 5 steps to reduce drug problems of residents in nursing facilities. • Step 1 (15-20 min): pharmacist looked after residents with 5 or more medications whose medication prescription or physical condition recently had changed. • Step 2 (120 min): the status of residents' function was checked (eg, locomotion), and when problems were identified, action was taken. • Step 3 (30 min): the resident's physician was contacted by the pharmacist and exchanged information. • Step 4 (60-90 min): prescription was checked with regard to drug interactions. Recommendations were provided to the physician.	Development: • The study was intended to develop a pharmacist visit intervention Rationale: • Evidence shows that pharmacist visits in nursing facilities can lead to a reduction in, for example, potentially inappropriate medications and falls in residents Theory: • Not reported	Materials used for the different steps: • Step 1: Activity-recording program, flow chart • Step 2: Activity-recording program, flow chart, nurse records, care worker records. • Step 3: Activity-recording program, flow chart • Step 4: Flow chart, Guidelines Step 5: Guidelines	Individually delivered	Pharmacist with >10 years of pharmacy experienced	Visits of the pharmacist were provided once a week

(continued on next page)

Supplementary Table 2 (*continued*)

Source	What? Procedures	Why? Development, Rationale and Theory	What? Materials	How? Modes of Delivery	Who? Intervention Provider	When and How Much? Number of Sessions, etc
	• Step 5 (15 min): nursing staff was briefed and asked to follow up.					
Nursing staff capacity Galik et al (2014)[41]	Function-Focused Care program for the Cognitively Impaired (FFC-CI): • The intervention consists of 4 components. • Environment and policy assessment: Within this component, the assessment of the environment, its description, and factors for the FFC intervention implementation are investigated (eg, presence of safety measures such as handrails). • Education: nursing staff and families participate in a 30-min (+15-min discussion) in-service about FFC, how residents can be motivated and how to include FFC in daily care. • Development of FFC goals: goals (eg, walking alone to the dining room) are documented by the nursing staff, the resident and their families. • Mentoring and motivating: nursing staff receives ongoing education by the specialized FFC nurse.	Development: • Development of FFC-CI was based on prior research with residents with dementia and their caregivers. Rationale: • Evidence shows that FFC-CI has a positive impact on nursing staff beliefs and on residents' physical function Theory: • FFC-CI is based on the social ecological model.[69,70]	Materials used for the different components: • Education: FFC-Handouts, FFC-Tips • Mentoring and motivating: Award for performing FFC	Group and individual sessions	FFC nurse	FFC nurse worked with nursing staff 10 h/wk for 6 mo
■ Jung et al (2020)[42] ■ Jung et al (2020)[56]	Korean-Function-Focus-Care program (K-FFC): • K-FFC consists of 3 components and focuses on 6 different domains (eating, dressing, using the toilet, walking, using assistive devices, and exercising). In addition, flexibility and muscular strength exercises were provided. • Evaluation: Cognitive abilities, physical function, performance of activities of daily living, the	Development: • Based on results of a systematic review and an expert review. Rationale: • Because evidence shows that FFC has a positive impact on nursing staff beliefs and resident physical function, an FFC intervention with the focus on Korean nursing facilities was developed Theory: • Not reported	Materials used for the different components: • Evaluation: Stickers • Education: Teaching materials (eg, printed materials) • Motivation: Behavioral checklist Materials for the exercises: • Elastic band, ball	Group and individual sessions	K-FFC: Research staff Additional exercise: • PhD student studying senior sports	• Research staff spent 20 h/wk to observe educated nursing staff, gave them feedback for providing K-FFC, and re-educated them if necessary • Exercises provided 3 times a week for 30 min per session

	environment, and available resources for each resident were assessed. Stickers with the individual capability of the residents were stuck on their beds. Customized care was provided to each resident. • Education: educational program for nursing staff consisted of one 2-hour FFC session focused on the philosophy as well as ways to conduct and ways not to conduct FFC to residents with respect to the above-mentioned 6 domains of the activities of daily living. • Motivation: contained the recording of the nursing staff caring practice and receiving constant motivation from researchers to provide FFC adequately to the residents.					
• Resnick et al (2009)[38] • Resnick et al (2009)[52] • Resnick et al (2009)[53] • Resnick et al (2009)[54] • Resnick et al (2008)[55]	Res-Care in-service educational component: • Res-care consists of a 6-week in-service educational program for the nursing staff and an additional coaching by a specialized nurse for 12 mo. • Week 1: the theory of restorative care was taught to the nursing staff, as well as techniques for motivating the residents. • Week 2: self-efficacy methods were provided for handling residents who reject nursing care. • Week 3 + 4: 2 classes consisted of restorative care interventions focusing on, eg, bathing. • Week 5: review of interventions and documentation of restorative care activities. • Week 6: recap of the educational program and the possibility for nursing staff to discuss	Development: • Not reported Rationale: • Evidence shows limited effectiveness of restorative care interventions in which motivation or behavior changes in nursing staff and residents are not addressed Theory: • Res-care is based on the theory of self-efficacy[71]	Materials used for the educational program: • Poster, handouts, restorative documentation flowsheet, information materials	Group and individual sessions	Six-week in-service educational program: • Advanced practice nurse Ongoing support after 6 wk: Research restorative care nurse	Advanced practice nurse worked 6 wk with nursing staff Research restorative care nurse supported nursing staff 20 h a week

(continued on next page)

Supplementary Table 2 (*continued*)

Source	What? Procedures	Why? Development, Rationale and Theory	What? Materials	How? Modes of Delivery	Who? Intervention Provider	When and How Much? Number of Sessions, etc
	challenges of restorative care. • After 6 wk, the nursing facilities were assisted by a research restorative care nurse. The main responsibility was working with the nursing staff (development of short- and long-term goals of the residents, review of the nursing records, ongoing encouragement and support) and as an interface between nursing staff, residents, families and administrators to explain restorative care and its importance.					
Görres et al (2016)[33]	Education workshop for the implementation of the German national mobility expert standard: • The first intervention group received an education workshop for nursing staff to raise awareness on the content of the German national mobility expert standard. • The second intervention included the same education workshop plus a concrete intervention for promoting mobility in residents. The concrete intervention involved a 3-step program. This program follows the aim to stop 3 steps in front ofhe, eg, the toilet, and walk with or without the support of the nursing staff for residents with mobility aids.	Development: • The expert standard is based on a literature review in which an expert panel of nurse practitioners determine the suitability of identified mobility interventions Rationale: • The education and mobility intervention are based on the content of the national German expert mobility standard. The national German expert mobility standard is a nursing standard with the aim of improving nursing practice, focusing on promoting mobility in people with care needs Theory: • Not reported	Materials used for the education session: • Presentations, handouts, parts of the expert standard Materials used for the 3-step program: • Presentations, handouts	Group sessions	Research staff	• The education session with and without the mobility intervention had a duration of 3 h and was provided once • After the education session, implementation of the expert standard began • The implementation (20 wk) consists of 2 kick-off meetings, individual educational sessions, information exchange, and modifying the content of the expert standard to the needs/ structures of each nursing facility
■ Graham et al (2020)[36] ■ Graham et al (2020)[36]	Skilful Care Training Package (SCTP): • Nursing staff received educational sessions aimed at a person-centered focus on better understanding postures and teaching handling	Development: • Empirically developed by senior physiotherapists in a pilot study Rationale: • Evidence shows that physiotherapy and activity interventions can lead	Materials for the educational sessions: • Course materials	Group sessions	Expert physiotherapists with training qualifications	The intervention consists of 3 × 2.5-h in-house training sessions for nursing staff

	techniques for assisting residents' movement.	to an improvement in well-being for residents • Individual physiotherapy is resource intensive. Enhancing skills of nursing staff could be a sustainable approach Theory: • Not reported				
■ Husebø et al (2019)[40] ■ Habiger et al (2019)[51] ■ Aasmul et al (2018)[48] ■ Blytt et al (2017)[50] ■ Aasmul et al (2018)[49]	COSMOS intervention: • COSMOS consists of an education program for nursing staff. • Communication: nursing staff was educated to understand the importance of the values and beliefs of the residents. In addition, nursing staff learned how to take residents wishes and preferences into account. • Systematic pain management assessment: nursing staff was taught, eg, how to identify, locate, and evaluate the intensity of pain. • Medication review: consisted of, eg, discussion of residents' drug prescriptions, possible reduction of drugs, and improvement of medication recording. • Organization of activities: nursing staff was taught how to develop and provide individual activities for the residents. These activities take resources, preferences, and wishes of the residents into account. • Safety: safety is embedded in every part of the educational program and it follows the aim to protect residents by integrating all above-mentioned factors.	Development: • Theoretically based on review articles and empirically on results of clinical research projects Rationale: • Evidence shows that multicomponent interventions are one way to decrease the decline in residents' physical and cognitive function because of multimorbidity Theory: • Not reported	Materials for the COSMOS intervention: • Guidelines, patient logs, presentations, handouts, flash cards, flyer, poster, and entrance place card	• COSMOS was provided to a group of named staff champions (min. 2) in each nursing facility • Educated staff champions educated their nursing unit	Research staff • Educated staff champions	• COSMOS implemented during a 2-d education seminar (7.5 h/d) • Educated staff champions provided 20-min education sessions for their nursing staff members several times a week. Each week focused on one part of COSMOS (eg, communication or medication review)
Morris et al (1999)[39]	"Self-Care for Seniors" (SCS) education program: • The 5-step approach considers specific protocols and includes an assessment and care planning process.	Development Not reported Rationale: • Not reported Theory: • Not reported	Materials used for SCS education program: • SCS protocols, logbooks	Not reported	Research staff	Not reported

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Supplementary Table 2 (*continued*)

Source	What? Procedures	Why? Development, Rationale and Theory	What? Materials	How? Modes of Delivery	Who? Intervention Provider	When and How Much? Number of Sessions, etc
	• Step 1: includes an evaluation of an assessment of the resident's actual physical and cognitive function. • Step 2: 2 persons from the nursing staff from different shifts (day/evening) conducted bedside assessments in which the capacity of residents' activities of daily living were assessed, and the outcomes of the 2 assessors were compared. • Step 3: the study-specific protocols were adapted to the individual needs of the resident. This adaptation process is guided by using environmental, communicational, and motivational guidelines to support the resident in self-care in activities of daily living. • Step 4: consists of reviewing and specifying the rehabilitation goals, which are either improving self-care or maintaining it. • Step 5: the developed care plan was implemented, monitored, and regularly evaluated by nursing staff.					
Walker et al (2016)[37]	Training for the Guide to Action for Falls Prevention Tool - Care Homes (GtACH): • The GtACH manual consists of 33 domains based on 4 factors: Falls history, medical history, movement, environment and personal needs. • Nursing staff received an educational training about fall prevention, information about falls in nursing facilities, and adequate use of the GtACH.	Development The intervention was theoretical and empirical developed by the University of Nottingham within a cooperation with nursing staff. They used meta-analyses and randomized controlled trials to identify relevant factors for falls in residents in nursing facilities and evidence-based interventions to prevent falls. These interventions were evaluated by clinical nurse specialists focusing on the	Materials used for the training: • GtACH supplies, reference manual, posters, certificate	Small group sessions (4-8 professionals)	Falls clinical specialist	Training was conducted in a 1-h session

	• After the training, nursing staff was asked to complete the GtACH with the residents and to discuss the results among the team and the relatives of the residents. • Additionally, the results were recorded in the nursing record of the resident, and if a risk was identified, actions according the GtACH were planned.	appropriateness for care facilites Rationale: • Evidence shows a small number of studies, which reported positive outcomes on falls for multifactorial interventions Theory: • Not reported				
Multifactorial intervention Dyer et al (2004)[44]	Multifactorial risk modification program: • The direct part of the intervention was an exercise program for the residents. • The exercises were related to daily functioning such as dressing and using walking aids. The program included a warm-up, a circuit program, and a cool-down and involved dancing to music and different games. Beyond the exercise sessions, residents were also asked to exercise on their own. • The indirect part of the multifactorial fall prevention program included staff education, medication reviews, environmental modifications, and optician and podiatric assessments. • Staff education consisted of an education day in which information about the home exercise program and fall prevention strategies were given. • Furthermore, a medical review was undertaken in which 2 consultant geriatricians screened all medication prescriptions. As a result, a letter with recommendations for medication improvement was sent to the residents' general practitioner.	Development: • Not reported Rationale: • A growing base of evidence shows that fall prevention programs have a positive effect on mobility and fall rates in residents of nursing facilities Theory: • Not reported	Materials used for the exercise: • Weights, Thera-bands Materials used for the education: • Information pack	Exercise, education, medical review, environmental, optician and podiatric assessments: • Group and individual sessions	Exercise: • Exercise assistant, physiotherapists Exercise: • Research staff • Medical review: • Consultant geriatricians • Environmental • Occupational therapy assistant, environmental health teams Optician and podiatric assessment: • Optician and podiatrist	Exercise: • Three visits per week with an exercise duration of 40 min per visit Exercise, education, medical review, environmental, optician and podiatric assessments: • Not reported

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Supplementary Table 2 (*continued*)

Source	What? Procedures	Why? Development, Rationale and Theory	What? Materials	How? Modes of Delivery	Who? Intervention Provider	When and How Much? Number of Sessions, etc
	• Furthermore, an occupational therapist and an environmental health team screened all nursing facilities with a focus on suspicious risk factors for falls. If risk factors were identified, they rearranged furniture and alerted the nursing facilities. • The last part was an optician assessment for residents who had a visual acuity of 6/12 or less or if they had not had an optician appointment during the last year. Residents who had problematic foot conditions at the baseline assessment received a podiatry appointment.					
■ Jensen et al (2002)[61] ■ Jensen et al (2003)[47] ■ Jensen et al (2004)[43]	Multifactorial risk modification program: • Resident exercise program targeted balance, gait, and safe transfers. • Nursing staff received an education session. The content included risk factors for falls and intervention strategies. The education program was designed in a case report style. • Environmental risk factors were assessed, and suspicious furniture was rearranged. Furthermore, adjustments in residents' accommodations were provided, eg, loose carpets or provision of grip bars, as well as improved lighting. • In terms of supplying and repairing aids, the condition of the aids was screened; new ones were supplied or the current aid was repaired if possible. • Medication, which was assumed to be a risk	Development: • Not reported Rationale: • Evidence shows that a decline in mobility is a predictor for falls and higher mobility is associated with better health status • Previous research with a focus on a multifactorial program shows a benefit in reducing falls only for people with higher cognitive function Theory: • Not reported	Materials used for the exercise: • Not reported Materials used for the assessment of environmental risk factors: • Grip bars, new beds, firm mattresses, new lightning Materials used for the part of supply and repair aids: • Tools	Exercise: • Small group (5-8 residents) sessions Education, environmental, supply and repair aids, medication, conferences and guidance: • Group and individual sessions	Exercise: Physiotherapists • Education, environmental, supply and repair aids, medication, conferences and guidance: • Research staff, physician and physiotherapist	Exercise: • Residents could choose independently how many times a week they wanted to exercise Education: • One education session for 4 h, ongoing support from extra employed physiotherapists

factor for falling, was readjusted, or pharmacologic treatment was provided.

- Hip protectors were provided for residents who were at high risk for falls.
- In case of falls, postfall problem-solving conferences were conducted in a multidisciplinary way.
- The last part of the intervention was staff guidance, in which the researchers discussed recent safety issues with the nursing staff to enhance safe mobility.

Supplementary Table 3
Risk of Bias 1 (RoB 1) and ROBINS-I Summary for Each Included Study

RoB 1 domain	Judgements
Random sequence generation and allocation concealment	We judged the risk for sequence generation and allocation concealment to be high in one study.[35] The reason was alphabetical allocation to the intervention or control group based on the names of the nursing home wards.[35]
Blinding of participants and personnel	Regarding the blinding of participants and personnel and the blinding of outcome assessors, we judged the risk of bias to be high in 2 studies.[36,61] In one study,[36] we judged the risk of bias to be high because the managers of the participating nursing facilities were informed about the group allocation. The other study[61] reported no blinding, as all stakeholders and the research group were informed about the results of the randomization. In addition, we rated the blinding of outcome assessors to be at high risk for the above-mentioned reason.[61]
Other bias	In 3 studies, the risk of a unit of analysis error was judged to be high.[37–39]
ROBINS-I domain	**Judgement**
Bias in selection of the reported result	We judged one study[34] to have a serious bias in selection of the reported results, because the main and secondary outcomes partially switched between trial registration and published study.