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SUPSI

FINAL REPORT – Sub-project 2.1 Work package 2 –

Evidence on interventions in quality indicators areas, implementation strategies and scale up evaluation

NATIONAL IMPLEMENTATION PROGRAMME – STRENGTHENING QUALITY OF CARE IN PARTNERSHIP WITH RESIDENTIAL LONG-TERM CARE FACILITIES FOR OLDER PEOPLE

NIP-Q-UPGRADE

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On behalf of the NIP-Q-UPGRADE Consortium

The NIP-Q-UPGRADE supports long-term care facilities in data-driven quality improvement based on the national quality indicators.

National Implementation Programme – Strengthening quality of care in partnership with residential long-term care facilities for older people (NIP-Q-UPGRADE), commissioned by the Federal Quality Commission (FQC) to ARTISET with the industry association CURAVIVA and senesuisse – Laufende Programme und Projekte (admin.ch).

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The National Programme is implemented using implementation science approaches. ARTISET and senesuisse have delegated the scientific management of the programme to their collaboration partner, the University of Basel, Institute for Nursing Science (INS). For its part, the INS works collaboratively with the Institut et Haute École de la Santé La Source (La Source), HES-SO University of Applied Sciences Western Switzerland in Lausanne and the Centro Competenze Anziani, Scuola universitaria professionale della Svizzera italiana (SUPSI) to implement the programme nationally and has delegated different sub-aims to the partner institutions. The research institutes' interpretation of the scientifically substantiated results, their conclusions and recommendations to the trustee and to the Federal Quality Commission EQC may differ from the trustee's point of view.

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List of abbreviations

Abbreviation	Explanation of abbreviation
ACP	Advance Care Planning
JBI	Joanna Brigs Institute
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PU	Pressure ulcers
RCT	Randomized-Controlled Trial
WHO	World Health Organization

Abstract

Project description: This report summarises evidence on:

(i) interventions seeking to address quality indicators areas in long-term care;
(ii) implementation strategies supporting data-driven quality improvement; and
(iii) quality improvement programme scale up evaluation.

Methods: Literature reviews to guide the upcoming development and implementation of a quality improvement programme.

Results:

Review 1 on *interventions in quality indicators areas* includes 42 reviews – eight on malnutrition, 10 on pain, one on pressure ulcers, five on physical restraints, 10 on advance care planning, two on polypharmacy, five on medication review and one on both pain and medication review. Key elements of interventions' effectiveness include staff education and training, multi-component interventions, promoting partnerships between residents, relative and professionals, acting on social norms, multi-disciplinarity, collaboration, and sustainment.

Review 2 on *implementation strategies* includes 10 studies. Effective implementation strategies include education and training, coaching, public reporting and large-scale campaigns.

Review 3 on *evaluating a quality improvement programme* includes 12 studies. An adaptive design with iterative evaluations is recommended. For interventions whose effectiveness has been extensively studied, the reach, adoption, fidelity and adaptations are key outcomes. A process evaluation to monitor institutionalisation is recommended. Embedding one or more evaluation studies could be considered if there is uncertainty about effectiveness.

Summary

Mission

This report summarises findings from three literature reviews. They will participate in guiding choices in good clinical practices and prepare for the upcoming implementation of a quality improvement programme (sub-aims 4, 5 and 6 of work package 2).

Background

As part of sustained efforts to improve care quality and meet the challenges associated with population ageing, Swiss long-term care facilities for older people are legally required to report quality indicators to federal authorities. Whilst an extensive literature focuses on individual indicator areas, the scattered nature of this knowledge makes it difficult for policymakers and practitioners to improve practices based on the best available evidence. Moreover, there is limited clarity on which implementation strategies may effectively support data-driven quality improvement in long-term care, or how to evaluate the scalability of such initiatives.

Against this backdrop, this report highlights key findings from the literature pertaining to:

(i) effective interventions for common geriatric conditions (malnutrition, pain, and pressure ulcers), care practices (physical restraints, advance care planning, and medication reviews) and polypharmacy;
(ii) effective implementation strategies that support data-driven quality improvement; and
(iii) appropriate methods to evaluate the scale-up of a quality improvement programme.[1]

These findings will inform the development of a care quality improvement intervention in Swiss long-term care facilities.

Method

We conducted three literature reviews: one umbrella review (i.e., a review of reviews) following JBI guidelines, one rapid review, and one methodological review.

Results

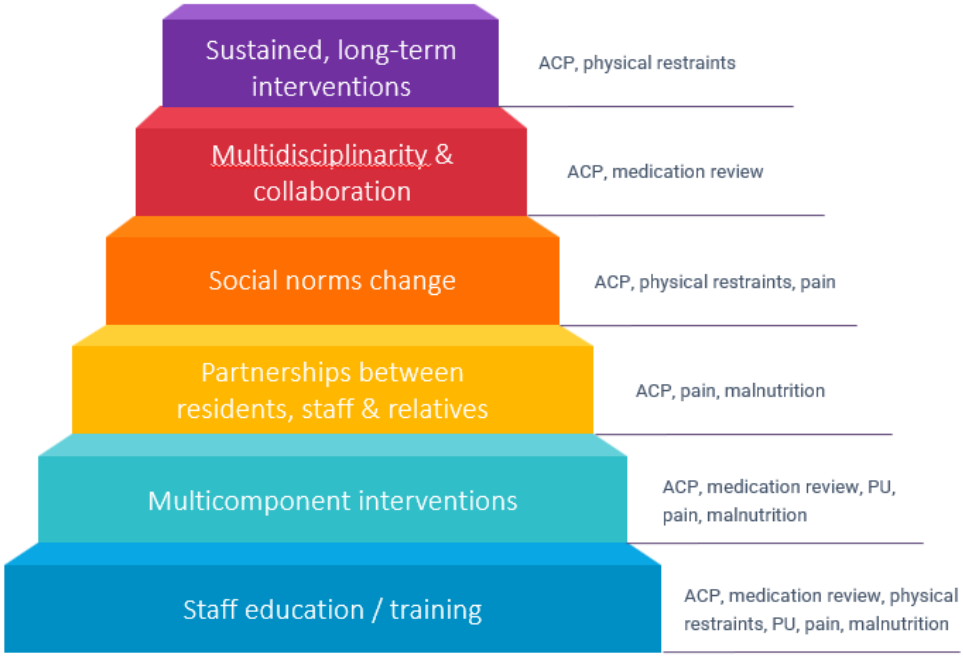
Review 1 - Interventions in quality indicator areas:

Out of 670 studies retrieved, 42 systematic reviews met the inclusion criteria. These include 8 reviews on malnutrition, 10 on pain, one on pressure ulcers, 5 on physical restraints, 10 on advance care planning, 2 on polypharmacy, 5 on medication review and one on both pain and medication review. We identified **six key elements of interventions' effectiveness**. These are shown in Figure 1 and listed below:

- Interventions including elements of staff education and training
- Complex or multi-component interventions seeking to initiate change holistically
- Interventions promoting partnerships between residents, relatives, long-term care staff and healthcare professionals
- Interventions targeting changes at the level of social norms
- Multidisciplinary, collaborative interventions
- Sustained or long-term interventions

[1] A fourth research question concerning international examples of large-scale, data-driven quality improvement strategies in long-term care is addressed in sub-aim 2, work package 2.

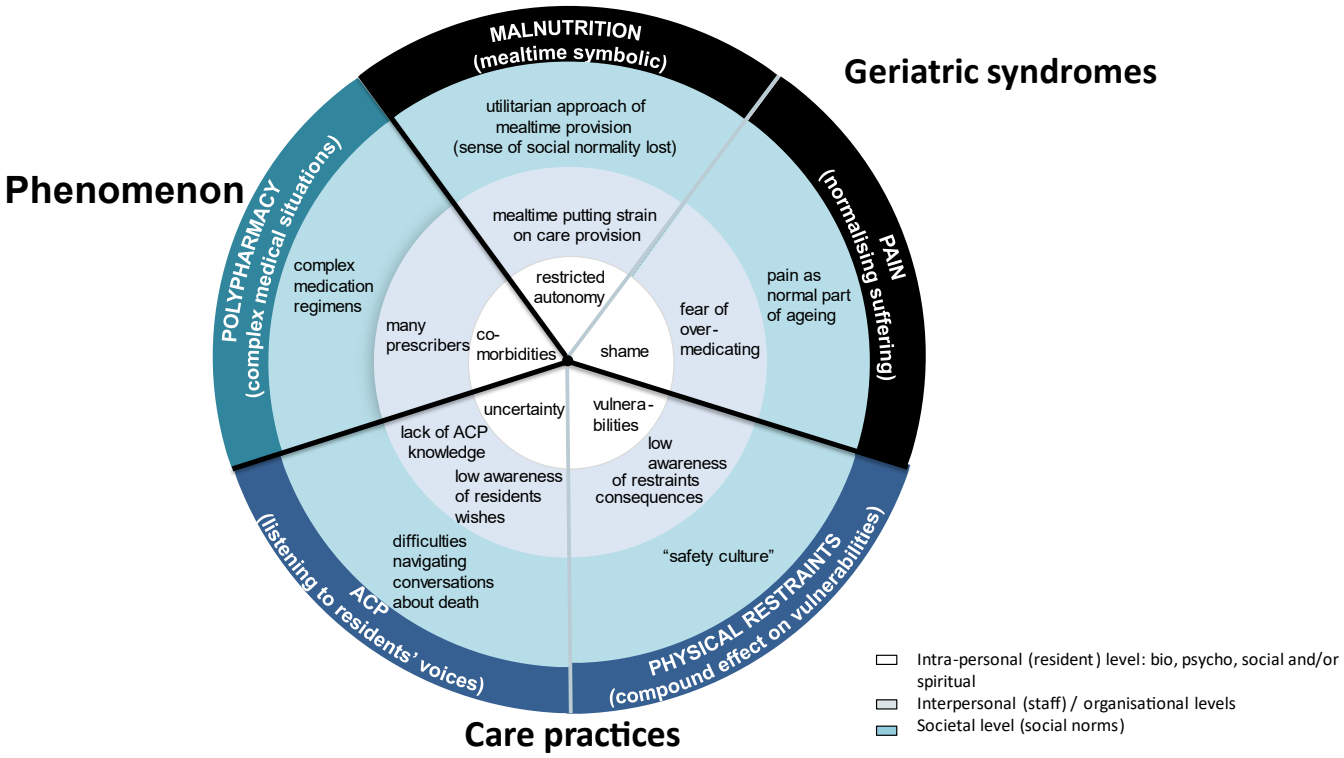
Figure 1 – Elements identified as playing a key role in interventions' effectiveness



ACP: advance care planning; PU: pressure ulcers

In turn, descriptive reviews have pointed to **risk factors characterising quality indicator domains**, as illustrated in Figure 2.

Figure 2 - Risk factors characterising malnutrition, pain, restraints, advance care planning and polypharmacy at the intra-, inter-personal and societal levels



Review 2 – Implementation strategies supporting data-driven quality improvement:

Out of 138 records retrieved, 10 studies met our inclusion criteria. **Effective implementation strategies** include education and training, coaching, public reporting and large-scale campaigns. **Key facilitators** identified were management involvement and support, adequate time and resources, multimodality (e.g. combining different strategies), interdisciplinarity, effective communication with residents and between staff members, staff open-mindedness towards change, and building significant learning opportunities into interventions.

Review 3 – Quality improvement programme scale up evaluation:

Out of 6337 studies initially retrieved, 12 reviews met our inclusion criteria. A **comprehensive evaluation plan** is needed for evaluating scale-up. No specific recommendations were made regarding study designs. A first, pre-implementation evaluation should focus on intervention's scalability. For interventions whose effectiveness has been extensively studied, the reach, adoption, fidelity and adaptations are key outcomes. A process evaluation to monitor the institutionalization is recommended. Embedding one or more evaluation studies could be considered if there is uncertainty about effectiveness. An adaptive design with iterative evaluations is recommended. Scale-up can also introduce negative effects, as inequalities are also scaled-up. This requires monitoring in the evaluation. Collaborating with policy makers also helps to discuss the impact of the scale-up and further support spreading the intervention through improved institutionalization (e.g. more allocation of resources). Therefore, an evaluation plan should have well defined scale-up targets with matching indicators for measuring success.

Conclusion and Recommendations

Review 1 – Interventions in quality indicator areas

Based on our review results, we recommend that:

1. the Federal Office of Public Health, CURAVIVA and senesuisse support both clinical practice and data measurement in advance care planning and medication review – including identifying funding sources and allocating a budget to enable these practices.
2. the Federal Quality Commission and the Federal Office of Public Health focus on improving residents' psycho-social and spiritual well-being through the promotion of data-driven care quality improvement.
3. CURAVIVA and senesuisse diffuse the results of the umbrella review nationally
4. the Federal Quality Commission examines whether evidence-based guidelines should be developed and, if so, allocates sufficient resources and follows a rigorous methodology such as the *Guidelines for clinical practice guidelines*.

Review 2 – Implementation strategies supporting data-driven quality improvement:

1. We recommend that during the post-NIP-Q-UPGRADE sustainment phase, CURAVIVA, senesuisse, the Federal Quality Commission or the Federal Office of Public Health answer two main questions. Firstly, which strategies are best adapted to the Swiss context? Secondly, which strategies should be led or undertaken by long-term care facilities themselves, and which should emanate from other stakeholders?

Review 3 – Quality improvement programme scale up evaluation:

1. We recommend that CURAVIVA and senesuisse adopt a structured scale-up evaluation plan to monitor scale-up success (sub-aim 11, work package 1).

Through these recommendations, we aim to promote the sustainability of the gains obtained through NIP-Q-UPGRADE, ultimately supporting data-driven care quality improvement in Swiss long-term care facilities.

Review 1: Interventions to improve care quality in long-term care facilities for older adults: An umbrella review

1. Introduction

Population ageing has been identified by the World Health Organization (WHO) as “the most important medical and social demographic problem worldwide” today (1), posing unprecedented challenges to healthcare systems across the world. Indeed, the fast growth of the population aged 60 and over, which is predicted to double to reach 2.1 billion by 2050 (2), brings about sharp rises in cognitive impairment, malnutrition, pain, frailty, and chronic inflammation, amongst other common geriatric conditions (2,3). Older adults living in long-term care facilities are particularly likely to experience advanced frailty, functional dependency, and multimorbidity (4–6). In Switzerland, about 80,000 or 5% of adults aged 65 or older and 14% of adults aged 80 or older are living in long-term care facilities (7), with an average admission age of 85 (8) and average length of stay of 2.4 years (9). In Switzerland and beyond, the advanced age at admission is characterised by particularly complex health needs (10,11).

As part of sustained efforts to monitor, evaluate, and ultimately improve the quality of care and meet the challenges associated with ageing, Swiss long-term care facilities for older people are under a legal obligation to report medical quality indicators to the federal authorities (12). Since 2019, the following indicators must be reported: malnutrition (measured through recent weight loss), physical restraints (i.e., bedrails or trunk fixation/seating that prevents residents from rising), polypharmacy (defined as taking at least nine different active substances), and pain (both self-reported and observed by an assessor). Additional quality indicators will be introduced in the next few years, namely pressure ulcers, advance care planning, and medication reviews. As such, Swiss quality indicators cover common geriatric conditions (malnutrition, pain, and pressure ulcers), care practices (physical restraints, advance care planning, and medication reviews), as well as polypharmacy.

Whilst a vast amount of literature focuses on individual areas of interest, there is no comprehensive overview or synthesis of knowledge available on these topics. This Umbrella review – which refers to “an overview of existing systematic reviews” (13) – seeks to address this gap to assist policymakers and practitioners in long-term care facilities to improve current practices based on the best available evidence.

2. Aim

The primary aim of this review is to identify and describe effective interventions to:

a. (a) improve monitoring, assessment, care, raise awareness, and/or reduce the prevalence of malnutrition, pain, pressure ulcers or polypharmacy in older adults residing in long-term care facilities;
b. (b) improve care practices by reducing the use of physical restraints and promoting advance care planning and medication reviews in long-term care facilities for older adults.

The secondary aim of this umbrella review is to identify and describe reviews that examined observational aspects of malnutrition, physical restraints, polypharmacy, medication review, pain, pressure ulcers, and advance care planning, such as prevalence, incidence, perceptions, cost-effectiveness, or other economic aspects.

3. Methods

This umbrella review was conducted following the JBI guidelines (13). Methodological considerations are outlined in Appendix 1. By presenting a unified synthesis of the latest evidence available, the review offers an avenue to support policymakers and practitioners in long-term care facilities in making informed decisions on how to improve care quality through actions at organisational, staff or resident level (14,15).

4. Results

The study inclusion process and methodological quality assessment are detailed in Appendix 2. Our umbrella review includes 42 reviews, with 23 systematic reviews, 16 systematic reviews with meta-analysis, one umbrella review, one realist review and one qualitative meta-synthesis. When indicated, the number of participants, predominantly long-term care residents, ranges from 102 to 1'439'311. Reviews mostly originate from Australia (n = 15), the UK (n = 9) and other European countries (n = 13). The number of relevant primary studies ranges from 2 to 171. Twenty-nine reviews examine interventions and 13 are observational, as presented in Table S7 (Appendix 3).

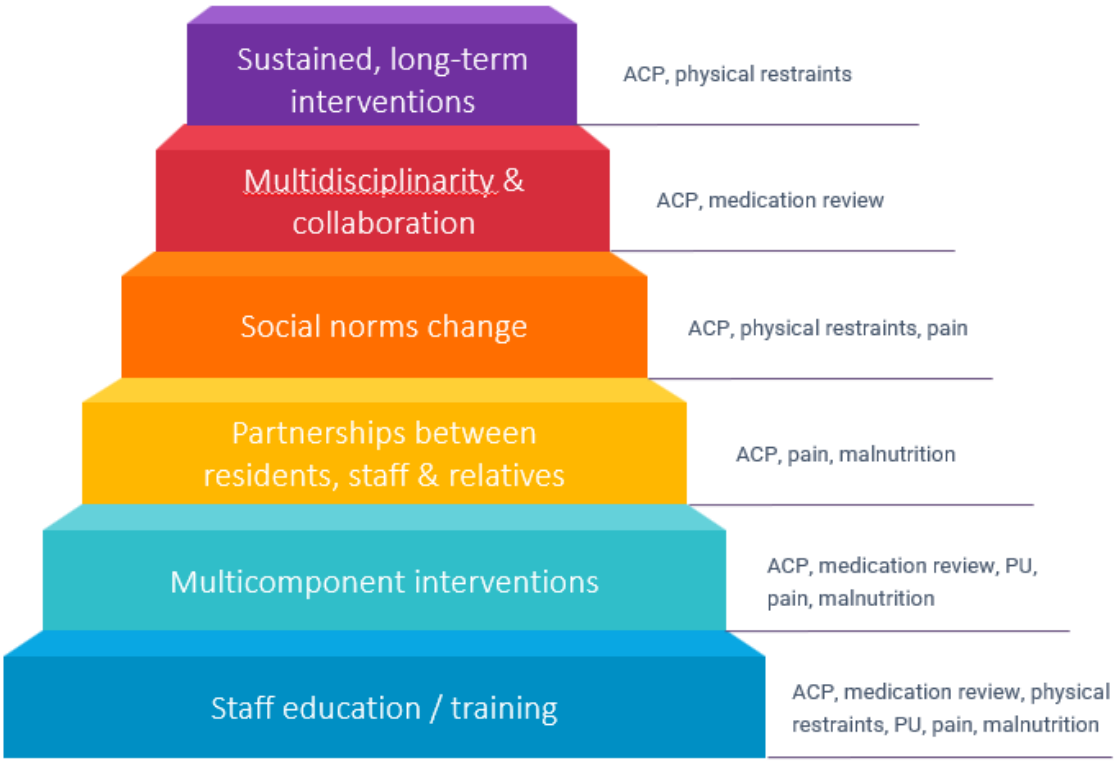
Included reviews were grouped according to areas of interest, namely: malnutrition (n = 8), pain (n = 10), pressure ulcers (n = 1), physical restraints (n = 5), advance care planning (n = 10), polypharmacy (n = 2), medication review (n = 5), and pain and medication review (n = 1). The level of information varies between different areas of interest, depending on the reviews that met our eligibility criteria.

Overall results

As highlighted in Figure 1, key elements of interventions' effectiveness are:

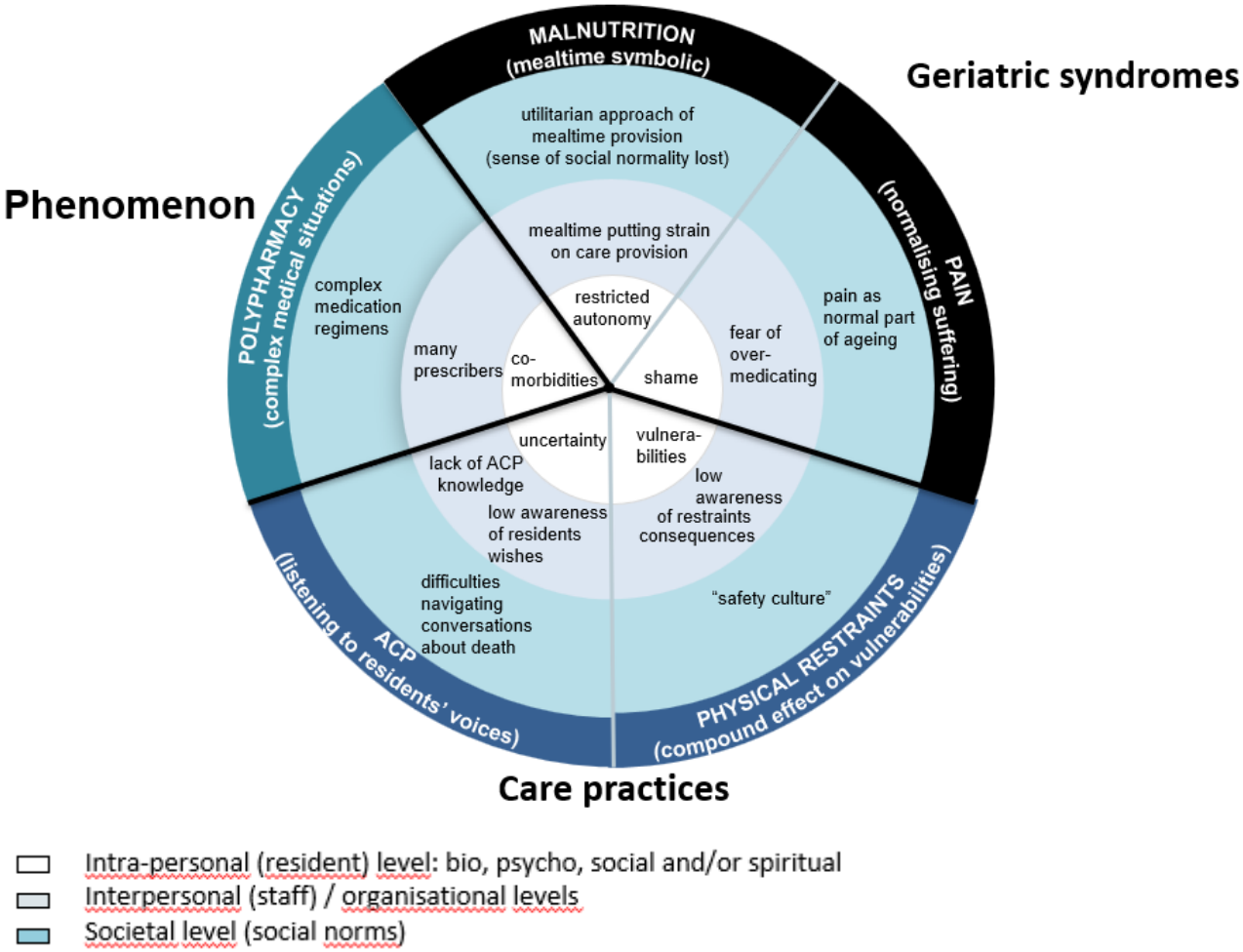
- staff education and training;
- complex or multi-component interventions seeking to address issue of interest in a holistic manner;
- partnerships between residents, relatives, long-term care staff and healthcare professionals;
- explicit aim to act on social norms;
- multidisciplinary, collaborative interventions; and
- sustained or long-term interventions.

Figure 1 – Elements identified as playing a key role in interventions' effectiveness



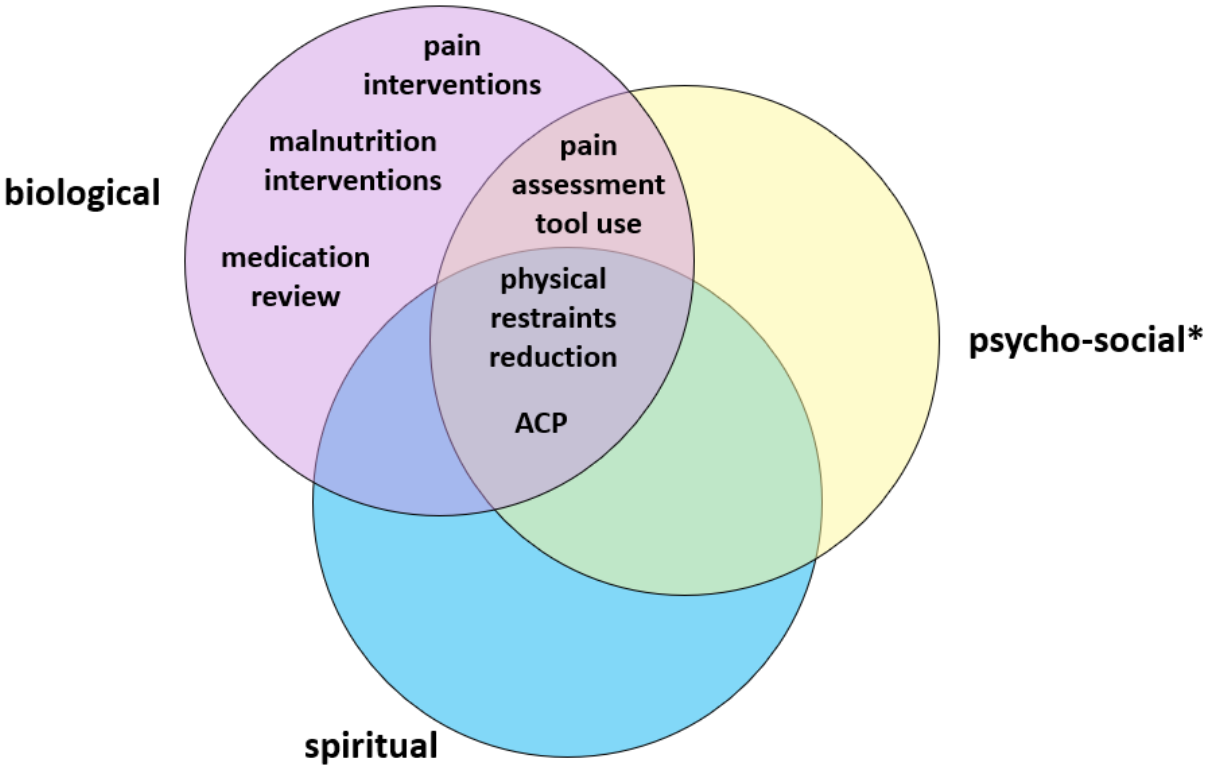
In turn, descriptive reviews have pointed to risk factors characterising five areas of interest (malnutrition pain, restraints, advance care planning and polypharmacy), which we summarised at the intra-, inter-personal and societal levels, as shown in Figure 2.

Figure 2 - Risk factors characterising malnutrition, pain, restraints, advance care planning and polypharmacy at the intra-, inter-personal and societal levels



As Figure 3 illustrates, most included reviews discuss interventions effects in terms of biological factors – apart from advance care planning and physical restraints reduction, for which psychosocial and spiritual factors are discussed, and pain assessment tool use, which addresses psychosocial factors. This points to an imbalance in published research, highlighting the importance of considering psychosocial and spiritual factors to better understand the effects of interventions in long-term care for older people.

Figure 3 - Levels where intervention are found effective based on the biopsychosocial and spiritual model



* the psychological and social levels are interlinked yet distinct; we represented them together as effects on these levels are not differentiated in included reviews

Results by area

Malnutrition

Eight reviews examine malnutrition. These include (i) seven intervention-based reviews, of which five focus on interventions targeting malnutrition in the general population of long-term care residents (16-20)

(5–9), one in residents with dementia (21), one in malnourished or nutritionally at-risk residents (22); and (ii) one descriptive review (23). Table S8 (Appendix 4) presents interventions identified as effective or partially effective, including (i) nutritional supplementation, dietary modification, food fortification and improvement, modification to dining environment and food service, staff training and feeding assistance for the general long-term care population; (ii) eating ability training and feeding assistance for residents with dementia; and (iii) nutrition education to healthcare professionals, home-like food environment, dining room enhancement, and fortified meals for malnourished or nutritionally at-risk residents. Whilst several interventions appear to be promising, no superior one can be identified.

Interventions that have not yielded statistically significant results include training staff caring for people with dementia (21) and flavoured enhanced foods for malnourished or nutritionally

at-risk residents (22). In the later population, no results were recorded or reported for additional supplementation of meals (22).

Table S9 (Appendix 5) presents main results from the descriptive review, underlining the importance of mealtime in terms of residents' quality of life, suggesting that multi-component interventions are likely to be most appropriate (23).

Pain

Eleven reviews examine pain. These include: (i) eight intervention-based reviews, of which three focus on the general long-term care resident population (24–26), four on people with dementia (27–30) and one on residents with chronic pain (31); and (ii) three descriptive reviews (32–34). One intervention-based review also presents descriptive findings pertaining to validated pain tools (29). Table S8 (Appendix 4) presents interventions shown to be at least partially effective in addressing pain, highlighting a wide range of interventions, from analgesic use to sensory simulation. In the general resident population and residents with chronic pain, two reviews identify analgesic interventions as most effective in addressing pain (25, 31).

Interventions found to be less or not effective in the general population of long-term care residents include the use of a no-rinse skin cleanser (24); a 45-min educational session to improve knowledge on pain and introduce a pain log (24); and non-analgesic treatment (25). Less to not effective interventions for people with dementia include passive movement therapy (27); routine pain assessment tool without other interventions (28); and algorithm-based pain management intervention[2] (30). The efficacy of analgesic drug in people with dementia remains to be investigated thoroughly, with limited evidence as to the effect of using paracetamol and morphine (29) and serious adverse events with analgesia including side effects and deaths (28).

Descriptive reviews, whose main results are presented in Table S9 (Appendix 5) point towards high prevalences of pain and suggest that key to appropriate pain assessment and management are communication amongst professionals and residents, professionals' knowledge of pain-related behaviours in residents, person-centred approaches and perceptions of pain as important to address.

Pressure Ulcers

One systematic review explores the effectiveness of interventions aimed at pressure ulcer prevention, more specifically a systematic review exploring the effectiveness of interventions aimed at pressure ulcer prevention (35). As highlighted in Table S8 (Appendix 4), the review found that several interventions are effective in reducing incidence and/or prevalence of pressure ulcers[3]. No intervention was shown to improve the length of healing time.

Physical restraints

Five reviews focus on physical restraints, including (i) three reviews examining interventions aimed at reducing restraints utilisation (36–38); and (ii) two describing restraints prevalence and factors associated with restraints use (39,40). Table S8 (Appendix 4) presents (partially) effective interventions in physical restraint reduction, suggesting that a key to effectiveness is to deploy interventions for at least 6 weeks or through continuous education.

Table S9 (Appendix 5) presents the main findings of descriptive reviews, pointing to high prevalence of physical restraint use, serious possible consequences, and residents' vulnerabilities associated with the use of restraints.

[2] Defined as a "step-by-step guidance (an algorithm) for nurses on how to manage pain" (19).

[3] Prevalence: number of existing cases of a condition or disease; incidence: number of new cases of condition or disease in a given period of time.

Advance care planning

Ten reviews focus on advance care planning. These include five reviews examining advance care planning-related interventions, three focusing on the general population (41–43) and two on people with dementia (44,45); and five descriptive reviews (46–50). At least partially effective interventions are presented in Table S8 (Appendix 4) and mostly consist of training or education for healthcare professionals. The most effective form of intervention with people with dementia and their carers, in terms of advance care planning uptake, was identified as a comprehensive education system for staff with multiple prompts over time (44). Reviews discuss the results of advance care planning as a form of intervention in and of itself, and of interventions aimed at increasing the practice of advance care planning such as staff education.

In turn, five descriptive reviews highlight key elements to successful advance care planning, four focusing on the general resident population (46–49) and one on residents with dementia (50), as presented in Table S9 (Appendix 5). These include advance care planning -related knowledge from residents, relatives and staff, willingness and ability to participate in advance care planning from all actors, good relationships between residents, staff and relatives, supportive facility-level culture with advance care planning embedded in standard care and approached from a person-centred, collaborative and multidisciplinary perspective, advance care planning conversations initiated gradually and sensitively, strategies helping people with decision-making, and normalising conversations about death.

Polypharmacy

Two systematic reviews focus on polypharmacy, both of which are descriptive (51,52). As summarised in Table S9 (Appendix 5), they highlight wide variations in polypharmacy prevalence – with up to 91%, 74%, and 65% of residents taking more than 5,9, and 10 medications respectively – and factors associated with polypharmacy, such as recent hospital discharge, number of prescribers, and comorbidities.

Medication review

Six reviews, which all report on interventions, focus on medication review. These include five on the general population (26, 53-57) and one on people with dementia (58). At least partially effective medication review interventions are summarised in Table S8 (Appendix 4).

5. Conclusions, recommendations, and implications

Whilst we only kept reviews of fair to high methodological quality, the quality of primary studies is variable. As such, the findings of this review should be interpreted as trends that may be useful in informing long-term care policies and practices, rather than unequivocal conclusions. More robust research is warranted, and future research should consider factors beyond the biological sphere, namely psychosocial and spiritual factors, to better understand the effects of interventions in long-term care for older people.

Based on the results of this umbrella review, we have formulated recommendations and clarified implications, described in Table 1.

Table 1. Recommendations and implications based on the umbrella review results

	Recommendations	**Rationale**	**Link with NIP-Q-UPGRADE**
1	As part of the implementation strategy for the additional indicators **advance care planning and medication review**, we recommend that the Federal Office of Public Health, CURAVIVA and senesuisse **support both clinical practice and data measurement of the indicators in the two domains.** This includes identifying funding sources and allocating a budget to enable these practices.	The literature has shown that advance care planning and medication review hold encouraging prospects for person-centred care. However, findings of sub-aim 3, work package 1, have indicated that in the Swiss context, these clinical practices could and should be further developed and supported.	Scale up by senesuisse/ CURAVIVA Sub-aim 3 of work package 1
2	We recommend that the Federal Quality Commission and the Federal Office of Public Health focus on **improving residents' psycho-social and spiritual well-being** through the promotion of data-driven care quality improvement.	The umbrella review results have shown that in the quality indicator areas, biological elements are well covered. By contrast psychosocial and spiritual elements remain under-studied (see Figure 3) and, as such, may not be sufficiently considered in interventions aimed at improving care quality. As psychosocial and spiritual dimensions are key to holistic person-centred care, they should be explicitly targeted as part of care quality improvement interventions. NIP-Q-UPGRADE will also consider whether and how to explore these dimensions in future projects. For instance, these dimensions could be explored during participatory interactions with residents when discussing pain and unexpected weight loss.	Scale up by senesuisse/ CURAVIVA Sub-aim 4 of work package 2 Sub-aims 3, 4 and 6 of work package 3

3	The ensure the sustainability of the NIP-Q-UPGRADE outcomes after 2026, we recommend that **the results of this umbrella review are diffused nationally** by CURAVIVA and senesuisse, in partnership with training providers (e.g., HES, universities, continuous education providers).	To ensure the sustainability of these results and insights, their diffusion should go beyond the remit of the NIP-Q-UPGRADE.	Scale up
4	We recommend that the Federal Quality Commission examines whether **evidence-based guidelines** should be developed – i.e. whether they are relevant and promising, in terms of to positively impacting care quality in long-term care facilities. If so, we recommend allocates **sufficient resources and following a rigorous guideline development methodology** such as the Guidelines for Clinical practice guidelines (59).	Whilst current factsheets include concrete recommendations for clinical actions, evidence-based guidelines should be developed using rigorous methodologies. NIP-Q-UPGRADE could explore the need for clinical guidelines with participating long-term care facilities (and potentially with regional sounding boards). However, the development of such guidelines is beyond the mandate of NIP-Q-UPGRADE programme, as it requires considerable expertise and resources, as stated in the guidelines of Federal Quality Commission (59).	Work package 0, regional sounding boards
	Implications	**Rationale**	**Link with NIP-Q-UPGRADE**
1	The umbrella review shows multiple interventions for individual quality indicator areas, which confirms that participatory methods are key for identifying and selecting interventions suited for the Swiss context. Through intervention mapping, NIP-Q-UPGRADE will find out which ways may be best to reach, engage and positively impact care quality in long-term care facilities. Such insights will enable us to develop appropriate approaches and tools (e.g. e-learning, updated factsheets, peer-to-peer support) in		Sub-aim 4 of work package 2 Sub-aims 3 and 4 of work package 3

	partnership with key stakeholders, including long-term care facilities.		
2	To enhance the participatory approach adopted by NIP-Q-UPGRADE, the results of the umbrella review will be discussed with key stakeholders in regional sounding board meetings, following the communication strategy chosen by CURAVIVA and senesuisse.		Work package 0, regional sounding board Work package 0, advisory group
3	The umbrella review pinpoints the necessity of partnership with residents, families, healthcare and other long-term care professionals as a basis for quality improvement. This confirms the participatory approach adopted in NIP-Q-UPGRADE. In future projects, NIP-Q-UPGRADE will explore the possibility of new partnerships beyond the remits of the usual care team, e.g. cooks, art therapists, community-based healthcare for prevention.		Sub-aim 4, work package 2 Sub-aim 6, work package 3
4	Complex interventions' key characteristics are particularly heterogenous (e.g. type of interventions, modality, frequency, duration, study population, providers and other people involved, knowledge materials, processes, influencing factors, outcomes). As such, the pilot study of a care quality improvement intervention will select and implement only the most relevant intervention elements (i.e. adapted to the Swiss context and likely to have a positive impact on selected areas of interest). We will identify these elements through participatory processes.	The literature reports both generic strategies (e.g. training) and area-specific elements (e.g. calorific and enjoyable meals). Not all can be introduced and tested all at once. A targeted pilot is needed.	Selection in 2.4 Test in sub-aim 6 of work package 2

Review 2: Which implementation strategies are effective in supporting LTC facilities in implementing data-driven quality improvement?

1. Introduction

The insights gained from this review are expected to inform the development of a quality improvement programme – built through participatory methodologies (sub-aim 4 of work package 2). To facilitate take up of quality improvement based on data-driven quality indicators, various implementation strategies are used internationally.

Implementation strategies refer to “methods or techniques used to enhance the adoption, implementation, and sustainability of a clinical program or practice” (1). They include, for example, training, education, coaching, train-the-trainer strategies, mass media, clinical assistance, champions, early adopters, resource and material development, altering incentive structure, facilitation, technical assistance, audit and feedback (2).

2. Aim

The objective of this literature review is to identify implementation strategies that are effective in supporting data-driven quality improvement in long-term care facilities.

3. Methods

We initially planned to conduct an unstructured Umbrella Review (3). However, in view of the limited amount of literature on the subject, we opted for a rapid review of the literature while still maintaining methodological rigor and quality (2). Methodological considerations are outlined in Appendix 6.

4. Results

Identification of relevant studies

The search and study selection process are presented in a Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow diagram (Appendix 7). A total of 138 unique records were retrieved from nine databases, of which 23 were selected for full-text review. Of these, 13 were excluded, mainly as they did not present data-driven quality improvement. Ten studies were included in the review.

Effective implementation strategies

Effective implementation strategies are detailed in Table 2 below, alongside their barriers and facilitators and lessons learned. Effectiveness was evaluated based on efficacy or impacts reported in included studies, rather than based on additional evaluation.

Table 2: Effective implementation strategies for data-driven quality improvement

Reference (study design)	Implementation strategies	Effects of implementation strategies	Barriers, facilitators and lessons learned
Crystal et al., 2020 (correlational study)	**National campaign** for more judicious prescribing of antipsychotics / safer dementia care with: • **public reporting** of quality measures • increased **regulatory scrutiny** • accompanying **state initiatives,** typically in the form of offer of **in-person training** and creation of **online repositories** for ongoing access by facilities • **training and technical assistance materials** to redefine prescribing and psychosocial practices around person-centred care principles	• Sustained data-driven quality improvement initiatives integrating educational and regulatory interventions, supported by public quality reporting, led to **substantial change in prescribing**, with antipsychotic prescribing declining by 29% and sedative-hypnotic prescribing by 43% in 2011-16 nationally.	Facilitators: • **public reporting** -- important tool and motivator for facility and state-level quality improvement • **training** in use of nonpharmacological strategies for symptom management to achieve individualised approaches • **adequate time and resources** (e.g. staffing, particularly registered nurses) for person-centred approach • **multimodal strategies** involving state-level interorganisational coordination and training and technical assistance at facility level • involving **various professional groups** in coalition activities, including physicians and pharmacists
Gallant et al., 2022 (correlational study)	To address the underassessment of pain in rural long-term care facilities, strategies include: • deploying an **interactive online training programme** focused on pain assessment practices for persons with dementia • remotely implement a **standardised pain assessment protocol**	Self-report questionnaires and semi-structured interview highlighted: • significant increase in knowledge about pain assessment following training • more frequent pain assessments on admission and on a weekly basis • inconsistent improvements in the timeliness of follow-up assessments for those identified as having moderate to severe pain	Barriers: • **poor communication** between professionals and residents or among professionals • difficulties **balancing benefits and potential side effects** pharmacological interventions • **pain occasionally minimised by staff members**, regarded as “a natural part of aging” • **perceived subjectivity** of pain assessment tools • **lack of time** to regularly assess residents • colleagues’ **resistance to change** • **lack of time** to complete online training • **rejecting technology** as a way of learning

			• **technical challenges** (e.g. unstable Internet connection) Facilitators: • **effective communication** with residents and between staff members • **interdisciplinary collaboration and support** to implement evidence-based pain assessment • **embracing technology** as a way of learning • staff **open-mindedness towards change** • **support from management** • ability to **see improvements in residents** (reportedly happier) • **integrating pain assessments** into pre-established weekly routine (e.g., baths) and charting process (e.g., daily records) • **adequate conditions** for online training (e.g., internet connectivity)
Meyer et al., 2021 (correlational study)	**Team-based learning-to-performance programme** comprising: • a suite of one-day **interprofessional workshops** with team-based learning of gerontological competencies • **experiential and interactive learning activities** such as simulated cases (i.e., trigger videos, simulated participants, role playing with co-learners), game-based learning, mindfulness techniques, and applied drama	• Preliminary evaluation through focus groups, interviews and surveys revealed evidence of transformed performance and overall positive impact on participants • For instance, over 90% of participants agreed “somewhat” to “a lot” that they had gained new knowledge, practiced new skills and were confident to apply them • Qualitative evidence highlighted participants’ ability to transfer training into nursing practice	Facilitators: • **experiential learning** enabling to understand scope of practice, gain role clarity in teams and develop skills and attitudes in collaboration with team • **valuing reciprocity in training**, which increases self-reflection and consideration of teamwork • **facilitators** as role models • benefit of **building significant learning opportunities into intervention** to transfer training to practice • **leadership/ management support** for sustained practice change

Vermunt et al., 2023 (correlational study)	To implement a **care quality improvement programme**, with person-centred care and resident safety as quality indicators, aiming to contribute to a dignified life for older people in nursing homes and help healthcare professionals take more pride in their work: • provision of on-site tailored support by **external expert coaches** guiding facilities through improvement trajectory • **knowledge component**, with participating facilities encouraged to share their 'lessons learned' through the programme website, newsletters, theme-specific meetings and an annual conference (open to all Dutch long-term care facilities)	• Expert coaches credited with substantially contributing to quality improvement by offering an outsider's perspective, bringing in experience and expertise and helping facilities stay committed and focused	Barriers: • on-site tailored support is **time and labour-intensive**, hence not feasible in every healthcare setting Lessons learnt: • for **facilities with urgent quality issues, intensive support** through external expert coaching, for instance, may be necessary • quality improvement programmes **in less demanding settings** (e.g. facilities with less urgent quality issues), **leaner approaches** may include scaling up and spreading best practices, stimulating innovation or forming quality improvement collaboratives
Gerritsen et al., 2021 (RCT)	To implement structured, biannual multidisciplinary medication review, strategies include: • **organisational preparation and education** • **evaluation and guidance** • support of a local **implementation coordinator**	• Implementation was deemed successful and applied implementation strategies were highly rated. • Participation rates in education sessions and evaluation meetings were high (95 and 82% respectively).	Barriers: • **time** • **investment** • **planning issues** • high **staff turnover** • education sessions overly pharmacologically oriented Facilitators: • **positive attitude of professionals** toward the intervention • **higher management support** • appointment of a **local implementation coordinator**

Implementation strategies with unclear or effects

Some implementation strategies were not evaluated or were examined in literature reviews, which found that their effects were unclear or mixed. These are presented in Table 3 below. It is important to note that they are not necessarily less effective than some of the strategies discussed above, as the later may not have been the object of close scrutiny through systematic literature review.

Table 3: Implementation strategies with unclear or mixed quality improvement effects

Reference (study design)	Implementation strategies	Effects of implementation strategies	Barriers and facilitators
Reviews with non-evaluated strategies or low certainty evidence regarding effects			
Yang et al., 2023 (scoping review and stakeholders' consultation)	• Most used implementation strategies for pressure injury prevention are **quality improvement** (structured, organisation-wide approach to understanding and improving work processes) and **training** • For quality improvement, implementation of internal strategies is particularly important and includes in-person training sessions, technical assistance, tools or toolkits, audit and feedback, implementation teams, site champions, Plan Do Study Act cycles, amongst others • Electronic devices, evidence-based practice, clinical decision support systems, and nursing protocols are also deployed	• Not evaluated	Barriers: • staff **fear of increased workload** and difficult content • **lack of senior management involvemen**t and support hierarchical organisational culture • **turnover** of managers and staff • **lack of familiarity with quality improvement**

Hall et al., 2021 (systematic review and meta-analysis of RCTs)	• **Champion model** for implementing a clinical practice guideline or evidence-based recommendation to optimise patient care	• Low certainty evidence that champions, as part of multicomponent interventions, improve staff adherence to guidelines (methodological issues and poor reporting) • In the two studies that measured guideline adherence and resident clinical health outcomes, the champion intervention had a positive effect on both outcomes	
Chadborn et al., 2021 (scoping review)	• Quality improvement strategies adopted in studies include Plan Do Study Act or similar iterative change management, quality improvement collaboratives or breakthrough series, and Toyota method (i.e., method of continuous improvement). • Reported components of improvement include education about clinical conditions or care, care pathway development, audit and feedback, changes to multidisciplinary team working, and peers or champions leading quality improvement initiatives	• No evidence that a particular quality improvement strategy was chosen to address a particular resident problem or was applied to a particular occupational group • Lack of reporting according to standardised checklists for quality improvement or resident-level interventions and low quality of studies make it difficult to ascertain what worked or not	
Mitigated success			
Lovink et al., 2022 (descriptive study)	• Practice development approach to developing an evidence-based nursing culture in long-term care facilities, with: team support from facilitators, learning on the spot, developing and applying evidence, creativity combined with cognition, involvement of stakeholders, tailored	• Varying degrees of success amongst teams • It is possible to coach nursing teams to work according to the principles of evidence-based nursing or create such a culture through practice development	Facilitators: • support of managers and/ or organisation • inspiring facilitators and/or role-models (usually nurses) close to the team • stable teams with driving forces and student nurses

	methods, facilitating, and involvement of stakeholders in evaluation • Internal and external facilitators offering guidance, tools and methods on evidence-based nursing, with nursing team choosing 2-5 evidence-based nursing themes to work on • Process consisting of a kick-off meeting presenting evidence-based nursing, organisation of tailored activities in each team, and final evaluation meeting		
Volk et al., 2020 (action research)	• **Training** of key staff members in each facility, assigning one staff member per team as **champion** (responsible for training and leading other staff), dental hygienist **coaches** providing ongoing support to long-term care staff	• Staff reported being able to implement the programme with the modest coaching provided • Overall implementation success was rated by the coach and champion of each facility as moderate (5.1 out of 10).	Facilitators: • participation of facilities on a voluntary basis • dedication of coaches Barriers: • staff turnover (of champions in particular)

5. Recommendations and insights

	Recommendations / insights	Rationale	Link with NIP-Q-UPGRADE
	Recommendation		
1	We recommend that during the post-NIP-Q-UPGRADE sustainment phase, CURAVIVA, senesuisse, the Federal Quality Commission or the Federal Office of Public Health consider which strategies are best adapted to the Swiss context.	The selected literature reports on initiatives from the USA, Canada, the UK, the Netherlands and China. It is important to determine whether elements with proven success across the world are relevant and culturally adapted to the Swiss context.	Scale up

		The NIP-Q-UPGRADE will also consider adaptability to the Swiss context as part of its preparation for a care quality improvement pilot intervention	Sub-aims 4 and 6 of work package 2
2	We recommend that during the post-NIP-Q-UPGRADE sustainment phase, CURAVIVA, senesuisse, the Federal Quality Commission or the Federal Office of Public Health consider which strategies should be led or undertaken by long-term care facilities themselves, and which should emanate from other stakeholders.	Multimodal strategies are recuring in the literature, with strategies simply launched or thoroughly guided by external teams during the implementation process. In the above evidence-based strategies, long-term care facilities take on diverse roles and responsibilities (from simple execution to active roles).	Scale up Sub-aims 4 and 6 of work package 2
		Insights	
1	The barriers reported in the international literature resonate with the Swiss context. As such, it should be noted that the NIP-Q-UPGRADE programme is likely to experience potential dropout of participating facilities and changes in staffing during pilot interventions (and other phases of the programme). This should not discourage the NIP-Q-UPGRADE initiative and its scale-up. In this regard, the literature might also help informing strategies to tackle dropouts and staffing turnover.	The barriers and facilitators reported in the literature resonate with barriers and facilitators noted in previous sub-aims of the NIP-Q-UPGRADE.	Sub-aims 3a and 3b, work package 2 Sub-aim 4, work package 1 Sub-aim 9, work package 1 Sub-aim 6, work package 2 (i.e., sub-aims with relatively long-term commitment needed from facilities)
2	For the next phases of the NIP-Q-UPGRADE, particularly the preparation of a care quality improvement pilot, the research team will consider which implementation strategies are most feasible and relevant to the Swiss context	Based on findings from the literature, the NIP-Q-UPGRADE team will select the strategies that are relevant feasible within the programme timeframe, in a participatory manner.	Sub-aim 4, work package 2 Scale-up after the pilot

Review 3: Methodological considerations for evaluating scale-up programmes in healthcare

1. Aim

The overall objective of this study was to inform how the scale-up of the NIP-Q-UPGRADE quality improvement programme could be evaluated. Note that the objective was to gather insights on evaluation, without necessarily stipulating how the scale up of the programme should be evaluated. This leads to the following sub-objectives:

1. Determine which research designs are appropriate for evaluating the scale-up of a programme in the healthcare sector.

2. Determine which types of (implementation) outcomes, which outcome measures, and which endpoints are appropriate for evaluating the scale-up of a programme in the healthcare sector.

3. Identify methodological considerations that are relevant when evaluating the scale-up of a programme in the healthcare sector.

2. Methods

A protocol was drafted based on the adaptation of the PRISMA guidelines for the reporting of meta-epidemiological methodology research. (1) The three aims are reported in one integrated review report summarising the latest scientific evidence on the appropriate evaluation of scale-up programmes in the healthcare setting. Methodological considerations are described in Appendix 8.

3. Results

A total of 6337 titles and abstracts were screened after the databases were searched. A total of 88 full text articles were assessed for eligibility. For objective one, one study was included. For objective two, seven studies were included. For objective three, four studies were included. A total of 28 additional full text articles were assessed for eligibility based on the additional search strategies. This did not yield additional inclusions.

What research designs can be used to evaluate scale-up?

There was no formal recommendation for a research design to evaluate scale-up. Scale-up was described as a long-term and multi-phased process. Consequently, a range of methods are needed to evaluate scale-up success. Different methods are needed to match the diversity of outcomes that can be measured. The different design considerations are therefore discussed in the next section with the outcomes that could be measured.

What outcomes can be used to evaluate scale-up?

Reach and degree of adoption are at the heart of scale-up

The starting point of scale-up is signalled by the availability of an effective intervention, and its availability to an increased number of beneficiaries. Thus “Reach and adoption are at the heart

of scale-up". (2, 3) In this context, adoption can be seen as the number of long-term care facilities who adopt the intervention that is scaled up. Reach can be seen as the number of persons in the target population (for example care staff in the facility) who receive the intervention. For this purpose, a non-experimental design could be used to monitor the spread of the scale-up, e.g. using a survey methodology or using routinely collected data (training logbooks, data from human resources, and billing or administrative data). The literature also uses the term coverage to refer to how much of the target organisations have the intervention implemented divided by the total number of targeted organisations in the scale-up. (4) It should be noted that coverage is also used as a term for geographical distribution of the implementation. (5) Success of scale-up could therefore be defined and evaluated as a percentage of intended coverage. Ideally, this definition includes defined targets for intended organisations (and if relevant settings), geographical areas, providers, each with predefined timelines/endpoints. (5)

Considering the complex nature of scale-up, **longitudinal measurements** would be needed to consider that timing of adoption will differ significantly from 'early adopters' to 'early majority', to 'late majority' and final the 'laggers'. An adaptive design with pre-specified intermediate analysis could be used to inform about relative success, adapt the plan, and monitor changes in the scale-up. (6) A scale-up could also focus on one region— evaluate, learn, adapt and then move to the next region; or on spreading through providers or health systems. (4, 5, 7). No specific advice was available for this.

Cost of scaling-up

Several sources refer to the importance of evaluating costs of scale-up, (8) although no specific information was provided. Costs estimated in an evaluation study or implementation study preceding the scale-up will likely not be informative for the cost of scale-up. (5) Successful scale-up will translate in legal, political and institutional changes. This entails additional costs in areas of scale-up management, human resources, administration, and possibly infrastructure. (9) This can be referred to as the cost of institutionalisation (see below for definition). (5)

Fidelity and adaptations

Ideally, before scale-up, a well-developed and tested programme theory is available after multiple multi-centre evaluation studies that included relevant contextual variation. Through multiple evaluation studies, a thorough understanding of how improvement can be achieved should be available.

A thorough understanding of core intervention components causally related to the desired outcomes is needed. (10) Similarly, we need to understand how intervention components interact with contextual factors, and how this may influence potential effects on health outcomes. The fidelity of core components needs to be monitored during a scale-up to ensure that the health effects are replicated. (3,5) Fidelity refers to the extent to which an intervention is implemented as it was described in the scale-up protocol. (11) Adaptations to the intervention will also need to be monitored. A certain degree of adaptation can be expected during the scale-up, as the implementation context may differ between geographical regions, providers and institutions. For adaptations, a distinction could be made between core intervention components that are needed to produce the effect, and peripheral interventions components that can be adapted to the context to support the implementation.

Different methods could be used to monitor fidelity and adaptations. Logbooks and surveys could be used to gather general data on fidelity on a large scale. To capture and understand adaptations, interviews may be required. Depending on the intervention to be studies, observations in organisations could provide additional rich information on the fidelity and

adaptations. As this may consume more resources from the evaluation team, it could be considered to only collect such detailed information in a sub-sample combining multiple sampling strategies (e.g. typical case sampling, negative case sampling, and diversity sampling).

Effectiveness

Effective interventions will more likely be adopted. Apart from monitoring fidelity to the original intervention protocol, it is advised to monitor effectiveness during scale-up. (12) Effectiveness data during the scale-up process will support the sustainment of the implementation and the spread of the scale-up to achieve a higher coverage. (4, 12, 13) No specific design recommendations were made for this type of evaluation. Several options could be considered, depending on the type of data that is available. If routine longitudinal data are available, and if the point of adoption can accurately be defined, **an interrupted time series analysis** could be used to study effectiveness on a large scale. A second option could be embedding one or more **experimental studies** in the scale-up. Depending on the nature of the scale-up project, a trial within cohort design could be used. It is likely that the unit of allocation will be at cluster level. For the experimental study design, a special consideration is needed for the control group. It would be unethical to withhold intervention, as scale-up focuses on increasing the reach of an effective intervention. Depending on the nature of the intervention in scale-up, a waiting-list control group, or a stepped-wedge design could be used. The evaluation design is likely to have a nested or partially nested design. For example, if educational interventions are implemented, their effect may be dependent on both the provider and instructor (nested design). Effects are expected to cluster but only in the intervention group (partially nested design; there is no provider/instructor in the control group).

A longitudinal design is advised to study effectiveness over time (2). Depending on the 'maturity' of evidence, one or multiple studies could be considered. This could be guided by the GRADE of evidence, but also by how much evidence is available for specific contexts and relevant subgroups. For example, variation in effectiveness could be explored by type of region (rural – urban), subgroups (with different risk profiles), or type of provider. In the context of an adaptive design, a comparative effectiveness study could also be introduced when problems with the scale-up are identified. Evaluation could then focus on studying the intervention versus a leaner-version of the intervention to improve acceptability. (14)

Institutionalisation

Institutionalisation indicators could be defined. As previously described, scale-up will affect legal, political and institutional changes to support and promote the adoption of the intervention. (5) Through these system level changes, an intervention is 'institutionalised'. Therefore, to understand the effects of scale-up, changes in these systems need to be monitored. Structure indicators will need to be defined (e.g., updated policy statement published, or updated nomenclature available to fund the intervention). This could be seen as a process evaluation, assessing whether the necessary contextual changes are in place to support implementation. No specific recommendation was given in the literature on how to examine institutionalisation. Several options are possible, ranging from interviews or survey with stakeholders and implementers to reviewing policy documents and legal texts.

Other considerations for evaluating scale-up

A dedicated programme theory and scale-up plan will be needed. This information can be used to define specific indicators for measurement in the scale-up. (15) A first evaluation, before implementation, should be the scalability. (16) Scale-up can also introduce negative effects, notably because inequalities are also scaled-up. (16) This would require monitoring in the

evaluation. A comprehensive evaluation of the scale-up will require a lot of resources. It is likely that choices will need to be made to balance validity of information, the need for specific information, and the feasibility of evaluation. A collaboration with policy makers during scale-up will help to discuss impact and further support spreading the intervention through improved institutionalisation (e.g., greater resource allocation). Therefore, an evaluation plan should have well defined scale-up targets with matching indicators for measuring success. (5) To measure success, it would be important to measure/define the 'starting point' of the scale-up (17).

4. Conclusion

We recommend that CURAVIVA and senesuisse adopt a structured scale-up evaluation plan to monitor and evaluate scale-up success, by January 2025 (as part of sub-aim 11, work package 1).

Evaluation will require a dedicated team to monitor the scale-up, and good collaboration with stakeholders. An adaptive evaluation design with iterative evaluations is recommended. To monitor this progression of the scale-up, success indicators should be clearly defined prior to the beginning of the scale-up. For well-studied interventions, the reach, adoption, fidelity and adaptations are key outcomes. A process evaluation to monitor the institutionalisation is recommended. In case there is uncertainty about the effectiveness of the intervention to be scaled-up, one or more evaluation studies need to be embedded in the scale-up plan.

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Appendix

Review 1

Appendix 1 – Methods

Justification of methods

An umbrella review design is recommended when multiple up-to-date systematic reviews and meta-analyses (collectively referred to as "reviews" hereafter) are available (60). A preliminary literature search – detailed in (61) – confirmed that a suitable number of recent reviews is available. Whilst a rich literature focuses on individual areas of interest, knowledge is scattered and not readily actionable. Moreover, across all areas, several reviews point out that variety in study designs and heterogeneity in data quality prevent robust conclusions from being drawn. Therefore, a synthesis of the literature on all areas of interest may be relevant and helpful in guiding policymakers and practitioners in the development, implementation, and sustainment of evidence-based care quality improvement initiatives .

An initial search for existing umbrella reviews on our topics of interest on Ovid MEDLINE, JBI EBP Database, EPPI, Epistemonikos and PROSPERO yielded two relevant umbrella reviews on two single care quality areas: malnutrition (62) and medication review (57). This further confirmed the need for and originality of the present work.

Inclusion Criteria

Eligibility criteria were based on a Population, Interventions, Context, Outcomes and Study design (PICO-S) framework, summarised in Table S1.

Table S1. Eligibility criteria

Criteria	**Include**	**Exclude**
Population	older people living in long-term care facilities, including specific populations or problematics within this group if mixed population, at least 75% population aged over 65 / described as older adults if mixed settings, over 50% facilities or stratified	community settings all other care settings (e.g., in-patient, ambulatory, assisted living, short-stay, respite care)
Intervention (intervention-based reviews)	interventions seeking to: 1. improve monitoring, assessment, care, raise awareness, and/or reduce the prevalence of malnutrition, pain, pressure ulcers, and polypharmacy 2. reduce the use of physical restraints 3. improve the coverage and effects of advance care planning and medication reviews	
Theme under examination (descriptive reviews)	perceptions, descriptions, evaluation or economic aspect of one of our seven thematic areas of interest	
Context	long-term care facilities, defined following the WHO as "establishments primarily engaged in providing residential long-term care that combines nursing, supervisory or other types of care as required by the residents" (63) no geographical restriction	
Outcomes	All	

Study design	systematic reviews and meta-analyses based on empirical evidence –primary studies based on quantitative, qualitative, or mixed methodologies	scoping reviews reviews focusing on primary studies based on non-empirical evidence (e.g. opinion papers, theoretical studies) non-systematic reviews

Search strategy

On 27 June 2023, we systematically searched 9 electronic databases – Medline (Ovid), CINHAL (EBSCO), PsycINFO (Ovid), Embase (Elsevier), Cochrane Library, JBI EBP Database (Ovid), Web of Science, and Epistemonikos for published systematic reviews and meta-analyses; and Dissertations and Theses (Proquest) for grey literature – for published systematic reviews and meta-analyses. We focused on reviews published within the past 10 years (2013-2023) to yield the most recent available evidence, and included reviews published in English, French, German, Italian, Spanish, Dutch, Portuguese, Polish. No geographical restrictions were applied. Key search concepts are shown in Table S2.

Table S2. Key search concepts

Concept	Search terms
Long-term care facility for other people	Nursing Homes or Homes for the Aged or Long-Term Care or Nursing Home or Residential Home* or Residential facility* or Nursing facility* or Institutional Care or Skilled Nursing facility* or Care Home* or Residential care or Residential Aged Care or Aged Care or Institutional Elderly Care
Pain	Pain or Pain Management or Analgesia or Pain Measurement
Physical restraint	Restraint, Physical or Physical restraint or Bed barrier* or Bedrail* or Bed rail* or Belt* or Fixat*
Malnutrition	exp Malnutrition/ or (“malnutrition” or “nutritional deficienc*” or “undernutrition” or “malnourishment” or “protein intake*” or “protein deficienc*” or “caloric intake*” or “caloric deficienc*”).mp.
Polypharmacy	Polypharmacy or polymedication or Multiple medication* or Multiple medicine* or Multiple drug* or Many medication* or Many medicine* or Many drug*
Pressure Ulcer	Pressure Ulcer or Bedsore* or Pressure sore* or Decubitus
Advance Care Planning	Advance Care Planning or Advance* care plan* or advance health care planning or Anticipatory care
Medication Review	Medication Review or Medication* review*

In turn, the search terms and strategies developed in collaboration with a scientific librarian (BK) and employed in each database are detailed in Table S3.

Table S3 – Search terms and strategies for 9 databases

Search performed on 27.06.2023

Database	Search terms
1. Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions	(exp Nursing Homes/ or Homes for the Aged/ or Long-Term Care/ or ("long-term care" or (home* adj1 aged) or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facility*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care").mp.) AND (exp Pain/ or Pain Management/ or exp Analgesia/ or Pain Measurement/ or ("pain" or "pain management" or analgesia*).mp. or Restraint, Physical/ or ("physical restraint" or "bed barrier*" or "bedrail*" or "bed rail*" or belt* or fixat*).mp.

1946 to June 26, 2023 (Classic search menu)	or exp Malnutrition/ or ("malnutrition" or "nutritional deficienc*" or "undernutrition" or "malnourishment" or "protein intake*" or "protein deficienc*" or "caloric intake*" or "caloric deficienc*").mp. or exp Polypharmacy/ or (polypharmacy or polymedication or "multiple medication*" or "multiple medicine*" or "multiple drug*" or "many medication*" or "many medicine*" or "many drug*").mp. or exp Pressure Ulcer/ or ("pressure ulcer*" or "bedsore*" or "pressure sore*" or decubitus).mp. or exp Advance Care Planning/ or ("advance* care plan*" or "advance health care planning" or "anticipatory care").mp or exp Medication Review/ or ("medication* review*").mp.) Results: 10287 AND (exp "Systematic Review"/ or exp Meta-Analysis/ or "systematic review".mp. or "meta-analysis".mp. or review.ti. or ("systematic review" or "meta-analysis").pt.) Results: 662 limit 14 to ("all aged (65 and over)" and last 10 years) **Results: 230**
2. CINHAL Ultimate (EBSCO) 1937 to Current	((MH "Nursing Homes") OR (MH "Skilled Nursing Facilities") OR (MH "Nursing Home Patients") OR (MH "Long Term ") Care Nursing OR (MH "Long Term Care") OR (MH "Residential Facilities") OR (MH "Residential Care") OR (MH "Gerontologic Care") OR (MH "Gerontologic Nursing")) AND ((MH "Pain+") OR (MH "Pain Management") OR (MH "Pain Management Nurses") OR (MH "Pain Measurement") OR (MH "Analgesia+") OR (MH "Restraint, Physical") OR (MH "Malnutrition+") OR (MH "Protein Deficiency") OR (MH "Protein-Energy Malnutrition") OR (MH "Energy Intake") OR (MH "Polypharmacy") OR (MH "Pressure Ulcer") OR (MH "Advance Care Planning") OR (MH "Medication Review")) AND ((MH "Systematic Review") OR (MH "Meta Analysis") OR PT(Meta Analysis OR Meta Synthesis OR Systematic Review) OR ("systematic review" OR "meta-analysis") OR (TI review)) results: 378 **Limiters** - Published Date: 20130101-20231231; Age Groups: Aged: 65+ years, Aged, 80 and over **Result: 130**
3. APA PsycInfo 1806 to June Week 3 2023 (Ovid) (Classic search menu)	(exp nursing homes/ or residential care institutions/ or long term care/ or nursing home residents/ OR elder care/ OR ("long-term care" or (home* adj1 aged) or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facility*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care").mp.) AND (exp pain/ or pain management/ or pain measurement/ or pain perception/ or pain thresholds/ or analgesia/ or ("pain" or "pain management" or analgesia*).mp. or physical restraint/ or ("physical restraint" or "bed barrier*" or "bedrail*" or "bed rail*" or belt* or fixat*).mp. or exp nutritional deficiencies/ or ("malnutrition" or "nutritional deficienc*" or "undernutrition" or "malnourishment" or "protein intake*" or "protein deficienc*" or "caloric intake*" or "caloric deficienc*").mp. or polypharmacy/ or (polypharmacy or polymedication or "multiple medication*" or "multiple medicine*" or "multiple drug*" or "many medication*" or "many medicine*" or "many drug*").mp

	or ("pressure ulcer*" or "bedsore*" or "pressure sore*" or decubitus).mp. or ("advance* care plan*" or "advance health care planning" or "anticipatory care").mp or ("medication* review*").mp.) Result : 2931 AND exp "Systematic Review"/ or exp Meta-Analysis/ or "systematic review".mp. or "meta-analysis".mp. or review.ti. or ("systematic review" or "meta-analysis").pt. Results: 183 Filtres limit 5 to (("380 aged <age 65 yrs and older>" or "390 very old <age 85 yrs and older>") and last 10 years) **Results: 29**
4. Embase (Elsevier)	('long term care'/de OR 'elderly care'/de OR 'geriatric care'/de OR 'home for the aged'/de OR 'nursing home'/de OR 'residential home'/de OR 'residential home'/de OR 'institutional care'/de OR 'residential care'/de) AND ('pain'/exp OR 'analgesia'/de OR 'pain measurement'/de OR 'physical restraint'/de OR 'malnutrition'/exp OR 'nutritional deficiency'/exp OR 'caloric intake'/de OR 'polypharmacy'/exp OR 'decubitus'/de OR 'advance care planning'/de OR 'drug utilization review'/de) Results: 31931 AND ('systematic review'/exp OR 'systematic review' OR 'meta-analysis'/exp OR 'meta-analysis' OR review.ti) Results: 1743 Filtres #3 AND (2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py OR 2021:py OR 2022:py OR 2023:py) AND ([aged]/lim OR [very elderly]/lim) **Results: 160**
5. Cochrane Library 1996 to Current	(advanced search menu, field keyword) ("long-term care" or "home for the aged" or "homes for the aged" or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facility*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care") in **Keyword** AND ("pain" or "pain management" or analgesia*) or ("physical restraint" or "bed barrier*" or "bedrail*" or "bed rail*" or belt* or fixat*) or ("malnutrition" or "nutritional deficienc*" or "undernutrition" or "malnourishment" or "protein intake*" or "protein deficienc*" or "caloric intake*" or "caloric deficienc*") or (polypharmacy or polymedication or "multiple medication*" or "multiple medicine*" or "multiple drug*" or "many medication*" or "many medicine*" or "many drug*") or ("pressure ulcer*" or "bedsore*" or "pressure sore*" or decubitus) or ("advance* care plan*" or "advance health care planning" or "anticipatory care") or ("medication* review*") in **Keyword** - (Word variations have been searched) **Results: 2**
6. JBI EBP Database (Ovid) 1996 to June 21, 2023	(Classic search menu) ("long-term care" or "home for the aged" or "homes for the aged" or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facility*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care").kw. AND (("pain" or "pain management" or analgesia*).kw. or ("physical restraint" or "bed barrier*" or "bedrail*" or "bed rail*" or belt* or fixat*).kw. or

	("malnutrition" or "nutritional deficienc*" or "undernutrition" or "malnourishment" or "protein intake*" or "protein deficienc*" or "caloric intake*" or "caloric deficienc*").kw. or (polypharmacy or polymedication or "multiple medication*" or "multiple medicine*" or "multiple drug*" or "many medication*" or "many medicine*" or "many drug*").kw. or ("pressure ulcer*" or "bedsore*" or "pressure sore*" or decubitus).kw. or ("advance* care plan*" or "advance health care planning" or "anticipatory care").kw. or ("medication* review*".kw.) Results: 13 limit to (("systematic review protocols" or systematic reviews) and last 10 years) **Results: 0**
7.Web of Science Core Collection (1900-present)	Topic ("long-term care" or "home for the aged" or "homes for the aged" or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facility*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care") AND Topic (elder* OR aged OR old OR older OR senior OR senil* OR septuagenarian* OR octagenarian* OR sexagenarian* OR nonagenarian* OR centenarian* OR supercentenarian* OR geriatric* OR gerontol*) AND Topic (("pain" or "pain management" or analgesia*) or ("physical restraint" or "bed barrier*" or "bedrail*" or "bed rail*" or belt* or fixat*) or ("malnutrition" or "nutritional deficienc*" or "undernutrition" or "malnourishment" or "protein intake*" or "protein deficienc*" or "caloric intake*" or "caloric deficienc*") or (polypharmacy or polymedication or "multiple medication*" or "multiple medicine*" or "multiple drug*" or "many medication*" or "many medicine*" or "many drug*") or ("pressure ulcer*" or "bedsore*" or "pressure sore*" or decubitus) or ("advance* care plan*" or "advance health care planning" or "anticipatory care") or ("medication* review*")) AND Title ("Systematic Review" or "Umbrella Review" or Meta-Analysis) Results: 305 Limits 2013-2023 **Results: 274**
8. Dissertations and Theses A&I (Proquest) 1997 to Current	subject(("long-term care" OR "home for the aged" OR "homes for the aged" OR "nursing home*" OR "residential home*" OR "residential facilit*" OR "nursing facility*" OR "institutional care" OR "skilled nursing facilit*" OR "care home*" OR "residential care" OR "residential aged care" OR "aged care" OR "institutional elderly care")) AND subject ((elder* OR aged OR old OR older OR senior OR senil* OR septuagenarian* OR octagenarian* OR sexagenarian* OR nonagenarian* OR centenarian* OR supercentenarian* OR geriatric* OR gerontol*)) AND subject(("pain" OR "pain management" OR analgesia*) OR ("physical restraint" OR "bed barrier*" OR "bedrail*" OR "bed rail*" OR belt* OR fixat*) OR ("malnutrition" OR "nutritional deficienc*" OR "undernutrition" OR

	"malnourishment" OR "protein intake*" OR "protein deficienc*" OR "caloric intake*" OR "caloric deficienc*") OR (polypharmacy OR polymedication OR "multiple medication*" OR "multiple medicine*" OR "multiple drug*" OR "many medication*" OR "many medicine*" OR "many drug*") OR ("pressure ulcer*" OR "bedsore*" OR "pressure sore*" OR decubitus) OR "advance* care plan*" or "advance health care planning" or "anticipatory care" OR "medication* review*") AND Title ("Review" OR Meta-Analysis) Supplementary limits Date: last 10 years **Results: 1**
9. Epistemonikos (Advanced search menu, field Title/abstract)	Title/Abstract ("long-term care" OR "home for the aged" OR "homes for the aged" OR "nursing home" OR "residential home" OR "residential facility" OR "nursing facility" OR "institutional care" OR "skilled nursing facility" OR "care home" OR "residential care" OR "residential aged care" OR "aged care" OR "institutional elderly care") AND Title/Abstract (elder* OR aged OR old OR older OR senior OR senil* OR septuagenarian* OR octagenarian* OR sexagenarian* OR nonagenarian* OR centenarian* OR supercentenarian* OR geriatric* OR gerontol*) AND Title/Abstract (("pain" OR "pain management" OR analgesia) OR ("physical restraint" OR "bed barrier" OR "bedrail" OR "bed rail" OR belt OR fixation) OR ("malnutrition" OR "nutritional deficiency" OR "undernutrition" OR "malnourishment" OR "protein intake" OR "protein deficiency" OR "caloric intake" OR "caloric deficiency") OR (polypharmacy OR polymedication OR "multiple medication" OR "multiple medicine" OR "multiple drug" OR "many medication" OR "many medicine" OR "many drug") OR ("pressure ulcer" OR "bedsore" OR "pressure sore" OR decubitus) OR ("advance* care plan*" or "advance health care planning" or "anticipatory care") OR ("medication* review*")) Filtre: systematic review **Results: 147**

Study screening and selection

Results were exported to the Covidence software and duplicates removed. Two reviewers (EP, VDG,) independently screened titles and abstracts. Two of 5 reviewers (EP and VDG or BVG or JH or NC) then independently assessed full texts against eligibility criteria. Disagreements about eligibility or exclusion criteria were solved through consensus or involvement of a third reviewer.

Assessment of methodological quality

Two reviewers (VDG, EP) independently assessed the quality of included reviews using the JBI critical appraisal checklist for systematic reviews and research synthesis (64). The item on publication bias was interpreted narrowly, as not pertaining to similar bias such as reporting bias. It was indicated as “yes” when performed and “unclear” when acknowledged yet not assessed. Whilst the JBI checklist, our aim was to exclude reviews of low quality. To do so, we designed the following scoring system: one point per “yes” answer -1 point per “no” answer and -0.5 point for “unclear” answer. Articles that scored less than 5 points were excluded from the review.

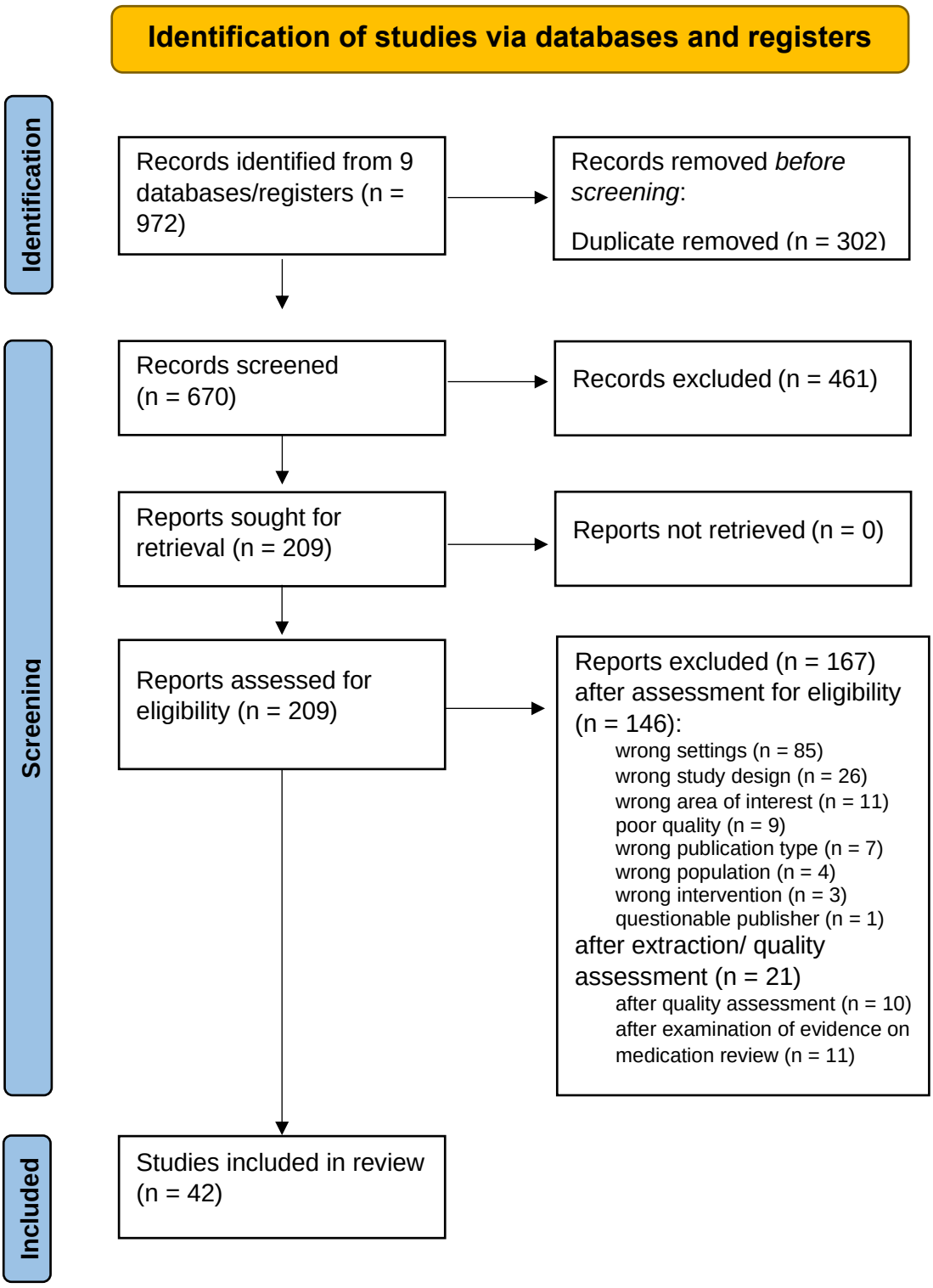
Data extraction and synthesis

Data extraction was performed by two reviewers (VDG, EP) independently. Our extraction form was piloted by the two reviewers on four reviews and adapted to extract relevant information. We extracted information related to review title, authors, year, journal, origin, review type, area(s) of interest, review aim, number of relevant primary studies / total number of primary studies, participants characteristics (number, mean age, specificities), countries and designs of relevant primary studies, relevant interventions, outcome variables, descriptive results / conclusions, quality of primary studies and quality assessment tool.

Appendix 2 – Study inclusion process and methodological quality assessment

The study inclusion process is detailed in the PRISMA flowchart in Figure S1 (65).

Figure S1 - PRISMA 2020 flow diagram



Our search strategy yielded 972 results. After removing 302 duplicates, 670 titles and abstracts were examined against inclusion criteria. This phase resulted in the exclusion of 461 articles. The full texts of 209 articles were retrieved and assessed for eligibility, leading to the exclusion of 146 studies. The most common reasons for exclusion were wrong settings (n = 85), wrong study design (n = 26) and wrong area of interest (n = 11). Excluded articles are listed in Table S4, alongside the main reason for exclusion.

Table S4 - Studies excluded at full text review stage

Study	Main reason for exclusion
Abdelhamid 2016	Wrong setting
Abdelsamad 2022	Wrong publication type
Abdelsamad 2022	Wrong publication type
Abizanda 2016	Wrong setting
Agarwal 2016	Wrong study design
Aitken 2020	Wrong study design
Allen 2013	Wrong population
Anderson 2017	Wrong area of interest
Arias-Casais 2022	Wrong study design
Artaza-Artabe 2016	Wrong setting
Bao 2022	Wrong setting
Bellenger 2018	Wrong area of interest
Beuscart 2017	Wrong setting
Bhagavathula 2022	Wrong setting
Binnekade 2017	Poor quality
Blackman 2017	Wrong study design
Bohorquez-Moreno 2021	Wrong setting
Borders 2020	Wrong setting
Bories 2021	Wrong setting
Brooke 2015	Poor quality
Brunner 2022	Wrong setting
BuildCARE 2016	Wrong area of interest
Bunn 2016	Wrong setting
Cacador 2021	Poor quality
Cadogan 2017	Wrong setting
Chaboyer 2022	Wrong setting
Chadborn 2023	Wrong intervention
Chang 2021	Poor quality
Chao 2019	Wrong study design
Cheng 2018	Wrong setting
Collins 2019	Wrong study design
Corish 2019	Wrong study design
Coronado 2020	Wrong setting
Correa-Perez 2019	Wrong setting
Cox 2019	Wrong setting
Crowe 2017	Wrong setting
Curkovic 2016	Wrong study design
Dautzenberg 2021	Wrong setting
Davies 2020	Wrong setting

deAlmeidaSilva 2020	Wrong setting
DíazPlanelles 2023	Wrong area of interest
Disalvo 2016	Wrong area of interest
Doorduijn 2019	Wrong setting
Douglas 2015	Wrong study design
Dowd 2022	Wrong area of interest
Dowd 2023	Wrong study design
Drageset 2014	Wrong area of interest
Estrada 2021	Wrong area of interest
Fahner 2019	Wrong setting
Felton 2021	Poor quality
Fielding 2023	Wrong setting
Fleurke 2020	Wrong setting
Flo 2017	Wrong setting
Gillespie 2014	Wrong setting
Gutiérrez-Valencia 2018	Wrong setting
Hahnel 2017	Wrong setting
Haider 2021	Wrong study design
Hanjani 2019	Wrong setting
Heelan 2020	Wrong setting
Hirakawa 2021	Wrong study design
Hukins 2019	Wrong setting
Huynh 2021	Poor quality
Iversen 2022	Wrong study design
Joyce 2018	Wrong setting
Kang 2018	Wrong setting
Kapoor 2015	Wrong study design
Ke 2015	Wrong setting
Ke 2017	Wrong setting
Konno 2020	Wrong publication type
Kramer 2022	Wrong setting
Lam 2016	Wrong study design
Lee 2021	Wrong setting
Leelakanok 2017	Wrong setting
Leelakanok 2019	Wrong setting
Leij-Halfwerk 2019	Wrong setting
Lichtner 2014	Wrong setting
Lombardi 2021	Wrong study design
Lozano-Montoya 2016	Wrong setting
Malhotra 2022	Wrong setting
Marsden 2015	Wrong study design
Mathewson 2021	Wrong study design
McLaren-Hedwards 2022	Wrong setting
Meid 2015	Wrong setting
Moloney 2021	Wrong study design

Moore 2019	Wrong setting
Moreira 2016	Wrong setting
Morilla-Herrera 2016	Wrong setting
Muhlack 2017	Wrong setting
Namasivayam 2015	Wrong population
Ng 2018	Wrong study design
Nothelle 2017	Wrong setting
Pagan 2015	Wrong setting
Page 2016	Wrong setting
Pana 2022	Wrong study design
Park 2015	Wrong setting
Pazan 2021	wrong study design
Perna 2019	Wrong setting
Pieper 2013	Wrong setting
Poscia 2018	Wrong setting
Prokopidis 2023	Wrong setting
Pu 2022	wrong study design
Ralph 2014	Wrong setting
Rathbone 2020	Wrong publication type
Richardson 2018	Wrong setting
Robins 2021	Wrong intervention
Rostad 2017	Wrong setting
Sanchez-Rodriguez 2023	Wrong study design
Santos 2015	Wrong setting
Saragih 2022	Wrong setting
Scheepmans 2018	Wrong setting
Schneider 2019	Poor quality
Schofield 2022	Poor quality
Sechaud 2014	Wrong study design
Sheehan 2018	Wrong population
Shi 2018	Wrong population
Shi 2021	Wrong setting
Shi 2021	Wrong setting
Shropshire 2018	Poor quality
Sluggett 2021	Wrong publication type
Smith 2022	Wrong setting
Smith 2022	Wrong setting
SoaresRodrigues 2016	Wrong setting
Sorensen 2019	Wrong setting
Strand 2019	Wrong setting
Tan 2015	Questionable publisher
Tangvik 2021	Wrong setting
Tark 2021	Wrong intervention
tenCate 2020	Wrong setting
Thomson 2022	Wrong setting
Tjia 2013	Wrong setting

Trabal 2015	Wrong setting
Tsuboi 2018	Wrong area of interest
vanDalen-Kok 2015	Wrong setting
vandenBerg 2021	Wrong setting
vanderSteen 2014	Wrong setting
VanWert 2018	Wrong publication type
Veronese 2022	Wrong setting
Wang 2018	Wrong area of interest
Wang 2022	Wrong area of interest
Weathers 2015	Wrong setting
Wei 2022	Wrong setting
Wey 2014	Wrong study design
Wong 2018	Wrong setting
Wu 2021	Wrong setting
Yildirim 2019	Wrong publication type
Zupo 2020	Wrong setting

Of the 63 remaining reviews, 9 were excluded following critical appraisal based on poor methodological quality, as detailed in Table S5.

Table S5. Quality assessment of reviews excluded for low quality

Study ID	clear review question	appro-priate inclusion criteria	appro-priate search strategy	adequate sources and resources	appro-priate criteria for appraising studies	inde-pendent critical appraisal	methods to minimize errors in data extraction	appro-priate methods to combine studies	publication bias assessed	policy/ practice recomm-endations supported by data	appro-priate directives for new research
Cereda 2016	+	?	-	-	+	+	+	+	-	+	+
Bell 2013	+	+	+	-	-	-	+	+	-	+	+
van Bokhorst-de van der Schueren 2014	+	-	+	+	-	-	?	+	-	+	+
Wilchesky 2015	+	?	?	+	-	-	?	+	-	+	+
Chow 2016	+	+	-	?	-	-	?	?	-	?	+
Briones-Peralta 2017	+	+	?	+	+	?	?	+	-	+	+
Storms 2017	+	+	+	-	+	?	+	+	-	+	-
Jester 2021	+	+	+	-	-	-	-	+	+	?	+
Lan 2017	-	-	-	+	?	+	?	+	+	+	-

Tamura 2013	+	?	?	-	+	+	+	+	-	+	-

A further 11 reviews were excluded after data extraction, as one umbrella review on medication review was retrieved and covered articles that had been included (49). As such, and as several reviews on medication review covered the same primary studies, we decided to exclude reviews published4 before the Umbrella review stated date of May 2021.

Methodological quality

The quality assessment results of the 43 included reviews are summarised in Table S6.

Table S6. Quality assessment results of included reviews

Review ID	clear review question	appro-priate inclusion criteria	appro-priate search strategy	adequate sources and resources	appro-priate criteria for appra-i-sing studies	inde-pendent critical appraisal	methods to minimize errors in data extraction	appro-priate methods to combine studies	Publi-cation bias assessed	policy/ practice recomm-endations supp-orted by data	appro-priate directives for new research
Abbott 2013	+	+	+	+	+	?	+	+	-	+	+
Batchelor 2019	+	+	+	+	+	+	?	+	NA	+	+
Brugnolli 2020	+	+	+	+	+	?	+	+	-	+	+
Chang 2023	+	+	+	+	+	+	+	+	-	+	+
Cole 2022	+	+	+	+	+	+	+	+	-	?	+
Dowd 2022	+	+	+	+	+	+	+	+	-	?	+
Gilissen 2017	+	+	+	+	+	-	?	+	NA	+	+
Gleeson 2021	+	+	+	+	+	+	+	+	-	+	+
Hofmann 2014	+	+	+	+	+	+	?	+	-	+	+
Hugo 2018	+	+	+	+	+	?	+	+	+	+	+
Husebo 2016	+	+	+	+	+	+	+	+	-	+	+
Jokanovic 2015	+	+	+	+	+	+	+	+	-	+	+
Kelly 2019	+	+	+	+	+	+	-	+	-	+	+
Kimber 2015	+	+	?	+	+	+	+	+	-	?	+
Knopp-Sihota 2016	+	+	+	+	+	?	?	+	-	+	+
Knopp-Sihota 2019	+	+	+	+	+	+	+	+	-	?	+

Knopp-Sihota 2022	+	+	+	+	+	+	+	+	-	+	+
Knopp-Sihota 2022	+	+	+	+	+	+	+	+	-	+	+
Kua 2019	+	+	+	+	+	+	+	+	+	+	+
Lan 2017	+	+	+	+	+	+	+	+	+	+	-
Lee 2021	+	+	+	+	+	?	+	+	-	?	+
Liang 2023	+	+	+	+	+	+	+	+	-	+	-
Maki-Turja-Rostedt 2019	+	+	?	+	+	+	?	+	-	+	+
Manietta 2022	+	+	+	+	+	+	+	+	-	+	+
Martin 2016	Yes	?	?	+	+	+	?	?	+	?	+
McGrattan 2017	+	+	+	+	+	?	+	+	-	+	+
Mignani 2017	+	+	+	+	+	+	+	+	NA	+	+
Morin 2016	+	+	+	-	+	?	+	+	+	+	+
Ng 2022	+	+	+	+	+	+	+	+	+	+	+
Pu 2019	+	+	+	+	+	+	?	+	+	+	+
Sadeq 2022	+	+	+	+	+	?	+	+	+	+	+
Sellars 2019	+	+	+	+	+	+	?	+	NA	+	+
Seppala 2022	+	+	+	+	+	+	+	+	-	+	+
Sossen 2021	+	+	+	+	+	+	?	+	+	+	+
Tsai 2021	+	+	+	+	+	+	?	+	+	+	+
Tucker 2022	+	+	+	+	+	-	+	+	+	+	+
Vaismoradi 2016	+	+	?	+	+	+	+	+	NA	+	+
Watkins 2017	+	+	Yes	+	+	-	+	+	NA	+	+
Zhou 2022	+	+	Yes	+	+	-	+	+	NA	+	+
Alruthea 2021	+	+	+	+	+	+	+	+	+	+	+
Donaldson 2019	+	+	+	+	+	+	+	+	+	+	+
Dixon 2018	+	+	+	+	+	?	?	+	?	+	+

We do not indicate the score of individual reviews, as our scoring system was devised to exclude publications of low methodological quality and include fair to high quality reviews. Although we only included reviews of good quality, the quality of the primary studies informing included review is highly variable. As such, the findings below should be interpreted as trends that generally warrant further investigation through high-quality studies.

Appendix 3 – Table S7. Characteristics of included reviews

Study ID	Origin	Review type	Review aim	Nb relevant primary studies / total nb primary studies	Participants number and characteristics*	Origin of relevant primary studies	Designs of relevant primary studies	Inter-vention-based or des-criptive
Malnutrition								
Abbott 2013	UK	Systematic review and meta-analysis	The aim of this systematic review was to determine the effectiveness of **mealtime** interventions for the elderly living in residential care	37/37	3'716 residents	US, Sweden, Holland, Canada, UK, Finland, France, Taiwan	10 RCT 22 CC/QE 3 obs	INT
Chang 2023	Australia	Systematic review and meta-analysis	To assess the effectiveness of interventions in **reducing feeding difficulties and improving the nutritional status** of individuals with dementia	7/7	345 residents with dementia	US, Taiwan, China	4 RCT 3 CC/QE	INT
Donaldson 2019	UK	Systematic review and meta-analysis	To evaluate the effectiveness of nonmeat, high-protein supplementation on health-related quality of life and relevant clinical and **nutritional** outcomes in older people in a care home setting	17/17	1'246 residents			INT
Hugo 2018	Australia	systematic review	To compare the **cost-effectiveness of implementing nutrition interventions** targeting malnutrition in aged care homes versus usual care	8/8	878 residents	US, Taiwan, Netherlands, UK	4 RCT 4 CC/QE	INT
Kimber 2015	UK	Systematic review	To synthesise evidence from nonrandomised studies aiming to improve **nutritional intake in nutritionally vulnerable individuals** and to describe their effects on cost, nutritional, clinical and patient centred outcomes	23/41	714 residents, malnourished or nutritionally at-risk, 24 professionals	unknown	17 CC/QE 6 obs	INT

Sossen 2021	Australia	Systematic review and meta-analysis	To determine the effect of **nutrition interventions** using fortification, nutrient-dense or enriched food and/or drinks on energy and protein intake in residents living in nursing homes, compared to the standard menu with or without oral nutritional support products	16/16	891 residents	Japan, France, US, Australia, HK, UK, Sweden, Germany, Canada	9 RCT 5 CC/QE 1 obs 1 feasibility	INT
Tucker 2022	Australia	Systematic review and meta-analysis	To evaluate the association between **nutritional status** and quality of life and the effectiveness of nutritional interventions on quality of life in older people in residential aged care	21/21	6'243 residents	12 countries in Europe, North America, Brazil	6 RCT 5 CC/QE 10 obs	INT
Watkins 2017	UK	Systematic review	To better understand factors that may contribute to **malnutrition** by examining the attitudes, perceptions and experiences of mealtimes among care home residents and staff	15/15	580 participants including residents, professionals and relatives	US, Australia, Denmark, Canada, UK, Sweden, Guyana, Canada, Spain, Netherlands	14 qual 1 mixed-meth	DES
Pain								
Cole 2022	US	Systematic review	To examine the international literature on **pain** prevalence in NH residents and the factors associated with the experience of pain	26/26	1'439'311 residents	20 countries in Europe, Asia, Israel, Brazil, Turkey, Australia	Unknown	INT
Husebo 2016	Norway, Netherlands	Systematic review	To identify studies that have investigated the efficacy of different analgesics on **pain** intensity or pain-related behaviour during nursing home stay and at the end of life	11/12	1'019 residents with dementia	US, Netherlands, Finland, Italy, Norway	7 RCT 1 CC/QE 3 obs	INT
Knopp-Sihota 2016	Canada	Systematic review and meta-analysis	To assess the efficacy of pharmacologic, non-pharmacologic, and alternative therapies for reducing **pain** in nursing home residents who are older adults (>65 years)	24/24	3'498 residents	US, Canada, Spain, Finland, Netherlands, Italy, Germany, Norway, China	19 RCT 5 CC/QE	INT

Knopp-Sihota 2022a	Canada	Systematic review and meta-analysis	To examine effectiveness of **pain management** interventions in care home residents with chronic pain (aged 60 years and over)	55/55	9'955 residents	19 countries, mostly from HK, US, Spain	38 RCT 16 CC/QE 1 feasibility	INT
Knopp-Sihota 2022b	Canada	Systematic review	To identify and synthesize primary (original) research that examines **pain management** interventions (1) directed at healthcare aides to improve their pain assessment and management practices or (2) directly delivered by healthcare aides to residents aged ≥60 years in long-term care settings	9/9	682 residents, 330 professionals	US, China	2 RCT 56CC/QE 1 corr	INT
Manietta 2022	Germany	Systematic review	To assess the effects of algorithm-based **pain management** interventions to reduce pain and challenging behaviour in people with dementia living in nursing homes, and describe the components of the interventions and content of the algorithm	3/3	808 residents with mild to severe cognitive impairment	US, HK, Taiwan	3 RCT	INT
Pu 2019	Australia	Systematic review and meta-analysis	To assess the effectiveness of psychosocial interventions on **pain** in older adults living with dementia	6/8	348 residents with dementia	US, Netherlands, Australia, Spain	6 RCT	INT
Tsai 2021	Australia	Systematic review and meta-analysis	To synthesize and evaluate the effectiveness of interventions for nurses to improve the assessment and management of **pain** in people living with dementia	5/6	1'050 residents with dementia	Norway, Netherlands, Taiwan, HK	5 RCT	INT
Knopp-Sihota 2019	Canada	Systematic review	To review and synthesize findings from qualitative studies that report primary barriers and facilitators to **pain assessment** in nursing home residents	31/31	1'016 residents 2281 professionals	US, Canada, Australia, UK, Ireland, Japan, Iceland, and Israel	21 qual 6 obs 3 mixed-meth	DES

Vaismoradi 2016	Norway, Sweden	Qualitative meta-synthesis (meta-ethnography)	To integrate current qualitative international findings and enhance the understanding of experiences of and perspectives on **pain and pain management** in the context of nursing homes	6/6	102 residents, professionals, and 16 relatives	US, Iceland, Norway, UK, Australia	6 qual	DES
Pressure ulcer								
Maki-Turja-Rostedt 2019	Finland	systematic review	To explore the effectiveness of interventions aimed at **pressure ulcer** prevention in long-term older people care facilities	18/18	111'298 residents, 52 professionals	11 countries in Europe, North America and HK	10 RCT 3 CC/QE 5 obs	INT
Physical restraints								
Brugnolli 2020	Italy	Systematic review and meta-analysis	To assess the effectiveness of interventions to reduce **physical restraint** use in older people living in nursing homes or residential care facilities	16/16	20'562 residents	Germany, US, Netherlands, Sweden, Norway	12 RCT 4 CC/QE	INT
Lan 2017	Taiwan	Systematic review and meta-analysis	To analyzes the impact of educational program on the **physical restraint** use in long-term care facilities	10/10	5'879 residents	US, Norway, Sweden, Netherlands, Germany	10 RCT	INT
Liang 2023	Taiwan	Systematic review	To evaluate the effectiveness of **restraint reduction** programs for nursing home care providers in enforcing physical restraint on residents and identify the best strategies for such programs	7/7	350 residents with dementia 17'953 professionals	Netherlands, Sweden, Germany, Norway, Korea	7 RCT	INT
Hofmann 2014	Switzerland	systematic review	To analyse and to summarise factors associated with nursing home residents' characteristics which could lead to **physical restraint**, and to investigate the consequences of physical restraint use for this population	9/9	280'300 residents, 7 relatives	US, Canada, Germany, Netherlands, Finland, Singapore, Switzerland, Japan	1 qual 8 obs	DES
Lee 2021	Australia, Germany	Systematic review and meta-analysis	To synthesize the prevalence and variability in **physical and chemical restraint use** and examine factors that may	82/85	residents (unknown number)	Over 16 countries in Asia, Europe, North America, Middle East (some studies	quant	DES

			contribute to this variability of prevalence rates			with multiple countries included)		
Advance care planning (ACP)								
Gleeson 2021	UK	systematic review	To identify the most effective ACP interventions to train/educate all levels of healthcare professionals working in care homes	6/6	residents and professionals (unknown numbers)	unknown	3 CC/QE 2 RCT 1 qual	INT
Kelly 2019	Australia, UK	Systematic review	To test the efficacy of ACP for people with dementia and describe the settings and population in which it has been evaluated	16/30	residents with dementia and carers (unknown numbers)	unknown	16 quant	INT
Martin 2016	Australia	Systematic review	To identify the effects of ACP interventions on nursing home residents	13/13	9'580 residents; families, professionals	US, Australia, HK, Canada, UK, Singapore, Netherlands	1 RCT 7 CC/QE 5 obs	INT
Ng 2022	HK, Taiwan	Systematic review and meta-analysis	To determine the effect of ACP interventions on end-of-life outcomes in nursing home populations	9/9	2'905 residents	Australia, UK, US, Netherlands, Norway	9 RCT	INT
Batchelor 2019	Australia	systematic review	To determine facilitators and barriers to implementation of ACP in Australian residential and community aged care	9/9	146 residents, 368 professionals	Australia	7 qual 2 CC/QE	DES
Dixon 2018	UK	Systematic review	To systematically and critically review empirical evidence concerning the effectiveness of ACP in improving end of-life outcomes for people with dementia and their carers	14/18	726'859 residents with dementia	UK, Belgium, Canada	3 RCT 3 CC/QE 12 correl	DES
Gilissen 2017	Belgium	systematic review	To identify the preconditions related to successful ACP in the nursing home setting	38/38	882 residents, 217 relatives, 195 professionals	Europe, US, Asia, Australia	14 qual 5 RCT 1 obs 18 reviews	DES

					(N.A. for reviews)			
Mignani 2017	Italy	systematic review	To search and synthesize qualitative studies exploring the perspectives of older people living in long-term care facilities and of their family members about ACP discussions	9/9	135 residents, 133 relatives/ friends	Australia, Belgium, Norway, UK, US	9 qual	DES
Sellars 2019	Australia	systematic review	To describe the perspectives of people with dementia and their carers on ACP and end-of-life care.	62/84	389 residents with dementia and 1864 carers	US, UK, Europe, Australia, Canada, Asia	62 qual	DES
Zhou 2022	UK	Realist review	To identify and explain mechanisms and contextual factors that underpin the implementation of ACP for older people in long-term care facilities	48/48	3327 residents, 748 professionals, 126 relatives	Australia, Norway, UK, Taiwan, HK, China, Singapore	14 quant 9 qual 7 reviews 3 mixed-meth 3 case studies 2 reports	DES
Polypharmacy								
Jokanovic 2015	Australia	Systematic review	To investigate the prevalence of, and factors associated with, **polypharmacy** in long-term care facilities	44/44	residents (unknown number)	21 countries in Europe, Asia, North America, Middle East, Australia, Brazil	44 obs	DES
Morin 2016	Sweden, France	systematic review	To systematically evaluate the prevalence of **potentially inappropriate medication use** in nursing home residents	48/48	326'562 residents	16 countries in Europe, Asia, North America	48 obs	DES
Medication review								
Alruthea 2021	Saudi Arabia, Australia	Umbrella review	To conduct a systematic synthesis of existing evidence reviews on interventions to enhance **medication safety** in residential aged-care settings (RACS) to	171/171	191'822 residents			INT

			establish and compare their effectiveness.					
Kua 2019	Malaysia, Australia	Systematic review and meta-analysis	To evaluate the impact of **deprescribing interventions** by healthcare professionals on clinical outcomes among the older residents in nursing homes.	41/41	18'408 residents	13 countries in Europe, North America, Australia and Israel	41 RCT	INT
McGrattan 2017	Ireland	Systematic review	To assess the effectiveness of **medicines management** interventions for people with dementia living in their own home or a care home, with or without nursing care	2/3	392 residents with dementia	UK	2 RCT 56CC/QE 1 corr	INT
Sadeq 2022	Ireland, Qatar	Systematic review and meta-analysis	To systematically identify and describe interprofessional interventions involving pharmacists that target the **medicine management process** in nursing homes	18/18	7'001 residents	Europe, Australia, UK, Canada, Asia, Middle East	18 RCT	INT
Seppala 2022	Netherlands, Denmark, UK, Finland, Belgium, Canada	Systematic review and meta-analysis	To assess the effectiveness of **medication review** and deprescribing interventions as a single intervention in falls prevention	11/49	3'728 residents	Europe, North America, Australia, Singapore	23 RCT	INT
Pain and medication review								
Dowd 2022	Australia	Systematic review	To systematically review the effectiveness of interventions to improve **analgesic use** and appropriateness in long-term care facilities	16/16 (3 medication review, 13 pain)	9’056 residents	US, Australia, Canada, Norway, Finland, Netherlands, Germany, Taiwan, HK	8 RCT 8 CC/QE	INT

*Approximate number, not reported in all primary studies

RCT: randomized controlled trial; CC/QE: Causal-Comparative/Quasi-Experimental; obs: observational; corr: correlational; quant: quantitative; qual: qualitative; mixed-meth: mixed-methods; INT: intervention-based; DES: descriptive

Appendix 4 – Table S8. Effective or partially effective interventions by area of interest

Intervention(s)	Resident population	Main results	Study ID
Malnutrition			
nonmeat, high-protein supplementation (mostly milk-based)	G[1]	• significant increase in mean body weight and mean BMI across all included trials • high-quality evidence of effects on health-related quality of life lacking	Donaldson 2019
supplements, food-based interventions	G	• low cost of implementation • clinical improvement for outcomes including weight, nutritional status and dietary intake • low cost per quality adjusted life year or unit of physical function improvement	Hugo 2018
nutritional supplementation, dietary modification	G	• non-significant positive to significant positive relationship between nutritional status following intervention and quality of life	Tucker 2022
menu / food fortification	G	• significant increase in energy and protein intake • benefits to weight and nutritional status recorded in some studies • variable cost-effectiveness and cost benefit of menu fortification/ supplementation	Sossen 2021
modification to dining environment	G	• positive effects on food/caloric intake • inconsistent evidence of effects on body weight • low cost of implementation	Abbott 2013 Hugo 2018
changes to food service and food improvement interventions	G	• inconsistent evidence of effects on body weight • positive effects on food/caloric intake	Abbott 2013
staff training and feeding assistance	G	• positive effects on food/caloric intake	
eating ability training	D[2]	• positive effect on feeding difficulty and self-feeding time • no effect on nutritional status	Chang 2023
feeding assistance	D	• positive effect on feeding difficulty • no effect on nutritional status	
nutrition education to healthcare professionals, home-like food environment, dining room enhancement, use of high-contrast plates and cups, music, fortified meals	M[3]	• statistically significant improvements in nutritional intake • effects on nutritional status, clinical outcomes and costs unclear • observations suggest beneficial effects on aspects related to residents' experience	Kimber 2015
Pain			
tender touch massage	G	• significantly improved reported pain scores	Knopp-Sihota 2022b
towel baths in bed	G	• significant improvements in discomfort	

certified nursing assistant pain assessment tool use	G	• reduced physical and verbal distressed nonaggressive episodes, antipsychotic medication use and pain	
analgesic interventions, educational interventions, system modification interventions	G	• statistically significant small treatment effect • residents receiving analgesic interventions benefited most, followed by those receiving educational interventions and those receiving system modification interventions	Knopp-Sihota 2016
multifactorial pain management interventions including education, decision support (e.g. toolkits, guidelines), system modifications (e.g. audit and feedback, Plan-Do-Study-Act cycles, formation of quality improvement teams, pain champions), and/or medication review	G	• reduced residents pain scores (7/16 interventions) • increased pain assessment using self-report and observational scales (5 interventions) • no specific interventional element identified as key to explaining effectiveness in addressing pain	Dowd 2022
sensory stimulation (reflexology, massage, ear acupressure, showering)	D	• significant reduction in observational pain	Pu 2019
comprehensive pain protocol models	D	• overall improvement in pain assessment and management • interventions that involved only nurses and other health professionals showing positive effect on non-pharmacological pain management • interventions that included physicians showing positive effect on opioid-based analgesic management	Tsai 2021
analgesic treatments, nondrug alternative treatments, combined interventions, education interventions	CP[4]	• all interventions at least moderately effective in reducing pain • analgesic treatments showed greatest treatment effect, followed by nondrug alternative treatments, combined interventions, and education interventions	Knopp-Sihota 2022a
Pressure Ulcers			
Program with intensive and routine staff training in pressure ulcers assessment, treatment and prevention and evidence-based prevention protocols	G	• decreased incidence and prevalence of pressure ulcers	Maki-Turja-Rostedt 2019
computerised decision-making support systems	G	• decreased incidence of pressure ulcers	

repositioning or advanced cushions	G	• decreased incidence of pressure ulcers	
advanced mattresses and overlays	G	• decreased prevalence of pressure ulcers	
adding protein and energy supplements to diet	G	• decreased prevalence of pressure ulcers	
Physical Restraints			
education only and multifactorial interventions	G	• trends indicating that both types of interventions are effective • heterogeneous operative definitions of physical restraints make generalisation difficult	Brugnolli 2020
educational interventions	G	• effective in reducing restraints use • for positive effects to be sustained, meta-regression results suggest that continuous education program should be deployed	Lan 2017
multifactorial interventions during at least 6 weeks including institutional policies promoting restraint reduction, education, consultation and development of alternatives to restraints	G	• improved healthcare professionals' knowledge, attitudes and behaviours about physical restraint • reduced physical restraint use	Liang 2023
Advance Care Planning			
educational programs, introducing or evaluating new ACP form or program	G	• decrease in hospitalization rates (not associated with increased mortality) • significant increase in number of residents dying in nursing home instead of hospital • increase in medical treatments' consistency with residents' wishes (although not fully compliant) • decrease in overall health costs • increase in community palliative care use but not in-patient hospice referrals • overall, difficult to identify superiority in effectiveness of one type of ACP intervention over another	Martin 2016
use of specific ACP documentation, education sessions/ workshops, regular facilitation/support	G	• significant reductions in hospitalisation rate, days, deaths and healthcare costs • experience perceived to have raised the profile of end-of-life care and led to improved practice and to ACP becoming routine • cascading of learning not consistently done	Gleeson 2021
staff education/ training, train-the-trainer approaches	G	• significant increase in documentation of end-of-life care preferences but not satisfaction with end-of-life care from families' perspectives • no variable identified to explain heterogeneity	Ng 2022
written advance directives,	D[2]	• ACP associated with some improved end-of-life outcomes including less likelihood of enteral "tube" feeding, positive results for	Dixon 2018

end-of-life conversation, staff training intervention ACP undertaken with the person with dementia prior to losing capacity or including carers		healthcare utilisation measures, and fewer burdensome transitions (e.g. transfer to hospital or to other long-term care facility) in the last 3 months of life • mixed results for place of death and a range of patient experience measures • evidence base currently limited yet ACP likely to be relevant and applicable to people with dementia	
ACP training/ education for professionals, provision of decision aid to carers half of interventions involving the person with dementia if assessed as competent; others excluding residents	D	• ACP found to increase concordance between end of life wishes and care provided. • mixed results on residents' outcomes, carer outcomes and carer satisfaction • interventions effective in increasing ACP practice, especially goals of care discussion rates (higher than rates of ACP documentation, e.g. advance directives) • overall positive effect on healthcare utilisation, e.g. reduced hospitalisation and length of stay • the programs that showed the greatest effect on ACP uptake involved a comprehensive education system for staff and those with multiple prompts over time	Kelly 2019
Medication Review			
pharmacist-initiated individualised medication review alongside education for nurses multidisciplinary medication review involving physician, nurse and pharmacist, mentoring physicians and staff on multidisciplinary medication review alongside education seminars for staff	G[1]	• effective in reducing analgesic use	Dowd 2022
medication review as deprescribing intervention	G	• effective in reducing all-cause mortality and number of fallers	Kua 2019
medication review, education and medication simplification interventions	G	• interventions significantly associated with improvements in prescribing appropriateness but not with hospitalisation and mortality	Sadeq 2022
medication reviews as part of single or multi-component interventions	G	• trend for a lower number of fallers in meta-analysis	Seppala 2022

multidisciplinary medication reviews performed by pharmacists, physicians (general practitioners or geriatricians), nurses and multidisciplinary teams	G	• effectiveness in improving medication safety – greatest effectiveness, alongside staff education, when compared with interventions such as staff meetings, academic detailing, case conferencing and computerised clinical decision support systems • effective in decreasing inappropriate use of medications, promoting appropriate polypharmacy, identifying actual and potential adverse drug events, encouraging medication adherence • might help identify and resolve complex medication issues such as reducing the number of doses and simplifying medication regimes	Alruthea 2021
multicomponent interventions including medication review alongside education and /or multidisciplinary case conferencing or collaboration	G	• effective in reducing antipsychotic prescribing rates (although return to baseline prescribing level post intervention in 2/5 studies) • appears as the most promising approach in enhancing medication safety (compared to single component interventions including medication review, staff education, multidisciplinary team meetings and computerised clinical decision support systems); more robust evidence needed to ascertain	
training and support intervention delivered to nursing home staff on alternatives to medication to manage agitation and medication review delivered by consultant old age psychiatrist	D[2]	• statistically significant reduction in neuroleptic use; not statistically significant effect on dose of neuroleptic and taking other psychotropic drugs • limited effects on other outcomes such as wellbeing, falls and dementia severity	McGratta n 2017
administration of West Wales Adverse Drug Reaction Profile for mental health medicines, a template to identify adverse drug events and facilitate discussions among multi-disciplinary teams in relation to medication review and prescribing	D	• statistically significant effect on medication-related problems and on reduction of mental health medicines • limited effects on other outcomes such as wellbeing, falls and dementia severity	

[1]G: general population of long-term care residents
[2]D: residents with dementia
[3]M: malnourished or nutritionally at-risk residents
[4]CP: residents with chronic pain

Appendix 5 – Table S9. Main descriptive results by area of interest

Theme(s) under examination	Resident population	Main results	Study ID
Malnutrition			
perceptions of mealtime in long-term care facilities and implications for nutrition-based interventions	G[1]	• mealtime recognised by staff as directly impacting quality of life yet putting strain on care provision • mealtimes potentially offering a sense of social normality, of control over one's life and an opportunity for social interaction • serving residents food they perceive as pleasurable is of paramount importance • multi-component interventions likely to be more appropriate and effective than single-component ones in improving food intake or residents' health and wellbeing, due to the multi-faceted nature of mealtimes	Watkins 2017
Pain			
pain prevalence and factors associated with pain	G[1]	• prevalence of current pain (based on 26 studies in 20 countries, total sample size: approximately 1'439'311 residents): 22-85%; persistent pain: 19-58%; chronic pain: 56-58% • higher pain prevalence found when using self-report measures or proxy measures compared with using chart review • elements presenting strongest association with pain: depression, activities of daily living impairment, arthritis, dementia, cognitive impairment	Cole 2022
barriers and facilitators to pain assessment	G	barriers to pain assessment include: • residents' factors: cognitive impairment, challenging behaviours, multiple comorbid chronic conditions, reluctance to report pain • healthcare providers' factors: lack of knowledge and skills, specific beliefs or attitudes towards pain (e.g. viewing pain as normal part of aging, fear to overmedicate) • healthcare system and organizational-level factors: breakdown of communication across organizational hierarchies, poor physician communication, lack of pain assessment specialists, deficient staff training, low staff levels and high turnover, lack of standardised routine assessments, policies and procedures facilitators to pain assessment include: • residents factors: observable pain-related behaviours • healthcare provider factors: knowledge, confidence and skills • healthcare system and organizational-level factors: facility-level pain assessment policies with protocols and guidelines	Knopp-Sihota 2019

experiences and perspectives on pain and pain management	G	• pain experiences and management along the lines of ‘‘normalizing suffering’’, with pain often regarded as unavoidable and acceptable in residents • older people should be encouraged to report pain • healthcare staff should be trained to take a person-centred approach towards assessment and management of pain	Vaismoradi 2016
validated pain tools	G	• Mobilization-Observation-Behaviour-Intensity-Dementia (MOBID)-2 pain scale found to be the only pain tool fully tested on responsiveness to treatment and demonstrated responsiveness and reliability	Husebo 2016
Physical restraints			
residents’ factors associated with physical restraints use and consequences of restraint use	G[1]	residents’ factors associated with restraints use: • severe cognitive impairment / low cognitive status • low activities of daily living scores • serious mobility impairments • previous fall and/or fracture • repeated verbal and physical agitation possible consequences of physical restraint: • lower cognitive and activities of daily living performance • higher walking dependence • falls • pressure ulcers • urinary and faecal incontinence	Hofmann 2014
prevalence of physical restraints use	G	• prevalence of physical restraints (in over 16 countries in Europe, the Middle East, Asia and North America, from 50 studies, total sample size unknown): 33% of residents • forms of physical restraints used (from most to least used): bedrails, force/ pressure in medical treatment or activities of daily living, chair belts or restraints, surveillance/ sensors/ tracking systems, trunk restraints, chairs or wheelchairs with locked tables, sleep suits, chairs to prevent rising, bed sheet restraints, bed belts, limb restraints, locked bedroom doors, removal of walking aids, bedrail protector	Lee 2021
Advance Care Planning			
key elements to successful ACP	G	• ACP-related knowledge and skills from staff, with training being sustainable and available, and residents and relatives’ knowledge about ACP and illness-related factors, such as assumed trajectories and treatment options	Gilissen 2017 Batchelor 2019 Zhou 2022
	G D[2]	• willingness and ability to participate in ACP from all actors, including residents opening up about their preferences for end-of-life care and facilitators making sure that residents’ voices are heard	Batchelor 2019 Gilissen 2017 Mignani 2017 Sellars 2019 Zhou 2022

	G D	• good relationships between residents, staff and relatives, with paternalistic attitudes of healthcare professionals and misalignment of relatives' wishes and residents preferences acting as key barriers to ACP • by contrast, a review found that trust that physicians would respect residents' wishes acted as a brake to ACP, whilst limited trust that family members would respect their wishes encouraged residents to resort to ACP	Batchelor 2019 Gilissen 2017 Sellars 2019 Zhou 2022 Mignani 2017
	G	• supportive facility-level culture including dedicated policies, procedures and resources, leadership support, and ACP embedded in standard care and approached from a person-centred, collaborative and multidisciplinary perspective	Batchelor 2019 Gilissen 2017 Zhou 2022
	G	• ACP conversations initiated gradually and sensitively in the context of routine care, by the professionals who know the resident well, introduced at a time deemed best for each individual resident rather than in a standardised manner	Mignani 2017 Zhou 2022
	G D	• ACP strategies helping people with decision-making, especially in the case of residents with dementia and their relatives, who may struggle with uncertainty and lack of confidence in healthcare settings	Batchelor 2019 Zhou 2022 Sellars 2019
	G	• normalising conversations about death, which can be done through a shared understanding of the aims and values promoted through the ACP process by residents, relatives and professionals	Gilissen 2017 Zhou 2022
Polypharmacy			
prevalence of polypharmacy and associated factors	G	• wide variations in prevalence reported, with up to 91%, 74%, and 65% of residents taking more than 5,9, and 10 medications respectively (based on 44 studies in 21 countries, total sample size unknown) • factors positively associated with polypharmacy: recent hospital discharge, number of prescribers, comorbidity including circulatory diseases, endocrine and metabolic disorders, and neurological motor dysfunctioning • factors negatively associated with polypharmacy: older age, cognitive impairment, disability in activities of daily living, length of stay in long-term care	Jokanovic 2015
factors associated with potentially inappropriate medications use	G	• polypharmacy (total number of prescribed medications) as the main determining factor of potentially inappropriate medications use – estimated at 43% in long-term care facilities in 1990-2015 and 50% in 2005-2015, with highest prevalence in European countries (49%), followed by Australia and Asia (30%) and North America (27%) -- based on 26 studies presenting point prevalence estimates of potentially	Morin 2016

		inappropriate medication use, representing 227,534 residents	

[1]G: general population of long-term care residents
[2]D: residents with dementia

Review 2

Appendix 6 – Methods

Eligibility criteria

As detailed in Table S10, we included empirical scientific articles (original research and reviews) utilizing quantitative, qualitative, or mixed methodologies published within the past five years (2019-2023) in French or English. We focused on long-term care facility settings, and included any interventions seeking to implement data-driven quality improvement and where implementations strategies are described.

Table S10: Article selection criteria

Include	Exclude
I.a. Population: older people living in long-term care facilities (includes specific populations or problematics within this group) If mixed population, at least 75% pop aged over 65 and population described as older adults	
I.b. Settings: long-term care facilities. If mixed settings, over 50% facilities or stratified	**I.b. Settings:** community settings, all other care settings (e.g., in-patient, ambulatory, assisted living, short-stay, respite care)
II. Intervention: any interventions seeking to implement data-driven quality improvement AND where implementations strategies are described	
III. Outcomes: all implementation outcomes	
IV. Context: No geographical restriction	
V. Language: English, French	
VI. Types of publications: Any review type based on empirical evidence (e.g. systematic, scoping) Empirical research based on quantitative, qualitative, or mixed methodologies	**VI. Types of publications:** Reviews based on non-empirical evidence (e.g. opinion papers, theoretical studies) Non empirical research Study protocols, abstracts, posters
VII. Publication date: past 5 years (2019-2024)	

Literature search

Based on input from co-authors, an experienced science librarian (BK) and the first author (EP) developed and iteratively tested specific search strategies for each database. The searches were limited to Medline (Ovid), Embase, and APA PsycInfo (Ovid). Grey literature searches were also conducted on repositories: Arodes, Renouvaud, Agency for healthcare research And quality and Proquest Dissertations & thesis. The search was conducted on the 21st February 2024. The search strategy is detailed in Table S11 below.

Table S11: Search strategy in diverse database and grey literature

DATABASES
Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions 1946 to February 16 2024 (Classic search menu)
1 (“implementation strateg*” or “training” or “education” or “coaching” or “national website*” or “train-the-trainer” or “mass media” or “clinical assistance” or “champion*” or “early adopter*” or “develop resource*” or “develop material*” or “incentive*” or “disincentive*” or “facilitation” or “technical assistance” or “audit” or “feedback”).mp.
2 "quality improvement"/ or Quality Indicators, Health Care/ or (“quality improvement*” or “quality management” or “quality strateg*” or ”quality gain*” or “quality of care” or “care quality” or “quality outcome*” or "quality indicator*" or "quality measure*" or "performance indicator*" or "comparative performance information" or "quality information" or "performance score" or "outcomes measurement").mp.
3 evidence-based practice/ or evidence-based nursing/ or (“data-informed” or “data-based” or “data-driven” or “data informed” or “data based” or “data driven” or “based on data” or “based on the data” or “determined by data” or “evidence base*” or “evidence-base*”).mp
4 exp Nursing Homes/ or Homes for the Aged/ or Long-Term Care/ or ("long-term care" or (home* adj1 aged) or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facilit*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care").mp.
limit 5 to (yr="2019 -Current" and (english or french or german))
Results: 71
Embase (Elsevier 1947 to Current)
1 ('implementation strateg*' or 'training' or 'education' or 'coaching' or "national website*" or 'train-the-trainer' or 'mass media' or 'clinical assistance' or 'champion*' or 'early adopter*' or 'develop resource*' or 'develop material*' or 'incentive*' or 'disincentive*' or 'facilitation' or 'technical assistance' or 'audit' or 'feedback'):ti,ab)
2 'total quality management'/de OR 'health care quality'/de OR 'quality of nursing care'/de OR 'health data'/de OR ('quality improvement*' or 'quality management' or 'quality strateg*' or 'quality gain*' or 'quality of care' or 'care quality' or 'quality outcome*' or 'quality indicator*' or 'quality measure*' or 'performance indicator*' or 'comparative performance information' or 'quality information' or 'performance score' or 'outcomes measurement'):ti,ab
3 'evidence based practice'/de OR 'evidence based nursing'/de or ('data-informed' or 'data-based' or 'data-driven' or 'data informed' or 'data based' or 'data driven' or 'based on data' or 'based on the data' or 'determined by data' or 'evidence base*' or 'evidence-base*'):ti,ab
4 'long term care'/de OR 'elderly care'/de OR 'geriatric care'/de OR 'home for the aged'/de OR 'nursing home'/de OR 'residential home'/de OR 'residential home'/de OR 'institutional care'/de OR 'residential care'/de OR 'long-term care':ab,ti OR 'nursing home':ab,ti OR 'residential home':ab,ti OR 'residential facilit*':ab,ti OR 'nursing facilit*':ab,ti OR 'institutional care':ab,ti OR 'skilled nursing facilit*':ab,ti OR 'care home*':ab,ti OR 'residential care':ab,ti OR 'residential aged care':ab,ti OR 'aged care':ab,ti OR 'institutional elderly care':ab,ti
5 AND (2019:py OR 2020:py OR 2021:py OR 2022:py OR 2023:py OR 2024:py)
AND ([english]/lim OR [french]/lim OR [german]/lim)
Results: 96
APA PsycInfo 1806 to February Week 3 2024 (Ovid) (classic search menu)
1 (“implementation strateg*” or “training” or “education” or “coaching” or “national website*” or “train-the-trainer” or “mass media” or “clinical assistance” or “champion*” or “early adopter*” or “develop resource*” or “develop material*” or “incentive*” or “disincentive*” or “facilitation” or “technical assistance” or “audit” or “feedback”).mp.
2 quality control/ or “quality of services”/ or “quality of care“/ or (“quality improvement*” or “quality management” or “quality strateg*” or ”quality gain*” or “quality of care” or “care quality” or “quality outcome*” or "quality indicator*" or "quality measure*" or "performance indicator*" or "comparative performance information" or "quality information" or "performance score" or "outcomes measurement").mp.

3 evidence-based practice/ or (“data-informed” or “data-based” or “data-driven” or “data informed” or “data based” or “data driven” or “based on data” or “based on the data” or “determined by data” or “evidence base*” or “evidence-base*”).mp
4 exp Nursing Homes/ or Homes for the Aged/ or Long-Term Care/ or ("long-term care" or (home* adj1 aged) or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facilit*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care").mp.
limit 5 to yr="2019 -Current"
limit 6 to (english or french or german)
Results: 32
GREY LITERATURE
Arodes
long-term care implementation strategies quality improvement data-driven
Results: 183
Renouvaud https://sp.renouvaud.ch
implementation “long-term care” data-informed quality
Filters: 2019-2024
Results: 2
Agency for healthcare research and quality
implementation “long-term care” data-informed quality
Filters: 2019-2024
Results: 0
Proquest Dissertations & thesis
subject("implementation strateg*" OR "training" OR "education" OR "coaching" OR "national website*" OR "train-the-trainer" OR "mass media" OR "clinical assistance" OR "champion*" OR "early adopter*" OR "develop resource*" OR "develop material*" OR "incentive*" OR "disincentive*" OR "facilitation" OR "technical assistance" OR "audit" OR "feedback")
AND
subject("quality improvement*" OR "quality management" OR "quality strateg*" OR "quality gain*" OR "quality of care" OR "care quality" OR "quality outcome*" OR "quality indicator*" OR "quality measure*" OR "performance indicator*" OR "comparative performance information" OR "quality information" OR "performance score" OR "outcomes measurement")
AND
subject (“data-informed” or “data-based” or “data-driven” or “data informed” or “data based” or “data driven” or “based on data” or “based on the data” or “determined by data” or “evidence base*” or “evidence-base*”)
AND
subject("long-term care" or "nursing home*" or "residential home*" or "residential facilit*" or "nursing facilit*" or "institutional care" or "skilled nursing facilit*" or "care home*" or "residential care" or "residential aged care" or "aged care" or "institutional elderly care")
Filter: 2019-2024
Results: 0

Study selection and data extraction

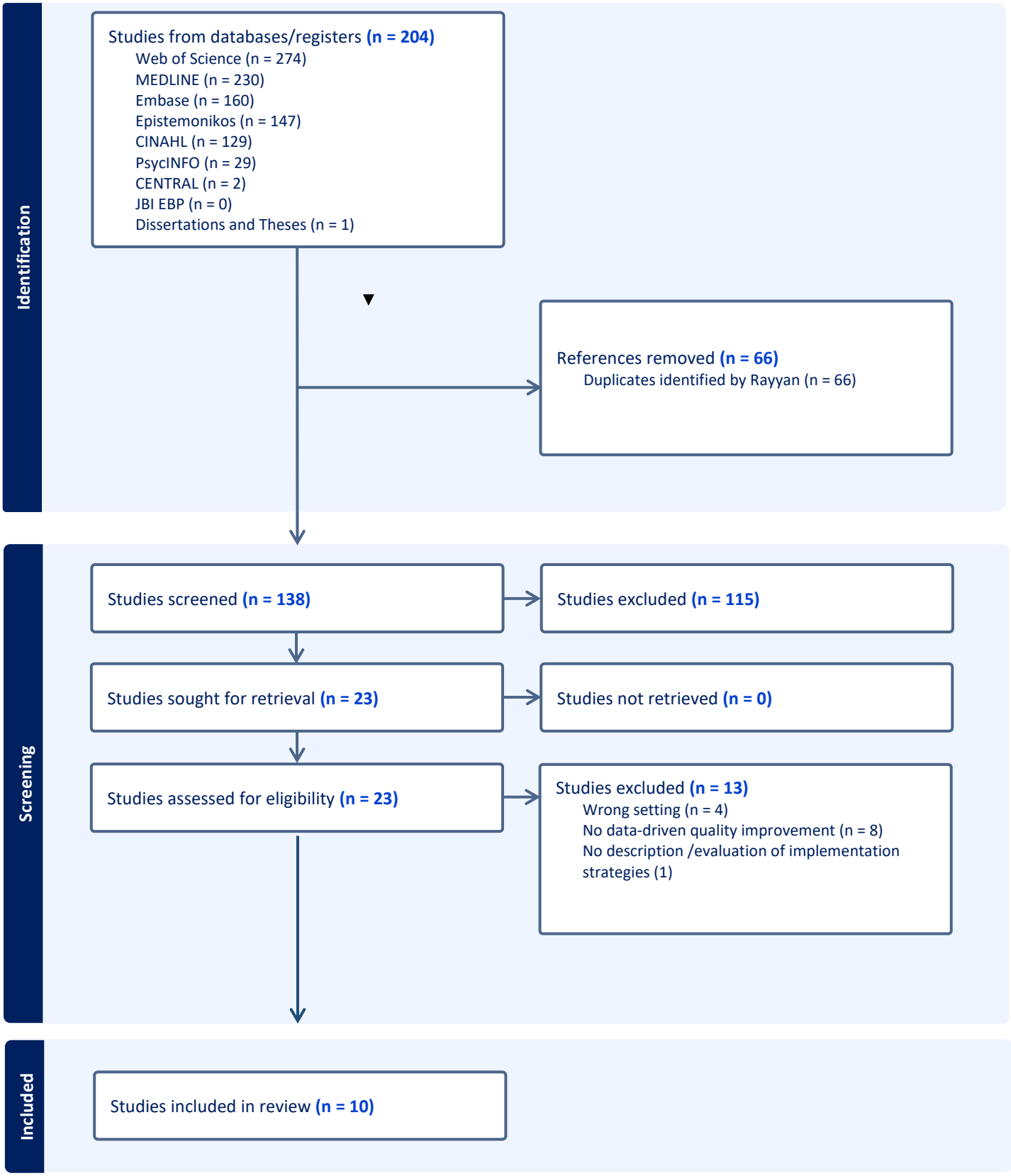
On 22 February 2024, search results were exported to the Rayyan software (Ouzzani et al. 2016). Duplicates were removed. Using predefined inclusion and exclusion criteria specified in Table S10, two reviewers (EP, NW) reviewed the abstract and title of all articles retrieved. Disagreements were solved by consensus. When no consensus could be reached, a third reviewer (VDG) resolved disagreements. All full-text reports were reviewed independently by two of three people (NW, EP, VDG), and disagreements were solved by consensus.

A data extraction form was developed by the first and last authors (NW, EP). Data was extracted by one person (ST) and checked fully by a second extractor (EP).

Study synthesis and risk of bias assessment

Evidence was synthesised in tabular form and narratively. No risk of bias or quality assessments were conducted.

Appendix 7 - PRISMA flow diagram



Review 3

Appendix 8 - Methods

Eligibility criteria

The eligibility criteria are described per sub-objective:

1) Objective 1 – appropriate research designs: Studies were included if they a) report methodological advice related to external and internal validity of research designs, or b) compare the validity of two or more research designs, in the context of scale-up of interventions/programmes in the healthcare setting.

2) Objective 2 – outcomes, measurements and endpoints: Studies were included if they report methodological advice related to or test the validity of a) outcomes, b) outcome measurements, c) endpoints, in the context of scale-up of interventions/programmes in the healthcare setting.

3) Objective 3 – methodological considerations: Studies were included if they report methodological advice on the topic of scale-up of interventions/programmes in the healthcare setting.

Information sources

Two bibliographic databases, PubMed and Embase, were searched. In addition, journals related to implementation science and meta-epidemiology were searched. These included the following journals: Implementation Science, Implementation Science Communications, Implementation Research and Practice, BMJ Quality and Safety, Administration and Policy in Mental Health and Mental Health Services Research, BMC Health Services Research, Lancet public health, Milkbank Quarterly, International Journal of Epidemiology, European Journal of Epidemiology, Journal of Clinical Epidemiology, BMC Medical Research Methodology. Reference lists and prospective citations of included studies, and names of authors who published on the topic were additionally searched. Handbooks on implementation science were searched for references.

Search strategy

Databases were searched using a combination of MeSH/Emtree terms and free text. No filters were used.

For objective 1, the following key words were used: (“scale-up” OR “scale up” OR “scaling-up” OR “scaling up” OR “system implementation”) AND (“internal validity” OR “external validity” OR “epidemiological research” OR “meta epidemiology” OR “meta-epidemiology” OR “meta epidemiological” OR “meta-epidemiological” OR “guidance” OR “advice” OR “advise” OR “critique” OR “bias” OR “validity”)

For objective 2: ("implementation outcome*" OR ((“scale up” OR “scale-up” OR “scaling up” OR “scaling-up”) AND "outcome*")) AND ("review" OR "literature")

For objective 3: ("scale-up" OR "scale up", "scaling-up" OR "scaling up" OR "system implementation") AND (“guidance" OR “methodological advice”)

Hand searching journals were based on the following strategy. Single search terms will be entered, i.e. “scale-up”, “scale up”, “scaling up”, “scaling-up”.

Studies identified in a specific search string that also provide information for another objective were selected for that objective.

Selection process

References were uploaded in Endnote, and duplicates were removed. Studies were selected in a two-step screening process, i.e. first screening title and abstract, and then evaluating full text articles of potentially eligible studies. One researcher conducted the database searches, secondary search strategies and selection process. The selection process was documented in Endnote.

Data collection and synthesis method

Data was documented in an Excel database by one researcher. One researcher produced a narrative description of the study results.