BMC Geriatrics

RESEARCH

Open Access

Development of a multifaceted implementation plan to guide falls prevention in residential aged care facilities

Goedele Belaen[1,2], Joris Poels[1,2,3], Sara Vandervelde[1,2], Greet Leysens[4], Theo van Achterberg[1], Fabienne Dobbels[1], Koen Milisen[1,2,5] and Ellen Vlaeyen[1,2,6*]

Abstract

Background Due to their serious consequences, falls are a well-documented problem in residential aged care facilities (RACFs). Although clinical practice guidelines (CPGs) on falls prevention in RACFs have been developed in many countries, their implementation remains challenging. Therefore, this study aimed to describe the development of a multifaceted plan for the implementation of a guideline on multifactorial falls prevention interventions in RACFs.

Methods An implementation plan was developed as part of a large-scale falls prevention implementation initiative in Flanders (Belgium). The development process was guided by prior research and Intervention Mapping, which includes six stages: 1) logic model of the problem, 2) logic model of change, 3) programme design, 4) programme production and testing, 5) programme implementation plan, and 6) evaluation plan. A stakeholder group of nine experts actively participated in this development process. The implementation plan was pretested in six RACFs and adjusted to better align with their context.

Results A three-phase implementation plan divided into seven steps was finalised. The first phase is preparation (steps 1 to 3), during which RACFs undertake the necessary preparations to start the implementation process by enabling broad support within their organisation, mapping the baseline situation, defining objectives, and setting priorities. The second phase (steps 4 and 5) concerns the actual implementation, which outlines the development and performance of implementation actions. In the third phase (steps 6 and 7), RACFs evaluate and adjust actions, and aim to sustainably anchor the implemented falls prevention policy in their daily practice and quality management system.

Conclusion We were able to develop a comprehensive implementation plan for falls prevention in RACFs. This plan supports RACFs in the implementation of tailored falls prevention interventions and maximise sustainability. Future research should further focus on larger-scale implementation and evaluating the effectiveness of the implementation plan in combination with the support of an external implementation facilitator. This includes assessing its impact on determinants, and implementation and clinical outcomes.

Keywords Falls prevention, Residential aged care facilities, Clinical practice guideline, Implementation science, Implementation plan

*Correspondence:
Ellen Vlaeyen
ellen.vlaeyen@uhasselt.be
Full list of author information is available at the end of the article

Background

With an estimated fall incidence rate of 1.6 falls per person-year, falls are a well-documented problem in residential aged care facilities (RACFs) [1]. The risk of falling increases with age and cognitive impairment [2]. A fall is defined as "*an event which results in a person coming to rest inadvertently on the ground or floor or other lower level. Falls, trips and slips can occur on one level or from a height*" ([3], p. 4). The consequences of falls are often severe, both physically (e.g. lacerations, hip fractures) and psychosocially (e.g. concerns of falling, depression, social isolation) [4, 5]. Up to 89% of all external causes of death in RACFs are related to falls [6]. Moreover, falls in RACFs result in an increased workload for healthcare workers, which in turn, depending on the severity of the fall-related injury, results in additional costs ranging from 193 Euros for a non-injurious fall to 10,170 Euros per resident for serious falls [7]. Falls often result from a complex interaction of risk factors (e.g. impaired balance, cognitive impairment, and reduced vision) [3, 8].

Various studies have assessed the effectiveness of falls prevention interventions in RACFs, demonstrating mixed results, mainly due to the different study methods [9, 10]. A systematic review concluded that, overall, falls prevention interventions reduced the number of falls by 27% (RR = 0.73, 95% CI = 0.60–0.88) and the number of recurrent fallers by 30% (RR = 0.70, 95% CI = 0.60–0.81) [9]. A subgroup analysis showed that multifactorial falls prevention interventions reduced the number of falls by 35% (RR = 0.65, 95% CI = 0.45–0.94) [9]. Multifactorial falls prevention interventions comprise a multifactorial falls risk assessment and multidomain interventions [3]. A multifactorial falls risk assessment refers to "*a set of assessments performed across multiple domains to judge an individual's overall level of risk of falling, to identify the individual risk factors potentially modifiable and non-modifiable to inform the choice of an intervention*" ([3], p.7). Multidomain interventions are defined as "*a combination of two or more intervention components across two or more domains (e.g. an exercise program and environmental modification) based on a multifactorial falls risk assessment and intended to prevent or minimise falls and related injuries*" ([3], p.7). Similarly, Logan et al. (2021) further confirmed the short-term effectiveness of multifactorial falls prevention interventions in a recent multicentre randomised controlled trial (IRR = 0.57, 95% CI = 0.45–0.71) and showed its cost-effectiveness. However, no significant differences were observed in the number of fallers for months 7–12 after randomisation [11]. According to Logan et al. (2021), this may be attributed to a lack of statistical power due to attrition resulting from mortality. The loss of intervention effect after 6 months could also be explained by a decrease in staff attention to falls prevention, which might have been avoided through additional support or training [11].

To support RACFs in preventing falls, several clinical practice guidelines (CPGs) on multifactorial falls prevention interventions have been developed in many countries [12–15]. Building on these efforts, the World guidelines for falls prevention and management for older adults were introduced, aiming to provide standardised, globally applicable CPGs across diverse settings and countries. The use of multifactorial falls prevention interventions in RACFs aligns with the recommendations outlined in these world guidelines [3]. Given the complexity of falls and the numerous risk factors involved, the importance of a multidisciplinary approach is strongly emphasised in the World guidelines for falls prevention and management in older adults. Effective collaboration between nursing staff, occupational therapists, physicians, and other healthcare workers is considered essential [3].

While multifactorial falls prevention interventions are recommended to prevent falls, their implementation in RACFs is a complex and dynamic process. Implementation success depends on various interacting barriers and facilitators (i.e. determinants) at different levels of care [16]. The most reported barriers include staff's perceived ability to control falls management, issues regarding staff availability, limited knowledge and skills, and poor communication. Frequently documented facilitators are good communication and facility equipment availability [16]. Implementation requires a systematic approach, linking these determinants to appropriate theories and implementation strategies, such as 'modelling' and 'active learning' [17–19]. Implementation strategies are defined as "*methods or techniques used to enhance the adoption, implementation, and sustainability of a clinical programme or practice*" ([20], p.2). Moreover, literature suggests employing multiple and tailored strategies to implement falls prevention interventions [11, 21].

RACFs need clear, actionable guidance on how to effectively implement falls prevention interventions into clinical practice. The World guidelines for falls prevention and management for older adults emphasise the importance of deliberate and thoughtful implementation [3]. To address this need, we developed an implementation plan specifically tailored to the context of Flemish (Belgian) RACFs. This plan is designed to support RACFs in the systematic and sustainable integration of a CPG on multifactorial falls prevention interventions into routine care. The purpose of this study is to outline the systematic development and content of this implementation plan, utilising the Intervention Mapping methodology [22].

Methods

An implementation plan was developed over a three-year period (2016 to 2019) as part of a large-scale falls prevention implementation initiative in more than 100 RACFs in Flanders. Intervention Mapping guided the development process [22, 23]. Intervention Mapping is a methodology for developing theory- and evidence-based health promotion interventions, such as falls prevention. It consists of six consecutive stages, with the outcomes of each stage building upon the results of the previous one: 1) logic model of the problem, 2) logic model of change, 3) programme design, 4) programme production and testing, 5) programme implementation plan, and 6) evaluation plan [22]. Figure 1 summarises these six stages, their specific objectives, and the methods used to achieve them.

Setting

The implementation plan was developed within the context of RACFs in Flanders (Belgium). RACFs are defined as "*residential facilities that provide 24-h-a-day surveillance, personal care, and limited clinical care for persons who are typically older adults and may require additional support*" ([24], p.212). In total, 825 RACFs in Flanders receive subsidies and official recognition from the Flemish government [25].

Stakeholders

As part of the Intervention Mapping methodology, a stakeholder group was established, consisting of nine Belgian experts recruited through purposive sampling based on the following criteria: 1) theoretical knowledge of implementation science, behaviour change theories and methods, and/or healthy living, 2) skills in leading and/or coaching organisational change processes or

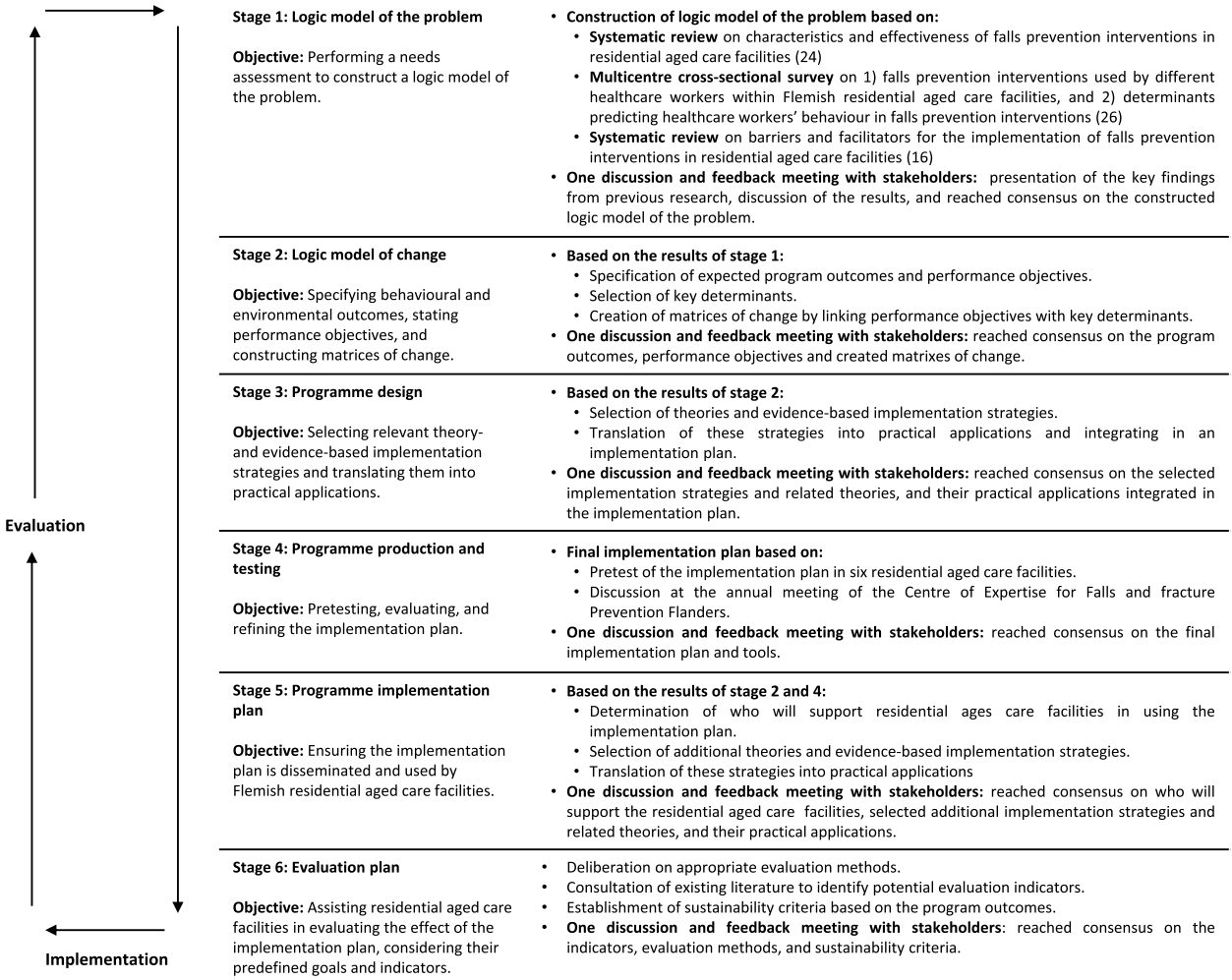

Fig. 1 Overview of the stages of Intervention Mapping and stakeholder involvement [22]

implementation projects, 3) practical expertise in the residential aged care field, or 4) legal authority over RACFs in Flanders (i.e. a delegate of the Flemish government). The experts received information about the development process and were invited via email to participate in the stakeholder meetings. A comprehensive overview of the experts, detailing their educational background, professional background, and field of expertise can be found in Additional File 1.

Each meeting with the stakeholder group had a specific objective aligned with the Intervention Mapping methodology. For example, reaching consensus on programme outcomes and performance objectives in stage 2, and on implementation strategies and related theories in stage 3. The timing of the discussions coincided with the conclusion of each stage to ensure that stakeholders could provide feedback on preliminary results presented by the research team and contribute to shaping the next stages. Meetings lasted, on average, between 1 and 2 h. Over the course of three years, a total of six stakeholder meetings were conducted, corresponding to the stages of Intervention Mapping. The research group employed various facilitation techniques to guide discussions, including open-ended questioning and probing for diverse or challenging viewpoints. After each meeting, a detailed report was compiled by the research group summarizing the final conclusions. These reports were shared with stakeholders.

Additionally, the final draft of the implementation plan was discussed during an annual meeting with partners of the Centre of Expertise for Falls and Fracture Prevention Flanders, where representatives from 40 organisations committed to falls prevention such as professional associations, were present. Final adjustments to the implementation plan were made based on their input.

Stage 1: logic model of the problem

The objective of the first stage of Intervention Mapping was to conduct a needs assessment and develop a logic model of the problem [22]. This logic model provides insights into the health problem of residents falling, the related behaviour of healthcare workers in RACFs, and the environmental conditions at multiple ecological levels (e.g. interpersonal, organisational). It also identifies the influencing determinants, namely the determinants that influence the behaviour of healthcare workers in RACFs and/or environmental conditions [22]. The logic model of the problem was constructed based on previously conducted systematic reviews and a multicentred cross-sectional survey (see Fig. 1) [16, 24, 26]. The determinants in the logic model were structured following the Tailored Implementation for Chronic Diseases (TICD) checklist [22, 27]. The TICD checklist consists of 57 potential determinants grouped across seven domains (e.g. guideline factors, individual healthcare workers factors, capacity for organisational change) [27].

Stage 2: logic model of change

The purpose of the second stage was to transition from the logic model of the problem to the logic model of change. The logic model of change outlines what and whose behaviour needs to change in order to implement the CPG on multifactorial falls prevention interventions in Flemish RACFs [22].

Based on the results of stage one (i.e. logic model of the problem), we specified the expected programme outcomes for the health-related behaviour of healthcare workers and environmental conditions at the interpersonal, organisational, community, and societal levels [22]. Next, performance objectives (i.e. specific expected behaviours or actions) for the desired behavioural and the environmental programme outcomes were stated. In addition, matrices of change objectives were created by linking performance objectives to key determinants identified by both the research group and the stakeholder group. These matrices represent a detailed schedule of desired changes at the individual and the organisational levels in behaviour and/or environment in order to address falls-related issues effectively [22].

Stage 3: programme design

The next stage involved selecting theory- and evidence-based implementation strategies to address the key determinants from the logic model of change and matrices of change objectives [22]. For this, the Taxonomy of Behaviour Change Methods of Kok et al. (2016) was used; this taxonomy provides an overview of potential theory- and evidenced-based implementation strategies linked to specific determinants [17, 22]. The research group selected implementation strategies based on related theories and practical insights from Bartholomew et al. (2016), stakeholder discussions, and feedback, ensuring relevance and feasibility for Flemish RACFs [22]. In addition, the selected implementation strategies and their practical applications were integrated into an implementation plan for RACFs in Flanders (Belgium).

Stage 4: programme production and testing

In stage 4, the implementation plan was pretested with a convenience sample of six RACFs in Flanders. RACFs were eligible to participate if they met the following inclusion criteria: 1) expressed a commitment to follow the various steps of the implementation plan, 2) provided explicit endorsement of policy changes in falls prevention by the management, and 3) ensured active involvement of the management throughout the 12-months

implementation process. RACFs were excluded if they were involved in ongoing studies on falls prevention or were expected to experience events that might influence the implementation negatively (e.g. planned relocation of the RACF).

During the 12-months of the implementation process, the six falls prevention coordinators responsible for coordinating the implementation process in the RACF were contacted monthly by a researcher via phone. These calls served as quality checks, during which the coordinators were asked to indicate their progress within the implementation plan. Subsequently, they were presented with the barriers for change at six levels of healthcare as identified by Grol et al. (2004), and asked whether they encountered these barriers, had not encountered them, or experienced other barriers [28]. They were encouraged by the researcher to provide additional comments elucidating their responses (see Additional File 2). The conversations were recorded and transcribed for thematic analysis. The identified barriers were then organised according to the TICD checklist, and proposed solutions addressing these barriers were included as facilitators [27].

Based on the results of the monthly quality checks, the implementation plan was adapted, and additional tools were developed. The final draft and the newly developed tools were then discussed at the annual meeting of the Centre of Expertise for Falls and fracture Prevention Flanders, where final adjustments were made based on the suggestions provided.

Stage 5: programme implementation plan

The aim of the fifth stage was to ensure that the implementation plan would be disseminated and used to support the implementation and sustainability of multifactorial falls prevention interventions over time in the Flemish RACFs [22]. Therefore, a discussion and feedback meeting was held with the stakeholder group. During this meeting, stakeholders provided input to identify key supporters to facilitate the use of the implementation plan and to determine which additional implementation strategies were needed. This was informed by the results of stages two and four of Intervention Mapping. The implementation strategies were selected from the Taxonomy of Behaviour Change Methods of Kok et al. (2016). Both the selection of the implementation strategies and their translation into practical applications considered acceptability, feasibility, and existing initiatives within Flemish RACFs [17, 22].

Stage 6: evaluation plan

To assist RACFs in evaluating the effect of the implementation plan, we deliberated on how they could independently measure the effects, considering their predefined goals and indicators. Existing scientific literature was consulted for potential indicators, and specific attention was given to indicators for falls prevention that are mandatory to report to the Flemish government. Additionally, criteria were established based on behavioural and environmental outcomes from the logic model of change to assess sustainability. Examples of indicators, along with their definitions, an evaluation method, and criteria for sustainability were integrated into the implementation plan. This step was carried out concurrently with stage 4 of Intervention Mapping [22].

Results

Stage 1: logic model of the problem

Figure 2 shows the logic model of the problem, consisting of the behaviour of healthcare workers in RACFs and various environmental conditions contributing to residents falling. Findings from the multicentred cross-sectional survey indicated that healthcare workers' behaviour included the lack of a tailored intervention plan based on the results of the multifactorial falls risk assessment and the absence of regular falls prevention meetings [26]. In addition, environmental conditions were identified at multiple levels, including interpersonal, organisational, community, and societal levels. At the interpersonal level, the survey also found that the unequal participation of colleagues in falls prevention was a key condition [26]. Conditions at the organisational level were, for example, the absence of a clear falls prevention policy supported by the management of the RACF and the lack of staff involvement in the falls prevention implementation. Lastly, at societal level, the absence of financial incentives was found to be an influencing condition [26].

From the systematic review and the multicentred cross-sectional survey, a total of 21 determinants from the TICD checklist could be identified. The most cited determinants were 'self-efficacy' (e.g. staff feeling helpless, frustrated, and concerned about their (in)ability to control fall management), 'priority of necessary change' (e.g. prioritising other tasks, lack of time), 'team processes' (e.g. staff involvement and empowerment, collaboration, teamwork) and 'communication and influence' (e.g. failure to communicate falls, (poor) information sharing across shifts/disciplines) [16, 26].

Stage 2: logic model of change

In the logic model of change, six behavioural outcomes (e.g. healthcare workers in the RACF developed a tailored interdisciplinary intervention plan based on the assessment results) and thirteen environmental outcomes (e.g. a clear vision about falls prevention is developed and communicated in the RACF) were stated. For each

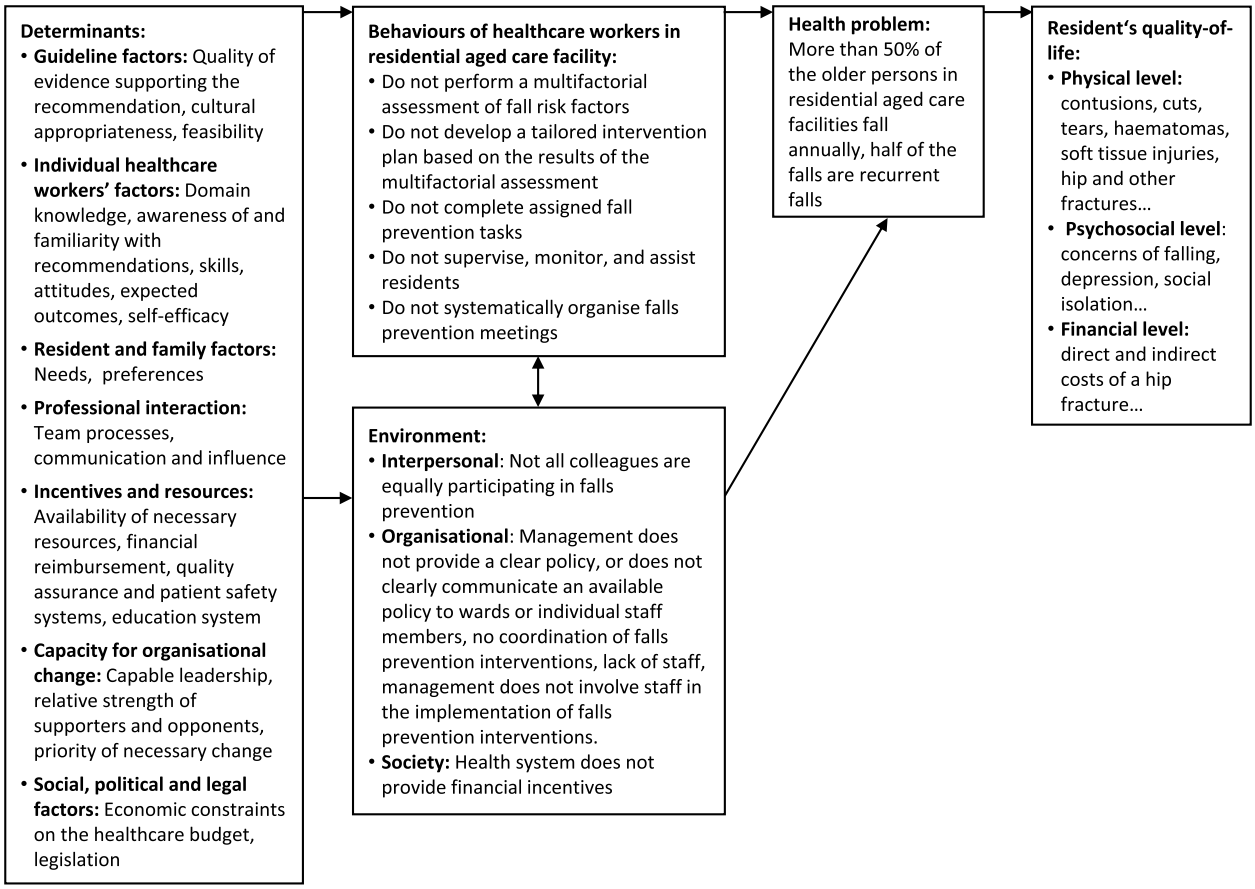

Fig. 2 Logic model of the problem [22]

of these outcomes, performance objectives were formulated. In addition, twelve key determinants (e.g. 'self-efficacy', 'education system') were identified (see Fig. 3). By combining performance objectives with the key determinants and specifying change objectives, different matrices were created. Additional File 3 shows an example of a matrix of change for the behavioural outcome 'healthcare workers in RACFs perform an interdisciplinary multifactorial assessment of fall risk factors on admission of new residents'.

Stage 3: programme design

The implementation plan consists of three phases, divided into seven steps (see Fig. 4). These steps are based on the Plan-Do-Study-Act Cycle [29, 30]. The first phase is the preparation, during which RACFs undertake the necessary preparations to start the implementation process. This includes enabling broad support within their organisation, appointing a healthcare worker to coordinate the implementation process (i.e. falls prevention coordinator), establishing a multidisciplinary team to support the falls prevention coordinator (i.e. falls prevention team), mapping the baseline situation, defining objectives, and setting priorities (steps 1 to 3). Subsequently, the actual implementation is performed in the second phase (steps 4 and 5), which outlines the development and performance of implementation actions. Finally, in the last phase, RACFs evaluate and adjust actions, and aim to sustainably anchor the implemented falls prevention policy in their daily practice and quality management system. (steps 6 and 7). More detailed information about these different steps and their actions can be found in Fig. 4.

The main implementation strategies behind the implementation plan are 'Modelling', 'Participation', and 'Technical assistance' from the Diffusion of Innovations Theory; 'Active learning', 'Guided practice' and 'Feedback' from the Social Cognitive Theory; 'Increasing stakeholders' influence' from the Stakeholder Theory; and 'Tailoring' from the Trans-Theoretical Model [31–34]. Table 1 provides an overview of the determinants we aim to influence, along with the selected implementation strategies to address them. It also outlines how these

Fig. 3 Logic model of change [22]

implementation strategies are practically applied within the implementation plan.

Finally, the implementation plan, along with supporting tools (e.g. knowledge test, meeting protocol template), was made available online via a dedicated platform by the researchers (i.e. online implementation platform). This platform enables the RACF to collaborate within a single document, consolidates all information in one place, and facilitates process tracking. A comprehensive overview of the developed tools, their purposes, and related actions within the implementation plan is provided in Additional File 4.

Stage 4: programme production and testing

The six participating RACFs were located in urban ($n=2$), suburban ($n=2$) and rural ($n=2$) areas. On average, they had 101 high care beds (SD = ± 74.61, range 51–249) and 49 low care beds (SD = ± 19.16, range 35–86). One RACF was public and five were private not-for-profit. During the 12-months implementation process, a total of 70 quality checks were conducted with the falls prevention coordinators of these RACFs, with an average duration of 26 min (range 2–61). From these monthly checks, it was found that one RACF completed all seven steps of the implementation plan. Three RACFs went through six steps, one RACF went through five steps, and one RACF completed two steps of the implementation plan.

In total, 32 determinants from the TICD checklist were identified during the monthly quality checks with the falls prevention coordinators when implementing a CPG on multifactorial falls prevention interventions in the RACFs. This process was supported by the implementation plan and its associated tools. Determinants reported by at least four out of the six falls prevention coordinators were 'clarity' (e.g. the implementation plan is perceived as clear, comprehensive and practical), 'feasibility' (e.g. multifactorial evaluation is challenging and time-consuming), 'domain knowledge' (e.g. lack of knowledge of falls prevention indicators or legislation), 'awareness and familiarity with the recommendations' (e.g. the knowledge test increases awareness of falls prevention among staff), 'residents' beliefs and knowledge' (e.g. increasing knowledge on falls prevention among relatives and residents through a flyer), 'team processes' (e.g. clear assignments of tasks per discipline regarding falls prevention), 'availability of necessary resources' (e.g. lack of time, shortage of staff), and 'information system' (e.g. integration of falls prevention into the residents'(electronic) health record).

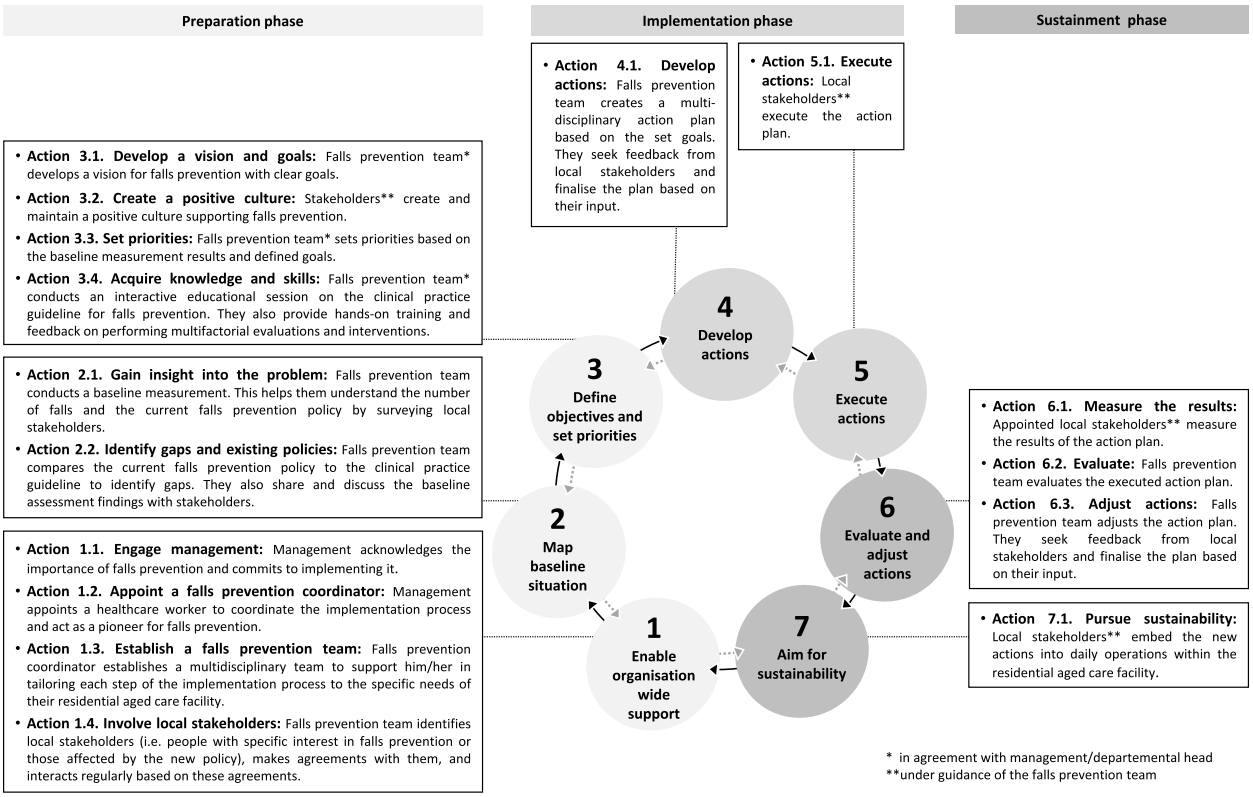

Fig. 4 The seven steps of the implementation plan for residential aged care facilities in Flanders

No determinants were reported in the domain 'Social, political, and legal factors'. A comprehensive overview of the identified barriers and facilitators for each individual RACF can be found in Additional file 5.

Based on the results of the monthly quality checks and the identification of modifiable barriers, adjustments were made to the implementation plan and its supporting tools to better align with the specific context of the RACFs. For example, technical jargon was simplified, and additional details were incorporated, such as the purpose of each step, timing, and specific process of carrying out each step). Additionally, new tools were developed (e.g. an automated falls registration tool 'Insights into Falls') or modified (e.g. simplification of the online implementation platform) to facilitate the process (See Additional File 4). Finally, preconditions were added to the implementation plan to foster successful implementation (e.g. ensuring that the managing board of the facility acknowledges falls as a significant health and quality of life issue requiring active intervention, and no simultaneous implementation processes or projects are being conducted concurrently).

These refinements were further shaped by discussions at the annual meeting of the Centre of Expertise for Falls and Fracture Prevention Flanders. The role of the falls prevention coordinator was defined in greater detail, highlighting key competencies such as expertise in falls prevention, motivational skills, and the ability to coordinate implementation processes. Additionally, the ideal composition of the falls prevention team—comprising professionals such as physiotherapists, occupational therapists, and nurses—was outlined, along with essential team member competencies, including teamwork and voluntary engagement, to enhance implementation effectiveness.

Stage 5: programme implementation plan

We identified facilitators as potential support for the implementers. An implementation facilitator is an external falls prevention champion who provides advice and new insights. They coach the falls prevention coordinator and the falls prevention team in successfully implementing the CPG. To prepare them for this role, the implementation facilitators received training focused on coaching skills, the CPG, the implementation plan with emphasis on their role, and the outlined specific tasks they need to undertake. The falls prevention coordinator and falls prevention team of the RACF can rely on them for up to 65 contact hours and for a minimum of two years. This is part of 'Implementation Guidance', a

Table 1 Implementation strategies and practical applications within the implementation plan [22, 23]

Determinants	Implementation strategy (*theory*)	Definition implementation strategy	Practical application whitin the implementation plan	Related actions in the implementation plan
• Self-efficacy • Capable leadership	• *Modelling* *(Diffusion of Innovations Theory* [33]*)*	• Modelling: 'Providing an appropriate model being reinforced for the desired action.'	**Falls prevention coordinator**: A healthcare worker appointed by management who will coordinate the implementation process of a clinical practice guideline (CPG) and will act as a pioneer for falls prevention (i.e. sets examples of good practices for colleagues). The falls prevention coordinator is part of the falls prevention team and is accessible to all the staff at the residential aged care facility (RACF), residents, relatives and informal care givers.	• Action 1.3. Establish a falls prevention team • Action 1.4. Involve local stakeholders • Action 2.1. Gain insight into the problem • Action 2.2. Identify gaps and existing policies • Action 3.1. Develop a vision and goals • Action 3.2. Create a positive culture • Action 3.3. Set priorities • Action 3.4. Acquire knowledge and skills • Action 4.1. Develop actions • Action 5.1. Execute actions • Action 6.1. Measure the results • Action 6.2: Evaluate • Action 6.3. Adjust actions • Action 7.1. Pursue sustainability
• Team processes • Communication and influence • Cultural appropriateness • Feasibility	• Participation *(Diffusion of Innovations Theory* [33]*)* • Tailoring *(Trans-Theoretical Model* [32]*)*	• Participation: 'Assuring high level engagement of the participants' group in problem solving, decision making, and change activities; with highest level being control by the participants' group.' • Tailoring: 'Matching the intervention or components to previously measured characteristics of the participant.'	**Falls prevention team**: A multidisciplinary team established by the falls prevention coordinator. They will support the falls prevention coordinator and ensure that all departments/wards of the RACF are involved. They are responsible for: 1) raising awareness about falls prevention among the staff of the RACF, residents, relatives, and informal care givers; 2) developing, executing, and sustaining a falls prevention policy based on the CPG, tailored to the context of the RACF taking into account their existing systems and structures; 3) actively communicating their decisions about the falls prevention policy to their own department and colleagues.	• Action 1.4. Involve local stakeholders • Action 2.1. Gain insight into the problem • Action 2.2. Identify gaps and existing policies • Action 3.1. Develop a vision and goals • Action 3.2. Create a positive culture • Action 3.3. Set priorities • Action 3.4. Acquire knowledge and skills • Action 4.1. Develop actions • Action 5.1. Execute actions • Action 6.1. Measure the results • Action 6.2. Evaluate Actions • Action 6.3. Adjust actions • Action 7.1. Pursue sustainability
• Cultural appropriateness • Priority of necessary change	• Increasing stakeholders influence *(Stakeholder Theory* [31]*)*	• Increasing stakeholders influence: 'Increase stakeholder power, legitimacy, and urgency, often by forming coalitions and using community development and social action to change an organization's policies.'	**Stakeholders involvement:** From the start of the process, local stakeholders from in and outside the RACF (e.g. residents, relatives, volunteers) are asked by the falls prevention team to be actively involved in each step of the implementation plan. With each local stakeholder, the falls prevention team makes an agreement on how, the frequency, by whom, and when they will be contacted.	• Action 1.4. Involve local stakeholders • Action 2.1. Gain insight into the problem • Action 2.2. Identify gaps and existing policies • Action 4.1. Develop actions • Action 6.3. Adjust actions

Table 1 (continued)

Determinants	Implementation strategy (*theory*)	Definition implementation strategy	Practical application whitin the implementation plan	Related actions in the implementation plan
• Domain knowledge • Skills • Awareness and familiarity with the recommendation • Education system	• Active learning *(Social Cognitive Theory* [34]*)* • Guided practice *(Social Cognitive Theory* [34]*)* • Feedback *(Social Cognitive Theory* [34]*)*	• Active learning: 'Encouraging learning from goal-driven and activity-based experience.' • Guided practice: 'Prompting individuals to rehearse and repeat the behaviour various times, discuss the experience, and provide feedback.' • Feedback: 'Giving information to individuals and environmental agents regarding the extent to which they are accomplishing learning or performance, or the extent to which performance is having an impact.'	**Interactive educational sessions**: The falls prevention team (in cooperation with the department head and management) organises and gives an interactive education session (e.g. asking questions, sharing experiences) concerning the CPG on falls prevention in RACFs and provides hands-on training and feedback on how to perform the multifactorial assessment and interventions.	• Action 3.4. Acquire knowledge and skills • Action 7.1. Pursue sustainability
• Availability of necessary resources	• Technical Assistance *(Diffusion of Innovations Theory* [33]*)*	• Technical Assistance: 'Providing technical means to achieve desired behaviour.'	**Online implementation platform:** To support the falls prevention team and the falls prevention coordinator, the implementation plan, along with various tools (e.g. knowledge test, meeting agenda template), will be made available online on a dedicated platform by the researchers. This enables them to collaborate within a single document, consolidates all information in one place, and facilitates easier tracking of their progress	/

CPG Clinical practice guideline, *RACF* Residential aged care facility

large-scale falls prevention implementation initiative in more than 100 RACFs in Flanders, funded by the Flemish Government [35].

Besides their initial training, implementation facilitators receive ongoing support from the research group through biannual peer coaching sessions, promoting sharing experiences and mutual learning. Moreover, every three months they receive assistance and advice from a trained researcher by phone. Finally, implementation facilitators have access to an online platform for asking questions to other facilitators and revisiting training information.

The implementation strategies behind 'Implementation Guidance' are 'Technical assistance' from the Diffusion of Innovations Theory, 'Active learning', 'Guided practice' from the Social Cognitive Theory, and 'Participatory problem solving' from the Organisational Development Theories [17, 33, 34, 36]. Table 2 provides an overview of the determinants we aim to influence, along with the selected implementation strategies to address them. It also outlines how these implementation strategies are practically applied within 'Implementation Guidance'.

Stage 6: evaluation plan

The implementation plan includes possible indicators for falls prevention, each accompanied by its definition. These indicators are categorised into three different types, as outlined by Mainz (2003) [37]: structural indicators (e.g. presence of a prevention coordinator in the RACF), process indicators (e.g. proportion of residents for whom various fall risk factors were evaluated), and outcome indicators (e.g. number of fall incidents) [37–42]. These indicators can be used by the falls prevention team to evaluate whether goals are reached ('Action 4.1: Develop actions'). The team also determines how this evaluation will take place and by whom data for these indicators will be collected. The results of the evaluation are discussed using the evaluation method: STOP-START-CONTINUE, which indicates actions to stop, start, or continue ('Action 6.2: Evaluate' and 'Action 6.3: Adjust actions') [43, 44]. In addition, step 7 of the implementation plan includes a list of ten sustainability criteria that the falls prevention team needs to review at least once a year (see Table 3). These criteria evaluate the extent to which the RACF sustains its implemented falls prevention policy and whether additional actions need to be developed.

The sustainment phase in the implementation plan necessitates the falls prevention team to engage in a cyclical process, wherein steps 4 to 7 are performed at least yearly to ensure sustainability. For example, when it is discovered through the sustainability checklist of the implementation plan ('Action 7.1. Pursue sustainability') that criteria are not met, new actions are to be developed in the initial action plan ('Action 4.1. Develop actions'), executed ('Action 5.1. Execute actions'), and later evaluated ('Action 6.2. Evaluate') and potentially adjusted ('Action 6.3. Adjust actions'). This enables continuous quality improvement of falls prevention care in RACFs [45].

Discussion

This article describes the development of an implementation plan for falls prevention interventions in RACFs using Intervention Mapping [22]. The implementation plan comprises seven steps: 1) enable organisation-wide support, 2) map baseline situation, 3) define objectives and set priorities, 4) develop actions, 5) execute actions, 6) evaluate and adjust actions, 7) aim for sustainability. The overall goal of this multifaceted implementation plan is to facilitate a systematic and sustainable implementation of multifactorial falls prevention interventions into RACFs in Flanders. Literature suggests that implementation should be performed stepwise [46, 47]. Therefore, our implementation plan outlines concise steps with fundamental actions that are required to implement falls prevention interventions. However, it should be adapted to the specific context of the RACF. Moreover, the implementation process should be seen as an iterative process.

The implementation plan comprises multiple implementation strategies. The main strategies behind the implementation plan are 'Modelling', 'Participation', 'Tailoring', 'Increasing stakeholders influence', and 'Active learning'. This is also in line with the systematic review of Albasha et al. (2023), in which the most reported implementation strategies, following the Expert Recommendations for Implementing Change (ERIC) Taxonomy, were education and training strategies (e.g. conduct educational meetings, conduct ongoing training), developing stakeholders' interrelationships (e.g. identification and preparing champions) and evaluative strategies (e.g. purposely re-examine the implementation) [48, 49]. In addition, the implementation plan was pretested in six RACFs. Using the TICD checklist, a total of 32 determinants were identified [27]. The most frequently reported determinants included 'clarity', 'feasibility', 'domain knowledge', 'awareness and familiarity with the recommendations', 'residents' beliefs and knowledge', 'team processes', 'availability of necessary resources' and 'information system'. No determinants were identified in the domain 'Social, political and legal factors'. Similar findings were reported in the evidence synthesis of McArthur et al. (2021) [50]. The most frequently identified barriers in this synthesis included time constraints and inadequate staffing (i.e. determinant 'availability of necessary resources'), knowledge gaps (i.e. determinant

Table 2 Implementation strategies and practical applications within Implementation Guidance [22, 23]

Determinants	Implementation strategy (*theory*)	Definition implementation strategy	Practical application whithin Implementation Guidance
• Feasibility • Availability of necessary resource	• Technical assistance *(Diffusion of Innovations Theory* [33])	• Technical assistance: 'Providing technical means to achieve desired behaviour.'	• **Facilitator:** An external falls prevention champion who provides advice and new insights to guide and support the local falls prevention coordinator and falls prevention team in effective implementation of the clinical practice guideline (CPG), utilising the various steps outlined in the implementation plan. The guidance is tailored to the unique needs and context of the residential aged care facilities (RACF). • **Online discussion and learning platform:** An online platform provided by the researchers for facilitators to review training materials and engage in a discussion forum for exchanging questions with fellow facilitators.
• Domain knowledge • Skills • Awareness and familiarity with recommendations	• Active learning *(Social Cognitive Theory* [34]*)* • Guided practice *(Social Cognitive Theory* [34]*)*	• Active learning: 'Encouraging learning from goal-driven and activity-based experience.' • Guided practice: 'Prompting individuals to rehearse and repeat the behaviour various times, discuss the experience, and provide feedback.'	• **Training:** Two training sessions spanning a total of 5 days are offered. The first training, conducted by the Flemish Institute for Healthy Living, focuses on administration and coaching skills. The second training, facilitated by the Centre of Expertise for Falls and Fracture Prevention Flanders, delves into the CPG, the implementation plan, and associated tools. During this second training, emphasis is placed on understanding their role, and the outlined specific tasks they are required to undertake in implementing the CPG.
• Feasibility	• Participatory problem solving *(Organisational Development Theories* [36]*)*	• Participatory problem solving: 'Diagnosing the problem, generating potential solutions, developing priorities, making an action plan, and obtaining feedback after implementing the plan.'	• **Peer coaching sessions:** Twice a year, the research group hosts peer coaching sessions. During these sessions, facilitators share their success stories and work collaboratively on solutions for challenges encountered during the implementation process • **Follow-up by phone:** Every three months, a trained researcher individually contacts each facilitator by phone to inquire about the progress of the implementation process, provide targeted feedback, and collaboratively explore solutions for any challenges they encounter.

CPG Clinical practice guideline, *RACF* Residential aged care facility

Table 3 Overview sustainability criteria

Sustainability criteria
1. Is every fall incident recorded by staff?
2. Is a multifactorial assessment performed at least annually for each resident; or after each fall incident?
3. Are multifactorial interventions scheduled for each resident based on the multifactorial assessment?
4. Is a follow-up scheduled for each resident to evaluate the effect of the intervention(s)?
5. Is every (new) staff member trained in the falls prevention policy?
6. Is every (new) staff member trained in using the falls prevention module in the residents (electronic) health record?
7. Is at least one training organised for employees each year?
8. Is feedback provided to each department every 6 months based on the fall registrations from the previous months?
9. Is falls prevention a standard agenda item in relevant meetings?
10. Does the falls prevention team still meet on a regular basis?

'domain knowledge'), and lack of teamwork (i.e. determinant 'team processes') [50]. However, in contrast, we did not find leadership (i.e. determinant 'capable leadership') or resources (i.e. determinant 'availability of necessary resources') as facilitators [50]. This discrepancy could possibly be explained by the fact that the semi-structured questionnaire was based on barriers for change at six levels of healthcare as defined by Grol et al., and the results were then analysed using the TICD checklist [27, 28]. While there are certain similarities between Grol et al.'s six levels of healthcare and the TICD checklist (e.g. 'individual professional level' corresponds to 'individual healthcare workers factors' of the TICD checklist), the TICD checklist is more comprehensive [27, 28]. Although participants had the opportunity to report additional barriers and facilitators, we did not explicitly ask for facilitators. Therefore, potentially relevant determinants they experienced may have been overlooked. The absence of determinants in the domain 'social, political and legal factors' could be attributed to this domain not being explicitly addressed in the semi-structured questionnaire. Lastly, it is important to note that not all RACFs completed all the steps of the implementation plan within the 12-months period. This may be due to the tailored approach of the implementation plan, which considers existing falls prevention policies (see 'Action 2.2. Identify gaps and existing policies'). Some facilities had already implemented more falls prevention interventions than others. Furthermore, the implementation process is iterative, allowing for the possibility of returning to previous steps if necessary. For instance, certain facilities had to revert to an earlier step due to the loss of a falls prevention coordinator. This may indicate that a 12-months period is possibly insufficient to fully implement a CPG on multifactorial falls prevention interventions. These observations underline the complexity and time investment associated with implementation efforts. As the pretesting was conducted in five private not-for-profit RACFs and one public RACF, this may present challenges for broader scalability—particularly in resource-limited RACFs.

This project has several strengths. The first strength lies in the development of an implementation plan for falls prevention interventions in RACFs using Intervention Mapping, in close collaboration with stakeholders. Throughout all aspects of the decision-making process, various stakeholders with different backgrounds were actively involved and engaged, reflecting a collaborative approach that is central to Intervention Mapping. Another strength is the use of Intervention Mapping itself, which offers more comprehensive and precise guidance throughout the development process compared to other frameworks, for example the often-cited Medical Research Council (MRC) framework [23, 51]. Although Intervention Mapping can be time-consuming and a resource-intensive approach, it enables researchers to target context-specific determinants that could hinder or support the implementation of falls prevention in Flemish RACFs. Furthermore, Intervention Mapping encourages researchers to use relevant theories and empirical evidence [22]. An additional strength lies in the use of the TICD checklist and the Taxonomy of Behaviour Change Methods of Kok et al. (2016) [17, 27]. The TICD checklist contributes to a systematic and uniform representation of the determinants for falls prevention implementations [27]. The decision to employ the Taxonomy of Behaviour Change Methods of Kok et al. (2016) is motivated by the fact that the taxonomy offers the advantage of linking changeable determinants with relevant implementation strategies, distinguishing it from alternatives such as the Behaviour Change Technique Taxonomy and ERIC Taxonomy [17, 49, 52, 53]. In addition, this taxonomy facilitates translating the implementation strategies into practical applications considering the specificities of the

targeted population, culture, and context. Moreover, Kok et al.'s Taxonomy of Behaviour Change Methods makes a clear link to the theoretical bases of the listed strategies [17]. The use of Intervention Mapping, TICD checklist and the Taxonomy of Behaviour Change Methods of Kok et al. (2016) aligns with the recommendations made by the authors of the World guidelines for falls prevention and management for older adults. They emphasise the importance of deliberately and thoughtfully implementing a falls prevention guideline by: 1) identifying barriers and potential facilitators (i.e. determinants) for change at the different level of the context (e.g. individual level, health system level) to develop targeted implementation strategies and 2) regularly engaging and interacting with key stakeholders throughout the implementation process [3].

There are limitations that need to be acknowledged. Overall, throughout the development of the implementation plan, no residents, relatives, or informal caregivers were included in the stakeholder group. As a result, their perspective could not directly be considered during this process [54–56]. Additionally, during the needs assessment (i.e. stage 1 of Intervention Mapping), no primary research was conducted with residents, relatives, or informal caregivers. This omission may explain why 'patient factors' (e.g. residents' preferences, family needs) are not directly targeted with suitable implementation strategies in this implementation plan. However, residents, relatives, and informal caregivers were represented by spokespersons from patient and representation organisations at the annual meeting of the Centre of Expertise for Falls and Fracture Prevention Flanders, where the implementation plan was discussed and modified based on their suggestions. Furthermore, at the start of the process, local stakeholders from in and outside the RACF (e.g. residents, relatives, volunteers) are asked by the falls prevention team to be actively involved throughout the different steps of the implementation plan as part of the implementation strategy 'Increasing stakeholder influence', ensuring their perspectives are integrated during the process. For example, in 'Action 2.2: Identify gaps and existing policies,' the falls prevention team shares and discusses the baseline assessment findings with the local stakeholders. Last, the Flemish Government granted funding for 'Implementation Guidance' which allows RACFs to submit a request for external support from an implementation facilitator in going through the different steps of the implementation plan (i.e. stage 5 of Intervention Mapping) [35]. The support of an implementation facilitator can be seen as a valuable additional implementation strategy (i.e. technical assistance). However, it is imperative that they are carefully selected to ensure they possess the requisite skills, traits, attitudes, and facilitation approach to optimise facilitation process [57]. Moreover, without this financial incentive of the Flemish Government, an implementation facilitator could be a crucial factor missing for RACFs to implement falls prevention. It is important that RACFs incorporate falls prevention into their daily operations so that it can survive beyond the presence of an implementation facilitator [22]. Therefore, the research group formulated various sustainability criteria to foster this process (See stage 5 of Intervention Mapping). Lastly, in the study of Fernandez et al., a systematic and comprehensive approach is described for planning implementation (i.e. Implementation Mapping). In doing so, they drew on insights from the Implementation Science field and Intervention Mapping [58]. Overall, Implementation Mapping could be considered as an elaboration of stage 5 of Intervention Mapping and could have provided the research team with additional support in selecting and designing implementation strategies.

Future research should focus on a larger-scale implementation and evaluate the effectiveness of the final implementation plan and tools in combination with the support of an external implementation facilitator. We recommend using a hybrid type 3 study, combining a mixed methods design to evaluate the implementation outcomes and process, and a longitudinal cluster randomised control design to explore the effectiveness of the intervention [59, 60]. A minimum follow-up period of 1 to 1.5 years after the implementation process is needed. This includes assessing the impact of the implementation plan and support of an external implementation facilitator on various determinants, such as self-efficacy, feasibility, and domain knowledge. Additionally, it is important to take into account implementation outcomes (e.g. adoption, reach, implementation costs) in accordance with Proctor et al.'s (2013) guidelines for specifying and reporting implementation strategies and clinical outcomes (e.g. falls, fall-related injuries) based on Lamb et al.'s (2005) Prevention of Falls Network Europe (ProFaNE) taxonomy [40, 61]. It is crucial to involve older adults and their families as key stakeholders in this process. Based on this, researchers can ensure that the health interventions take into account their needs and preferences [54].

Conclusions

This article describes the development process and the different steps of the implementation plan for falls and fracture prevention in RACFs. The integration of results from prior research and the guidance of Intervention Mapping in developing the implementation plan might provide more tailored support to RACFs for a stepwise and sustainable implementation. Moreover, this

implementation plan could also guide the change process for other prevention policies in RACFs setting.

Abbreviations

RACF	Residential aged care facility
CPG	Clinical practice guideline
TICD checklist	Tailored Implementation for Chronic Diseases checklist
ERIC Taxonomy	Expert Recommendations for Implementing Change Taxonomy
MRC Framework	Medical Research Council framework
ProFaNE taxonomy	Prevention of Falls Network Europe taxonomy

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12877-025-05969-8.

Additional file 1. Characteristics of the stakeholders.

Additional file 2. Questionnaire for monthly quality checks [28].

Additional file 3. Example of a matrix of change objectives.

Additional file 4. Overview of the developed supporting tools for the implementation plan.

Additional file 5. Overview of the identified barriers and facilitators.

Acknowledgements
We would like to thank the residential aged care facilities, their staff and residents, the stakeholder group and Margot Himpe for their valuable contributions.

Authors' contributions
GB, JP, SV, KM and EV: study design. GB, JP, SV, GL, TvA, FD, KM and EV: development of the implementation plan. GB: drafting the manuscript. EV: supervision. The authors read and approved the final manuscript.

Funding
The development of the implementation plan was executed with the support of The Flemish Government, Department care.

Data availability
All data generated and analysed during the study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Conducted in accordance with the principles of the Declaration of Helsinki, the study received ethical approval from the Social and Societal Ethics Committee of Leuven University Hospitals, on 25 March 2021 (G-2021–3315-R2(MIN)). All participants provided written informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Department of Public Health and Primary Care, Academic Centre for Nursing and Midwifery, KU Leuven, Kapucijnenvoer 7, bus 7001, Leuven 3000, Belgium. [2]Centre of Expertise for Falls and Fracture Prevention Flanders, KU Leuven, Kapucijnenvoer 7, bus 7001, Leuven 3000, Belgium. [3]University Hospital Antwerpen, Drie Eikenstraat 655, Edegem 2650, Belgium. [4]Faculty of Movement and Rehabilitation Sciences, KU Leuven, Tervuursevest 101, Bus 1500, Leuven 3001, Belgium. [5]Department of Geriatric Medicine, University Hospital Leuven, Herestraat 49, Leuven 3000, Belgium. [6]Faculty of Medicine and Life Sciences, Hasselt University, Agoralaan, Diepenbeek 3590, Belgium.

Received: 22 March 2024 Accepted: 18 April 2025
Published online: 23 August 2025

References

1. Rapp K, Becker C, Cameron ID, König H-H, Büchele G. Epidemiology of Falls in Residential Aged Care: Analysis of More Than 70,000 Falls From Residents of Bavarian Nursing Homes. J Am Med Dir Assoc. 2012;13(2):187.e1–e6.
2. Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: A review of the literature. Maturitas. 2013;75(1):51–61.
3. Montero-Odasso M, van der Velde N, Martin FC, Petrovic M, Tan MP, Ryg J, et al. World guidelines for falls prevention and management for older adults: a global initiative. Age Ageing. 2022;52(10):7.
4. Gillespie S, Friedman S. Fear of Falling in New Long-Term Care Enrollees. J Am Med Dir Assoc. 2007;8(5):307–13.
5. Becker C, Rapp K. Fall Prevention in Nursing Homes. Clin Geriatr Med. 2010;26(4):693–704.
6. Ibrahim JE, Murphy BJ, Bugeja L, Ranson D. Nature and Extent of External-Cause Deaths of Nursing Home Residents in Victoria. Australia J Am Geriatr Soc. 2015;63(5):954–62.
7. Sterke CS, Panneman MJ, Erasmus V, Polinder S, Beeck EF. Increased care demand and medical costs after falls in nursing homes: A Delphi study. J Clin Nurs. 2018;27(13–14):2896–903.
8. Deandrea S, Bravi F, Turati F, Lucenteforte E, Vecchia C, Negri E. Risk factors for falls in older people in nursing homes and hospitals. A systematic review and meta-analysis. Arch Gerontol Geriatr. 2013;56(3):407–15.
9. Gulka HJ, Patel V, Arora T, McArthur C, Iaboni A. Efficacy and Generalizability of Falls Prevention Interventions in Nursing Homes: A Systematic Review and Meta-analysis. J Am Med Dir Assoc. 2020;21(8):1024–35.e4.
10. Cameron ID, Dyer SM, Panagoda CE, Murray GR, Hill KD, Cumming RG, et al. Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database Syst Rev. 2018;9(9):CD005465.
11. Logan PA, Horne JC, Gladman JRF, Gordon AL, Sach T, Clark A, et al. Multifactorial falls prevention programme compared with usual care in UK care homes for older people: multicentre cluster randomised controlled trial with economic evaluation. BMJ. 2021;375: e066991.
12. Milisen K, Vlaeyen E, Coussement J, Leysens G, Van der Elst E, Boonen S, et al. Valpreventie in woonzorgcentra: praktijkrichtlijn voor Vlaanderen. Leuven: ACCO; 2012.
13. Registered Nurses' Association of Ontario. Preventing Falls and Reducing Injury from Falls. 4th ed. Toronto: Registered Nurses' Association of Ontario; 2017.
14. Panel on Prevention of Falls in Older Persons, American Geriatrics Society and British Geriatrics Society. Summary of the Updated American Geriatrics Society/British Geriatrics Society clinical practice guideline for prevention of falls in older persons. J Am Geriatr Soc. 2011;59(1):148–57.
15. Australian Commission on Safety and Quality in Health Care. Preventing falls and harm from falls in older people; Best practice guidelines for Australian residential aged care facilities. Australia; 2009. Australia; 2009.
16. Vlaeyen E, Stas J, Leysens G, Van der Elst E, Janssens E, Dejaeger E, et al. Implementation of fall prevention in residential care facilities: A systematic review of barriers and facilitators. Int J Nurs Stud. 2017;70:110–21.
17. Kok G, Gottlieb NH, Peters GJY, Mullen PD, Parcel GS, Ruiter RAC, et al. A taxonomy of behaviour change methods: an Intervention Mapping approach. Health Psychol Rev. 2016;10(3):297–312.
18. Moullin JC, Dickson KS, Stadnick NA, Albers B, Nilsen P, Broder-Fingert S, et al. Ten recommendations for using implementation frameworks in research and practice. Implementation science communications. 2020;1:1–12.
19. Nilsen P. Making sense of implementation theories, models, and frameworks: Implementation science. Springer Philadelphia, PA, USA; 2015.
20. Proctor EK, Powell BJ, McMillen JC. Implementation strategies: recommendations for specifying and reporting. Implement Sci. 2013;8:2.
21. Breimaier HE, Halfens RJ, Lohrmann C. Effectiveness of multifaceted and tailored strategies to implement a fall-prevention guideline into acute care nursing practice: a before-and-after, mixed-method study using a participatory action research approach. BMC Nurs. 2015;14:18.

22. Bartholomew LK KG, Ruiter RA., Fernandez ME, Markham CM. Planning Health Promotion Programs: An Intervention Mapping Approach. 4th ed. Hoboken: John Wiley & Son; 2016.
23. Vandervelde S, Scheepmans K, Milisen K, van Achterberg T, Vlaeyen E, Flamaing J, et al. Reducing the use of physical restraints in home care: development and feasibility testing of a multicomponent program to support the implementation of a guideline. BMC Geriatr. 2021;21(1):77.
24. Vlaeyen E, Coussement J, Leysens G, Van der Elst E, Delbaere K, Cambier D, et al. Characteristics and Effectiveness of Fall Prevention Programs in Nursing Homes: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. J Am Geriatr Soc. 2015;63(2):212.
25. Departement Zorg. Overzicht aanbod ouderenzorg. Available from: https://www.zorg-en-gezondheid.be/overzicht-aanbod-ouderenzorg. Cited 2024 15 January.
26. Vlaeyen E. Fall prevention in nursing homes: documented effectiveness, prevailing views and current practices. Leuven: ACCO; 2017.
27. Flottorp SA, Oxman AD, Krause J, Musila NR, Wensing M, Godycki-Cwirko M, et al. A checklist for identifying determinants of practice: a systematic review and synthesis of frameworks and taxonomies of factors that prevent or enable improvements in healthcare professional practice. Implement Sci. 2013;8(1):35.
28. Grol R, Wensing M. What drives change? Barriers to and incentives for achieving evidence-based practice. Med J Aust. 2004;180(6):S57–60.
29. Deming WE. Out of the Crisis. Cambridge: MIT press; 2018.
30. Shewhart WA, Deming WE. Statistical method from the viewpoint of quality control. Mineola: Courier Corporation; 1986.
31. Kok G, Gurabardhi Z, Gottlieb NH, Zijlstra FRH. Influencing Organizations to Promote Health: Applying Stakeholder Theory. Health Educ Behav. 2015;42(1_suppl):123S-32S.
32. Glanz K, Rimer BK, Viswanath K. Health behavior and health education - theory, research and practice. 4th ed. San Francisco: Jossey-Bass; 2002.
33. Rogers EM. Diffusion of innovations. New York: Free Press; 2003.
34. Bendura A. Social Foundations of thought and action: a social cognitive theory. Englewoods Cliffs: Prentice-Hall; 1986.
35. Departement Zorg. Procesbegeleiding preventie voor de setting Zorg en Welzijn. Available from: https://www.zorg-en-gezondheid.be/procesbegeleiding-preventie-voor-de-setting-zorg-en-welzijn. Cited 2023 9 May.
36. Butterfoss FD, Kegler MC, Francisco VT. Mobilizing organizations for health promotion: Theories of organizational change. Health behavior and health education: Theory, research, and practice. 4th ed. San Francisco: Jossey-Bass; 2008. p. 335–61.
37. Mainz J. Defining and classifying clinical indicators for quality improvement. Int J Qual Health Care. 2003;15(6):523–30.
38. Scott V, Higginson A, Sum A, Metcalfe S. Falls and related injuries in residential care: A framework and toolkit for prevention. Vancouver: Centre of Excellence for Mobility, Fall prevention and Injury in Aging & Centre for Hip Health and Mobility; 2010.
39. Scott V. Fall Prevention Programming: Designing, Implementiing and Evaluating Fall Prevention Programs for Older Adults. Vancouver, North Carolina, Raleigh: Lulu Publishing; 2012.
40. Lamb SE, Jorstad-Stein EC, Hauer K, Becker C. Development of a common outcome data set for fall injury prevention trials: The Prevention of Falls Network Europe Consensus. J Am Geriatr Soc. 2005;53:1618–27.
41. Australian Commission on Safety and Quality in Health Care. Implementation Guide for Preventing Falls and Harm from Falls in Older People; Best Practice Guidelines for Australian Hospitals and residential Aged Care Facilities. Sydney: Australian Commission on Safety and Quality in Health Care; 2009.
42. Resnick B, Simpson M. Implementing the Falls Clinical Practice Guidelines in Long-Term Care: An Exemplary Model. The Director. 2004;12(2):76–81.
43. Neyens JC, van Haastregt JC, Dijcks BP, Martens M, van den Heuvel WJ, de Witte LP, et al. Effectiveness and Implementation Aspects of Interventions for Preventing Falls in Elderly People in Long-Term Care Facilities: A Systematic Review of RCTs. J Am Med Dir Assoc. 2011;12(6):410–25.
44. DeLong TD. Three Questions for Effective Feedback: Harvard Business Review; Available from: https://hbr.org/2011/08/three-questions-for-effective-feedback. Cited 2023 1 November.
45. Singh J. Strategic Implementation of Continuous Improvement Approach: Improving the Performance of Small and Medium-Sized Enterprises: Cham: Springer; 2018.
46. Fischer F, Lange K, Klose K, Greiner W, Kraemer A. Barriers and Strategies in Guideline Implementation-A Scoping Review. Healthcare (Basel). 2016;4(3):36.
47. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. Lancet. 2003;362(9391):1225–30.
48. Albasha N, Ahern L, O'Mahony L, McCullagh R, Cornally N, McHugh S, et al. Implementation strategies to support fall prevention interventions in long-term care facilities for older persons: a systematic review. BMC Geriatr. 2023;23(1):47.
49. Powell BJ, Waltz TJ, Chinman MJ, Damschroder LJ, Smith JL, Matthieu MM, et al. A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. Implement Sci. 2015;10(1):21.
50. McArthur C, Bai Y, Hewston P, Giangregorio L, Straus S, Papaioannou A. Barriers and facilitators to implementing evidence-based guidelines in long-term care: a qualitative evidence synthesis. Implement Sci. 2021;16(1):70.
51. French SD, Green SE, O'Connor DA, McKenzie JE, Francis JJ, Michie S, et al. Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework. Implement Sci. 2012;7(1):38.
52. Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W, et al. The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions. Ann Behav Med. 2013;46(1):81–95.
53. Vandervelde S, Vlaeyen E, de Casterlé BD, Flamaing J, Valy S, Meurrens J, et al. Strategies to implement multifactorial falls prevention interventions in community-dwelling older persons: a systematic review. Implement Sci. 2023;18(1):4.
54. Israel BA, Schulz AJ, Parker EA, Becker AB. Review of community-based research: Assessing partnership approaches to improve public health. Annu Rev Public Health. 1998;19(1):173–202.
55. Francis-Coad J, Watts T, Etherton-Beer C, Panes G, Griffiths H, Anderson M, et al. Evaluation of older people's knowledge, awareness, motivation and perceptions about falls and falls prevention in residential aged care homes: a tale of two cities. Ageing Soc. 2019;39(11):2541–59.
56. Francis-Coad J, Watts T, Bulsara C, Hill A-M. Designing and evaluating falls prevention education with residents and staff in aged care homes: a feasibility study. Health education (Bradford, West Yorkshire, England). 2022;122(5):546–63.
57. Lizarondo L, McArthur A, Porche D, Corremans M, Perrenoud B, Rodrigues R, et al. Facilitation in evidence implementation – experiences, challenges, and determinants of perceived effectiveness: a qualitative systematic review. JBI Evidence Implementation. 2023;21(4):409–31.
58. Fernandez ME, Ten Hoor GA, van Lieshout S, Rodriguez SA, Beidas RS, Parcel G, et al. Implementation Mapping: Using Intervention Mapping to Develop Implementation Strategies. Front Public Health. 2019;7:158.
59. Wolfenden L, Foy R, Presseau J, Grimshaw JM, Ivers NM, Powell BJ, et al. Designing and undertaking randomised implementation trials: guide for researchers. BMJ. 2021;372: m3721.
60. Curran GM, Bauer M, Mittman B, Pyne JM, Stetler C. Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact. Med Care. 2012;50(3):217–26.
61. Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, et al. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. Administration and policy in mental health and mental health services research. 2011;38(2):65–76.

Publisher's Note