Management of neuropsychiatric symptoms in nursing home residents with dementia

An intervention to Reduce Inappropriate and frequent psychotropic Drug use

Claudia Groot Kormelinck

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CHAPTER 1

General introduction

Dementia: a global and growing concern

Dementia is a progressive condition and may affect memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgement. [1] Currently, over 55 million persons worldwide live with dementia. Annually, approximately 10 million new cases will follow. Given the aging of our population, it is anticipated that 78 million persons in 2030 and 139 million persons in 2050 will have dementia. Dementia is one of the major reasons for disability and dependency and is the seventh leading cause of death. [1,2]

The Dutch way

In the Netherlands, about 290.000 people live with dementia, of whom 80.000 people reside in long-term care. In the Netherlands, care for people with dementia is organized in a rather unique manner. Currently, people with chronic conditions are expected to continue living at home as long as possible. [3] Consequently, admission to a nursing home only applies for persons with severe and complex health care problems who are in need of fulltime surveillance and multidisciplinary care. [4] In addition to this high threshold for nursing home admission, care for people with dementia in the Netherlands is provided in dementia special care units (DSCUs). This is increasingly being organized on a small-scale basis with residents living in groups of six to eight persons. This type of care aims to reflect the home environment by creating a homely atmosphere in the living rooms, preparing meals in the kitchen of the living rooms and nursing staff performing household chores. [3] Nursing home staff comprises a multidisciplinary team, including specially trained physicians (elderly care physicians), nursing and paramedical staff as well as psychologists. [4,5]

Neuropsychiatric symptoms

While dementia often is characterized by cognitive - and functional impairment, the presence of neuropsychiatric symptoms (NPS), also known as challenging behavior or behavioral and psychological symptoms of dementia, predominantly influences the course of disease. [6–8] NPS comprise psychiatric symptoms, including delusions, hallucinations, depression, euphoria or anxiety and behavioral symptoms such as agitation, aggression, apathy and disinhibition (socially and sexually inappropriate behaviors). [9] Multiple symptoms often coexist. [10] The vast majority of people living with dementia experiences NPS at some point during the course of their illness. [7,9,11]

A large Canadian study reported a five year prevalence of 97% of having at least one NPS. [9] NPS are not simply a result of cognitive degeneration. Multiple factors have been identified that may contribute to NPS. These can be categorized as factors related to the person with dementia, including neurobiological factors, acute medical conditions (including pain and undetected illness), pre-existing personality and psychiatric illnesses, and unmet needs as well as caregiver factors and environmental triggers. [6] Other research also underlines this finding by stating that biological, psychological, and social factors must be taken into account to understand the causes of NPS. [7] Therefore, NPS can be seen as a result of a complex interplay of several factors. NPS can be very challenging for persons themselves and their family members, who often take care of their relative at home. [1] NPS are associated with a potentially faster disease progression [12] and an increased risk for nursing home admission. [13,14] In addition, the presence of NPS is associated with increased caregiver stress, depression and reduced employment. [15,16] Moreover, approximately one-third of care costs are attributed to the management of NPS in persons with dementia, related to increased use of services and caregiver time. [17] Hence, the number of people with NPS of dementia is large and has a profound impact on the persons themselves, their family and on society.

Within the population of people with dementia residing in nursing homes, NPS are highly prevalent as well. [7,10,18] Over 80% of residents with dementia experience at least one symptom. [10,18] The majority even has multiple NPS [10] and agitation and apathy are the most frequently displayed symptoms. [7,10] The presence of NPS in residents with dementia negatively effects their quality of life [19] and is associated with distress of nursing staff. [20]

Managing NPS in nursing homes

The treatment of NPS in nursing home residents with dementia consists basically of psychosocial interventions, including for example interventions directed at staff, the physical environment or physical activities, [21] and/or the prescription of psychotropic drugs, including antipsychotics, hypnotics or sedatives, anxiolytics, antidepressants, anticonvulsants, and anti-dementia drugs. [22,23] Psychosocial interventions are recommended as first-line treatments for NPS. Because NPS can be caused by several factors, it requires a multidisciplinary approach and psychosocial or psychological interventions should be given priority in the first instance. [3,6,15] In addition, many psychotropic drugs are only modestly effective and have risks of adverse events.

[24] For example, the use of antipsychotics for the treatment of psychosis and aggression is modestly effective and is associated with serious cerebrovascular events, extra-pyramidal symptoms, diabetes, seizures, somnolence and cognitive decline. [6,25,26] The use of sedatives, hypnotics, antidepressants, and benzodiazepines is associated with falls. [27] Furthermore, an increased mortality risk is documented [28,29] and psychotropic drug use reduces resident quality of life. [19] While about 60% of nursing home residents uses psychotropic drugs for NPS with dementia, only 10% of the prescriptions is considered fully appropriated according to the Appropriate Psychotropic drug use In Dementia (APID) index. [30] Most prescriptions are not fully appropriate, especially concerning its indication, evaluation, and therapy duration. For example, it is not seldom that indications and evaluations cannot be found in the medical records, or are not adequately registered. Also, it is common that residents are using psychotropic drugs longer than is advised according to guidelines, and therefore exceed the recommended therapy duration.

Despite that the disadvantages of psychotropic drugs are well-known and both national and international (clinical) guidelines advocate psychosocial interventions, [15,24,31–34] the use of psychotropic drugs remains high and widespread. [22] In western European nursing homes, especially antipsychotics and antidepressants are commonly used. [35] In Dutch nursing homes, antipsychotic prescriptions decreased between 2003 and 2018, but anti-dementia drug use increased. Overall, the use of psychotropic drugs did decrease somewhat over the years, which indicates a favorable development, but remains still relatively high and is therefore an ongoing concern. [23]

Although psychotropic drugs can be necessary, especially for the management of acute situations where safety of the resident or their environment is at risk, [6] guidelines designate that only when psychosocial interventions have insufficient effect, psychotropic drugs can be prescribed by physicians when there is an indication for use. [3,15] It is necessary that effects and possible side effects are then frequently monitored and documented. Even when prescriptions are fully in adherence to guidelines, psychotropic drugs still may lead to adverse effects and are only modestly effective. Hence, bearing in mind the limited evidence to support the use of some psychotropic drugs for NPS, the prescription of psychotropic drugs in older residents should be treated with caution. The quality of psychotropic drug prescribing should be optimized as well as aiming to lower the frequency of use. [3,24,25] This highlights the need for psychosocial interventions in the treatment of NPS. Because NPS can

be caused by several factors and given the complex nature of symptoms, there are no standard solutions and a multidisciplinary and tailored approach is needed. [3,6]

Psychosocial interventions over the years and their challenges

Researchers over the years focused on the development of interventions aimed at reducing (inappropriate) psychotropic drug use and to increase the use of psychosocial interventions, [3,21,36–42] ultimately leading to guidelines further advocating psychosocial interventions as first-line treatment for managing NPS. [24,31–33]These interventions roughly comprise two categories.

One category comprises the person-centered interventions, targeting a resident's behavior, emotion or cognition. Examples are reminiscence, validation, and sensory stimulation such as music- and pet therapy. [43] Tailoring to the resident is needed to take into account the variations and causes of NPS. This is a widely shared vision, and to provide person-centered and tailored care, a multidisciplinary approach is indispensable in which an essential step is to assess any treatable cause such as pain, infections, thirst, [3,6,32,44,45] and to assess for example any unmet needs including the need for social interaction or meaningful activity. [46]

The second category consists of multidisciplinary interventions targeting nursing home staff, and comprise for example staff education, skills training, in-reach services such as improving multidisciplinary teamwork, medication reviews or changes to the nursing home environment. [45,47] Many interventions consist of a combination of elements and they may target several aspects and involve several disciplines within the nursing home. Therefore, they are commonly referred to as complex, multidisciplinary- and multicomponent interventions that may include numerous implementation strategies such as audit and feedback, reminders and structural changes for example. [45,48] Often, these interventions have in common that they are multidisciplinary and use a methodological, structured approach to improve the detection, assessment, management and treatment of NPS. [21,49,50]

Considering the latter category of psychosocial interventions (e.g., complex, multidisciplinary- and multicomponent interventions), the strength of effects varies. To date, the majority of multicomponent interventions aimed at reducing inappropriate psychotropic drug use or increased use of psychosocial interventions have rather small or lacking effects. [38,51–53] Compared to a randomized controlled intervention trial

which examines one psychotropic drug or one intervention, implementing complex interventions is very challenging considering the variety of actors that are at stake. For example, reducing (inappropriate) use of psychotropic drugs in nursing home residents with dementia and NPS necessitates the involvement of several disciplines each with their own expertise, including amongst others psychologists, physicians, nursing staff and paramedics. [3,54] Hence, an adequate problem analysis of NPS and the context in which they occur needs to be followed by a treatment plan based on identifying any modifiable causes. [3,21,50] Targeting many persons from diverse professions can be challenging, especially when a new intervention or working method is introduced. [55] In addition, the implementation of this type of intervention is not directly aimed at the resident. It initially targets nursing home staff, who learn to implement a new type of multidisciplinary stepwise approach to structure the management of NPS. When this new method is being applied in practice, this in turn has an effect on the resident. [55]

Moreover, evaluations of previous studies have identified two major factors contributing to the finding that changing practice within nursing homes is challenging. First, many studies found that the lack – or diminished - effects of their intervention was mainly due to suboptimal implementation resulting from various local barriers. These may include perceived lack of time caused by staff shortages; lack of commitment as a result of this high workload or due to negative attitudes towards the intervention and/or top-down decision-making processes within the nursing home. [55,56] Second, sometimes intervention effects varied across studies, as results of one intervention study could not be reproduced in another setting. [51] Effectiveness and implementation are context dependent. [57] This emphasizes the need to take into account the specific organizational characteristics of nursing homes, including their culture, whilst implementing an intervention. Similarly to person-centered interventions in which interventions should fit a resident and address the cause(s) of the NPS, tailoring and adapting intervention and implementation to local contexts is essential for multidisciplinary- and multicomponent interventions as well, rather than just implementing a standardized intervention. [45,48,57] In order to achieve a good fit between an intervention and the local context, involving stakeholders with knowledge of this local context and managing neuropsychiatric symptoms is relevant. This is also known as co-production. [57–59] There is evidence that the active involvement of nursing home staff can be crucial in successful implementation. [56,60]

Summarized, there are a number of reasons why implemented interventions targeting the management of NPS and (inappropriate) use of psychotropic drugs over the

years experienced challenges and delivered suboptimal effects. Taking into account the available evidence and lessons that were derived from those studies as well as from national and international guidelines, several vital points emerge. Besides the importance of using a step by step approach in a multidisciplinary setting to examine causes and triggers of neuropsychiatric symptoms to further guide interventions, [3,6,34] interventions appear to be more effective when they are adapted to the local organizational context as 'one size fits all' solutions do not exist. [6,45,48,57,59] The need for including a collaborative approach is acknowledged, in which a multidisciplinary team of healthcare professionals is engaged in designing and implementing an intervention from an early stage. [56–59,61] This may include for example addressing initial scepticism about psychosocial approaches prior to implementation. [56] Collaborative approaches that include any external expertise can help address concerns and problems experienced by nursing home staff and incorporate any preferences. [60] It is assumed that this approach can address the local barriers and factors affecting implementation and provide opportunities for ongoing discussion and problem solving.

Towards a tailored and collaborative approach nursing homes

The rationale behind this study was a result of the many years of developments that have taken place regarding the management of NPS and (appropriateness of) psychotropic drug use in nursing home residents with dementia, including the challenges and the lessons learned as a consequence of these efforts. The Reducing Inappropriate psychotropic Drug use (RID) intervention was developed, based on elements that were considered relevant in order to increase effectiveness of multicomponent interventions.

At its core, the RID intervention allows nursing homes to implement existing multicomponent interventions, aimed at a resident with dementia or at nursing home staff. These interventions may be effective, but have most likely failed to show effects due to insufficient consideration of local contexts and the barriers to implementation of those complex interventions. The RID intervention does not alter these existing interventions, but rather focusses on the method of implementation using three central elements. First, to ensure a collaborative approach between researchers and key stakeholders in nursing homes we incorporated Participatory Action Research (PAR). In using PAR, nursing home staff was allowed to have an active role in formulating problems targeting psychotropic drug use and NPS in residents

with dementia, followed by identifying potential solutions and implementing them. Second, tailored information provision was given. Local problems and perceived bottlenecks of nursing homes regarding the management of neuropsychiatric symptoms and (inappropriate) use of psychotropic drugs were examined by means of a local problem analysis. This allows the identification of barriers to change before implementation and matches the specific needs and characteristics within each nursing home. Third, external coaching was provided to guide the whole process. The RID intervention is described in detail in chapter two.

In sum, this thesis has emerged from the hypothesis that efforts in nursing homes aiming to reduce inappropriate psychotropic drug use as well as its frequency, would benefit from the active involvement of staff in determining the problems of managing NPS, followed by the implementation of an organizational tailored solution with support of an external coach. This has led to the development of a complex intervention containing these implementation promoting elements.

Objectives and outline of the thesis

The main objective of this thesis was to examine the effectiveness of a complex intervention using PAR, tailoring, and guided implementation with an external coach on two outcomes. The primary outcome was reduction of inappropriate psychotropic drug use and frequency of psychotropic drug use in nursing home residents with dementia was the secondary outcome.

The second important objective of this thesis was to evaluate the complex intervention on a process level. Evaluating complex interventions is known to be challenging. The added value of performing a process evaluation is now widely acknowledged as it may provide information on the effective components of an intervention, the causal mechanisms and contextual factors associated with variation in outcomes. [62] Therefore, a process evaluation of the intervention was performed.

Chapter 2 presents the protocol of a study about a complex intervention using PAR, tailoring and guided implementation with an external coach in nursing home residents with dementia, in a special case of a stepped-wedge cluster randomized trial. The protocol comprehensively describes the PAR-RCT RID intervention and specifies inappropriate psychotropic drug use as the primary outcome and the secondary outcomes, being frequency of psychotropic drug use, frequency of NPS and quality of life.

Thereafter, each chapter addresses one or more of the following research questions.

1. *What are barriers and facilitators influencing the implementation of complex interventions targeting neuropsychiatric symptoms and psychotropic drug use in long-term care?*

Complex interventions often face difficulties with implementation, limiting the effectiveness of these interventions. Chapter 3 describes the results of a systematic review on barriers and facilitators of complex interventions targeting neuropsychiatric symptoms and psychotropic drug use for residents with dementia in long-term care.

2. *What is the quality of a complex intervention using PAR, tailoring and guided implementation with an external coach, followed by the implementation of tailored action- and implementation plans, and what are the barriers and facilitators to implementation of this intervention?*

Chapter 4 describes a process evaluation of the RID study using Leontjevas' model [63] and provides information on why the complex intervention was successful or unsuccessful and how it could be optimized, which is essential for its credibility. The relevance and feasibility and extent of performance of the intervention are described, as well as barriers and facilitators to implementation.

3. *What are the effects of a complex intervention using PAR, tailoring and guided implementation with an external coach, followed by the implementation of tailored action- and implementation plans, on inappropriateness and frequency of psychotropic drug use in nursing home residents with dementia?*

In order to evaluate effectiveness, a complex intervention using PAR, tailoring and guided implementation with an external coach, followed by the implementation of tailored action- and implementation plans, on inappropriateness and frequency of psychotropic drug use in nursing home residents with dementia was implemented in sixteen Dutch nursing homes using a special case of a stepped-wedge cluster randomized controlled trial (Chapter 5).

Chapter 6 covers the general discussion in which a summary of key findings will be given. Furthermore, (inappropriate) psychotropic drug use will be put in perspective, followed by discussing methodological considerations, implications for clinical practice and recommendations for future research.

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CHAPTER 2

Reducing inappropriate psychotropic drug use in nursing home residents with dementia: protocol for participatory action research in a stepped-wedge cluster randomized trial

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Abstract

Background: Psychotropic drugs are often prescribed to treat neuropsychiatric symptoms in nursing home residents with dementia, despite having limited efficacy and considerable side effects. To reduce the inappropriate prescribing of these psychotropic drugs, various non-pharmacological, psychosocial, person-centered, or multidisciplinary interventions are advocated. However, existing multidisciplinary interventions have shown variable effects, with limited effectiveness often resulting from suboptimal implementation. We hypothesize that an effective intervention needs to fit the local situation of a nursing home and that support should be offered during implementation.

Methods: We will embed participatory action research within a stepped-wedge cluster randomized controlled trial to study the effects of a tailored intervention and implementation plan to reduce inappropriate psychotropic drug prescribing. Nursing homes will be provided with tailored information about the perceived problems of managing neuropsychiatric symptoms and we will offer coaching support throughout. Alongside the participatory action research, we will perform a process evaluation to examine the quality of the study, the intervention, and the implementation. Our aim is to recruit 600 residents from 16 nursing homes throughout the Netherlands, with measurements taken at baseline, 8 months, and 16 months. Nursing homes will be randomly allocated to an intervention or a deferred intervention group. During each intervention stage, we will provide information about inappropriate psychotropic drug prescribing, neuropsychiatric symptoms, and difficulties in managing neuropsychiatric symptoms through collaboration with each nursing home. After this, a tailored intervention and implementation plan will be written and implemented, guided by a coach. The primary outcome will be the reduction of inappropriate prescribing, as measured by the Appropriate Psychotropic drug use In Dementia index.

Secondary outcomes will be the frequency of psychotropic drug use and neuro-psychiatric symptoms, plus quality of life. A mixed methods design will be used for the process evaluation. Effects will be assessed using multilevel analyses. The project leader of the nursing home and the coach will complete questionnaires and in-depth interviews.

Discussion: We anticipate that the proposed tailored intervention with coaching will reduce inappropriate psychotropic drug prescribing for nursing home residents with neuropsychiatric symptoms. This study should also provide insights into the barriers to, and facilitators of, implementation.

Background

Dutch nursing homes (NHs) accommodate approximately 50,000 residents with dementia, [1] and in these, the prevalence of neuropsychiatric symptoms (NPS) is high. A systematic review, for example, indicated that 82% of residents exhibited at least one NPS, with agitation and apathy being most prevalent. [2] These symptoms affect both the quality of life (QoL) of residents [3] and the health of nursing staff. [4]

NPS in dementia is typically treated with psychotropic drugs, including anti-psychotics, hypnotics or sedatives, anxiolytics, antidepressants, anticonvulsants, and anti-dementia drugs. [5-8] Despite the frequency with which these are prescribed, there is evidence that such drugs have limited effect on NPS in residents with dementia [9,10] especially when used in the long-term. [11] These psychotropic drugs are also associated with significant side effects. Antipsychotics are known to increase the risk of stroke and mortality [6,12] and to cause extrapyramidal symptoms and drowsiness. [13] The use of sedatives, hypnotics, antidepressants, and benzodiazepines is also associated with falls. [14] Together, these side effects can negatively affect QoL. [10,15-17] Although guidelines recommend that the use of psychotropic drugs be restricted in the treatment of NPS in dementia, and although non-pharmacological alternatives are recommended for first-line treatment, [18] psychotropic drugs are often prescribed in Western Europe, with antipsychotics and antidepressants being used with the greatest frequency. [19] Indeed, despite the existence of these guidelines, psychotropic drug prescribing has not substantially decreased in the Netherlands, with 60% of Dutch NH residents with dementia and NPS being prescribed at least one of these agents. [20] In addition, there is evidence that psychotropic drugs are frequently prescribed in the long-term, which again runs contrary to the guideline recommendations. [21-23] Research suggests that only 10% of psychotropic drug prescriptions for NPS are fully appropriate for residents with dementia, in terms of indication, evaluation, dosage, drug-drug interactions, drug-disease interactions, duplications, and therapy duration. [20]

Several studies provide insights into the factors associated with the psychotropic drug prescribing. Relevant factors include physician and nurse attitudes to NPS and psychotropic drugs, [6,24,25] knowledge or experience of NPS, the interpersonal skills of nurses, knowledge of the effectiveness and side effects of psychotropic drugs, communication or cooperation between professionals and with family, [24] and external factors (e.g., staffing, the NH setting, and local policies). [24,25] However, these can only be challenged if effective non-pharmacological interventions are available, including

person-centered and multidisciplinary interventions. Person-centered interventions focus on behavior, emotion, stimulation, or cognition (e.g., reminiscence, validation, music therapy, sensory stimulation), [26] whereas multidisciplinary interventions for NH staff focus on education, in-reach services, medication reviews, or multicomponent interventions to reduce inappropriate prescribing. [27]

In recent decades, a number of multidisciplinary care programs have been developed to target the factors associated with inappropriate prescribing and/or to shift practice toward a greater use of non-pharmacological interventions (e.g., STA-OP, GRIP, PROPER, AiD, Dementia Care Mapping, RedUSe, and TIME). [28-34] RedUSe is a good example of a multi-strategic interdisciplinary intervention that took place in 150 residential aged care facilities and was shown to reduce antipsychotic prescribing by 13% and benzodiazepine prescribing by 21%, without increasing their pro re nata use. Although this showed that such an intervention can be successful, [34] it is generally the case that the effects of these multidisciplinary care programs or interventions are variable. In the GRIP study, for example, the effects of a multidisciplinary care program for challenging behavior were considered small, probably due to suboptimal implementation. Adjusted analyses showed larger effects in Dementia Specialized Care Units (DSCUs), in which implementation was good. [29] The results of a successful and widely implemented person-centered care approach in the United Kingdom have not been replicated in German NHs. [35] Although several changes were made to the intervention, it was thought that implementation barriers caused the loss of effect between populations. In other research, Grimshaw et al. stated that implementation studies seeking to change professional behavior achieve an effect size of 10% to 20%, with the effects likely related to the degree to which underlying barriers are addressed. [36] Striving for any culture change is challenging and takes time, and it might be unrealistic to expect larger effects. However, it is documented that a lack of effect may reflect a failure of implementation rather than a failure of the intervention itself. [37, 38]

It appears that several preconditions are required for successful implementation of a new intervention, and the absence of these can effectively block implementation. Common barriers to implementation in terms of an organization's culture have been reported to be the attitude to change and the support of key persons. Staff turnover, experience of concurrent and former projects, and organizational change have also been considered important organizational barriers. [39] By contrast, organizational preconditions for implementation are the presence of well-functioning networks,

flexible organizational structures, a dementia-friendly culture, and positive attitudes of involved staff. [32]

As one might imagine, creating a change in NH practice can be challenging given the complex nature of these institutions. Consequently, standardized interventions are less likely to be successful, with a need to emphasize the specific organizational features of a NH and their culture to better adapt to their specific needs. [27, 32, 38, 39] A prerequisite for successful implementation of any psychosocial intervention, whether person-centered or multidisciplinary, must therefore be that it includes some degree of tailoring. On the one hand, a person-centered intervention needs to be tailored to the preferences and abilities of a given resident, [40] whereas on the other hand, a multidisciplinary program should consider the specific features of the organization and whether it fits with the needs, resources, and conditions of the NH at which it is to be implemented. [32, 39] In addition, as the complexity of an intervention increases, so too do the demands of implementation (e.g., GRIP involves multiple interacting components and requires behavioral changes in both caregivers and recipients). Complexity also varies with the possible outcomes, the number of individuals involved, and as stated, the degree to which an intervention is tailored. [38] Due to these challenges, studies of complex interventions tend to show only small to modest outcome effects. [28, 29, 32, 41.]

Designing interventional trials that have enough flexibility to be meaningful and successful in a local setting, without compromising generalizability, has proved challenging. In an effort to tackle this issue, Leykum et al. (2009) explored the integration of participatory action research (PAR) with a randomized controlled trial (RCT) design, successfully accounting for the local differences while creating a framework that allowed for a degree of generalizability. [41] In PAR, researchers and participants work collaboratively to define a problem, identify unmet needs, explore and implement potential solutions, and evaluate the efficacy of the implemented actions. [42] PAR aims not only to improve work practices but also to learn from the implementation process itself, helping to understand how successful implementation can be achieved. This allows the knowledge that is gained to be used to implement future complex care programs or interventions that focus on both the content and processes of the intervention. Consequently, PAR allows complex interventions to be implemented, supported by knowledge about the local NH context. According to Leykum et al. (2009), group facilitation, relationship building, and reflection should be addressed to encourage the incorporation of local conditions and contexts.

In our study, we will integrate PAR with a stepped-wedge cluster RCT to create a PAR-RCT study design. This approach will help us to account for local differences by adapting to local needs, to use a tailored approach to improve local practice, and to create a framework that allows for a degree of generalizability. A cyclic approach of planning, acting, observing, and reflecting will be used. [42] We specifically plan to address two strategies that we assume will increase the intervention's effectiveness. First, we will provide NHs with tailored information about their perceived problems in managing NPS, including psychotropic drug use, to obtain a match between the problems experienced by NHs and the interventions to be implemented. Second, we will provide NHs with coaching to facilitate implementation. The coach will help to draft and implement the intervention plan, paying close attention to the local context of the NH. This will require dealing with any initial skepticism about non-pharmacological approaches or NH staff concerns in an effort to engender the commitment to change and the active engagement of staff that are essential for successful implementation. [40]

We aim to study the effectiveness of implementing a tailored intervention to reduce inappropriate psychotropic drug prescribing in a PAR-RCT. Our goal is to change work practices, processes, and cultures at the level of DSCUs in NHs because these changes tend to have longer lasting effects. [43] Therefore, interventions chosen by the NH staff will not directly target residents, but will instead target medication reviews, behavioral visits, or the provision of information on residents' life stories. We expect that these psychosocial interventions targeting NH staff can enhance the quality of professional conduct in NH practice, with positive effects for residents. For example, a systematic review demonstrated that studies reporting on cultural change and involving physicians may lead to a substantial reduction of antipsychotic drug prescribing. [43] It is anticipated that our intervention will lead to reductions in inappropriate psychotropic drug prescribing, the frequency of psychotropic drug use, and the frequency of NPS, as well as to an improvement in residents' QoL. Parallel to the PAR-RCT, a comprehensive process evaluation will be conducted to provide insights into the contribution of the intervention to practice and to identify any barriers to, or facilitators of, implementation.

Methods/design

Design and eligibility

We will use a two-armed cluster RCT with a stepped-wedge design to allow each NH to participate in the intervention phase and to increase the study's power (Figure 1). We expected that recruitment to a classic RCT design would be problematic because half do not receive the intervention, which can be off-putting. A waiting list procedure would also require including more NHs, and we want to avoid this because of the resource-intensive design in terms of time, dedication, and money. In addition to allowing for smaller sample sizes, other advantages of stepped-wedge designs are the possibility to compare both between- and within-cluster effects, as well as the ability to model effects over time. [44]

2

The study duration will be 16 months, split into two 8-month periods. Based on a pilot study, we estimated that the problem analysis for PAR-RCT would take about 2 months. We plan to allow 6 months to implement the chosen interventions because a longer period may lead to a loss of enthusiasm among NH staff, and because we anticipate high turnover rates among residents [5] and staff. [32, 39] The coaching will also be time and cost intensive, and the amount of data collected will require a huge investment from research assistants and NH staff.

Although we believe that 8 months will be optimal for these reasons, we do recognize that it might be insufficient to bring about a change in NH practice. Therefore, we plan to use the stepped-wedge design to compare the 8 month intervention with a 16 month extended intervention that will allow us to study possible long-term effects. Using a computer program, 16 NHs will be randomized by fixed-block randomization into an intervention group or a deferred intervention group (8 NHs each). In Period 1, the intervention group (Figure 1, green blocks) will start by implementing the PAR method, while the deferred intervention group will start with care as usual. After 8 months, Period 2 will start, and the deferred intervention group will start the intervention and the original intervention group will complete a second intervention phase.

The primary outcome will be the reduction of inappropriate psychotropic drug prescribing based on data collected at baseline, 8 months, and 16 months. The statistician will be blinded to the cluster randomization process, and the NH staff and researchers will be aware of their participation group by design. Given that we aim to intervene at the DSCU level and that residents are not directly subject to an intervention, we have no discontinuing criteria, trial stopping rules, or modifying allocations.

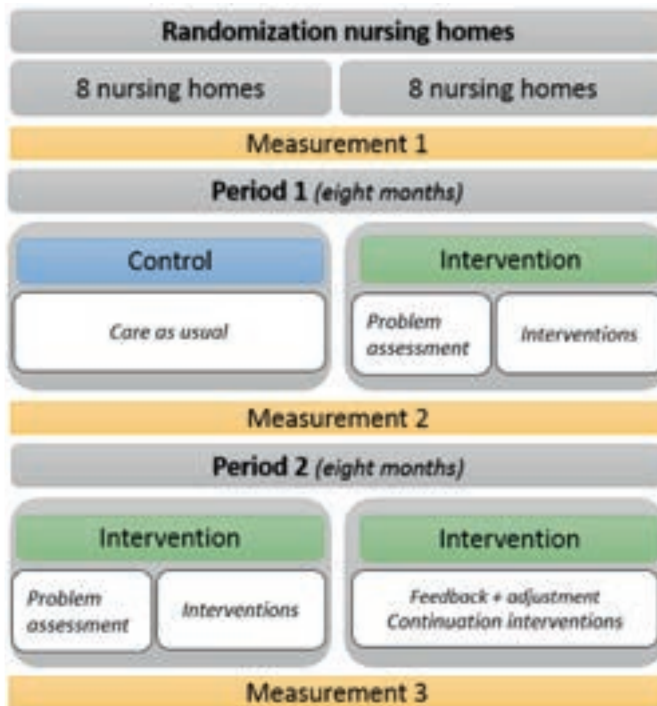

Fig. 1 RID study design. The randomization of nursing homes into start or deferred intervention groups. *Abbreviation: RID, Reducing Inappropriate Psychotropic Drug use*

Study population and recruitment

NHs will be recruited by organizing a national kick-off and using media channels to gain attention. Any interested NHs in the Netherlands can apply to participate and will be considered eligible if the board of directors and the client council agree to participate and are prepared to invest the requisite time. We will exclude NHs in which major organizational changes are expected during the study period or if other projects related to psychotropic drug use are currently running.

The study population will comprise residents with dementia who reside in psychogeriatric units (e.g., DSCUs). NHs can have several DSCUs, and several DSCUs from one NH can participate. However, DSCUs designed to deliver care for residents with Korsakov syndrome, acquired brain injury, Down syndrome, or young-onset dementia will be excluded. Although interventions will be aimed at the DSCU level, we will still need to gather data on residents to assess outcomes. Residents will be eligible to participate if they have a diagnosis of dementia according to the Diagnostic and Statistical Manual of

Mental Disorders (fifth edition), have a life expectancy of at least 3 months, as judged by a physician, and provide written informed consent. We will also include users and nonusers of psychotropic drugs. It is anticipated that most residents will be at an advanced stage of dementia and may be mentally incompetent. The physician of the relevant DSCU will therefore be asked to assess a resident's mental competence to provide informed consent. If they are not deemed competent, an employer of the registry office at each NH will send the informed consent form to a residents' legal representative. In the absence of a response, a reminder request to return the informed consent form will be made once. If no response will be obtained, residents will not be included.

The PAR-RCT study

The PAR-RCT element will involve a cyclic approach of planning, acting, observing, and reflecting (Figure 2). [42] Half of the NHs will complete two cycles (i.e., those in the starting intervention group) and the other half of the NHs will complete one cycle (i.e., the deferred intervention group). Each NH will initially form a multidisciplinary project team (MPT) that will include, as a minimum, an internal project leader, a nursing staff representative, a psychologist, and a physician. An external coach will also participate in the MPT to facilitate the whole process.

The action research cycle will start with the researchers carrying out a problem assessment. We will start with the observation phase because effective interventions should meet the needs identified by staff. [45] This assessment will focus on current daily practice and difficulties managing NPS, including inappropriate psychotropic drug use, and the results will be presented to the MPT. Next, the MPT and the coach will reflect on these results. In this reflection phase, opportunities for improvement will be identified before the MPT moves on to formulate goals to tackle the identified problems. Two expected outcomes are predicted. First, a problem analysis may reveal that the evaluation of psychotropic drugs is inappropriate. In this instance, NHs may opt to pursue a clear work policy between physicians, to clarify the evaluation of psychotropic drugs, or to do medication reviews more frequently. Second, early detection of NPS may be identified as a problem. In this instance, they may recommend e-learning on NPS or implementing the routine use of the Neuropsychiatric Inventory-Nursing Home version (NPI-NH) by nurses for monitoring. How an NH intervenes will be decided by the coach and the MPT, with only indirect input from the researchers. The identified goals will be converted into an intervention and implementation plan. The coach will support this process and the researchers will assess whether the plan aims to reduce inappropriate psychotropic drug use.

Fig. 2 Cyclic approach of the PAR-RCT. Period 1 is shown in black and Period 2 is shown in gray. *Abbreviations, PAR, Participatory action research; RCT, Randomized Controlled Trial*

In summary, the information gained during the problem assessment will be used to formulate and operationalize the goals for the intervention and implementation plan (planning phase), after which NHs will implement the interventions (action phase).

NHs will be provided with a toolkit that contains several multidisciplinary care programs, such as GRIP or PROPER, as well as person-centered psychosocial interventions. The toolkit is a bundle of existing evidence and practices from which NHs can draw. They will befree to implement any intervention, either from the toolkit or elsewhere, provided the selected interventions match the problems identified in managing NPS and psychotropic drug use. Table 1 provides an overview of the toolkit's content. In contrast to traditional PAR, the primary outcome (reduction of inappropriate prescribing of psychotropic drugs) is fixed in our study.

During the implementation phase, the MPT will have regular meetings with the coach to monitor progress (observation phase). At 8months, NHs that start in the intervention group will receive feedback on the level of inappropriate psychotropic drug prescribing. The results of this interim analysis should allow them to reflect on changes in inappropriate prescribing (reflection phase), making it possible to adapt the intervention and implementation plan (planning phase), and act accordingly (action phase). When there is little or no reduction in the rate of inappropriate prescribing of psychotropic drugs, the MPT will be guided to consider choosing different interventions, changing their implementation strategy, or increasing the effort put into implementation.

Table 1 Overview of the eight themes in the toolkit, including examples

1. Leaflets, tips, and explanations	- Collection of stories: *A pill against yelling*
2. Training courses managing NPS	- Alzheimer Experience [a] - E-learning dementia
3. Videos about psychotropic drugs	- Parodies on psychotropic drug use
4. Finding alternatives	- 85 practical alternatives to restraint - The memory suitcase [b]
5. Methods for NPS and depression	- GRIP [c] - STA-OP [d] - Act in case of depression care program
6. Improving prescription policy	- PROPER: structured medication review - Guideline problem behavior
7. Involving residents and relatives	- Digital workbook: tools and materials to improve contact and cooperation between client, caregivers, and family
8. Research, articles, publications	- Dissertation GRIP study - Many articles, guidelines

[a] Film in which the viewer experiences what dementia entails from different perspectives
[b] Nostalgic suitcases full of memories and music, possibly with animation
[c] Multidisciplinary care program for managing challenging behavior
[d] Stepped care protocol for the assessment and management of pain and challenging behavior
Abbreviations: GRIP (study), Grip on challenging behavior; NPS, Neuropsychiatric symptoms; PROPER, PRescription Optimization of Psychotropic drugs in Elderly nuRsing home patients with dementia; STA-OP (study), serial trial intervention for pain and challenging behavior in advanced dementia patients

Coaches will be responsible for the following aspects: (1) advising and supervising the internal project leader and the MPT; (2) being present at meetings of the MPT; (3) advising on the logistical aspects of the research and improvement process in the organization, including problem analysis, planning, multidisciplinary embedding, and sustainability; (4) offering substantive knowledge about psychotropic drugs, inappropriate prescribing, and reducing psychotropic drug use; (5) supporting the organization to get set up; (6) providing access to tools, methodologies, and learning networks; and (7) advising on quality assurance and dissemination of the results. We plan to recruit eight coaches through the Vilans Center of Expertise for Long-term Care, who in turn, will source them internally or through cooperating partners. The coaches must be knowledgeable about dementia and have previous consultation expertise in nursing home organizations.

Each coach will support two NHs. They may spend an average of 3 h per week with an NH over each 8-month intervention period. The 8 NHs that start in the intervention group and have an extended intervention duration will only receive coaching in the

first 8 months, which will end after discussing the interim results. It is expected that time-intensive weeks will be compensated for by weeks in which little to no input is needed. Coaches will not be required to use all allocated hours, and the actual time spent with each NH is to be determined in consultation with the relevant MPT. The coaches will be asked to keep a logbook in which they will be asked to write down the number of hours spent on coaching, any agreements made with the NH, and other findings they consider relevant. They will also participate in monthly supervision sessions, led by a trainer at Utrecht University. The aim of these sessions is to discuss any difficulties experienced, to find suitable solutions, and for coaches to exchange tips. The extent to which a coach succeed will be addressed in the process evaluation.

Process evaluation

It is essential for credibility that researchers acquire information about the quality of an intervention and its implementation in a given study. [46, 47] Leontjevas et al. (2012) proposed a process evaluation model based on first- and second-order data, which we will adopt in this study. The first-order data provide information about the internal and external validity, comprising of the sample quality (e.g., recruitment, randomization, and reach) and the intervention quality (e.g., relevance, feasibility, and extent to which an intervention was performed). The second-order data are then examined (implementation knowledge), such as implementation components that were delivered and received and the barriers to, and facilitators of, implementation. The internal project leader and coach will each receive a digital questionnaire to assess these aspects. We will follow this up with a semi-structured telephone interview to address ambiguities and to seek additional comments.

Measurements

An overview of the outcomes and measurement instruments is provided in Table 2. Demographic data will be extracted from medical files by the researchers, including residents' age, sex, type of dementia, pro re nata psychotropic drug use, date of last medication review, and date of admission to the DSCU. Cognitive abilities will be examined using the Cognitive Performance Scale (CPS), a reliable and valid scale that rates cognition, communication, activities of daily living and consciousness from 0 (intact) to 6 (very severe impairment). [48] The instrument has a sensitivity and specificity of 0.94 and has been validated against the Mini Mental State Examination. [49] The CPS will be used by nursing staff, on paper, in the presence of a researcher.

Primary outcome

Psychotropic drugs will be categorized according to the Anatomical Therapeutic chemical (ATC) classification. [50] The primary outcome is the appropriateness of psychotropic drug use, and this will be measured with the Appropriateness of Psychotropic drug use In Dementia (APID) index. [23] This index rates the prescription of regular psychotropic drugs for NPS in people with dementia, including antipsychotic, anxiolytic, hypnotic, antidepressant, anticonvulsant, and anti-dementia drugs. Psychotropic drugs administered for dementia, sleep disturbance, and delirium will be scored with the APID index, but those prescribed for psychiatric disorders will not be scored. Treatment appropriateness will be measured on seven domains: indication, evaluation, dosage, drug-drug interactions, drug-disease interactions, duplications, and therapy duration. For each domain, a score between zero (appropriate) and two (inappropriate) can be given, allowing an overall appropriateness score to be calculated (weighted sum score). The APID has been validated in residents of DSCUs in the Netherlands (intraclass correlation coefficient, 0.577–1.000). [23] The researchers will extract information on psychotropic drug prescribing from medical records.

Secondary outcomes

The secondary outcomes will be the frequency of psychotropic drug use, the frequency of NPS, and the QoL. The frequency of psychotropic drug use will be extracted by the researchers from medical files, and NPS and QoL will be assessed by nursing staff on paper, in the presence of a researcher. Proxy measures of NPS and QoL (nurse assessments) will be used on the assumption that residents lack capacity. NPS will be measured with the NPI-NH and the Cohen–Mansfield Agitation Inventory (CMAI). QoL will be measured using the visual analog scale (VAS) of the EQ. 5D (i.e., the EQ-VAS).

The NPI-NH measures the prevalence, frequency, severity, and associated caregiver distress of 12 neuropsychiatric symptoms. All symptoms are rated on Likert-type scales, with four-point scales used for frequency, three point scales used for severity, and six-point scales used for caregiver distress. When a symptom is not present, the frequency, severity, and caregiver distress are not scored. [51]

Table 2 Overview of the measurement instruments

Variable	*Measurement instrument*	*Outcome measure*	*Problem analysis/ feedback MPT*
Inappropriate psychotropic drug use	APID	Primary outcome	Problem analysis + feedback 8 and 16 months [a]
Frequency psychotropic drug use	Retrieval from medical records	Secondary outcome	Problem analysis + feedback 8 and 16 months [a]
NPS	NPI-NH	Secondary outcome	-
	CMAI		Problem analysis
QoL	EQ-VAS [b]	Secondary outcome	Problem analysis
	RISE		-
Current difficulties managing NPS; *NH staff*	Self-designed questionnaire [digital] + semi-structured interviews for NH staff	-	Problem analysis
Current status of managing NPS and quality of care; *relatives*	Self-designed questionnaire for relatives	-	Problem analysis
Attitude toward new interventions	EBPAS [digital] [c]	Process evaluation	Problem analysis
Organizational culture	Questionnaire [digital] *CVF scale for long-term care* [c]	Process evaluation	Problem analysis
Process evaluation data *model of Leontjevas et al., 2012*	Self-designed questionnaire [digital] + semi-structured interview internal project leader and coach	Process evaluation	-

[a] NHs who start as an intervention group receive information on psychotropic drug use at the beginning (problem assessment), 8 months (interim results) and 16 months. NHs who start as a deferred intervention group receive information on psychotropic drug use at 8- (problem assessment) and 16 months.

[b] EQ-VAS is administered to both nursing staff and relatives, at each measurement (0, 8, 16 months).

[c] The EBPAS + organization culture questionnaires are administered in the context of the problem assessment at 0 months (start intervention group) or 8 months (start deferred intervention group), as well as at 16 months in the context of the process evaluation.

Abbreviations: APID, Appropriateness of Psychotropic Prescription in Dementia; CMAI, Cohen–Mansfield Agitation Inventory; CPS, Cognitive Performance Scale; CVF, Competing Values Framework; EBPAS, Evidence-Based Practice Attitude Scale; MPT, Multidisciplinary project team; NPS, neuropsychiatric symptoms; NH, Nursing homes; NPI-NH, Neuropsychiatric Inventory-Nursing Home; QoL, Quality of Life; RISE, Revised Index of Social Engagement; VAS, Visual analog scale.

We plan to use the Dutch version of the NPI-NH, which has demonstrated high inter-rater agreement and validity as a rating scale. [52]

The CMAI is the most used tool for determining the frequency of agitation and aggression. [53] The CMAI consists of 29 items, subdivided into three subscales: physical aggression, physically nonaggressive behavior, and verbally agitated behavior. Scores are rated on seven-point Likert-type scales, rating symptoms over the preceding 2 weeks from "never" to "several times an hour". [54] The translated and validated Dutch version by De Jonghe and Kat (1996) will be used, which has established reliability (Cronbach's α = 0.82) and construct validity (Inter-rater agreement = 0.89). [55–57]

The EQ-VAS records a respondent's self-rated health on a vertical scale ranging from "best imaginable health state" to "worst imaginable health state". [58] In our study, we will use the two proxy-versions of the EQVAS reported in a previous Dutch study. [59] Nursing staff and family members will be asked to rate the residents' QoL and health status, both from their own perspective and from the perspective of the resident. In addition, the social engagement of residents will be measured as an important proxy of QoL, using the Revised Index of Social Engagement (RISE). [60] The RISE is part of the inter-RAI Long-Term Care Facilities Assessment System and consists of six dichotomous items related to social behavior. [61-63] Its reported reliability and validity are considered sufficient. [60]

Measurements problem assessment

We will gather information on inappropriate psychotropic drug prescribing, frequency of psychotropic drug use, NPS frequency, and QoL. Also, we will analyze current difficulties in managing NPS using a self-designed, digital questionnaire for NH staff (i.e., physicians, psychologists, and nurses) to assess the following: (1) the detection, analysis, treatment, and evaluation of NPS, and (2), efforts to prevent NPS, any views about NPS, and the presence of multidisciplinary cooperation. The questionnaire will not be used to measure an outcome; instead, it will only be used to examine problems that NH staff perceive when dealing with NPS and inappropriate psychotropic drug prescribing. Scores will be rated on four-point Likert-type scales ranging from "never/rarely" to "at all times" for the frequency measure, and from "not satisfied" to "very satisfied" for the extent of satisfaction. The questionnaire has been piloted in two NHs and adjusted based on user experiences.

To gain a more in-depth insight into the processes that play a role in managing NPS and the prescription of psychotropic drugs, researchers (CGK, CvT) will conduct several

semi-structured interviews with members of the MPT (e.g., physicians, psychologists, nursing staff, and managers). Several interviews were trialed in a pilot study at two NHs, and the interview formats have been adjusted according to user experience.

We also plan to address the attitudes of health care staff toward the use of new interventions or treatments. Values and beliefs on these issues influence the degree to which innovations are initiated and implemented in clinical practice, [64-66] and considering the attitudes of professionals toward adopting new interventions can facilitate implementation. [67] Therefore, we will administer the Evidence-Based Practice Attitude Scale (EBPAS) developed by Aarons in 2004. This scale consists of four subscales for 15 items that are measured on five-point Likert scales, ranging from 0 (not at all) to 4 (to a very great extent). The EBPAS assesses the extent to which a professional (1) finds the intervention intuitively appealing, (2) would adopt an intervention if required by a supervisor, (3) has a general openness to trying new interventions, and (4) perceives interventions as being of limited clinical value and less important than clinical experience. We will use the Dutch version, for which the factor structure and reliability are comparable to the original version. [68]

Furthermore, the organizational culture of the DSCUs will be assessed using a Competing Values Framework (CVF) scale. [69] This involves a questionnaire that consists of 24 items on four-point Likert-type scales, ranging from 1 (not characteristic) to 4 (very characteristic). It aims to provide insight into the cooperation between staff members and the working conditions and characteristics of the DSCU, and it suggests either a dominant culture type, a market type, an adhocracy type, or a hierarchy culture type. We will use a Dutch version of the questionnaire. [70]

Both the EBPAS and the CVF scale will also be administered in the process evaluation, and they will be sent digitally to NH staff. Finally, a self-designed paper and pencil questionnaire will be used to assess the opinion of family members regarding the delivered care and degree of communication received with respect to NPS and/or psychotropic drug use.

Sample size

For our primary outcome, we aim to detect a reduction in inappropriate psychotropic drug prescribing of 5 points minimum (standard deviation = 15) on the APID index from the baseline to the final measurement (16 months). [23, 71] We expect that APID values will be nested within NHs, the main level of randomization in our design. Assuming an average size of 25 residents per NH, a power of 0.80, a significance

level (alpha) of 0.05, we will need 284 psychotropic drug users. Given the multilevel design with two measurements after baseline, we anticipate that we will then need to increase this to a sample size of 364 (15 clusters) for an intraclass correlation coefficient of 0.1 [44] and a calculated design factor of 1.28 (the factor at which the original N has to multiplied). To allow for a cluster dropout of about 10%, [72] and to obtain an even number of clusters, we plan to include 16 clusters with 364 residents in total. Given that approximately 60% of residents with dementia will be prescribed psychotropic drugs, [20] this number will need to be further increased to 607 residents. Previous studies have shown that we can also anticipate a loss to follow-up of about 30% per year, [5] which would amount to 40% in the 16 months in our study. However, in the event a resident dies or moves away from the unit, we will enroll the newly admitted resident, precluding the need to account further for attrition. Consequently, the case mix during our study will vary, and information from dropouts will need to be included in an intention to treat analysis.

Data analysis

Primarily, we will examine results between both arms; the intervention group and the control group. Secondarily, we will examine results between the short intervention duration (8 months) and the long intervention duration (16 months). All data will be entered in a secured digital data management program. After collection, the data will be checked for outliers and extracted into a statistical software package. Descriptive statistics will be used to compare the baseline data between groups. A multilevel model will then be used to study the effects of a tailored intervention and implementation plan on reducing inappropriate psychotropic drug prescribing, based on the methods described by Twisk. [73] This model will be used for both the primary and secondary outcomes to account for the dependency of information due to the repeated measurements and cluster randomization. A restricted iterative generalized least squares algorithm will be used to estimate the regression coefficients, and the Wald test will be used to obtain a P value for each regression coefficient. Models will include a fixed and a random intercept.

Analyses will be adjusted for baseline outcome values (e.g., inappropriate psychotropic drug prescribing and NPS), time, and confounders (e.g., cognitive abilities, as measured with the CPS, type of dementia, distress in nurses due to NPS). We will adjust for factors that could explain why an intervention did not succeed at the team level (e.g., staff attitudes toward the use of new interventions or treatments, as measured by the EBPAS, and the cooperation between staff

members, the working conditions and characteristics of the DSCU, as measured by the CVF scale). Possible interaction effects of the intervention with time and with an NH will also be investigated. Sensitivity analyses will be used to examine differences between NHs with respect to extent of performance, considering whether degree of implementation (such as more coaching) is associated with a greater reduction of inappropriate prescribing or whether attitude serves as an effect modifier. When indicated, subgroup analyses will be used to consider NHs that implement their plans unsuccessfully and NHs that implement their plans successfully. We will also conduct a missing value analysis to evaluate whether missing data are likely to be missing at random, and we will consider replacement if appropriate. Normal probability plots and plots of standardized residuals versus predicted values will be inspected to assess whether the assumptions of normality and homogeneity of variance are met. In the event of noncompliance, data transformation will be considered. The double ratings of QoL and health status, as perceived by nursing staff and family members, will be analyzed separately. Data from the process evaluation interviews will be examined in the content analysis and any barriers and facilitators will be analyzed according to the Consolidated Framework For Implementation Research. [74]

Discussion

To the best of our knowledge, no study has used a PAR-RCT design to examine the effect of a tailored intervention and implementation plan on the reduction of inappropriate psychotropic drug prescribing for NH residents with dementia. We consider the study design to be a strength of this proposal because active participation of NH staff (those most involved in the care process) is most likely to engender engagement and intervention suitability in the long-term. [41] In addition, the use of coaching should ensure that implementation conditions are optimal by ensuring that close attention is paid to the local NH context, including staff commitment. [40]

We anticipate that the results of our study will provide evidence for the effectiveness of a tailored intervention and implementation plan. Additionally, the results should offer insights into the issues surrounding the implementation of complex interventions in NHs, including relevant barriers and facilitators, which can be accounted for in future implementation processes. The use of a stepped-wedge design offers several advantages, such as the possibility of between- and within-group analyses, increased study power, and of comparing long- and short-term intervention durations. [44] Given that the design also ensures that each NH receives

the intervention, unlike in a standard RCT with a regular control group that does not receive the intervention, we also anticipate that this will enhance motivation in the participating NHs. [75]

A few limitations also warrant mention, such as NHs not being randomly selected and participation being on a voluntary basis, which could introduce selection bias. NHs and researchers will also be aware of the condition (deferred intervention or intervention), which might increase the likelihood of bias. In our sample size calculation, we use an effect size of 5 points on a scale ranging from 0 to 102.8. Although this was required to show a significant effect in favor of the intervention group in an earlier study, there is insufficient literature to determine whether this is clinically relevant. The APID index measures the appropriateness of psychotropic drug use based on medical records, and its “indication” and “evaluation” items have low inter-rater agreement, largely due to bias in medical record extraction. In addition, scoring the APID index can be affected by the quality of reporting. Suboptimal recordkeeping, such as not reporting an indication, could influence the score. Keeping medical files up to date is therefore essential for accurate judging of the appropriateness of prescribing. [23]

Other limitations include the difficulty inherent to examining the effect of an implemented intervention. In the tailored intervention and implementation plan with coaching, we can only evaluate the PAR-RCT design as a whole to help local practice with current knowledge tailored to specific needs. We will be unable to state whether an intervention in NH “A” (e.g., GRIP) was more or less effective than that in NH “B” (e.g., medication review), because each NH will be at liberty to choose its own interventions. At best, the sensitivity analyses will be able to show whether the degree of implementation (e.g., more coaching) was associated with a greater reduction in inappropriate psychotropic drug prescribing or whether attitudes better serve as an effect modifier. Also, secondary outcomes (e.g., NPS and QoL) will be measured based on proxy reports by nursing staff, which may be less reliable than direct measures. To account for this, we will use common observation scales for NPS (e.g., the NPI-NH and CMAI). Reporting bias may also occur for the QoL measures. [75] Therefore, to enhance the credibility of the results in these domains, only NH staff who are frequently involved in the daily care of a given resident will be asked to complete the questionnaires.

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CHAPTER 3

Systematic review on barriers and facilitators of complex interventions for residents with dementia in long-term care

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Abstract

Objectives: Psychotropic drugs are frequently and sometimes inappropriately used for the treatment of neuropsychiatric symptoms of people with dementia, despite their limited efficacy and side effects. Interventions to address neuropsychiatric symptoms and psychotropic drug use are multifactorial and often multidisciplinary. Suboptimal implementation of these complex interventions often limits their effectiveness. This systematic review provides an overview of barriers and facilitators influencing the implementation of complex interventions targeting neuropsychiatric symptoms and psychotropic drug use in long-term care.

Design: To identify relevant studies, the following electronic databases were searched between 28 May and 4 June: PubMed, Web of Science, PsycINFO, Cochrane, and CINAHL. Two reviewers systematically reviewed the literature, and the quality of the included studies was assessed using the Critical Appraisal Skills Programme qualitative checklist. The frequency of barriers and facilitators was addressed, followed by deductive thematic analysis describing their positive of negative influence. The Consolidated Framework for Implementation Research guided data synthesis.

Results: Fifteen studies were included, using mostly a combination of intervention types and care programs, as well as different implementation strategies. Key factors to successful implementation included strong leadership, and support of champions. Also, communication and coordination between disciplines, management support, sufficient resources, and culture (e.g. openness to change) influenced implementation positively. Barriers related mostly to unstable organizations, such as renovations to facility, changes towards self-directed teams, high staff turnover, and perceived work and time pressures.

Conclusions: Implementation is complex and needs to be tailored to the specific needs and characteristics of the organization in question. Champions should be carefully chosen and the application of learned actions and knowledge into practice is expected to further improve implementation.

Introduction

The prevalence of neuropsychiatric symptoms (NPS) associated with dementia is high. Over 80% of people with dementia in nursing homes (NHs) exhibit NPS (Selbæk et al., 2013). The treatment of NPS often consists of the prescription of psychotropic drugs (Cornegé-Blokland et al., 2012; Nijk et al., 2009; Selbaek et al., 2007; Wetzels et al., 2011), despite concerns about their limited efficacy (Seitz et al., 2013; Sink et al, 2005; Zuidema et al., 2007) and side effects (Zuidema et al., 2006). Hence, non-pharmacological interventions are recommended as a first-line treatment for managing NPS.

NPS are the result of interactions of biological, psychological, social and physical environmental factors (Cohen-Mansfield, 2000; Steinberg et al., 2006; Zuidema et al., 2010). Complex, multicomponent interventions seem to be the most appropriate approach to address these, given the multifactorial origin of NPS. Complex interventions comprise multiple interacting components, and are characterized by the number and difficulty of behaviors required by those delivering or receiving the intervention, the number of groups or organizational levels targeted by the intervention, the number and variability of outcomes and the degree of flexibility or tailoring of the intervention permitted (Craig et al., 2013).

Although complex interventions have the potential to reduce inappropriate prescribing of antipsychotic drugs in NHs (Livingston et al., 2017; Thompson Coon et al., 2014), these interventions commonly show small to modest effects (O'Connor et al., 2009; Quasdorf et al., 2016; Zwijsen et al., 2014a), which often reflects suboptimal implementation rather than shortcomings of the implemented intervention (Anderson et al., 2013; Craig et al., 2013).

To examine barriers and facilitators influencing the implementation of complex interventions for people with dementia in long-term care, we reviewed literature on process evaluations, qualitative studies and (cluster) randomized controlled trials targeting NPS and/or psychotropic drug use (PDU). By assembling knowledge about factors influencing implementation of complex interventions, effectiveness of interventions can be maximized, and translating results into practice is enabled which in turn enhances widespread implementation (Craig et al., 2013; Lawrence et al., 2012; Thompson Coon et al.,2014; Quasdorf et al., 2016; Zwijsen et al., 2014b).

Methods

Eligibility Criteria

A predefined protocol was developed and registered on PROSPERO (CRD42018112731), on November 9, 2018, and is available in full on the National Institute for Health Research website: https://www.crd.york.ac.uk/prospero/ (Groot Kormelinck et al., 2018).

Types of studies

We included process evaluations, qualitative studies (that may include quantitative process data) and (cluster) RCT studies that reported barriers and facilitators affecting the implementation of complex interventions targeting NPS/PDU for residents with dementia in long-term care. Systematic reviews or studies not being published in peer-reviewed journals were excluded.

Types of interventions

This review was limited to studies targeting implementation barriers and facilitators of complex interventions aimed at PDU (antipsychotics, anxiolytics, hypnotics, antidepressants, anticonvulsants, anti-dementia drugs) and/or NPS (umbrella term, or at least one symptom). We defined a complex intervention as introduced by Craig *et al.* (2013, p.588): ''multiple interacting components, a certain number and difficulty of behavior of those delivering or receiving the intervention, the number of groups or organizational levels the intervention targets, the number and variability of outcomes and the degree of flexibility or tailoring of the intervention permitted''.

Search

Electronic databases were searched to identify relevant studies. The search was applied to PubMed, Web of Science, PsycINFO, Cochrane, and CINAHL. Searches were run between 28 May and 4 June 2018. No publication date restrictions were imposed. Studies published in English, German and French were eligible for inclusion. Key search terms related to institution; outcome (barriers, facilitators); and psychotropic drugs or NPS. For full search strategy, see Appendix A1, published as supplementary material online.

Study Selection Method

Two reviewers (CMGK and SIMJ) independently screened titles and abstracts, and selected potentially relevant articles for full-text review. Duplicates were removed using reference manager software (Refworks), after which two reviewers independently reviewed the full text for in- or exclusion. Reviewer findings were

compared during the screening process, with disagreements being resolved by involvement of a third reviewer.

Data Extraction

We used a pre-designed data extraction sheet, which was piloted on several articles before actual use and refined it accordingly. One reviewer extracted data (CMGK), which was checked by a second (SIMJ). Additional reviewers were involved to reach consensus in the case of disagreement. Data that were extracted included: setting, study aim, type -, content-, and results of intervention, implementation method, data collection method, method of analysis, data collection moment, and implementation barriers and facilitators.

Study Quality

The methodological quality of each study was assessed using the Critical Appraisal Skills Programme qualitative checklist (Critical Appraisal Skills Programme, 2017). The quality of the studies was appraised by one reviewer (CMGK) and scores were checked by a second (SIMJ). Disagreements were resolved by discussion. Papers were not excluded based on quality. Instead, quality of studies is addressed in the discussion section.

Data Synthesis

Each barrier or facilitator was given a code, using Atlas.ti 8.3. The Consolidated Framework for Implementation Research (CFIR) was used to guide data synthesis, following a deductive approach. The CFIR is a comprehensive, 'meta-theoretical' framework. The standardized list of constructs allows researchers to identify variables that are most relevant to a particular intervention (Damschroder et al., 2009). The codes were subdivided into the five domains of the CFIR framework: intervention characteristics, outer setting, inner setting, characteristics of individuals, and process. We kept in mind the possibility that codes might not fit the CFIR.

The importance of the barrier/facilitator was addressed by gaining insight into their frequency. Deductive thematic analysis was used to assess a factor's positive or negative influence (Elo and Kyngäs, 2008; Hsieh and Shannon, 2005).

Two reviewers (SIMJ and CMGK) independently coded four studies and findings were compared and discussed. After this, one reviewer (CMGK) continued with coding the other studies. The coding of each study was discussed by both reviewers to reach agreement. The other reviewers were involved to obtain consensus in case of disagreements.

Results

Study Selection

The search of all the databases yielded 4734 records of which 15 studies were included. See Preferred Reporting Items for Systematic Reviews and Meta-analysis flow for application of eligibility criteria (Figure 1).

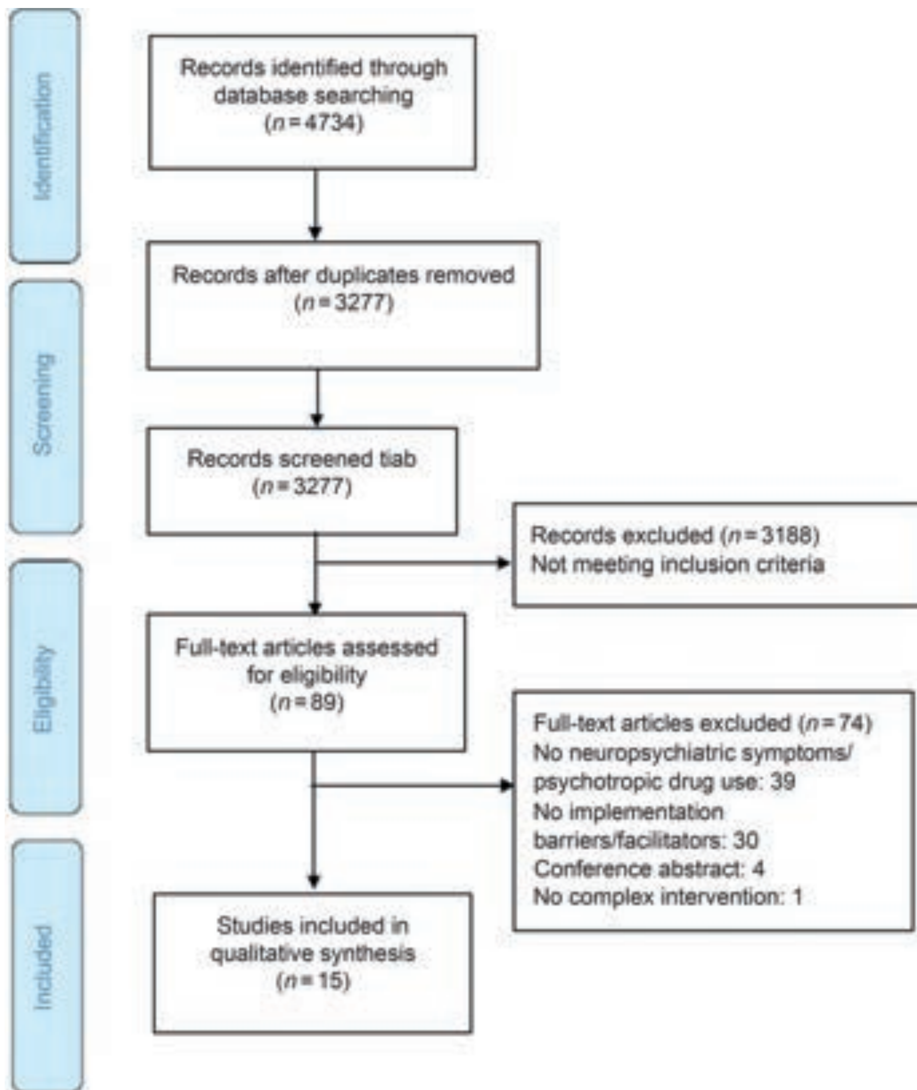

Figure 1. Flowchart of study selection process.

Study Characteristics

Table 1 presents the study characteristics. With the exception of one German study, all studies were published in English. Studies were carried out in Australia (n = 2), Canada (n = 2), the United States (n = 1), the United Kingdom (n = 3), Norway (n = 1), Germany (n = 2), and the Netherlands (n = 4). The majority of the studies were qualitative (process) evaluations, sometimes combined with quantitative data. Most studies pertained to residents with dementia in NHs, residential aged care facilities, or long-term care homes. We identified four types of interventions, often combined: 1) managing NPS by methodical and multidisciplinary collaboration (n = 10); 2) psychosocial interventions tailored to the resident or person-centered care (PCC) approaches (n = 9); 3) training and education (n = 2); and 4) an activity or exercise program (n = 2). Several implementation strategies were used, such as coaching on the job, follow-up meetings, sharing experiences, and telephone support. Multiple methods of data collection were used, amongst others questionnaires, focus groups, and individual interviews. Most studies applied triangulation to enhance credibility of findings. A range of stakeholders provided the data on implementation factors, mostly being staff, managers, and/or project coordinators.

Study Quality

Table 2 provides a detailed overview of the quality assessments of the studies. On a scale from 0 to 10 (the higher the more quality), five studies scored 5 to 7 points (Borbasi et al., 2011; Kovach et al., 2008; McAiney et al., 2007; Stein-Parbury et al., 2012; Wingenfeld et al., 2011), and ten studies scored 8 to 10 points (Appelhof et al., 2018; Boersma et al., 2016; Bourbonnais et al., 2018; Ellard et al., 2014; Van Haeften-Van Dijk et al., 2015; Latham and Brooker, 2017; Lawrence et al., 2016; Mekki et al., 2017; Quasdorf et al., 2016; Zwijsen et al., 2014b).

Barriers and Facilitators

The barriers and facilitators reported in the studies were grouped according to the five domains and 36 constructs of the CFIR. All codes fitted within the CFIR. Table 3 shows the frequency with which the CFIR constructs were addressed and provides an overview of the CFIR constructs pertaining to the individual studies. A short description of each construct can be found in Table S1, published as supplementary material online.

Table 1. Characteristics of included studies

Author	**Aim intervention + setting**	**Country + study design**	**Type***	**Results intervention**	**Implementation method**	**Data collection method**	**Method analysis**	**Moment**
Appelhof, 2018	Effect intervention based on “Grip on Challenging Behavior” care program on prevalence of NPS, PDU, workload, absenteeism, job satisfaction of NH staff delivering specialized treatment + support for residents with young-onset dementia.	Netherlands, process evaluation	1	No differences in agitation, aggression, NPS, PDU.	Educational program, training, champions supporting implementation.	Open-ended questionnaire.	Deductive content analysis.	Pre, during, post.
Boersma, 2016	Veder contact method: combines elements from psychosocial and PC interventions with theatrical, poetic, musical communication into daily care to improve communication, reciprocity in contact, QoL, behavior, identity, self-esteem for people with dementia in NHs. Adapted version.	Netherlands, qualitative process analysis with multiple cases	2	Original method: positive effect QoL, mood, behavior; only performed by actors not nurses.	Training and coaching, team meetings + follow up, feedback, coaching on the job, program evaluation.	Focus groups + interviews.	Deductive + inductive.	Post.
Borbasi, 2011	Dementia Outreach Service. Implementation of tailored interventions in aged care facilities suited to resident’s needs. Aim: increased QoL, reduction inappropriate referrals to other services, improved management of BPSD, increased capacity + clinical skills of staff.	Australia, evaluation of quantitative & qualitative data	1+2	Increased self-confidence dealing with residents. Reduction stress, referrals, difficult behaviors.	NP, clinical facilitator, social worker, administrative assistant. Coaching, educational material, face-to-face instruction.	Focus groups, interviews, reflective journals.	Open coding.	Post.
Bourbonnais, 2018	Development and implementation of individualized interventions based on meanings of screams of older people with Alzheimer’s disease or related disorder in NHs. Assessing strategies useful in implementing complex intervention.	Canada, qualitative pilot using action research	1+2	Unknown (in press).	Local leaders, training, workshop, study coordinators; monitoring obstacles.	Focus groups, interviews.	Content analysis, inductive.	During.

Table 1. *(continued)*

Author	**Aim intervention + setting**	**Country + study design**	**Type***	**Results intervention**	**Implementation method**	**Data collection method**	**Method analysis**	**Moment**
McAiney, 2007	Gain knowledge for assessing and managing older person's complex physical and mental health needs + associated behaviors in long term care homes. Learning strategy (Intensive program/ core curriculum) to develop role of in-house resource psychogeriatric person and Team.	Canada, evaluation of quantitative data	3	Increased ability to use assessment tools, recognize + understand challenging behaviors, mental health problems.	Active participation, sharing experiences, homework, ongoing evaluation, leadership support, educator team, post-education.	Evaluation survey.	Quanti-tative.	Post.
Kovach, 2008	Serial Trial Intervention: assessing and treating unmet needs of people with advanced dementia in NHs who not report needs verbally. Goal: to improve assessment + treatment of pain, to identify changes in behavior, appropriate use of PDs.	US, feasibility study, pilot	1	Less discomfort, behavior to baseline, broader scope physical + affective assessment, more pharmacological comfort treatments.	1 day training for nursing staff, follow up meetings. Feedback on changes in care.	Survey; open-ended questions.	Unknown	Post
Ellard, 2014	Older People's Exercise intervention in Residential and nursing Accommodation: training for staff with twice-weekly, physiotherapist-led exercise classes on depressive symptoms in care home residents.	UK, process evaluation, mixed methods	4	No effect on prevalence or incidence of depression.	A home 'champion'.	Interviews, focus groups, observation.	Thematic analysis.	Post.
Latham, 2017	Focused Intervention Training and Support program for care home staff. Aim: reducing inappropriate anti-psychotic prescribing for people with dementia by implementing psychosocial interventions. Adapted programme of original trial: using lower level of resources.	UK, mixed methods eval-uation, in-depth case studies	1+2+3	Reduction anti-psychotic prescribing.	Supervision, expert + peer support, sharing experiences, coaching.	Interviews, reflective diaries.	Inductive, thematic analysis.	During and post.

Table 1. *(continued)*

Author	**Aim intervention + setting**	**Country + study design**	**Type***	**Results intervention**	**Implementation method**	**Data collection method**	**Method analysis**	**Moment**
Lawrence, 2016	Training in PCC, antipsychotic review, social interaction and pleasant events + exercise. Aim: to improve mental health and reduce sedative drug use for people with dementia in long term care homes.	UK, qualitative study part of cRCT	2+4	Unknown.	Trained therapists for delivery of intervention. Champions, coaching and supervision.	Focus groups.	Thematic analysis.	Pre.
Mekki, 2017	The Modelling and Evaluating eviDence-based Continuing Education program. Increased understanding of PCC, dementia and agitation would help NH staff to find PC and confidence-building alternatives to the use of restraint and PDs.	Norway, qualitative exploratory study in cRCT	1+2	Use of restraint reduced in intervention + control group. Reduction CMAI score.	2 external facilitators delivering intervention: 2-day seminar, 6 monthly coaching sessions.	Focus group, field studie, notes, workshop.	Herme-neutic, co-analysis.	Post.
Quasdorf, 2017	DCM: multicomponent method to develop PCC practice at various levels of the NH. Standardised observation of residents' well-being, cyclic approach.	Germany, Process eval-uation, conver-gent parallel mixed methods in quasi-experi-mental trial	1+2	No effect on QoL or challenging behavior.	Project coordinator, qualified trainer (intervention) + nursing manager (control).	Interviews, report/e-mails, questionnaire.	Deductive, descriptive statistics.	Pre, during, post.
Stein-Parbury, 2012	CADRES: compared the effectiveness of PCC, DCM and usual care on reducing agitation in residential settings for people with dementia.	Australia, evaluation in cRCT study	1+2	PCC cost-effective of reducing level of agitation.	Champions, site visits, telephone support.	Evaluations, open-ended questions.	Unkown.	During and post.

Table 1. *(continued)*

Author	**Aim intervention + setting**	**Country + study design**	**Type***	**Results intervention**	**Implementation method**	**Data collection method**	**Method analysis**	**Moment**
Van Haeften, 2015	Veder method; Care staff trained to apply theatrical stimuli combined with PC communication for people with dementia in NHs. Aim: improve reciprocity in interaction, positively influence behavior, mood, QoL + enhance work satisfaction of care staff.	Netherlands, qualitative process evaluation	2	Positive effects on behavior, mood and quality of life.	On-the-job coaching,feedback, refresher days, consultation, sharing experiences, knowledge transfer.	Interviews, focus groups.	Deductive + inductive.	Pre, during, post.
Wingenfeld, 2011	Complex intervention developed to prevent disruptive behavior of reisdents with dementia in NHs, without using restrictive means. 5 steps for NH staff (assessment, aim, intervention, process, evaluation).	Germany, experiences & utilization, part of prospective controlled study	1	Problem behavior decreased more in intervention group.	Training by researchers.	Interviews.	Unknown.	Post.
Zwijsen et al., 2014 b	Grip on Challenging Behavior: stepwise, structured approach to manage challenging behavior for residents with dementia in NHs. Aim: decrease in challenging behavior + in prescription of PDU without increase in use of restraints.	Netherlands, process eval-uation along-side cRCT effect study	1	Diminished some forms of challenging behavior + use of PDU.	Training, telephone + email support. Evaluation sessions, tailored communiction.	Digital questionnaire, interviews.	Directed content analysis.	Post.

Overview of the aim and setting, type and results of intervention, implementation method, data collection method, analysis, and moment of data collection.

* Intervention type: 1= methodical/multidisciplinary collaboration; 2 = tailored psychosocial interventions/PCC; 3= training and education; 4= activity or exercise program.

Abbreviations: BPSD, behavioral psychological symptoms dementia; CADRES, Caring for Aged Dementia Care Resident Study; CMAI, Cohen-Mansfield Agitation Inventory; cRCT, cluster Randomized Controlled Trial; DCM, Dementia Care Mapping; NPS, neuropsychiatric symptoms; NP, nurse practitioner; NH, nursing home; PC(C), person centered (care); PDs, psychotropic drugs; PDU, psychotropic drug use; QoL, Quality of Life; UK, United Kingdom; US, United States.

Table 2. Indicators of study quality

Author	Clear statement of aim	Qualitative methodology	Design	Recruitment strategy	Data collection	Relationship researcher/ participants	Ethical issues	Data analysis	Findings	Value
Appelhof, 2018	✓	✓	✓	?	✓	✗	✓	✓	✓	✓
Boersma, 2016	✓	✓	✓	?	✓	✓	✓	✓	✓	✓
Borbasi, 2011	✓	✓	✓	✗	✓	✗	✓	?	✓	✓
Bourbonnais, 2018	✓	✓	✓	?	✓	✗	✓	✓	✓	✓
McAiney, 2007*	✓	N.A.	✓	✓	✓	N.A.	✗	✓	✓	✓
Kovach, 2008	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓
Ellard, 2014	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
Latham, 2017	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lawrence, 2016	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
Mekki, 2017	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Quasdorf, 2017	✓	✓	✓	✓	✓	?	✓	✓	✓	✓
Stein-Parbury, 2012	✓	✓	✗	✗	✗	✗	✓	✗	✓	✓
Van Haeften, 2015	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
Wingenfeld, 2011	✓	✓	✓	✗	✗	✗	✗	✗	✓	✓
Zwijsen et al., 2014[b]	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓

Including study aim, qualitative methodology, design, recruitment strategy, data collection, relationship researcher/participants, ethical issues, data analysis, findings, and value.

* McAiney, 2007. This study is quantitative. Therefore, the two fields are scored as N.A. These fields are considered not relevant in this type of study.

Table 3. Count of CFIR constructs and overview of individual studies

		Appelhof	Boersma	Borbasi	Bourbonnais	Ellard	Van Haeften	Kovach	Latham	Lawrence	McAiney	Mekki	Quasdorf	Stein-Parbury	Wingenfeld	Zwijsen et al., 2014b	# of studies
Intervention Characteristics	Intervention Source																0
	Evidence Strength & Quality																0
	Relative Advantage	X	X		X	X	X			X							6
	Adaptability				X		X					X					3
	Trialability																0
	Complexity		X		X		X	X	X		X		X	X	X	X	10
	Design Quality & Packaging																0
	Cost	X	X				X				X						4
Outer Setting	Patient Needs & Resources		X														1
	Cosmopolitanism																0
	Peer Pressure																0
	External Policy & Incentives						X										1
Inner Setting	Structural Characteristics	X	X		X	X	X		X				X			X	8
	Networks & Communications	X	X		X	X	X	X	X	X		X	X	X		X	12
	Culture		X							X		X	X	X			5
	Implementation Climate: Tension for Change										X						1
	Implementation Climate: Compatibility	X	X				X		X							X	5
	Implementation Climate: Relative Priority	X	X		X		X		X							X	6

Table 3. *(continued)*

		Appelhof	Boersma	Borbasi	Bourbonnais	Ellard	Van Haeften	Kovach	Latham	Lawrence	McAiney	Mekki	Quasdorf	Stein-Parbury	Wingenfeld	Zwijsen et al., 2014b	# of studies
Inner Setting	Implementation Climate: Organizational Incentives & Rewards																0
	Implementation Climate: Goals and Feedback											X					1
	Implementation Climate: Learning Climate	X	X	X		X			X	X		X				X	8
	Readiness for Implementation: Leadership Engagement										X	X	X	X	X	X	6
	Readiness for Implementation: Available Resources	X	X		X	X	X	X	X	X	X		X	X		X	12
	Readiness for Implementation: Access to Knowledge & Information																0
Characteristics of Individuals	Knowledge & Beliefs about the Intervention	X	X		X	X	X	X		X			X		X	X	10
	Self-efficacy			X			X							X			3
	Individual Stage of Change		X	X	X	X		X		X		X					7
	Individual Identification with Organization						X			X							2
	Other Personal Attributes	X	X		X		X	X		X		X	X				8
Process	Planning		X			X	X						X				4
	Engaging: Opinion Leaders																0
	Engaging: Formally Appointed Internal Implementation Leaders		X		X							X					3
	Engaging: Champions	X	X			X	X		X	X		X	X	X	X	X	11
	Engaging: External Change Agents																0
	Executing																0
	Reflecting & Evaluating						X										1

Abbreviation: CFIR, Consolidated Framework for Implementation Research

Domain 1. Intervention Characteristics

Relative advantage was addressed in six articles (Appelhof et al., 2018; Boersma et al., 2016; Bourbonnais et al., 2018; Ellard et al., 2014; Van Haeften-VanDijk et al., 2015; Lawrence et al., 2016). The added value of the intervention was having a shared method for multidisciplinary consultations (Boersma et al., 2016), and expected gains in care time led to increased implementation willingness and efforts of staff (Van Haeften-Van Dijk et al., 2015). Also, experiencing visible effects and positive reactions of residents were facilitators (Ellard et al., 2014; Van Haeften-Van Dijk et al., 2015; Boersma et al., 2016). Concerns about consequences of the intervention, such as how to deal with aggression when PDU is reduced, impeded implementation (Bourbonnais et al., 2018; Lawrence et al., 2016).

Adaptability was addressed by three articles as a facilitating factor (Bourbonnais et al., 2018; Van Haeften-Van Dijk et al., 2015; Mekki et al., 2017). For example, the transfer of information and knowledge was tailored to the local NH culture, which stimulated implementation (Bourbonnais et al., 2018).

Complexity was addressed in ten articles (Boersma et al., 2016; Bourbonnais et al., 2018; Van Haeften-VanDijk et al., 2015;Kovach et al., 2008; Latham and Brooker, 2017; McAiney et al., 2007; Quasdorf et al., 2016; Stein-Parbury et al., 2012; Wingenfeld et al., 2011; Zwijsen et al., 2014b). Six articles reported that perceived easiness to apply the intervention in everyday working life was a facilitator (Boersma et al., 2016; Bourbonnais et al., 2018; Van Haeften-Van Dijk et al., 2015; McAiney et al., 2007; Stein-Parbury et al., 2012; Wingenfeld et al., 2011). This was especially true for interventions that encouraged on the job reinforcement of the learning, role modeling, and assisting in integrating knowledge into practice (McAiney et al., 2007). Barriers were experienced difficulty in applying the learned actions and knowledge into practice (Latham and Brooker, 2017; Quasdorf et al., 2016), and the required use of multiple forms and tools (Zwijsen et al., 2014b).

Cost was addressed in four articles (Appelhof et al., 2018; Boersma et al., 2016; Van Haeften-Van Dijk et al., 2015; McAiney et al., 2007). Facilitators were sufficient funding for the proposed intervention (Van Haeften-Van Dijk et al., 2015), wards receiving extra budget from the NH (Appelhof et al., 2018), and inexpensive training, especially if a regular training budget exists that can be used to provide the intervention (Boersma et al., 2016). Pressures on financial resources such as budget cuts negatively affected the implementation process (Boersma et al., 2016; Van Haeften-Van Dijk et al., 2015; McAiney et al., 2007).

Four constructs within the domain intervention characteristics yielded no relevant factors affecting implementation in the included articles (see table 3).

Domain 2. Outer Setting

Only few studies reported about factors affecting implementation within this domain. The domain contains four constructs, of which Cosmopolitanism and Peer Pressure were not represented in the reviewed articles (see table S1 CFIR constructs with short definitions).

Patient Needs & Resources was addressed by one article. A lack of background information about the residents was a barrier for implementation (Boersma et al., 2016).

External policy was addressed by one article, which stated that changing laws and regulations can negatively affect the implementation (Van Haeften-Van Dijk et al., 2015).

Domain 3. Inner Setting

Structural Characteristics were addressed by eight articles (Appelhof et al., 2018; Boersma et al., 2016; Bourbonnais et al., 2018; Ellard et al., 2014; Van Haeften-Van Dijk et al., 2015; Latham and Brooker, 2017; Quasdorf et al., 2016; Zwijsen et al., 2014b). Facilitating factors were a well-functioning and stable team, a less hierarchical structure and flexible organizational structures, being specialized in dementia care (Quasdorf et al., 2016), and having a small-scale care setting and rural environment (Boersma et al., 2016). Barriers regarding high patient-to-caregiver ratios (Bourbonnais et al., 2018), and multiple levels of management made access to resources challenging (Latham and Brooker, 2017). Half of the articles found staff turnover/absenteeism/fluctuations, shortages, and changing positions to be an impeding factor (Appelhof et al., 2018; Boersma et al., 2016; Bourbonnais et al., 2018; Ellard et al., 2014; Van Haeften-Van Dijk et al., 2015; Quasdorf et al., 2016; Zwijsen et al., 2014b). It might lead to hindering factors such as new staff not being informed about, or familiar with, the program (Appelhof et al., 2018; Bourbonnais et al., 2018; Zwijsen et al., 2014b), and new staff needing time to get acquainted with the intervention (Appelhof et al., 2018; Zwijsen et al., 2014b).

Networks & Communications was mentioned by all but three articles (Borbasi et al., 2011; McAiney et al., 2007; Wingenfeld et al., 2011). Facilitators were communication and contact between staff members and across disciplines (Van Haeften-Van Dijk et al., 2015; Kovach et al., 2008; Stein-Parbury et al., 2012), an open communication climate (Quasdorf et al., 2016), and support within the team (Boersma et al., 2016;

Latham and Brooker, 2017; Mekki et al., 2017). Implementation benefitted from regular multidisciplinary meetings (Appelhof et al., 2018), whereas lack of (formal) meetings between staff hindered implementation (Bourbonnais et al., 2018; Ellard et al., 2014; Zwijsen et al., 2014b). Conflicts and misunderstandings within the team (Quasdorf et al., 2016), lack of contact between disciplines (Zwijsen et al., 2014b), difficulty in transferring information between shifts (Bourbonnais et al., 2018), and poor information dissemination were barriers (Ellard et al., 2014). Consequences of communication difficulties were insufficient role awareness regarding responsibilities (Boersma et al., 2016; Latham and Brooker, 2017), being unfamiliar with mutual expectations such as required time and commitment (Van Haeften-Van Dijk et al., 2015; Latham and Brooker, 2017) and problems with receiving appropriate support (Latham and Brooker, 2017). Collaborative relationships with family facilitated implementation, and relationships strained by relatives being critical of staff impeded implementation (Lawrence et al., 2016).

Culture was addressed in five articles (Boersma et al., 2016; Lawrence et al., 2016;Mekki et al., 2017; Quasdorf et al., 2016; Stein-Parbury et al., 2012). A more dementia friendly culture as expressed in staff attitudes and the physical environment was helpful (Quasdorf et al., 2016), as were mutual respect and reciprocity in relationships with residents (Lawrence et al., 2016), a positive team culture where people acknowledge each other (Mekki et al., 2017), and staff feeling able to voice opinions (Stein-Parbury et al., 2012). Staff with different cultural backgrounds and difficulties with the Dutch language were barriers (Boersma et al., 2016).

Implementation climate consists of six sub-constructs, of which five were addressed (see table 3)

1. Tension for Change was reported in one article. Pressure from peers to resist change negatively affected implementation (McAiney et al., 2007).
2. Compatibility was addressed by five articles (Appelhof et al., 2018; Boersma et al., 2016; Van Haeften-Van Dijk et al., 2015; Latham and Brooker, 2017; Zwijsen et al., 2014b). Interventions being consistent with care goals facilitated implementation (Van Haeften-Van Dijk et al., 2015), while a barrier was that the intervention – as perceived by the care professionals – may not necessarily be in line with the corporate image – as set by the management (Latham and Brooker, 2017). Overlap with current working was reported as a barrier in two studies. For example, an overlap with tools already available in the electronic health record, led to staff

being more inclined to keep working according to their old working routine (Appelhof et al., 2018).

3. Relative Priority was addressed by six articles (Appelhof et al., 2018; Boersma et al., 2016; Bourbonnais et al., 2018; Van Haeften-Van Dijk et al., 2015; Latham and Brooker, 2017; Zwijsen et al., 2014b). Limited involvement in research projects promoted implementation (Appelhof et al., 2018), while other innovations implemented at the same time were a barrier (Van Haeften-Van Dijk et al., 2015). Implementation of the care program was easier on wards that rarely initiated new projects, which helped staff to remain motivated. Being involved in several new projects seemed to interfere with implementation, since time was scarce (Zwijsen et al., 2014b). Ward issues such as renovations to the facility (Appelhof et al., 2018), transition towards self-directed teams (Appelhof et al., 2018; Boersma et al., 2016), staff turnover (Bourbonnais et al., 2018; Latham and Brooker, 2017), and changes in staff members' positions and management structure were barriers (Zwijsen et al., 2014b).
4. Goals and Feedback was reported by one article. Little or no feedback and collaboration with internal facilitators, and a low level of feedback and engagement within the team and on the individual level hindered implementation (Mekki et al., 2017).
5. Learning climate was addressed by eight articles (Appelhof et al., 2018; Boersma et al., 2016; Borbasi et al., 2011; Ellard et al., 2014; Latham and Brooker, 2017; Lawrence et al., 2016; Mekki et al., 2017; Zwijsen et al., 2014b). Openness to changing working routines facilitated implementation (Appelhof et al., 2018; Mekki et al., 2017), while an insufficient learning climate limited implementation (Boersma et al., 2016; Ellard et al., 2014). The degree of learning climate can depend on the ward. In one study, several wards were reluctant to alter routines, whereas wards that were enthusiastic to work with the care program seemed to have a more open attitude towards change and welcomed external input (Zwijsen et al., 2014b). Other facilitators were that the intervention team worked on the floor together with the staff and provided compliments and encouragement (Borbasi et al., 2011). Also, sufficient support and meetings to discuss events during the day and their negative and positive sides led to positive experiences (Latham and Brooker, 2017), as did reporting details of success-stories and sharing strategies that worked (Borbasi et al., 2011; Mekki et al., 2017). Staff fearing criticism of the training team hindered implementation (Lawrence et al., 2016).

Readiness for implementation contains three sub-constructs, of which two were addressed (see table 3).

1. Leadership Engagement was addressed by six articles (Mekki et al., 2017; McAiney et al., 2007; Stein-Parbury et al., 2012; Wingenfeld, et al., 2011; Quasdorf et al., 2016; Zwijsen et al., 2014b). Key stakeholders taking the lead and an engaged leader acting as internal facilitator were mentioned (Mekki et al., 2017; Quasdorf et al., 2016; Stein-Parbury et al., 2012; Zwijsen et al., 2014b), as well as insufficient authority or guidance, absent or disengaged leaders limiting implementation (Mekki et al., 2017; McAiney et al., 2007; Wingenfeld et al., 2011).
2. Available Resources were reported in all but three articles (Borbasi et al., 2011; Mekki et al., 2017; Wingenfeld et al., 2011). Work and time pressures were common barriers and existed in eight studies (Boersma et al., 2016; Bourbonnais et al., 2018; Ellard et al., 2014; Van Haeften-Van Dijk et al., 2015; Latham and Brooker, 2017; Lawrence et al., 2016; McAiney et al., 2007; Zwijsen et al., 2014b). Management support facilitated implementation (Appelhof et al., 2018; McAiney et al., 2007; Quasdorf et al., 2016; Stein-Parbury et al., 2012; Zwijsen et al., 2014b), while other studies reported lack of management support (Ellard et al., 2014; Latham and Brooker, 2017). Lack of sufficient resources for implementation were described as a barrier in four studies (Ellard et al., 2014; Latham and Brooker, 2017; Lawrence et al., 2016; McAiney et al., 2007). For example, the absence of a quiet space for staff to attend training impeded implementation (Ellard et al., 2014). Enabling staff members to participate the training by offering it at two moments facilitated implementation (Boersma et al., 2016), while staff members failing to attend training due to inconvenient shift arrangements impeded implementation (Ellard et al., 2014).

Domain 4. Characteristics of Individuals

Knowledge and beliefs about the intervention were addressed in all but five articles (Borbasi et al., 2011; McAiney et al., 2007; Mekki et al., 2017; Latham and Brooker, 2017; Stein-Parbury et al., 2012). In one study, management had limited awareness of the added value of the intervention and some staff had critical attitudes. However, the expected gains in terms of care time and experienced positive effects on residents made staff enthusiastic to implement the intervention (Van Haeften-Van Dijk et al., 2015). Implementation of the program (Appelhof et al., 2018) or managing disruptive behaviors (Kovach et al., 2008) was time consuming and increased stress and frustration. Repeatedly starting a functional analysis of behavior was perceived as discouraging (Bourbonnais et al., 2018), and interventions being perceived as childish or disrespectful to people with dementia hindered implementation (Boersma et al., 2016; Van Haeften-Van Dijk et al., 2015).

Three articles addressed Self-efficacy (Borbasi et al., 2011; Van Haeften-Van Dijk et al., 2015; Stein-Parbury et al., 2012). Staff working together with the intervention team improved self-confidence and capacity among staff to manage behaviors (Borbasi et al., 2011). Yet, one study reported that staff became reserved and insecure during training, because they thought they could not acquire the necessary level of performance (Van Haeften-Van Dijk et al., 2015).

Individual Stage of Change was addressed in seven articles (Boersma et al., 2016; Borbasi et al., 2011; Bourbonnais et al., 2018; Ellard et al., 2014; Kovach et al., 2008; Lawrence et al., 2016; Mekki et al., 2017). Staff reluctance with respect to the intervention – or to alter routines were implementation barriers (Boersma et al., 2016; Borbasi et al., 2011; Bourbonnais et al., 2018; Ellard et al., 2014; Kovach et al., 2008; Lawrence et al., 2016).

Individual Identification with the Organization was addressed in two articles (Van Haeften-Van Dijk et al., 2015; Lawrence et al., 2016). Staff feeling that their qualities were validated was helpful (Van Haeften-Van Dijk et al., 2015). A lack of recognition from managers, relatives (and society), limited implementation (Lawrence et al., 2016).

Other Personal Attributes were mentioned in eight articles (Appelhof et al., 2018; Boersma et al., 2016; Bourbonnais et al., 2018; Van Haeften-Van Dijk et al., 2015; Kovach et al., 2008; Lawrence et al., 2016; Mekki et al., 2017; Quasdorf et al., 2016). Educated staff (Kovach et al., 2008), and having had earlier experience with PCC methods facilitated implementation (Van Haeften-Van Dijk et al., 2015). Low educated staff impeded implementation (Boersma et al., 2016; Appelhof et al., 2018), and staff having limited knowledge about their residents' personal and medical aspects, restricted the creativity to find restraint free solutions (Mekki et al., 2017). For staff, several skill-related barriers were mentioned; limited communication skills (Boersma et al., 2016), having difficulties initiating partnerships with family (Bourbonnais et al., 2018), low willingness and ability to analyze and express reflections (Bourbonnais et al., 2018; Mekki et al., 2017), and a too strong reliance on other persons (Bourbonnais et al., 2018; Lawrence et al., 2016). The staff's functional understanding of care/'to-do' task-oriented-focus was found to be impeding (Boersma et al., 2016; Van Haeften-Van Dijk et al., 2015; Quasdorf et al., 2016), as was poor mastery of the Dutch language by staff (Boersma et al., 2016).

Domain 5. Process

Planning was addressed in four articles (Boersma et al., 2016; Ellard et al., 2014; Van Haeften-Van Dijk et al., 2015; Quasdorf et al., 2016). A strict procedure for implementation

was a facilitating factor, although a plan for sustaining the intervention was lacking (Boersma et al., 2016). Considerable performance differences were found between wards with a detailed study protocol with defined implementation components and wards lacking this (Quasdorf et al., 2016).

Engaging consists of four sub-constructs. Engaging Formally Appointed Internal Implementation Leaders was addressed in three articles (Boersma et al., 2016; Bourbonnais et al., 2018; Mekki et al., 2017). An engaged, participative leader facilitated implementation (Bourbonnais et al., 2018; Mekki et al., 2017). The support of the study coordinators, who worked actively with staff and key persons of the NH was essential. This contributed to overcoming organizational challenges such as staff turnover and transfer of information between shifts (Bourbonnais et al., 2018). However, identifying such a leader might not be easy. Insufficient directive guidance to identify a project leader was a barrier (Boersma et al., 2016).

Engaging Champions was addressed in all but four articles (Borbasi et al., 2011; Bourbonnais et al., 2018; Kovach et al., 2008; McAiney et al., 2007). Indeed, the support of champions is acknowledged as a facilitating factor (Appelhof et al., 2018; Ellard et al., 2014; Quasdorf et al., 2016; Wingenfeld et al., 2011; Zwijsen et al., 2014b). However, sometimes no champions were identified at all, or a problems with shifts, time or enthusiasm limited their effectiveness (Ellard et al., 2014). Change of champions was also a hindering factor (Boersma et al., 2016; Van Haeften-Van Dijk et al., 2015; Quasdorf et al., 2016; Zwijsen et al., 2014b). Changes of the ward leader, psychologist and physician was detrimental due to their crucial role in implementation (Zwijsen et al., 2014b). Also, champions need to able to effectively influence their colleagues (Latham and Brooker, 2017; Stein-Parbury et al., 2012). Their success depends on drive and enthusiasm (Stein-Parbury et al., 2012), as well as having listening skills, confidence, to be able to team work, and having good relationships with colleagues (Latham and Brooker, 2017). Hence, the ways in which the individual was able to fulfil the role seemed more important than power and experience (Latham and Brooker, 2017).

Reflecting & Evaluating is addressed by one article. Timely solving of bottlenecks and continuous evaluation were seen as facilitating factors (Van Haeften-Van Dijk et al., 2015).

Discussion

Key factors to successful implementation identified in this review included perceived easiness to apply the intervention in practice, strong leadership, support of champions, communication and coordination between disciplines, management support, sufficient resources, educated staff, and culture. Barriers related mostly to unstable organizations, such as renovations, changes towards self-directed teams, high staff turnover, perceived work and time pressures and being involved in several projects.

Similar to our findings, other reviews demonstrated that lack of time, high staff turnover (Vlaeyen et al., 2017) and lack of organizational support (Beeber et al., 2010) can be barriers to implementation. In a review on implementation of evidence-based practice in community nursing, organizational changes such as decentralization were a barrier, while facilitators were the use of local champions, training being embedded in practice, actual or perceived skills, perceptions about usefulness and evidence that the intervention will positively impact the resident or caregiver (Mathieson et al., 2018). Despite the fact that these reviews took place in a different setting, the barriers and facilitating factors found are comparable to our findings, implying that some barriers and facilitators are generic in nature. However, several 'setting specific' factors seem to affect implementation as well. For example, in a systematic review on fall prevention in residential care facilities, poor information transfer among care providers, staff and family, and across shifts, and lack of care plan communication were barriers (Vlaeyen et al., 2017). Similar barriers emerged in our review, implying that these 'setting specific' factors should be taken into account in care innovations. As is suggested by Vlaeyen et al. 2017, we also underline that a focus on modifiable barriers and facilitators such as communication is needed in implementation projects in daily practice.

Other recently published papers in International Psychogeriatrics on implementation in long term care, had similar findings. A review on strategies for successful implementation of psychosocial (including multicomponent) interventions in daily residential dementia care for instance, found that time required to learn and apply the intervention, having a learning culture, and putting knowledge into practice (such as on-the-job reinforcement of learning) were facilitators, whereas multiple projects running simultaneously impeded implementation (Boersma et al., 2015). The commitment of higher management and professionals were important factors in two studies (Boersma et al., 2015; Gerritsen et al., 2019), which is in line with our results. Our systematic review specifically focuses on the implementation of complex

interventions targeting NPS/PDU, while other studies focused on the implementation of guidelines for PCC in NHs (Vikström et al., 2015), implementation of the Meeting Centers Support Program (Van Mierlo et al., 2018), or implementing best practice dementia care in hospitals (Tropea et al., 2017) for example. Several barriers and facilitators identified in those studies are in line with our results, such as inadequate staffing levels (Vikström et al., 2015; Tropea et al., 2017), workload, insufficient time, communication difficulties within team and with family, and limited staff knowledge and skills of dementia (Tropea et al., 2017). In addition, the need for qualified and motivated staff, the presence of a project manager to guide the implementation, and the possibility to target the program to the needs of the target population were identified as facilitators (Van Mierlo et al., 2018). Although those studies had a different focus compared to our review, several barriers and facilitators were in line with our findings. Perhaps this implies that the barriers and facilitators identified in our review may account for different types of interventions and settings, beyond merely complex interventions targeting NPS/PDU.

To summarize, although some implementation factors are generic in nature, setting and organizational factors seem to play an important role in implementation. Our systematic review adds to this that the factors or issues that are perceived as impeding implementation in one care organization – can be perceived as no barrier in another care organization. For instance, some organizations seemed to have more difficulties as a result of staff turnover than other organizations. In the study of Bourbonnais et al., 2018 for example, staff turnover did not negatively affect implementation, since other persons such as study coordinators continued to work actively with staff. Differences may even exist between wards of a care organization. In the study of Zwijsen et al., 2014b, for instance, the degree of learning climate depended on the ward. Several wards were reluctant to alter routines, while other wards had an open, enthusiastic attitude towards the care program. Hence, perhaps the most important recommendation is that we stress to take into account the local conditions and specific barriers and facilitators of a care organization by means of a tailored implementation plan.

Strengths and Limitations

A strength is the use of a well-known, meta-theoretical framework and the applied deductive thematic analysis to synthesize the results. Using the pre-defined codes of the CFIR provided the complex data with a clear direction (King, 2004). The coded data fitted the pre-defined constructs of the CFIR. Its standardized nature enhances

comparison across studies. A limitation that warrants further consideration is that we did not exclude studies based on our qualitative appraisal. This requires some caution in the interpretation of findings. Ten studies did not consider the relationship between researcher and participant which potentially led to researcher bias (Critical Appraisal Skills Programme, 2017). Selection and recruitment of participants was also not thoroughly described, potentially leading to bias in the included studies, and consequently in our review. However, for the other categories, the quality of the included studies was generally considered sufficient. Also, the factors found in the included studies might not be the most important ones, but the ones focused on the most. Our results show that constructs within the domains 'intervention characteristics', 'outer setting', and 'process' were less frequently addressed than the other domains. Apparently, several parts of the CFIR framework receive little research attention. This is contrary to a recent systematic review, which assessed the application of the CFIR in implementation research in a wide range of study aims and settings. In this review, all constructs were identified to a greater or lesser extent (Kirk et al., 2016). This difference might be explained by the fact that Kirk et al., (2016) only included studies that used the CFIR, while in our review, the included studies used different theories or frameworks to evaluate implementation. CFIR constructs were not used as a 'checklist' of variables for consideration. Possible consequences are that relevant factors were not assessed.

Although it might be relevant to distinguish between barriers and facilitators related to the intervention and those related to the implementation strategy, the reviewed articles rarely present their results in this manner. Furthermore, several interventions incorporate elements, such as training, (Smeets et al., 2013) that are considered implementation strategies by others (Gerritsen et al., 2011). Further research could explore the added value of this distinction.

Conclusions and implications

Our study showed that the engagement of champions can be an important facilitator, but their effectiveness relies on personal skills and relationships with colleagues. Consequently, we stress that champions should be carefully chosen. Translating learned actions and knowledge into practice by means of on the job reinforcement of learning or role modeling should be part of the implementation strategy for complex interventions by default. Caution should be employed while participating in several projects/studies. The capacity of the involved key stakeholders should be leading.

The current systematic review demonstrated that the implementation of complex interventions requires a lot of effort of the organizations and their staff members, and the degree of implementation is subject to many factors, which makes it complex. Our results indicate that some factors are generic in nature, but the setting and factors related to the organization such as staff turnover and reorganizations seem to influence implementation as well. The presence of factors and degree to which these are perceived as a barrier might differ between organizations and even between wards, depending on potential facilitating factors that can reduce the influence of the barrier and on the coping strategies of staff. Organization problems on the ward as such may be not necessarily barriers to successful implementation, but the coping mechanisms of the team could be of greater importance. Therefore, barriers and facilitators might be best examined at the organizational level, being for instance a nursing home, or even on the level of a nursing home ward. We underline that implementation needs to be adapted to the specific needs and characteristics of the organization in question, and needs to focus on modifiable barriers and facilitators. To implement a complex intervention with several interacting components, in a complex and dynamic organization, with its own local characteristics and specific barriers and facilitators, is challenging and advocates for a tailored intervention and implementation plan. Assessing and addressing possible barriers and facilitators before and during implementation by means of tailored implementation can increase effectiveness (Baker et al., 2015).

Frameworks such as the CFIR can help identify which constructs have predictive ability, which can be manipulated to enhance implementation outcomes, and the situations in which specific constructs are salient.

Future studies could explore whether a focus on the 'forgotten' constructs would be beneficial for implementation.

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Appendix A1. Search strategy PubMed

Search ((((“Nursing Homes”[Mesh] OR “Homes for the Aged”[Mesh] OR “Long-Term Care”[Mesh] OR longterm care[tiab] OR long-term care[tiab] OR nursing home*[tiab] OR assisted living[tiab] OR inpatient institution *[tiab] OR “Care homes”[tiab] OR homes for the aged[tiab] OR (resident*[tiab] AND (longterm*[tiab] OR long-term*[tiab] OR institut*[tiab]))))) AND ((“Process Assessment (Health Care)”[Mesh] OR “Outcome and Process Assessment (Health Care)”[Mesh:NoExp] OR “Health Plan Implementation”[Mesh] OR fidelit*[tiab] OR process evaluat*[tiab] OR process assess*[tiab] OR change init*[tiab] OR organizational chang*[tiab] OR organisational chang*[tiab] OR (implement*[tiab] AND (barrier*[tiab] OR facilitat*[tiab] OR determinant*[tiab] OR factor*[tiab] OR evaluat*[tiab] OR succes*[tiab] OR strat*[tiab] OR process*[tiab] OR challeng*[tiab])) OR (interdisciplinary[tiab] AND evaluation[tiab])))) AND ((“Psychotropic Drugs”[Mesh] OR “Hypnotics and Sedatives”[Mesh] OR “Anticonvulsants”[Mesh] OR “Cholinesterase Inhibitors”[Mesh] OR “Feeding and Eating Disorders”[Mesh] OR “Sleep Wake Disorders”[Mesh] OR “Anxiety”[MeSH] OR “Appetite”[MeSH] OR “Behavioral Symptoms”[MeSH] OR “Euphoria”[MeSH] OR “Hallucinations”[MeSH] OR “Irritable Mood” [MeSH] OR “Psychomotor Agitation”[MeSH] OR “Apathy”[Mesh] OR psychotropic*[tiab] OR Tranquili*[tiab] OR anti-anxiety[tiab] OR Anxiolytic* [tiab] OR (Antidepress*[tiab] OR anti-depress*[tiab]) OR Antipsycho*[tiab] OR Hypnoti*[tiab] OR Sedative*[tiab] OR Anticonvulsant*[tiab] OR Cholinesterase[tiab] OR aberrant motor behav*[tiab] OR (affect*[tiab] AND sympt*[tiab]) OR aggression[tiab] OR aggressive[tiab] OR agitation[tiab] OR anxiety[tiab] OR apathy[tiab] OR (behav*[tiab] AND sympt*[tiab]) OR biting[tiab] OR cognitive sympt*[tiab] OR complaining[tiab] OR crying[tiab] OR cursing[tiab] OR delirium[tiab] OR delusions[tiab] OR demanding[tiab] OR depress*[tiab] OR disinhibit*[tiab] OR disrupt*[tiab] OR eating disturb*[tiab] OR euphoria[tiab] OR hallucinations[tiab] OR hitting[tiab] OR hoarding[tiab] OR kicking[tiab] OR misidentification[tiab] OR negativism[tiab] OR neuropsychiatric*[tiab] OR pacing[tiab] OR psychopathology[tiab] OR psychiatric sympt*[tiab] OR psychosis[tiab] OR psychotic[tiab] OR antipsychotic[tiab] OR (psychogeriatric*[tiab] AND sympt*[tiab]) OR (psychol*[tiab] AND sympt*[tiab]) OR repetition[tiab] OR repetitive behav*[tiab] OR screaming[tiab] OR sleep dis*[tiab] OR restlessness[tiab] OR sexual disinhibition[tiab] OR Sexual Behav*[tiab] OR sundowning[tiab] OR troublesome[tiab] OR uncooperative behav*[tiab] OR verbal outburst[tiab] OR agitation[tiab] OR violen*[tiab] OR wandering[tiab] OR yelling[tiab] OR appetite[tiab] OR Eating Disorders[tiab] OR Irritable mood[tiab] OR Mental Disorders[tiab] OR Mood Disorders[tiab] OR Neurobehavioral Manifest*[tiab] OR Neuropsycho*[tiab] OR Psychomotor Agitation[tiab] OR social behavi*[tiab] OR behavior disorder*[tiab] OR behaviour disorder*[tiab] OR “Dementia”[Mesh:NoExp] OR challenging behav*[tiab] OR dementia[tiab]) NOT “Review” [Publication Type]

Table S1. CFIR Constructs with Short Definitions.

Topic	Short Description
I. INTERVENTION CHARACTERISTICS	
A Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.
B Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.
C Relative advantage	Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution.
D Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.
E Trialability	The ability to test the intervention on a small scale in the organization [8], and to be able to reverse course (undo implementation) if warranted.
F Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement.
G Design Quality and Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled.
H Cost	Costs of the intervention and costs associated with implementing that intervention including investment, supply, and opportunity costs.
II. OUTER SETTING	
A Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs are accurately known and prioritized by the organization.
B Cosmopolitanism	The degree to which an organization is networked with other external organizations.
C Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented or in a bid for a competitive edge.
D External Policy & Incentives	A broad construct that includes external strategies to spread interventions including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.
III. INNER SETTING	
A Structural Characteristics	The social architecture, age, maturity, and size of an organization.
B Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.
C Culture	Norms, values, and basic assumptions of a given organization.
D Implementation Climate	The absorptive capacity for change, shared receptivity of involved individuals to an intervention and the extent to which use of that intervention will be rewarded, supported, and expected within their organization.

Table S1. *(continued)*

Topic	Short Description
1 Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change.
2 Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.
3 Relative Priority	Individuals' shared perception of the importance of the implementation within the organization.
4 Organizational Incentives & Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary and less tangible incentives such as increased stature or respect.
5 Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff and alignment of that feedback with goals.
6 Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.
E Readiness for Implementation	Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.
1 Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.
2 Available Resources	The level of resources dedicated for implementation and on-going operations including money, training, education, physical space, and time.
3 Access to knowledge and information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.
IV. CHARACTERISTICS OF INDIVIDUALS	
A Knowledge & Beliefs about the intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.
B Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.
C Individual Stage of Change	Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.
D Individual Identification with Organization	A broad construct related to how individuals perceive the organization and their relationship and degree of commitment with that organization.
E Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.

Table S1. *(continued)*

Topic	Short Description
V. PROCESS	
A Planning	The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance and the quality of those schemes or methods.
B Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and other similar activities.
1 Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention.
2 Formally appointed internal implementation leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.
3 Champions	"Individuals who dedicate themselves to supporting, marketing, and 'driving through' an [implementation]" [101] (p. 182), overcoming indifference or resistance that the intervention may provoke in an organization.
4 External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.
C Executing	Carrying out or accomplishing the implementation according to plan.
D Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.

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Abbreviations: CFIR, Consolidated Framework for Implementation Research

CHAPTER 4

Process evaluation of a tailored intervention to Reduce Inappropriate psychotropic Drug use in nursing home residents with dementia

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Abstract

Background: Research suggests that collaborative and tailored approaches with external expertise are important to process implementations. We therefore performed a process evaluation of an intervention using participatory action research, tailored information provision, and external coaching to reduce inappropriate psychotropic drug use among nursing home residents with dementia. The process evaluation was conducted alongside a randomized controlled trial assessing the utility of this approach.

Methods: We used Leontjevas' model of process evaluation to guide data collection and analysis, focusing on the relevance and feasibility, extent of performance, and barriers and facilitators to implementation. Data on the relevance and feasibility and on the extent of performance were collected using a questionnaire targeting internal project leaders at nursing homes and our external coaches. Implementation barriers and facilitators were identified by individual semi-structured interviews. The Consolidated Framework for Implementation Research was used to structure and describe the identified barriers and facilitators.

Results: The intervention was viewed positively, but it was also considered time consuming due to the involvement of many people and designing a tailored action and implementation plan was viewed as complex. The extent of performance differed between nursing homes. Delays in implementation and suboptimal execution of actions may have reduced effectiveness of the RID intervention in some nursing homes. Barriers to implementation were reorganizations, staff turnover, communication issues, unclear expectations, and perceived time pressures. Implementation also depended on the involvement and skills of key stakeholders, and organizations' readiness to change. Although external coaches stimulated implementation, their additional value was rated variably across organizations.

Conclusions: Barriers to implementation occurred on several levels and some barriers appear to be inherent to the nursing home environment and could be points of leverage of future implementation trajectories. This underlines the importance of assessing and supporting organizations in their readiness to change. Sensitivity analyses, taking into account the week in which nursing homes started with implementation and the degree to which actions were implemented as intended, will be appropriate in the effect analyses of the trial.

Background

Neuropsychiatric symptoms (NPS) are common in nursing home (NH) residents with dementia. Over 80% exhibits NPS such as agitation and apathy. [1] NPS are often treated with psychotropic drugs (PDs), including antipsychotics, hypnotics or sedatives, anxiolytics, antidepressants, anticonvulsants, and anti-dementia drugs. [2-5] However, PDs are associated with significant side effects. Antipsychotics may increase the risk of stroke and mortality. [2,6] They are also associated with extrapyramidal symptoms and drowsiness. [7] The use of sedatives, hypnotics, antidepressants, and benzodiazepines is associated with falls. [8] In addition, there is evidence that PDs are of limited effectiveness on NPS in residents with dementia, [9,10] especially when used in the long-term. [11] Despite these concerns, about 60% of NH residents uses PDs for NPS and only 10% of PDs are prescribed fully appropriate, with indication, evaluation and therapy duration contributing to inappropriate use. [12] Consequently, the appropriateness of prescribing should be optimized. Moreover, clinical guidelines recommend restricted use of PDs and propose non-pharmacological interventions as first-line treatment for managing NPS. [13,14] As a result, various interventions have been developed over the years, aimed at reducing inappropriate prescribing and/or targeting a greater use of non-pharmacological interventions in practice. [15-19] Often, these interventions comprise complex, multicomponent interventions. [20] However, the strength of the effects varies for complex and multicomponent interventions to reduce inappropriate psychotropic drug prescribing or to increase the use of non-pharmacological interventions among nursing home (NH) residents with dementia. Although complex interventions can be effective, [21] to date they have tended to have relatively small or lacking effects, [16,22,23] with suboptimal implementation emerging as a prime reason. Process evaluations in NHs have demonstrated that suboptimal implementation results from barriers, [24–26] not least of which are skepticism about using non-pharmacological approaches. [27] From a broader healthcare perspective, implementation problems relate to perceptions that the issue is not a priority, [28] and the use of standardized “one size fits all” solutions. [20] Complex healthcare interventions may work best if tailored to local circumstances rather than being standardized, [20,28] especially if they identify and target modifiable barriers to change before implementation. [28,29] Consistent with this, process evaluations of complex interventions among NH residents with dementia have underlined that we must adapt to the specific needs and features of each care organization. [24,26] It also appears that collaborative approaches that introduce external expertise can address

the concerns and problems faced by NH staff, while ensuring awareness of their preferences and increasing awareness. [30]

This information was taken into account when designing the Reducing Inappropriate Psychotropic Drug Use in NH Residents with Dementia (RID) study. [31] We hypothesized that implementation would be facilitated if NH staff were actively involved in determining the problem(s) and potential solutions, if interventions could be tailored to the local setting, and if the implementation was guided by a coach. To resolve the challenges of existing strategies, we developed a RID intervention that incorporated three active elements: (1) participatory action research (PAR), which allowed staff to formulate problems and potential solutions concerning inappropriate psychotropic drug use (PDU) and neuropsychiatric symptom (NPS) management; (2) tailored information provision about inappropriate PDU and NPS management; and (3) external coaching. It was anticipated that these active elements would lead to the implementation of a tailored action and implementation plan (AIP) to reduce inappropriate PDU for NH residents with dementia. [31] Including a process evaluation can then provide insight into the true contribution of the intervention to daily practice, helping us to understand why the intervention was successful or unsuccessful, and indeed, how it could be optimized. [20] Information on the relevance and feasibility of a given intervention, as well as the extent of performance, is essential for the credibility of research. For example, difficulties with implementation may result in low treatment fidelity, meaning that the intervention could not be carried out as intended, which in turn may lead to a loss of effect. [32]

In this research, we aimed to present the process evaluation of the RID study. To our knowledge, no other researchers have evaluated the implementation of such a complex and tailored intervention in NHs. Given its three active elements, we hypothesize that the degree of implementation of the intervention will be good.

Methods

Design

Alongside an effect study, executed between July 2016 and December 2018, a process evaluation was conducted between March 2018 and January 2019. The study was performed in sixteen Dutch NHs caring for residents with dementia who reside in Dementia Special Care Units (DSCU). DSCUs designed to deliver care for residents with Korsakov syndrome, acquired brain injury, Down syndrome, or young-

onset dementia were excluded. In- and exclusion criteria were not proposed for the internal project leader, although the tasks and aspects associated with this role were communicated with the NHs (such as creating support, logistics management and provision of information). The external coaches needed to be knowledgeable about dementia and have previous consultation expertise in NHs. More information about recruitment and in- and exclusion criteria can be found in our protocol article. [31] The effect study constituted a two-armed, stepped wedge, cluster randomized controlled trial (RCT). [33] The data collection period was 16 months per NH, split into two 8-month periods. In the first period, eight NHs started with the RID intervention and another eight NHs deferred the intervention. In the second period, the NHs that started with the intervention continued with implementation of the AIP and the other eight NHs started the intervention. Thus, we had an intervention group and a deferred intervention group, with measurements performed at 0, 8, and 16 months. Participation was on a voluntary basis. Besides the external coaching being offered freely to participating NHs, no financial incentives or additional external influences were provided. Further information about the RID study is provided elsewhere. [31]

Since information from the process evaluation can be incorporated in the effect analyses, [34] we performed the process evaluation before conducting the effect analyses of the RCT.

We used Leontjevas' model to guide the collection and evaluation of process data. [34] In the process evaluation, we investigated whether our RID intervention with the active elements PAR, tailored information provision, and external coaching successfully addressed the problems identified with earlier studies. Specifically, we studied two elements: (1) the intervention quality, consisting of the relevance and feasibility of the RID intervention and the extent of performance of the RID intervention (degree of implementation); and (2) the barriers and facilitators to implementation.

The RID study was registered with the Netherlands Trial Registry (NTR5872) on May 27, 2016, https://www.trialregister.nl/trial/5719. We complied with the Consolidated Standards of Reporting Trials (CONSORT) guidelines in conducting and reporting this study. [35]

RID Intervention

The RID study examined the effectiveness of an intervention to change practice through cooperation between practice and research, using PAR, external coaching, and tailored information provision to implement tailored AIPs to reduce inappropriate PDU. A multidisciplinary project team (MPT) in each NH (including an internal project leader), an external coach, and researchers, were given specific tasks within the cyclic intervention.

1. *Organizing stakeholder efforts:*
    - Researchers organized a kick-off meeting in the NH.
    - NHs formed an MPT consisting of at least nursing staff, psychologist(s), physician(s), and an internal project leader. The MPT preferably included stakeholders, such as management and representatives of the residents. Each MPT was supported during their intervention period by an external coach.
    - Throughout the process, the MPT and external coach had several meetings (total number was not pre-defined).

2. *Problem analysis:*
    - Researchers carried out a problem analysis (both quantitative and qualitative data) using interviews and questionnaires. Problems (as perceived by NH staff) regarding inappropriate PDU and NPS management were examined (observation phase).
    - Researchers presented the results of the tailored problem analysis to the MPT and external coach, which was followed by interpretation and reflection in the context of the local NH (reflection phase).

3. *Designing tailored AIP*
    - The MPT and external coach created an AIP that matched the identified problems (planning phase).
    - The external coach and researchers provided feedback on the AIP (relevance and feasibility of actions, concreteness).

4. *Implementation of tailored AIP*
    - The MPT started by implementing the tailored AIP (action phase).

5. *Monitoring progression*
   - Researchers carried out an interim measurement on inappropriate PDU. The eight MPTs that started as the intervention group were given interim results at 8 months (observation phase).

6. *Stimulating progression*
   - The external coach and MPT discussed and reflected on the interim results (reflection phase).

7. *Adjustments to tailored AIP*
   - The MPT was able to adjust the AIP based on the interim results (planning phase) and implement any changes during the second period (action phase).

8. *Providing the final results*
   - Researchers carried out a final measurement with respect to inappropriate PDU and provided the MPT with their final results after 16 months.

Intervention Quality and Barriers and Facilitators to Implementation

Table 1, supplemented by Additional File 1, provides an overview of the operationalization of the intervention quality and of the barriers and facilitators to implementation. We examined the quality of the RID intervention. For the relevance and feasibility of the RID intervention, the role of each (group of) stakeholder(s) was evaluated (i.e., researchers, internal project leaders, MPTs, and external coaches). For the extent of performance, each intervention task was evaluated with respect to whether implementation was as intended. We then evaluated the barriers and facilitators to implementation. We did not evaluate the relevance and feasibility of the AIPs. Given that the RID intervention focused on PAR, tailored information provision, and external coaching, we decided that evaluating the relevance and feasibility of each of the self-created and highly variable actions would be impractical and offer limited information in the confines of this study. However, we did examine the extent of performance on the AIP tasks because of their expected impact on the overall effectiveness of the RID intervention.

Table 1. Indicators and Operationalization of Intervention Quality, including Barriers and Facilitators to Implementation

INTERVENTION QUALITY		
Relevance and Feasibility of RID Intervention		
Stakeholder	***Indicator***	***Source***
1) Researchers	Added value tailored information provision	Questionnaire: Likert scale
	Experiences with researchers	Interviews: description
2) Internal project leader & MPT	Competence [A] of project leader *(perceived by coach)*	Questionnaire: Likert scale
	Experiences with project leaders	Interviews: description
	Experiences with MPT	Interviews: description
3) External coach	Added value of coaching	Questionnaire: Likert scale
	Coaching necessity for (continued) implementation	Questionnaire: Yes/No
	Competence [A] of coach (perceived by project leader)	Questionnaire: Likert scale
	Experiences with coaching	Interviews: description
Extent of Performance of RID Intervention		
Task	***Indicator***	***Source***
1) Organizing efforts of stakeholders		
- Researchers	Kick-off meeting in nursing home	Questionnaire: Yes/No
- MPT	Formation of an MPT	Questionnaire: Yes/No
	Attendance physicians, psychologists, and nursing staff at MPT meetings [B]	Questionnaire: % attendance [B]
- External coach	Meetings coach and MPT in nursing home [C]	Questionnaire: # meetings
	(Phone)meetings coach and project leader [C]	Questionnaire: # meetings
2) Problem analysis	Researchers carried out problem analysis and presented results to the MPT and coach	Questionnaire: Yes/No

Table 1. *(continued)*

INTERVENTION QUALITY		
3) Designing tailored AIP	AIP created	Questionnaire: Yes/No
	Contribution coach, project leader, and MPT to designing the AIP	Questionnaire: Likert scale
	Perceived match between problems and actions	Questionnaire: Likert scale
	Coach provided feedback on the AIP	Questionnaire: Yes/No
	Researchers provided feedback on the AIP	Questionnaire: Yes/No
	Adjustments to AIP based on feedback	Questionnaire: Yes/No
4) Implementation of tailored AIP	Start with implementation [D]	Questionnaire: # weeks passed
	Execution actions as intended: [E] Implementation score	Questionnaire: 10-point scale
5) Monitoring progression	Researchers carried out interim measurement and provided the MPT with the results *	Questionnaire: Yes/No
6) Stimulating progression	Coach discussed and reflected on interim results with the MPT *	Questionnaire: Yes/No
7) Adjustments to tailored AIP	MPT adjusted the AIP based on interim results [F] *	Questionnaire: Yes/No Interviews: description
8) Providing final results	Researchers carried out final measurement and provided the MPT with the end results	Questionnaire: Yes/No
Barriers and Facilitators to Implementation		Interviews: data structured with CFIR

Abbreviations: AIP: Action and Implementation Plan; CFIR: Consolidated Framework for Implementation Research; MPT: Multidisciplinary Project Team

[A] Evaluated as: (very) competent on content (PDs, alternatives in managing NPS) and process (motivate, structure).

[B] Since these disciplines are directly managing PDs and NPS, their attendance was considered most important. For each NH, the % of attendance was given as a mode (most frequently occurring % of separate disciplines). Attendance of separate disciplines is depicted in Additional File 2.

[C] The MPT and coach were supposed to have regular contact, but the number of meetings was not pre-defined.

[D] 8 weeks were planned for the problem analysis and designing the AIP, leaving 6 or 14 months (short vs. long duration) for implementation: Implementation within 8 weeks is as intended, 8 – 16 weeks suboptimal, > 16 weeks is deviation.

[E] Mean of Implementation scores of each action from AIP: 10-point scale (0 not at all implemented as intended – 10 totally implemented as intended) per action.

[F] Providing MPTs with their interim results was supposed to provide NHs with the opportunity to adapt the AIP. Not making changes while results indicated no improvement with respect to inappropriate PDU is considered a deviation.

* Only for the 8 NHs who started in the intervention group

Data collection

After the final measurement, the researcher (CGK) sent a web-based questionnaire to the internal project leader and external coach at each NH. Approximately one or two weeks after completion of the questionnaire, the same researcher (CGK) held individual semi-structured telephone interviews with the internal project leader and external coach. The information derived from the questionnaires was explored in-depth during the interviews, to gain a more thorough understanding. The duration of an interview was approximately one hour. As with the interviews, the questionnaires were completed individually at a time that was convenient for them. External coaches evaluated the process for each NH separately. Relevance and feasibility were examined using both sources, while the extent of performance was based only on the questionnaire. Given that our study was designed to consider the barriers and facilitators identified in previous studies, we explored this matter in depth based on data from the telephone interviews. The telephone interviews were audio recorded and transcribed verbatim.

Data analysis

Quantitative data were analyzed with IBM SPSS version 25 (IBM Corp., Armonk, NY, USA), using descriptive statistics. Qualitative data were analyzed by deductive content analysis, [36] using the Consolidated Framework for Implementation Research (CFIR) to structure and describe the barriers and facilitators. [37] Two researchers independently coded the data (CGK and DG), with another three authors available for discussion in case of disagreement (CVT, MS, SZ). The process evaluation focused on a general evaluation of the implementation process, but we also examined differences in the extent of performance among NHs.

Results

The respondent characteristics are summarized in Table 2. All 16 internal project leaders participated in the process evaluation, although one completed the questionnaire partially and one did not respond to the request for an interview. All six external coaches also participated in the process evaluation, and a completed digital questionnaire was received for each NH; however, due to a change of jobs, one external coach could not give an interview for one of the NHs. Therefore, we have data for 31 questionnaires and 30 interviews (response rates of 97% and 94%, respectively). The majority of respondents is female (over 80%). The respondents have varying educational backgrounds and current positions (see Table 2).

Table 2. Participant Characteristics

Internal project leader (n=16)		External coach (n=6)	
Female, *n* (%)	*14* (88%)	Female, *n* (%)	*5* (83%)
Function, *n* (%)		Education, *n* (%) [d]	
Elderly care physician	*5* (31%)	Health sciences	*2* (33%)
Nurse [a, b]	*4* (25%)	Public administration	*1* (17%)
Team leader [c]	*2* (13%)	Business economics	*1* (17%)
Project employer	*2* (13%)	Health business Administration	*1* (17%)
Policy advisor	*1* (6%)	Social sciences	*1* (17%)
Quality and policy employer	*1* (6%)		
Training coordinator	*1* (6%)		

[a] *Including two specialized gerontology and geriatrics nurses*
[b] *One nurse also being the care director*
[c] *One team leader also being behavior consultant*
[d] *Highest education. In addition, all coaches are experienced in health care, four of which have followed a professional nurse education. All coaches were at the time employed by Vilans as (senior) consultant.*

Intervention Quality: Relevance and Feasibility of the RID Intervention

The results for the quantitative evaluation of the contributions by researchers, internal project leaders, MPTs, and external coach are summarized in Table 3. The majority of the respondents perceived the tailored information provision to be of high added value. External coaching was perceived to be of high added value by the majority of the internal project leaders, whereas the majority of the external coaches indicated that coaching was of added value ‘to a reasonable extent’.

The majority of the external coaches indicated that coaching is a necessity for (continued) implementation, while the majority of the internal project leaders indicated this is not a necessity. Both the majority of the internal project leaders as well as the external coaches perceived the other party to be competent or very competent. The qualitative evaluation is provided below.

1. *Researchers*

   The problem analysis was often perceived to create urgency for change because researchers provided MPTs with information about inappropriate PDU and NPS management. This initiated a dialog and resulted in NHs comparing themselves to other organizations. The fixed measures motived NHs to achieve change, and the provision of interim results not only provided valuable insights into their

progression but also provided an opportunity to make changes. Although the ability to tailor action and implementation to each organization was evaluated positively, the process was considered both time consuming and complex.

Table 3. Relevance and Feasibility of the RID intervention

	Internal project leader N = 15 *N*, (%)	External coach N= 6 [a] *N*, (%)
1) Researchers		
Added value tailored information provision [b]		
Strongly	*9* (60%)	*12* (75%)
To a reasonable extent	*5* (33%)	*3* (19%)
To some extent	*1* (7%)	*1* (6%)
2) Internal project leader		
Competence of project leader [c] perceived by coach		
Competent or very competent	N.A.	*9* (56%)
Not competent/not incompetent	N.A.	*3* (19%)
Other [d]	N.A.	4 (25%)
3) External coach		
a) Added value of coaching [b]		
Strongly	*7* (47%)	*6* (38%)
To a reasonable extent	*6* (40%)	*9* (56%)
To some extent	*2* (13%)	*1* (6%)
b) Coaching necessity for (continued) implementation		
Yes	*5* (33%)	*9* (56%)
No	*7* (47%)	*4* (25%)
I don't know	*3* (20%)	*3* (19%)
c) Competence of coach [c] perceived by project leader		
Competent or very competent	*11* (73%)	N.A.
Not competent/not incompetent	*1* (7%)	N.A.
Other [d]	3 (20%)	N.A.

[a] N = 6 coaches for N = 16 nursing homes

[b] Scale: Not at all/to some extent/to a reasonable extent/strongly

[c] Likert Scale: Very incompetent/incompetent/not competent-not incompetent/competent/very competent

[d] Differences between competence in content and process, such as incompetent on content and competent on process.

2. *Internal project leader and MPT*

   The role of the internal project leader was considered essential, but this was highly dependent on their skills, such as creating support, engagement, and informing staff. The MPT was also considered relevant because of the multidisciplinary nature of managing NPS and inappropriate PDU. Actively involving the MPT in formulating the problems and solutions was positively evaluated:

> Internal project leader: *"The actions are self-created, which creates greater support. You can impose all sorts of things but that won't work. It really has to come from themselves, what they think might work."*

3. *External coach*

   External coaching was considered especially useful for translating the problem analysis to a tailored AIP, with many stating that this process was difficult. However, although many respondents thought that external coaching was necessary, others considered it relevant but non-essential. A positive appraisal is illustrated by the following quote:

> External coach: "*They had project groups and those people were quite driven to get started. They definitely had a clear direction… and they acted on this as well.*"

Intervention Quality: Extent of Performance

Results for the RID intervention's extent of performance are depicted in Table 4.

1. *Organizing efforts of stakeholders*

   Researchers: As intended, the researchers carried out a kick-off meeting in each NH.
   MPTs: All 16 NHs formed MPTs from various disciplines, and in most cases, attendance was good. Several other NHs (no. 2, 3, 5, 6, 8, 12) had a low attendance level (Table 4, column 1a, and Additional File 1).
   External coaches: The number of meetings (Table 4, columns 1b and 1c) with the external coach and the MPT on location varied substantially between NHs (range

5–13), as did the number of (phone) meetings between the external coach and internal project leader (range 0–12).

2. *Problem analysis*
   The researchers carried out a problem analysis at each NH and presented the results to all MPTs.

3. *Designing tailored AIP*
   In NH 11, communication issues between the person who decided to participate in the project and the persons responsible for executing it delayed the process to the extent that no AIP was created (Table 4, column 3a). The AIPs otherwise contained the following actions: multidisciplinary and methodical working (including use of person-centered interventions), education and training, and adaptations to the living environment. Generally, actions in the AIPs addressed the identified problems. Apart from NH 11, which lacked an AIP, all NHs were given feedback on their AIP by the external coaches and researchers. The contributions of the external coach, internal project leader, and MPT in designing the AIP were large (Table 4, column 3b). Also, apart from NH 11, all NHs adjusted their AIP based on the feedback given by the external coach and researchers (Table 4, section 3c).

4. *Implementation of tailored AIP*
   Only NHs 1, 4, and 13 did not need more than the allocated 8 weeks to start AIP implementation, and NHs 3 and 11 only started implementation after 16 weeks (Table 4, column 4a). The mean implementation scores for executing the AIPs on a 10-point scale (range, 3.4–8.5) were below 6.0 in NHs 3, 10, 11, and 15 (Table 4, column 4b).

5. *Monitoring progression*
   The researchers carried out an interim measurements as intended, and the relevant MPTs were given interim results at 8 months.

6. *Stimulating progression*
   All external coaches discussed the interim results within each MPT.

Table 4. Extent of Performance of the RID intervention

NH	1a) Attendance MPT	1b) Meetings coach + MPT	1c) (Phone)-meetings coach + PL	3a) AIP * created	3b) Contribution coach, PL, MPT in designing AIP	3c) Adjustments AIP based on feedback	4a) Start with implementation in weeks	4b) Execution [A] actions of AIP as intended	7) Adjustments AIP based on interim results
1	76%–100%	9	0	Yes	(Very) large	Yes	Within 8	8.4	Not necessary
2	0%–25%	7	5	Yes	(Very) large	Yes	Within 8-16	8.5	Yes
3	26%–50%	13	12	Yes	(Very) large	Yes	> 16	5.4	No
4	76%–100%	7	3	Yes	(Very) large	Yes	Within 8	7.0	Yes
5	26%–50%	9	7	Yes	(Very) large	Yes	Within 8-16	6.4	Yes
6	26%–50%	5	4	Yes	(Very) large	Yes	Within 8-16	7.9	Not necessary
7	51%–75%	8	3	Yes	(Very) large	Yes	Within 8-16	7.9	Yes
8	26%–50%	11	12	Yes	(Very) large	Yes	Within 8-16	6.3	Yes
9	76%–100%	9	8	Yes	(Very) large	Yes	Within 8-16	7.0	N.A. [B]
10	51%–75%	6	2	Yes	(Very) large	Yes	Within 8-16	3.4	N.A.
11	76%–100%	5	3	No.	N.A.	N.A.	> 16	5.0	N.A.
12	26%–50%	7	2	Yes	(Very) large	Yes	Within 8-16	6.8	N.A.
13	76%–100%	8	4	Yes	(Very) large	Yes	Within 8	7.3	N.A.
14	76%–100%	5	7	Yes	(Very) large	Yes	Within 8-16	7.8	N.A.
15	76%–100%	5	1	Yes	Reasonable	No	Within 8-16	5.3	N.A.
16	76%–100%	7	10	Yes	(Very) large	Yes	Within 8-16	6.3	N.A.

Abbreviations: AIP: (tailored) Action and Implementation Plan; MPT: Multidisciplinary Project Team; NH: Nursing Home; PL: (internal) Project Leader

[A] Mean of implementation scores of each action from AIP: 10-point scale (0 not at all implemented as intended – 10 totally implemented as intended) per action

[B] Not Applicable: nursing homes 9 – 16 were in the deferred control group (start with the intervention in the second 8-month period and had therefore no interim results)

4

7. *Adjustments to tailored AIP*

   Most NHs adjusted their AIP after discussing the interim results. Changes mostly focused on not only what was important to keep doing or what was likely to succeed but also defining actions and strategies more precisely. Two NHs (no. 1, 6) had positive results and decided to continue with the original AIP, and one NH (no. 3) did not change the AIP despite negative interim results. In the latter case, the MPT argued that further change was unwise because they had barely started to implement the original AIP (Table 4, column 7).

8. *Providing final results*

   The researchers carried out a final measurement at each NH and presented all MPTs with the final results.

Barriers and Facilitators to Implementation

The barriers and facilitators identified from the interviews could be categorized into three of the CFIR themes: intervention characteristics, inner setting, and process. [37] Description of the CFIR topics are given in Additional File 2.

Intervention characteristics

Involving NH staff in addressing the problems, needs, and solutions created the engagement and support needed for implementation, but involving so many people also seemed to slow the process. This was key to why some perceived the planned implementation period as too short. Several NHs in the deferred intervention group indicated that the amount of time between project registration and action was too long, which reduced their enthusiasm. It was also perceived that NH staff sometimes struggled to translate knowledge into practice after education or training, but on-the-job coaching was considered to be helpful in applying what was learned into practice.

Inner setting

Several barriers were common, such as reorganizations, staff shortages and turnover, and communication issues within and between disciplines (i.e., too little contact, criticizing each other, or not being receptive to feedback). Another perceived barrier was the use of self-directed teams that had responsibilities and duties assigned to teams without a formal lead. Some NHs embraced change whereas others seemed more reluctant; for example, it was observed that some MPT members questioned every suggestion or assumed that colleagues would not keep to the agreements

made. Limited self-reflection was also mentioned, with respondents indicating that MPT members and NH staff sometimes found it hard to accept that the level of PDU in their NH was high, despite feedback and evidence to the contrary. Time pressure interfered with implementation in other instances, and in some cases, the NH management did not grant their staff the time needed to complete the project; however, several respondents indicated that the issue of time constraints, whether perceived or real, was about setting priorities. Implementation was facilitated when NHs developed a view or vision on PDU with sufficient alternatives, because it allowed them to build on a basic level and focus on finetuning agreements. Levels of innovative power were different among NHs, and it appeared that those used to participating in research had an easier time with implementation. It was also easier to implement the RID intervention when it could be integrated with other projects, but this was at the cost of the multiple projects placing excess demands on staff.

Process

The involvement of stakeholders, such as internal project leaders, physicians, and psychologists, differed among the NHs, but if these key persons could continue their efforts, staff turnover did not negatively impact the project. Notably, arranging for proper transition facilitated implementation when there was turnover in these positions. Active participation by management also conveyed to the MPT that the project was important. In some cases, it also seemed that the internal project leaders lack the skills and personality for their role. In fact, a change in the internal project leader was not a barrier when that person was replaced by someone who was better suited to the role.

> External coach: “*She read all information about the project, was well prepared, and brought structure; she worked according to a fixed agenda, with notes and action lists. She asked about intrinsic motivation (why are you in the project team) and held them accountable ... She was decisive and sought connection with relevant parties such as the policy advisor and manager.*”

External coaches mentioned that there were variations between NHs, requiring that they customized their approaches to each NH. Often external coaches were

perceived to facilitate implementation by providing structure and reflection, and in some instances, they "scaled up," examined the internal dynamics, and tried to create engagement by addressing the need for change and the relative advantage. Nevertheless, staff in some NHs were perceived to remain reluctant despite these strategies. An issue was that the expectations of the project were not always in line with what was communicated. It was sometimes expected (mostly by internal project leaders, but also by a few external coaches) that the results of the problem analysis would yield manageable and directly applicable information, without the need for reflection and translation by the MPT and external coach (e.g., "what does this information mean?" and "what do we want to do?"). Also, some MPT members failed to engage in the project either because the external coach was treated as the main carrier of the project or because MPTs were not open to being coached.

> External coach: *"I can be very facilitating, and I can be a guide, but the organization must act itself. I can't tell people what to do … I can only advise 'it is smart to do this' or 'you can choose from this and this and choose for yourself what fits your organization' best."*

Although MPT members were generally very enthusiastic, this did not guarantee results because the ability to move forward was sometimes perceived as limited. According to respondents, overestimating the ease of implementing the innovations led some NHs to create AIPs that included either non-specific or excessive actions that could result in an unclear division of roles and responsibilities. Despite researcher feedback in which these concerns were stressed, no changes were made by the relevant MPTs.

Discussion

In general, the RID intervention with PAR, external coaching, and tailored information provision was evaluated positively. The local problem analysis, coupled with the presence of external coaches and researchers, often generated an impetus for action. However, the overall process was complex and time consuming from the problem analysis to the design of a tailored AIP, with external coaching being key during this transition. Coaching also seemed to have an empowering effect, with some

NHs even considering it a prerequisite for ongoing implementation. Nevertheless, important issues were that the set time period of 8 weeks for problem analysis and AIP design was too short and that the extent of performance was suboptimal, with several differences emerging among the NHs. For example, 4 of the 16 NHs had short implementation periods because of delays. This might have resulted in limited execution of key actions that may have reduced the effectiveness of the RID intervention in these NHs.

Actively involving NH staff throughout the implementation process was deemed essential by respondents. This is consistent with existing literature showing that bottom-up approaches that include local stakeholders are key to gaining support for, and the adoption of, a given intervention. [38] A potential downside of PAR is that actively involving staff in the whole process meant that it was often impossible to complete implementation within 6 months, because in practice, the process can be very time intensive. Staff turnover and reorganizations further complicated implementation, which is again consistent with other findings. [24,25] To date, these contextual/environmental characteristics have been viewed as confounders or barriers, but it might be more appropriate to accept them as normal conditions into which interventions must be integrated. [39] In our view, placing preconditions on organizations before they can participate (e.g., requiring stability) is unrealistic, and we must instead better account for discontinuity due to staff turnover or reorganization during implementation processes. As such, because the issue of staff turnover cannot be resolved, the challenge lies in learning to implement a new strategy in a changing context. Our results suggest that the negative impact of such change can be mitigated if communication and takeover are handled well.

The extent to which NH staff are willing and able to implement nonpharmacological strategies is important, considering that many nonpharmacological strategies depend upon implementation by NH staff. [40] Earlier research has concluded that the readiness of staff for change must be considered during implementation planning. [41] Similarly, we found that differences existed in the extent to which NH staff were open to change. For example, time pressures often were used as an argument for impeded implementation. Although this common barrier has been mentioned in other studies, [42-44] some of our external coaches noted that time pressures were often an issue of perception and stressed that the true problem was about setting priorities. Although literature illustrates that dealing with NPS is indeed a priority in long term care, taking into account that NPS can result in distress amongst nursing

staff, [45-47] the uptake of nonpharmacological treatments in daily practice is still limited. Nonetheless, the results of our study indicate that despite discussing the relevance of change (i.e., the degree of inappropriate PDU in the NH) and the added value of intervening, some NHs remained reluctant to change. In these instances, creating engagement based on content and reflection with an external coach could therefore have been ineffective. Nevertheless, assessing and supporting an organization's readiness for change might facilitate successful implementation. This is in line with Pimental et al stressing that an organization's readiness for change is essential and is a function of organizational members' shared commitment to implementing change and a shared belief in their collective capability to do so. [48]

Communication issues impeded implementation in our study, which is again consistent with previous research. [24,26] Notably, our problem analysis revealed that many NHs struggled with there being little interdisciplinary contact. Although staff in some NHs recognized this as a point for improvement, budget cuts meant that NH management were often unwilling to invest in the AIP. Also, some MPTs had expectations of the external coaches and researchers that were too high, underlining a need to communicate what they can expect more clearly and to empower teams to feel confident in taking action themselves.

We confirmed two findings of our recently published systematic review on the barriers and facilitators of complex interventions for residents with dementia in long-term care. [49] First, limited skills of internal project leaders impeded implementation in some cases. As suggested in our earlier review, greater care may be needed to ensure that we select competent and suitable staff to drive change (e.g., identifying a role model whose advice is accepted by colleagues). Second, as concluded in our review, we found that nursing staff occasionally struggled to apply their newly acquired knowledge in practice, indicating that the education or training methods we adopted may not have been suited to their learning styles. This also underlines the importance of interventions that are compatible with the intended users. Approaches such as on-the-job coaching let to enhanced applicability and should be considered in the future.

Finally, despite the aim of this study, no role was defined for pharmacists. In the Netherlands, it is common for organizations to have monthly pharmacotherapeutic consultations and annual mandatory medication reviews with their supervising pharmacists. [50] If organizations wanted additional involvement from their pharmacist, this could be included in the tailored AIP. Nevertheless, in retrospect we do argue

that informing pharmacists about the study and the possibility to be involved could have been of added value.

In a subsequent study, it could also be interesting to include the impact of NPS for nursing staff and relate this to compliance. In addition, qualitative data indicates that improvements were perceived, for example related to multidisciplinary collaboration. This was not measured as an outcome. Taking this into account, and considering that many of the implemented actions relate indirectly to PDU, we stress that future trials emphasize a broader range of outcomes such as knowledge, multidisciplinary collaboration, or use of person centred interventions.

Given that residents and their family members are relevant stakeholders and can be an important motivator to change, future studies should consider an implementation strategy in which they can contribute to realizing change.

Strengths and Limitations

The use of a mixed methods approach ensured that we obtained an extensive and thorough insight into all aspects of our process evaluation. However, a critical comment is appropriate regarding our respondents. The external coach and internal project leader represented our respondents, while many other stakeholders participated in the study as well. Considering this, we have included a relatively small number of respondents. Moreover, various stakeholders have different professions and areas of expertise, which is likely to influence somebody's vision, opinion and, as a result, evaluation of the process. Consequently, the data reflects the opinion of these two roles and might be a limited representation of reality. Nevertheless, both roles were key to the RID intervention and we considered the majority of the respondents to be relatively well aware of the perceptions of others involved in the process. Due to turnover, some respondents were not involved from the beginning of the intervention, which possibly affected completeness of the data. The evaluation parameters we used may represent an important limitation given the tailored nature of our intervention. It was overly complicated to determine what parameters needed to be included and how these should be operationalized to evaluate the implementation. For instance, the use of a mean implementation score for AIP actions was deemed suboptimal because each score does not acknowledge the different importance of each action. Finally, recall bias may have influenced the results because the data were only collected after the project, and this may have

influenced the reliability and comprehensiveness of our results given the turnover of external coaches and/or internal project leaders in some NHs.

It should be noted that we deviated from our study design in two aspects. [31] First, although the tailored information provision and external coaching were described as implementation strategies, we now believe they should be considered inherent to the core intervention. This is consistent with many complex interventions that incorporate implementation strategies in this way. [49] Given that the process evaluation model we used assumes that intervention and implementation strategies be separate, [34] this model may need to be adapted for process evaluations of complex interventions. The second deviation from our design concerns the examination of barriers and facilitators. To ensure that this aspect was well examined, we developed questionnaires based on common factors reported in other studies [24,26,34,51] and detailed in the CFIR. [37] However, it was difficult to answer the questions without ambiguity, which meant that the interviews were more useful for in-depth exploration.

Conclusions

We hypothesized that implementation would be facilitated using an intervention with PAR, external coaching and tailored information provision. Although these elements were appreciated and implementation may indeed have been facilitated, the added value and effectiveness of these elements depends on a large number of factors. Consequently, the level of implementation (e.g. extent of performance) differed between NHs.

The RID intervention was evaluated positively, but it was also considered to be time consuming and complex. Although external coaching was certainly considered relevant, it was not considered indispensable, with its added value rated differently across organizations. That said, the external coaches stimulated implementation and even had a role in mitigating the effects of some of the barriers we encountered (e.g., facilitating proper takeover of key roles). Also, the effectiveness of coaching may have been dependent on a range of factors, including the organization, openness to coaching and change in general, and whether NH staff and management can be motivated by arguments, facts, and numbers. Staff turnover and reorganization were recurring themes in the analysis of barriers, and given that these are ubiquitous to normal practice, we believe that any future implementation strategy should address innovating within the broader confines of an ever changing environment. Despite

our efforts, we partially encountered well-known barriers. This process evaluation provides insights into the implementation of a complex intervention, but it also shows how difficult it is to realize quality improvement and culture change within NHs. This takes time and affects all different kinds of stakeholders and organizational levels. Therefore, future studies do well to assess and support organizations in their readiness to change. Given that the extent of performance of the NHs varied, sensitivity analyses are appropriate when investigating the effects of the RID intervention, taking into account the week in which nursing homes started with implementation and the degree to which actions were implemented as intended. We stress that future trials emphasize a broader range of outcomes such as knowledge, multidisciplinary collaboration, or use of person centered interventions.

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Additional File 1. Attendance Multidisciplinary Project Team

Nursing home	Physicians	Psychologists	Nurses
1	76%–100%	51%–75%	76%–100%
2	0%–25%	0%–25%	76%–100%
3	0%–25%	26%–50%	51%–75%
4	26%–50%	76%–100%	76%–100%
5	0%–25%	26%–50%	26%–50%
6	26%–50%	26%–50%	26%–50%
7	51%–75%	76%–100%	51%–75%
8	26%–50%	26%–50%	76%–100%
9	51%–75%	76%–100%	76%–100%
10	76%–100%	51%–75%	26%–50%
11	76%–100%	76%–100%	76%–100%
12	51%–75%	26%–50%	0%–25%
13	76%–100%	76%–100%	76%–100%
14	76%–100%	76%–100%	76%–100%
15	76%–100%	76%–100%	76%–100%
16	76%–100%	76%–100%	26%–50%

- In case of differences in answers between coach and internal project leader, the most conservative (low) score was depicted, given the importance of distinguishing nursing homes that have implemented less successfully.
- 4-point scale: 0%–25%/26%–50%/51%–75%/76%–100%.

Additional File 2. CFIR Constructs with Short Definitions.

Topic	Short Description
I. INTERVENTION CHARACTERISTICS	
A Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.
B Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.
C Relative advantage	Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution.
D Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.
E Trialability	The ability to test the intervention on a small scale in the organization [8], and to be able to reverse course (undo implementation) if warranted.
F Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement.
G Design Quality and Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled.
H Cost	Costs of the intervention and costs associated with implementing that intervention including investment, supply, and opportunity costs.
II. OUTER SETTING	
A Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs are accurately known and prioritized by the organization.
B Cosmopolitanism	The degree to which an organization is networked with other external organizations.
C Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented or in a bid for a competitive edge.
D External Policy & Incentives	A broad construct that includes external strategies to spread interventions including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.
III. INNER SETTING	
A Structural Characteristics	The social architecture, age, maturity, and size of an organization.
B Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.
C Culture	Norms, values, and basic assumptions of a given organization.

Additional File 2. *(continued)*

Topic	Short Description
D Implementation Climate	The absorptive capacity for change, shared receptivity of involved individuals to an intervention and the extent to which use of that intervention will be rewarded, supported, and expected within their organization.
1 Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change.
2 Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.
3 Relative Priority	Individuals' shared perception of the importance of the implementation within the organization.
4 Organizational Incentives & Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary and less tangible incentives such as increased stature or respect.
5 Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff and alignment of that feedback with goals.
6 Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.
E Readiness for Implementation	Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.
1 Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.
2 Available Resources	The level of resources dedicated for implementation and ongoing operations including money, training, education, physical space, and time.
3 Access to knowledge and information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.
IV. CHARACTERISTICS OF INDIVIDUALS	
A Knowledge & Beliefs about the intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.
B Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.
C Individual Stage of Change	Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.
D Individual Identification with Organization	A broad construct related to how individuals perceive the organization and their relationship and degree of commitment with that organization.
E Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.

Additional File 2. *(continued)*

Topic	Short Description
V. PROCESS	
A Planning	The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance and the quality of those schemes or methods.
B Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and other similar activities.
1 Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention.
2 Formally appointed internal implementation leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.
3 Champions	"Individuals who dedicate themselves to supporting, marketing, and 'driving through' an [implementation]" [101] (p. 182), overcoming indifference or resistance that the intervention may provoke in an organization.
4 External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.
C Executing	Carrying out or accomplishing the implementation according to plan.
D Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.

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Abbreviations: CFIR, Consolidated Framework for Implementation Research

CHAPTER 5

Tailored interventions for inappropriate psychotropic drug use in nursing home residents with dementia: participatory action research in a special case of a stepped-wedge cluster randomized controlled trial

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Abstract

Background: Psychotropic drugs are modestly effective and may cause adverse effects. Efforts to reduce inappropriateness and increase usage of psychosocial interventions often suffer from suboptimal implementation. The purpose of this study was to evaluate effectiveness of an innovative study using implementation promoting elements in nursing home residents with dementia and neuropsychiatric symptoms.

Methods: A multicenter cluster randomized controlled trial with a special case of a stepped-wedge design with two arms and one stap was designed. The intervention comprised participatory action research, tailored information provision and external coaching, leading to the implementation of tailored action and implementation plans. The primary outcome was inappropriateness of psychotropic drug use (Appropriate Psychotropic Drug Use in Dementia [APID] index) and the secondary outcome was percentage of psychotropic drug use at baseline, 8 months, and 16 months. Homes were allocated to start with usual care or the intervention. After 8 months, the control group crossed over to receive the intervention. The other homes continued the intervention to 16 months. Patients were eligible if they were diagnosed with dementia, had a life expectancy of at least 3 months, and resided in psychogeriatric units.

Results: An adjusted multilevel model revealed no effect on the APID index sum score at 8 months (0.564; 95% confidence interval [CI], -2.449–3.577; p = 0.714) or 16 months (2.165; 95% CI, -1.113–5.443; p = 0.196). An adjusted generalized estimation equation (GEE) model showed an effect at 16 months for percentage of use (OR 0.654; 95% CI, 0.481–0.889; p = 0.007). Adjusted GEE models showed an effect especially at 16 months for anxiolytics (OR 0.573; 95% CI, 0.382–0.859; p = 0.007) and antidepressants (OR 0.678; 95% CI, 0.475–0.968; p = 0.033).

Conclusions: No reduction of inappropriateness was found although overall usage was reduced. Professionals focused on implementing alternatives to compensate for usage, rather than prescribing quality. Future studies may focus on changing physicians' prescribing behaviors in combination with multicomponent and multidisciplinary psychosocial alternatives.

Introduction

Dementia afflicts over 55 million people worldwide, with projections suggesting the potential for nearly 10 million new cases each year. [1] At some point, most people living with dementia will exhibit neuropsychiatric symptoms, such as depression, psychosis, agitation, aggression, apathy, and disinhibition. Estimates indicate that about 80% of nursing home residents in the Netherlands will experience at least one. [2,3] Given that psychotropic drugs have only modest effectiveness at best and significant potential to cause side effects and adverse events, [4-7] guidelines recommend psychosocial interventions as the first-line treatment. [8-11] Nevertheless, psychotropic drug usage remains prevalent. [12,13] Regular use of at least one psychotropic drug is about 61%, whilst pro re nata use of psychotropic drugs is also common. [14,15] In Western Europe nursing homes, for example, antipsychotics (range, 12%–59%) and antidepressants (range, 19%–68%) are being regularly prescribed. [16] Over the years, antipsychotic usage may have decreased somewhat, whilst benzodiazepine use may have increased. Moreover, the prescribing of psychotropic drugs may be considered inappropriate, for example regarding its indication, evaluation, and duration. [14,17-20]

Guideline recommendations [8] have led researchers to focus on reducing (inappropriate) psychotropic drug use and to increase the use of psychosocial and multidisciplinary multicomponent interventions for nursing home residents with dementia and neuropsychiatric symptoms. [21-29] This has produced mixed results, with some finding modest reductions in (inappropriate) psychotropic drug use [22–24,26,29] and others finding no change. [25,27] When reductions occurred, the interventions generally produced relatively small effects. [21,22,24,25,27] Process evaluations have since uncovered barriers to suboptimal implementation, including high workloads, staff turnover, and lack of time to implement complex multicomponent interventions. [30–34] By contrast, engaging leaders, supporting key workers, and having a shared focus on change (i.e., specifically acceptance, commitment, and a positive attitude) may facilitate implementation. [30,31,33] However, especially the latter remains challenging. Agitation and aggressive behavior of residents may cause severe distress amongst nursing staff. [35] Physicians can feel pressured by nursing staff to prescribe psychotropic drugs as nursing staff may believe that the possible benefits outweigh any potential side effects [36] or there is a lack of trust in psychosocial interventions. [37] Discontinuation of psychotropic drugs may be impeded by fear of nursing staff for negative consequences. [19] Hence, it can be stated that creating a change can be challenging given the complex nature of nursing homes and concerning the potential attitudes

and emotions that may play a role regarding this topic. As a result, ''one size fits all'' standardized interventions are less likely to succeed and it is acknowledged that intervention and implementation should be tailored to emphasize the specific organizational contexts and addressing the culture, nature and characteristics of each organization. [38–40] The effectiveness of complex interventions within nursing homes may be improved by adapting interventions to local contextual barriers and facilitators. [41,42] Employing a collaborative approach that engages multidisciplinary healthcare teams [33,43] and provides guidance with opportunities for ongoing discussion and problem solving [43] may offer a solution. The RID intervention was designed against this background. We hypothesized that interventions to reduce (inappropriate) psychotropic drug prescribing in nursing homes would benefit from a bottom-up approach with active involvement of staff in determining the problems and potential solutions, before tailoring the solution to the local setting with the support of an external coach. Participatory action research (PAR) can deliver precisely this type of collaborative and reflective strategy. It requires that researchers and participants work together to improve local practices by exploring and implementing potential solutions and making adjustments based on evaluations of their effectiveness in practice. Integrating this approach within a randomized controlled trial (RCT), known as PAR-RCT, can ensure generalizability. [44] Using this design, we evaluate whether tailored information provision and external coaching can produce action and implementation plans that reduce both inappropriate psychotropic drug use and the frequency of psychotropic drug use in nursing home residents with dementia. We also evaluate whether repeating the intervention cycle improves outcomes.

Methods

Study design

This multicenter cluster RCT with a special case of a stepped-wedge design with two arms and one step used a PAR approach in Dutch nursing homes and is part of the Reducing Inappropriate Psychotropic Drug Use (RID) study. The full study protocol has been published elsewhere. [45] This report follows the 2010 CONSORT guidelines. [46]

The stepped-wedge design [47] had an overall duration of 16 months and comprised two 8-month phases, with measurements taken at baseline, 8 months, and 16 months. Phase one started with 16 nursing homes randomized to either the RID intervention group or the control group (usual care). Phase two started after 8 months with the

nursing homes in the control group crossing over to the RID intervention group and the other eight nursing homes continuing with the RID intervention (figure 1). An independent statistician performed computer-generated blinded randomization in fixed blocks : round 1 (6 homes; blocks, 2-2-2) and round 2 (10 homes; blocks, 4-2-4). [45]

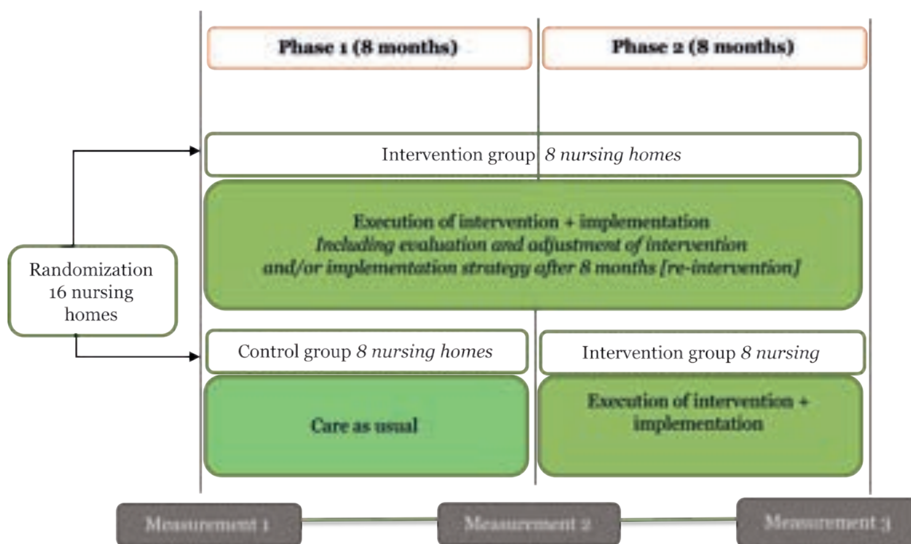

Figure 1. The RID Study: A special case of a stepped-wedge design with one step, two phases and three measurements
RID = reducing inappropriate psychotropic drug use

Setting and participants

In the Netherlands, nursing homes provide dementia care in special care units (DSCUs). An elderly care physician typically has responsibility for any medical treatment, working in close collaboration with a psychologist, nurse practitioner, and nursing staff with varying levels of education and responsibilities. Homes may also employ physical, occupational, and activity therapists to improve well-being, functioning, and quality of life. [48,49] We recruited nursing homes online after attending a national kick-off conference with presentations and an information market. An intake telephone call was then scheduled to assess the suitability of each home for inclusion, with 16 homes included by their order of application. DSCUs delivering care for residents with Korsakoff syndrome, acquired brain injury, Down's syndrome, or young-onset dementia were excluded. Each nursing home participated with a few large-scale units or multiple small-scale units. Nursing home residents were eligible for participation if they had a diagnosis of dementia and a life expectancy of

at least 3 months, as judged by a physician. All eligible residents were approached for participation, including newly admitted residents, after the study began. More information can be found in the study protocol. [45]

RID intervention

A detailed description of the RID intervention can be found elsewhere. [50] The RID intervention involved forming a multidisciplinary project team with an internal project leader, a physician, a psychologist, and a nursing staff representative, together with a certified external coach to guide the cyclical process across four phases. Each intervention started with researchers executing a problem analysis on the management of neuropsychiatric symptoms and the appropriateness and percentage of current psychotropic drug use in their home (observation phase). The team then evaluated this tailored information and formulated specific goals under the guidance of the external coach (reflection phase), before operationalizing the goals into an action and implementation plan (planning phase). Finally, each nursing home implemented a set of interventions (action phase).

In some cases, there were differences between participating DSCUs within a nursing home, regarding the problem analysis or the potential solutions. Implementation was allowed to be tailored to a given DSCU, although in practice, most nursing homes developed and executed one action and implementation plan for all the participating DSCUs within their nursing home. The actions implemented by each nursing home varied based on their tailored problem analysis, but they generally targeted multidisciplinary and methodical working (including person-centered interventions), education and training, and adaptations to the living environment. [50] For the nursing homes that started in the RID intervention group in phase one, the measurement at 8 months was treated as an interim analysis that triggered the repetition of all four phases of the PAR cycle during the second phase of the trial (figure 1). Nursing homes that started in the control group in phase one provided care as usual for the first 8 months and entered an intervention cycle in phase two.

Sample size

The sample size was based on the primary outcome (inappropriateness of psychotropic drug use). To detect a reduction of 5 points (standard deviation 15) on the Appropriateness of Psychotropic Drug Use in Dementia (APID) index with a power of 0.80, a two-sided α value of 0.05, and an average of 25 residents per nursing home, we estimated the need for 16 clusters (nursing homes). Not taking

clustering into account, we needed to include 284 residents who used psychotropic drugs. However, allowing for the multilevel design with two measurements after baseline, an intraclass correlation coefficient of 0.1, a calculated design factor of 1.28, and a 10% cluster dropout, this increased to 364 residents. Given that an estimated 60% of residents with dementia are prescribed psychotropic drugs, [17] we needed to include 607 residents (i.e., psychotropic drug users and non-users). We attempted to mitigate the expected 40% loss to follow-up by enrolling newly admitted residents throughout the study. [45]

Outcomes and data collection

Data on age, sex, dementia diagnosis, length of stay in the current DSCU, and number of psychotropic drugs were collected from each participant's medical record. For both outcomes, researchers extracted data from the medical records of residents. Psychotropic drug usage included prescriptions of antipsychotics, anxiolytics, hypnotics, antidepressants, anticonvulsants and anti-dementia drugs. Anticonvulsants and antidementia drugs are listed as psychotropics drugs because they could have been prescribed to treat agitation in dementia and psychosis in Lewy Body dementia, respectively. Psychotropic drugs were grouped according to the Anatomical Therapeutic Chemical classification. [51] We excluded psychotropic drugs used pro re nata. If residents died or relocated more than 2 months after the measurements at baseline or 8 months, we collected any recorded data on psychotropic drug use at the next measurement.

The primary outcome was the inappropriateness of psychotropic drug use, as measured with the APID index. The APID index was developed by an expert panel based on the items of the Medication Appropriateness Index. The index has been evaluated among DSCU residents in the Netherlands. [52,53] The APID rates the appropriateness of psychotropic drug use for residents with neuropsychiatric symptoms and dementia. Therefore, psychotropic drugs given for dementia, sleeping disorders, or delirium are included in the scoring, but those given for other psychiatric disorders are excluded. The APID instrument contains seven domains: indication, evaluation, dosage, drug-drug interaction, drug-disease interaction, duplication, and therapy duration. Using data from medical records, each domain is scored 0, 1, or 2 to reflect "appropriate," "marginally appropriate," and "inappropriate" usage, respectively. During the development, an expert panel weighted the relative importance of each single domain on a scale from one to ten, resulting in different ranges per domain: indication (range 0-18.8), evaluation (range 0-19.2), dosage (range 0-13.4), drug-drug interactions (range

0-11.6), drug-disease interactions (range 0-13.2), duplication (range 0-14.4), and therapy duration (range 0-12.2). These single domains can be incorporated into a weighted sum score using mean weights. The APID sum score ranges from 0 (fully appropriate) to 102.8 (fully inappropriate) per rated psychotropic drug. Hence, lower scores indicate more appropriate psychotropic drug use. [52] The APID index applies different rules regarding the indication and evaluation domains for prescriptions that are started prior to nursing home admission and for prescriptions started at the DSCU of the nursing home. For example, for psychotropic drugs that are started at the current DSCU the normal rules apply: a (correct) indication needs to be found within two months after starting the psychotropic drug. To assess the indication of a psychotropic drug that is started before admission to the DSCU, a 6-month period is allowed. Moreover, the indication is still considered appropriate even if an indication is lacking or incorrect if the 6-month period has not yet expired. The rationale behind this, according to the expert panel that developed the APID index, was that the physician should be given enough time to set an indication and to evaluate the usage of psychotropic drugs that were prescribed prior to nursing home admission.

The secondary outcome was the percentage of psychotropic drug use, evaluated as a binary variable (i.e., yes/no).

Data about neuropsychiatric symptoms were collected using the Neuropsychiatric Inventory-Nursing Home version (NPI-NH). [54] A member of the nursing staff filled in paper versions of the questionnaire in the presence of a researcher. The NPI-NH assesses the frequency (score, 1–4), severity (score, 1–3), and caregiver distress (score, 0–5) for 12 psychiatric and behavioral symptoms. Item scores are generated by multiplying the frequency and severity (1–12), with possible scores ranging from 0 to 144, where a higher score indicates more frequent and severe neuropsychiatric symptoms. [55]

Statistical analysis

IBM SPSS, version 25 (IBM Corp., Armonk, NY, USA), was used to prepare the datasets and perform the descriptive statistics. Stata software, version 17.0, was used for all other analyses. Descriptive statistics were used to summarize the characteristics of residents at baseline by treatment arm, with data included for newly recruited residents at 8- and 16-months' follow-up.

For the primary outcome, data was used from the residents using psychotropic drugs, with single psychotropic drug prescriptions as the level of observation. We compared the inappropriateness of psychotropic drug use between the intervention and control

groups using multilevel models to accommodate the hierarchical data structure. These models were used to adjust for the clustering of residents within nursing homes (random intercept at the nursing home level) and for the correlation of the repeated measures and multiple prescriptions within residents (random intercept at the resident level). The dependent variable was set as the change in APID index score between two consecutive measurements. The analysis was adjusted for the number of psychotropic drugs per resident, sex, baseline NPI-NH total score, length of stay in the DSCU at baseline (in months), and time in the study arm. Residents were evaluated in four groups: full duration, later enrollment, early drop out, and later enrollment with early drop out. Time and the interaction of time with treatment were included as fixed effects. The model compared changes in the APID index sum score between baseline and either 8- or 16 months. Multilevel models were fitted with the restricted maximum likelihood method, and effect estimates are presented with 95% confidence intervals (CIs) and p values. Newly admitted residents were included at 8- and 16-month's follow-up, but, considering that change scores were used for the primary outcome, data was only taken into account when residents were included in at least two measurements.

A different dataset and structure were used to evaluate the secondary outcome, percentage of psychotropic drug use. This dataset included all residents (psychotropic drug users and non-users) with observations at the resident level. Data of residents included at 8- and 16-month's follow-up was taken into account. Psychotropic drug use between the control and intervention groups was compared by logistic generalized estimating equations (GEE), accounting for the clustering of repeated measurements within residents. GEE was used because it generates population average estimates that are preferable for intervention studies. [56] The model contained psychotropic drug use (yes/no) at 8 and 16 months as the dependent variables and assessed the main effect by group (intervention vs control). We intended to correct for baseline NPI-NH sum score and baseline psychotropic drug use. Given the possibility of collinearity between these variables, they were added to the model one by one. Many residents were not included at the baseline measurement, which led to missing data; however, imputation was not feasible because the data concerned the period before admission. Two GEE models were ultimately executed: 1) analysis of all cases without correction for the NPI-NH sum score and psychotropic drug use at baseline, and 2) analysis of complete cases only, with subsequent correction for the NPI-NH sum score and psychotropic drug use at baseline. Adjustments were made for sex, length of DSCU stay (in months), and time in the study arm (full duration, later enrolment, early drop out, and later enrolment with early drop out; for all cases only). In addition to overall psychotropic drug usage, we performed post hoc

analyses for psychotropic drug subgroups: antipsychotics, anxiolytics, antidepressants and hypnotics. We did not perform analyses for anticonvulsants and anti-dementia drugs separately, because of the small sample sizes within these groups. Several models were executed for each subgroup, in line with the analysis of overall usage. The models adjusted for confounders and containing all cases are considered the main models for both the pre-specified and post hoc analyses.

Finally, we conducted sensitivity analyses for the primary and secondary outcomes that considered the results of the process evaluation by excluding nursing homes with tardy or low implementation (n = 4). [50]

There were some deviations from the study protocol, [45] see Additional file 1.

Results

Descriptive data

Figure 2 indicates the flow of nursing homes and residents through the study. Of the 25 homes eligible for inclusion between July 2016 and November 2018, nine decided not to participate (before randomization) due to lack of staff commitment or being unable to meet the requirements of participation, leaving sixteen nursing homes available for randomization. One nursing home in the control group also dropped out after randomization, but before the baseline measurements. Therefore, no data were gathered for this nursing home and we recruited a replacement nursing home through our national platform (Vilans Center of Expertise for Long-term Care). There was no loss to follow-up at the cluster level, and loss to follow-up at the resident level did not differ between clusters (control, 46%; intervention, 51%). At baseline, 576 residents participated (control, 280; intervention, 296), of which 311 residents used psychotropic drugs (control, 160; intervention, 151). Thereafter, a total of 236 residents were newly included during the study at the second and third measurement (newly allocated residents minus the dropouts prior to measurement). Hence, in the control group, respectively 81 and 60 residents were newly included at both measurements (total control, 141) and in the intervention group 57 and 38 residents were newly included (total intervention, 95). Characteristics were similar between the control and intervention groups at baseline and for the newly recruited residents at the second and third measurements (see Additional files 2, 3, and 4).

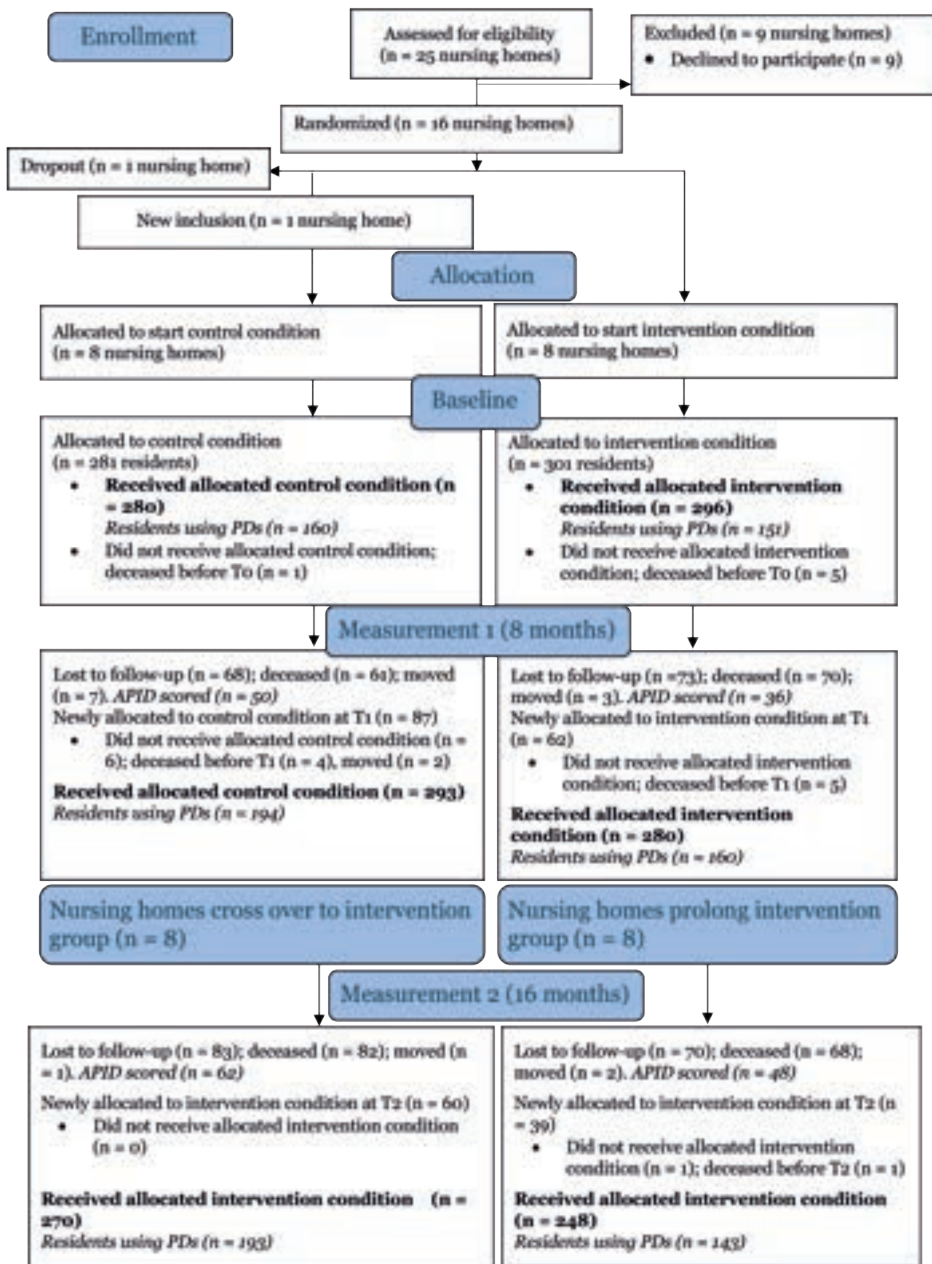

Figure 2. Study flow chart

APID = Appropriate Psychotropic Drug Use in Dementia; PD = psychotropic drug

Primary outcome

An additional file indicates the descriptive data for the mean APID index sum scores at baseline, 8 and 16 months (see Additional file 5).

Table 1 regards the effects of the RID intervention on the appropriateness of psychotropic drug use, showing the multilevel model analyses using the APID index sum scores. The crude multilevel model indicated a difference of 0.216 (95% CI: -2.580 to 3.012; p = 0.879) on the APID index sum score from baseline to 8 months between the RID intervention and control group.

Table 1. Effect of the RID intervention on the appropriateness of psychotropic drug use

	APID index sum score*			***P***
		95%CI		
	Estimate	***Lower bound***	***Upper bound***	
Model I: Crude model				
Difference between:				
RID intervention and control group from baseline to 8 months	0.216	-2.580	3.012	0.879
RID intervention and re-intervention**** from baseline to 16 months	1.321	-1.655	4.296	0.384
Model II: Including confounders**				
Difference between:				
RID intervention and control group from baseline to 8 months	0.564	-2.449	3.577	0.714
RID intervention and re-intervention**** from baseline to 16 months	2.165	-1.113	5.443	0.196
Model III: Post hoc sensitivity analysis* excl. 4 least performing nursing homes**				
Difference between:				
RID intervention and control group from baseline to 8 months	0.784	-2.970	4.538	0.682
RID intervention and re-intervention**** from baseline to 16 months	2.129	-1.779	6.038	0.286

* Theoretical range: 0–102.8. Higher scores indicate less appropriate PD prescribing. The estimates are the differences in APID index sum score between the intervention and control group from baseline to 8 months or from baseline to 16 months. The estimated effect size is approximately 0.33 (in the sample size calculation we aimed for a difference of five points on the APID index sum score between groups and a standard deviation of 15: Van der Spek et al. A reliable and valid index was developed to measure appropriate psychotropic drug use in dementia; Journal of Clinical Epidemiology 2015 [66]).
** Number of psychotropic drugs per resident, sex, NPI-NH sum score, duration of stay on the unit (in months) and time in the study arm (full duration, later enrolment, early drop out, and later enrolment with early drop out)
*** Corrected for the abovementioned confounders
**** control group in phase I, crossed over to intervention in phase II
APID = Appropriate Psychotropic Drug Use in Dementia; CI = confidence interval; NPI-NH = Neuropsychiatric Inventory-Nursing Home version; RID = reducing inappropriate psychotropic drug use.

For baseline to 16 months follow-up (i.e., prolonged intervention group and control group crossed over to intervention), this was 1.321 (95% CI: -1.655 to 4.296; p = 0.384). The crude effects on the APID index sum score were smaller than the a priori anticipated five points. The results did not change materially after adjusting for confounders or in the sensitivity analyses that excluded the four nursing homes with the lowest implementation levels. Similar numbers of appropriate and inappropriate prescriptions were either stopped or started during the trial.

Secondary outcome

An additional file shows the descriptive data for the percentage of psychotropic drug users, covering overall usage as well as use of psychotropic drug subgroups at baseline, 8 and 16 months (see Additional file 6). No major baseline differences were found between the intervention and control group, although psychotropic drug use was a little higher in the control group. Overall usage was about 50% in the intervention group and about 57% in the control group. Antipsychotics and antidepressants were most frequently used, followed by anxiolytics. The results of the GEE analysis on overall psychotropic drug use are summarized in table 2. The crude model (Model 1) showed a relatively large intervention effect at 8 months and a larger effect at 16 months. The odds of psychotropic drug usage in the RID intervention group were 0.7 (95% CI: 0.546 to 0.988; p = 0.041) and 0.6 (95% CI: 0.460 to 0.839; p = 0.002) times as high at 8 and 16 months, respectively. Effect estimates were very similar in the analyses adjusted for confounders (Model 2), though with slightly broader confidence intervals. No large difference in psychotropic drug usage existed between the RID intervention and control group for complete cases (Model 3a and 3b). Again, a greater intervention effect was observed at 16 than at 8 months.

The sensitivity analysis that excluded four nursing homes produced smaller effect sizes that retained the same directionality (see Models 1 and 2 of Additional file 7). The post hoc analysis on the psychotropic drug subgroups (table 3) revealed no change on hypnotics and on antipsychotics, although the odds on antipsychotic usage decreased a little. Relatively large effects were found on usage of anxiolytics as well as antidepressants. The odds of anxiolytics usage in the RID intervention group (Model 5, adjusted for confounders) were 0.6 times as high at 8 months (95% CI: 0.430 to 0.952; p = 0.027) and about 0.5 times as high at 16 months (95% CI: 0.382 to 0.859; p = 0.007) compared to baseline. The odds of antidepressant usage in the RID intervention group (Model 8, adjusted for confounders) were about 0.7 times as high at 8 months (95% CI: 0.478 to 0.973; p = 0.035) as well as at 16 months (95%

CI: 0.475 to 0.968; p = 0.033). Similar effects were found for both subgroups in the crude models. Overall, most of the results showed effect estimates in favor of the intervention, though with variations in effect size and confidence interval width.

Table 2. Effect of the RID intervention on the percentage of psychotropic drug use

	Psychotropic drug use			
		95%CI		
	OR	***Lower bound***	***Upper bound***	***P***
Model 1. Crude model. Ratio of:				
RID intervention and control group at 8 months	0.734	0.546	0.988	0.041
Both RID intervention groups [a] at 16 months	0.621	0.460	0.839	0.002
Model 2. Including confounders. [b] Ratio of:				
RID intervention and control group at 8 months	0.776	0.573	1.051	0.101
Both RID intervention groups [a] at 16 months	0.654	0.481	0.889	0.007
Model 3a. Complete cases only, including confounders. [c] Ratio of:				
RID intervention and control group at 8 months	0.915	0.616	1.358	0.659
Both RID intervention groups [a] at 16 months	0.879	0.593	1.305	0.523
Model 3b. Complete cases only, including confounders [d] Ratio of:				
RID intervention and control group at 8 months	0.836	0.497	1.407	0.500
Both RID intervention groups [a] at 16 months	0.745	0.410	1.352	0.333

[a] control group in phase I, crossed over to intervention in phase II.
[b] corrected for sex, duration of stay on the unit (in months) and time in the study arm (full duration, later enrolment, early drop out, and later enrolment with early drop out).
[c] corrected for sex, duration of stay on the unit (in months). Not corrected for time in the study arm, since this concerns a subset of data of the complete cases (e.g., full duration). Not corrected for baseline psychotropic drug use and baseline NPI-NH sum score.
[d] corrected for sex, duration of stay on the unit (in months), baseline psychotropic drug use, baseline NPI-NH sum score. Not corrected for time in the study arm, since this concerns a subset of data of the complete cases (e.g., full duration).
* Regarding complete cases analyses; there appeared no effect of collinearity between the two variables NPI and PDU.
CI = confidence interval; NPI-NH = Neuropsychiatric Inventory-Nursing Home; OR = odds ratio; RID = reducing inappropriate psychotropic drug use.

Table 3. Effect of the RID intervention: post hoc analysis on subgroups (all nursing homes)

Model and ratio	*OR*	95%CI		*P*
		Lower bound	*Upper bound*	
Model 1. Antipsychotics, crude model.				
RID Intervention and control group at 8 months	0.818	0.581	1.150	0.248
Both RID intervention groups[a] at 16 months	0.797	0.565	1.125	0.197
Model 2. Antipsychotics, including confounders.[B] Ratio				
RID Intervention and control group at 8 months	0.882	0.621	1.254	0.486
Both RID intervention groups[a] at 16 months	0.856	0.601	1.219	0.389
Model 3a. Antipsychotics, complete cases only, including confounders.[C] Ratio				
RID Intervention and control group at 8 months	1.444	0.892	2.338	0.135
Both RID intervention groups[a] at 16 months	1.500	0.924	2.435	0.101
Model 3b. Antipsychotics, complete cases only, including confounders.[D] Ratio				
RID Intervention and control group at 8 months	1.429	0.765	2.671	0.263
Both RID intervention groups[a] at 16 months	1.598	0.809	3.156	0.177
Model 4. Anxiolytics, crude model.				
RID Intervention and control group at 8 months	0.636	0.428	0.946	0.026
Both RID intervention groups[a] at 16 months	0.572	0.382	0.855	0.007
Model 5. Anxiolytics, including confounders.[B] Ratio				
RID Intervention and control group at 8 months	0.640	0.430	0.952	0.027
Both RID intervention groups[a] at 16 months	0.573	0.382	0.859	0.007
Model 6a. Anxiolytics, complete cases only, including confounders.[C] Ratio				
RID Intervention and control groups at 8 months	0.836	0.506	1.381	0.484
Both RID intervention groups[a] at 16 months	0.805	0.482	1.342	0.405
Model 6b. Anxiolytics, complete cases only, including confounders.[D] Ratio				
RID Intervention and control groups at 8 months	0.957	0.517	1.774	0.890
Both RID intervention groups[a] at 16 months	0.851	0.403	1.797	0.673
Model 7. Antidepressants, crude model.				
RID Intervention and control group at 8 months	0.694	0.489	0.984	0.040
Both RID intervention groups[a] at 16 months	0.693	0.484	0.992	0.045

Table 3. *(continued)*

Model and ratio	***OR***	**95%CI**		***P***
		Lower bound	***Upper bound***	
Model 8. Antidepressants, including confounders. [B] Ratio				
RID Intervention and control group at 8 months	0.682	0.478	0.973	0.035
Both RID intervention groups [a] at 16 months	0.678	0.475	0.968	0.033
Model 9a. Antidepressants, complete cases only, including confounders. [C] Ratio				
RID Intervention and control group at 8 months	0.703	0.449	1.099	0.122
Both RID intervention groups [a] at 16 months	0.796	0.507	1.248	0.320
Model 9b. Antidepressants, complete cases only, including confounders. [D] Ratio				
RID Intervention and control group at 8 months	0.681	0.396	1.173	0.166
Both RID intervention groups [a] at 16 months	0.836	0.451	1.551	0.570
Model 10. Hypnotics, crude model.				
RID Intervention and control group at 8 months	0.976	0.641	1.487	0.911
Both RID intervention groups [a] at 16 months	0.855	0.549	1.332	0.488
Model 11. Hypnotics, including confounders. [B] Ratio				
RID Intervention and control group at 8 months	1.059	0.688	1.630	0.794
Both RID intervention groups [a] at 16 months	0.932	0.596	1.457	0.758
Model 12a. Hypnotics, complete cases only, including confounders. [C] Ratio				
RID Intervention and control group at 8 months	1.252	0.692	2.266	0.457
Both RID intervention groups [a] at 16 months	0.956	0.508	1.797	0.888
Model 12b. Hypnotics, complete cases only, including confounders. [D] Ratio				
RID Intervention and control group at 8 months	1.625	0.825	3.201	0.160
Both RID intervention groups [a] at 16 months	0.951	0.391	2.314	0.912

[a] control group in phase I, crossed over to intervention in phase II.
[b] corrected for sex, duration of stay on the unit (in months) and time in the study arm (full duration, later enrolment, early drop out, and later enrolment with early drop out).
[c] corrected for sex, duration of stay on the unit (in months). Not corrected for time in the study arm, since this concerns a subset of data of the complete cases (e.g., full duration). Not corrected for baseline usage of the psychotropic drug subgroup and baseline NPI-NH sum score.
[d] corrected for sex, duration of stay on the unit (in months), baseline usage of the psychotropic drug subgroup, baseline NPI-NH sum score. Not corrected for time in the study arm, since this concerns a subset of data of the complete cases (e.g., full duration).

Table 3. *(continued)*
- The two subgroups anti-dementia drugs and anticonvulsants were not included in the GEE analysis given their small number of observations.
- Regarding the complete cases analyses; there appeared no effect of collinearity between the two variables NPI and psychotropic drug use.
CI = confidence interval; NPI-NH = Neuropsychiatric Inventory-Nursing Home version; OR = odds ratio; RID = reducing inappropriate psychotropic drug use.

Discussion

Summary of findings

Tailoring interventions to local contexts using PAR did not reduce inappropriate psychotropic drug use, but it did reduce overall usage, especially in the subgroups anxiolytics and antidepressants. Although one would expect a decrease of inappropriate - and an increase of appropriate prescriptions when targeting appropriateness, similar numbers of appropriate and inappropriate prescriptions were either stopped or started during the trial.

Comparison to literature

The mean APID sum scores in this study ranged from 23.0 to 27.1 (Additional file 5), which is broadly in line with earlier reports showing a mean APID sum score of 26.6 in a comparable setting and with the same inclusion criteria. [17] Baseline psychotropic drug use was 51% in the intervention group and 57% in the control group, which compares favorably with the previously reported frequencies of 61% and 66% in the Netherlands between 2003 – 2011. [57,58] Despite the lower percentage of psychotropic drug users at baseline in our intervention group, we observed a further decrease at 16 months (51.0%, 50.6%, and 48.3% at baseline, 8-, and 16 months, respectively). A more recent study concluded that psychotropic drug use declined from 62.7% to 40.4% over the period 2003-2018 and no reductions were perceived regarding anxiolytic and antidepressant usage. Compared to this study, our baseline use of psychotropic drugs was about 10% higher and we did observe a reduction of anxiolytic and antidepressant usage. [13] The usage of anxiolytics and antidepressants is common, [14,15] and therefore there is room for improvement to strive for a further reduction of anxiolytics and antidepressants.

Strengths and limitations

This study used an innovative PAR-RCT design containing several elements that promoted implementation based on knowledge from previous research. Therefore,

we could target matters known to be important, such as implementing an intervention tailored to the local context and being able to adjust the implementation over time. Using PAR with two cycles enabled us to examine short- and long-term implementation effects and our study is likely to have had value for nursing homes considering that possible solutions are explored and implemented for problems in local nursing home practice in direct cooperation with relevant stakeholders. The process evaluation [50] suggested that our multicomponent RID intervention was well designed, consistent with a review that argued for a comprehensive approach targeting organizational culture and multidisciplinary collaboration. [59]

However, several issues warrant further consideration. First, our recruitment process might have selected nursing homes in which staff already had an interest in psychotropic drug use, meaning potentially above-average standards of usual care. Second, we lacked follow-up data for some residents. Given this is consistent with the naturalistic course of people living in nursing homes, and that no differences were found between study groups, we consider this non-selective dropout. Third, full blinding was not feasible and might have biased the results. [60] Fourth, adjusting for baseline differences was not feasible in the multilevel analyses of appropriateness of psychotropic drug use since each single prescription is the level of observation. Instead, we used change scores. These can be less precise and validity issues such as regression to the mean might occur. Fifth, there might have been an underestimation of the effect size of our intervention. APID index scores were slightly higher in the control group as opposed to the intervention group (Additional file 5), leaving less room for improvement. Also, the determination of the indication and evaluation according to the APID index is difficult for psychotropic drugs that were prescribed prior to nursing home admission (see methods). This might have led to increased sum scores at the next measurement indicating less appropriate prescribing. Nevertheless, this applies to the intervention and control groups, meaning there is no selective bias. Sixth, the RID intervention might have been able to reduce the concomitant use of multiple psychotropic drugs, but this was not an outcome. The APID index cannot capture this change and this was neither captured in the percentage of usage, which was defined as a binary outcome. Seventh, psychotropic drugs used pro re nata were not included in data analysis. Finally, we included fewer residents than anticipated; nevertheless, the power was deemed sufficient because the a priori sample size should have relied on the number of prescriptions and not on the number of residents.

Implications for research and practice

In retrospect, we still underly the importance of a multidisciplinary approach. Caring for residents with dementia and neuropsychiatric symptoms is a team effort and therefore it is important to include all relevant disciplines. Naturally, (prescribing) physicians play a vital part. Although our study did include physicians in the multidisciplinary project team, their actual involvement and influence in practice differed between nursing homes. [50] Moreover, occasionally participating in a project team is not the same as actively reviewing psychotropic drugs and adjusting them when deemed necessary. This may account for the fact that no effect was found on appropriateness. Hence, we think it is safe to state that when studies aim for reducing (inappropriateness of) psychotropic drug use, the intervention should be a combination of multidisciplinary psychosocial efforts and directly targeting the prescribing behavior among physicians. Taking into account that the domains indication, evaluation and therapy duration contribute the most to the APID index sum score, the biggest gain in more appropriate prescribing probably lies here for physicians. A possible risk of our PAR intervention was that local practice experienced a great deal of freedom, which potentially contributed to the fact that we did not achieve our main aim. Our process evaluation revealed that despite warnings from our research team, many nursing homes tried to implement a large number of actions which did not target appropriateness of use. Instead teams seemed to have focused on implementing psychosocial alternatives to compensate for a decrease of psychotropic drug use. [50] This may explain the reduction in overall psychotropic drug use without a change in the appropriateness of use. Consequently, many good actions are implemented in daily nursing home practice as a result of our PAR intervention that were beyond our aim. Given that our process evaluation suggested improvements such as better multidisciplinary collaboration, future studies may benefit from including additional outcomes directly associated with the chosen interventions, such as the number of multidisciplinary care team meetings or the time spent with a resident. [50] These could indicate improvements in care that are not captured by the metrics used in the current study. Future studies targeting the management of neuropsychiatric symptoms should therefore include (appropriate) psychotropic drug use and (multicomponent), psychosocial alternatives because neuropsychiatric symptoms can worsen when psychotropic drugs are reduced without compensating for this by using alternatives.

The association with higher mortality, [61] highlights the importance of more appropriate usage. Thus, the decrease in overall usage as a result of our intervention is still highly relevant considering that usage of psychotropic drugs often comes with adverse effects and are at most modestly effective even when prescriptions are in adherence to guidelines. [4–7] It is promising that it is possible to reduce usage of psychotropic drugs or certain subgroups, such as anxiolytics and antidepressents in our study. This finding of our study should encourage nursing home staff and prescribing physicians to rely less on psychotropic drugs and preferably to stop the prescription of psychotropic drugs where possible. Especially, when we take into consideration that there is certain evidence that discontinuation of antipsychotics for example, can be succesful and has no large effect on neuropsychiatric symptoms, cognitive function and quality of life. [62]

Conclusions

The RID intervention ultimately reflected practical considerations, such as “what will help a resident?” and alternatives to compensate for psychotropic drug use, rather than the quality of prescribing. Indeed, although it did not improve the appropriateness of usage, it reduced overall psychotropic drug use at 8 and 16 months in the subgroups anxiolytics and antidepressants. This should encourage nursing home staff to stop the prescription of psychotropic drugs where possible.

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Additional file 1. Protocol deviations

We noticed that correcting for baseline differences was not feasible for the multilevel analyses of the appropriateness of psychotropic drug use because residents can use multiple psychotropic drugs. We did not anticipate this a priori.
The study protocol also specified multilevel analyses for the secondary outcome (frequency of psychotropic drug use), but we used logistic GEE. This was because the multilevel analysis did not converge and the GEE accounted for clustering of repeated measurements within residents and nursing homes (see also *Methods*). In addition, we decided to do a post hoc analyses based on the results of overall psychotropic drug use for the four largest psychotropic drug subgroups (i.e., antipsychotics, hypnotics, anxiolytics, and antidepressants). This was not explicitly stated in the study protocol.
Studies completed before starting the analysis reported few associations (Smeets et al., 2018; Van Der Spek et al., 2018). Therefore, we concluded that it would be better to make a more parsimonious model in which four of the least relevant confounders were excluded. In our opinion, these included: 1. Cognitive abilities: excluded due to insufficient variance. DSCUs are specialized in treating residents with advanced stages of dementia. We only included DSCU residents, and all of these were likely to have had severe levels of cognitive impairment. 2. Distress in nurses due to neuropsychiatric symptoms: Distress is strongly correlated with the severity of neuropsychiatric symptoms (Zwijsen et al., 2014), the latter of which is also included in the analysis. 3. Staff attitudes toward the use of new interventions or treatments, 4. Cooperation between staff members, the working conditions, and characteristics of the DSCU. Both staff attitudes and cooperation between staff members are team level factors. Since we mainly expected an effect of these variables on the degree of implementation, both variables were replaced by an extensive extent of performance score developed for our process evaluation (Groot Kormelinck et al., 2021). We have included this more comprehensive extent of performance variable in our sensitivity analysis.
Ultimately, a fifth confounder was excluded (dementia subtype) because no effective baseline differences were found between groups in our data (table S2).

DSCUs = dementia care in special care units; GEE = generalized estimating equations.

Groot Kormelinck, C. M. *et al.* (2021) “Process evaluation of a tailored intervention to Reduce Inappropriate psychotropic Drug use in nursing home residents with dementia,” *BMC geriatrics*. BMC Geriatrics, 21(414), pp. 1–14.

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5

Additional file 2. Characteristics of nursing home residents included at baseline, both overall and for psychotropic drug users

	Residents using psychotropic drugs		**All residents**	
	RID intervention (n = 151)	Control (n = 160)	RID intervention (n = 296)	Control (n = 280)
Mean age (years), [SD] (range)	83.41 [7.02] (61–97)	82.24 [8.47] (58–103)	84.50 [7.12] (58–100)	82.84 [8.04] (57–103)
Sex, female, n (%)	108 (71.5)	111 (69.4)	226 (76.4)	198 (70.7)
Length of stay at dementia special care unit (months), [SD] (range)	21.72 [16.50] (0-80)	21.08 [18.04] (0-96)	26.50 [21.77] (0-120)	22.34 [19.68] (0-102)
PDs per resident, n [SD] (range)	1.68 [0.95] (1–5)	1.82 [0.96] (1–5)	N.A.	N.A.
Diagnosis of dementia, n (%)				
Alzheimer's dementia	74 (49.0)	68 (42.5)	145 (49.0)	113 (40.4)
Vascular dementia	20 (13.2)	18 (11.3)	36 (12.2)	38 (13.6)
Mixed Alzheimer's/vascular dementia	10 (6.6)	16 (10.0)	25 (8.4)	36 (12.9)
Frontotemporal dementia	4 (2.6)	5 (3.1)	8 (2.7)	6 (2.1)
Lewy body dementia and Parkinson's disease	10 (6.6)	12 (7.5)	10 (3.4)	16 (5.7)
Other dementia	33 (21.9)	40 (25.0)	72 (24.3)	70 (25.0)

Dementia diagnosis had one missing in control group.
Abbreviations: NA = not applicable; PDs = psychotropic drugs; RID = reducing inappropriate psychotropic drug use; SD = standard deviation.

Additional file 3. Characteristics of newly recruited nursing home residents at T1–all residents and PD users only

Newly included residents at measurement 2	**Residents with PD**		**All residents**	
	RID Intervention	Control	RID Intervention	Control
Number	29	43	57	81
Mean age (years), [SD] (range)	82.97 [8.72] (62–96)	81.40 [7.18] (64–97)	83.77 [7.37] (62–96)	81.64 [7.55] (61–97)
Sex, female, n (%)	20 (69.0)	21 (48.8)	39 (68.4)	45 (55.6)
Length of stay in DSCU at (months), [SD] (range)	4.10 [2.41] (0-8)	6.53 [9.05] (0-43)	7.09 [12.57] (0-74)	6.42 [10.02] (0-70)
PDs per resident (number), [SD] (range)	1.34 [0.61] (1-3)	1.81 [0.93] (1-4)	N.A.	N.A.
Dementia diagnosis, n (%)				
Alzheimer's dementia	9 (31.0)	17 (39.5)	20 (35.1)	35 (43.2)
Vascular dementia	3 (10.3)	5 (11.6)	4 (7.0)	7 (8.6)
Mixed Alzheimer's/vascular dementia	4 (13.8)	7 (16.3)	10 (17.5)	15 (18.5)
Frontotemporal dementia	2 (6.9)	0 (0.0)	2 (3.5)	1 (1.2)
Lewy body dementia and Parkinson's disease	0 (0.0)	3 (7.0)	1 (1.8)	4 (5.0)
Other dementia	11 (38.0)	11 (25.6)	20 (35.1)	19 (23.5)

DSCU = dementia special care unit; n = number; PD = psychotropic drug; SD = standard deviation.

Additional file 4. Characteristics of newly recruited nursing home residents at T2–all residents and PD users only

Newly included residents at measurement 3	**Residents with PD**		**All residents**	
	RID Re-intervention	RID intervention	RID Re-intervention	RID intervention
Number	17	42	38	60
Mean age (years), [SD] (range)	82.65 [7.00] (70–94)	82.05 [7.09] (66–95)	83.08 [7.92] (61–94)	83.08 [7.27] (66–95)
Sex, female N (%)	9 (52.9)	24 (57.1)	24 (63.2)	37 (61.7)
Length of stay at dementia special care unit (months), [SD] (range)	3.76 [2.46] (0-9)	4.81 [4.32] (0-26)	4.79 [3.46] (0-19)	4.95 [4.11] (0-26)
PDs per resident (number), [SD] (range)	1.47 [0.62] (1-3)	1.79 [1.07] (1-5)	N.A.	N.A.
Diagnosis of dementia, N (%)				
Alzheimer's dementia	12 (70.5)	18 (42.9)	20 (52.6)	22 (36.7)
Vascular dementia	0 (0.0)	4 (9.5)	5 (13.2)	5 (8.3)
Mixed Alzheimer's/vascular dementia	2 (11.8)	5 (11.9)	4 (10.5)	9 (15.0)
Frontotemporal dementia	0 (0.0)	2 (4.8)	0 (0.0)	2 (3.3)
Lewy body dementia and Parkinson's disease	1 (5.9)	4 (9.5)	2 (5.3)	4 (6.7)
Other dementia	2 (11.8)	9 (21.4)	7 (18.4)	18 (30.0)

PD = psychotropic drug; RID = reducing inappropriate psychotropic drug use; SD = standard deviation.

Additional file 5. Mean APID index sum scores over time

Condition (Phase I)	***Baseline [548 PDs]***	***8 months [596 PDs]***	***Condition (Phase II)***	***16 months [562 PDs]***
RID intervention	26.08 (15.34) [254]	24.46 (16.19) [257]	*Re-intervention*	24.74 (15.89) [233]
Control	27.07 (17.01) [294]	25.38 (16.59) [339]	*RID intervention*	23.03 (15.60) [329]

Observed mean APID index sum score (SD) [n of PDs]. Theoretical range: 0–102.8. Higher scores indicate less appropriate PD prescribing
APID = Appropriate Psychotropic drug use In Dementia; PDs = psychotropic drugs; RID = reducing inappropriate psychotropic drug use; SD = standard deviation.

Additional file 6. Psychotropic drug use (overall and subgroups) over time

Psychotropic drugs	Condition					
	RID intervention (phase I) + re-intervention (phase II)			**Control (phase I) + RID intervention (phase II)**		
	Baseline *n=296*	8 months *n=316*	16 months *n=296*	Baseline *n=280*	8 months *n=343*	16 months *n=332*
Overall usage	151 (51.0)	160 (50.6)	143 (48.3)	160 (57.1)	194 (56.6)	193 (58.1)
Antipsychotics	71 (24.0)	72 (22.8)	70 (23.6)	76 (27.1)	88 (25.7)	81 (24.4)
Anxiolytics	50 (16.9)	47 (14.9)	43 (14.5)	56 (20.0)	70 (20.4)	71 (21.4)
Antidepressants	62 (20.9)	66 (20.9)	61 (20.6)	65 (23.2)	87 (25.4)	92 (27.7)
Hypnotics	40 (13.5)	45 (14,2)	38 (12.8)	51 (18.2)	48 (14.0)	49 (14.8)
Anti-dementia drugs	20 (6.8)	18 (5.7)	15 (5.1)	28 (10.0)	24 (7.0)	20 (6.0)
Anticonvulsants	3 (1.0)	2 (0.6)	2 (0.7)	5 (1.8)	7 (2.0)	4 (1.2)

The number and percentage n (%) of residents with one or more regular psychotropic drug prescriptions (per subgroup).

Additional file 7. Effects of the RID intervention on the percentage of psychotropic drug use sensitivity analysis

Model and ratio	Psychotropic drug use			
		95%CI		
	OR	***Lower bound***	***Upper bound***	***P***
Sensitivity analysis part I: Four nursing homes excluded				
Model 4. Including confounders. [B] Ratio				
RID Intervention and control group at 8 months	0.820	0.576	1.168	0.272
Both RID intervention groups[a] at 16 months	0.639	0.447	0.915	0.014
Model 5a. Complete cases only, including confounders. [C] Ratio				
RID Intervention and control group at 8 months	0.946	0.594	1.506	0.815
Both RID intervention groups[a] at 16 months	0.821	0.516	1.308	0.407
Model 5b. Complete cases only, including confounders. [D] Ratio				
RID Intervention and control group at 8 months	0.816	0.448	1.484	0.505
Both RID intervention groups[a] at 16 months	0.596	0.297	1.199	0.147

[a] control group in phase I, crossed over to intervention in phase II.
[b] corrected for sex, duration of stay on the unit (in months) and time in the study arm (full duration, later enrolment, early drop out, and later enrolment with early drop out).
[c] corrected for sex, duration of stay on the unit (in months). Not corrected for time in the study arm, since this concerns a subset of data of the complete cases (e.g., full duration). Not corrected for baseline psychotropic drug use and baseline NPI-NH sum score.
[d] corrected for sex, duration of stay on the unit (in months), baseline psychotropic drug use, baseline NPI-NH sum score. Not corrected for time in the study arm, since this concerns a subset of data of the complete cases (e.g., full duration).
* Regarding the complete cases analyses; there appeared no effect of collinearity between the two variables NPI and psychotropic drug use.
CI = confidence interval; NPI-NH = Neuropsychiatric Inventory-Nursing Home version; OR = odds ratio; RID = reducing inappropriate psychotropic drug use.

CHAPTER 6

General discussion

A complex intervention to Reduce Inappropriate psychotropic Drug (RID) use utilizing three central elements being Participatory Action Research (PAR), tailoring, and guided implementation with an external coach was developed for nursing home residents with dementia and neuropsychiatric symptoms (NPS). Tailoring included that nursing homes were provided with a local problem analysis about the perceived problems of managing NPS and (inappropriate) psychotropic drug use, ultimately aiming for the implementation of tailored action- and implementation plans. This chapter starts with addressing the results of the research questions. Thereafter, (the main findings on) reducing (inappropriate) psychotropic drug use will be put in perspective, followed by discussing methodological considerations, implications for clinical practice, recommendations for future research and a conclusion.

Research questions: summary of main findings

Chapter 2 addressed the study protocol of the RID study. Each chapter thereafter concerned the research questions. A summary of findings is provided below.

1. *What are barriers and facilitators influencing the implementation of complex interventions targeting neuropsychiatric symptoms and psychotropic drug use in long-term care?*

In our literature review, we found strong leadership, support by champions, communication and coordination between disciplines, management support, sufficient resources, organizations' readiness to change and perceived easiness to apply the intervention in practice to be facilitators. Barriers related mostly to unstable organizations, such as building renovations, changes toward self-organizing teams, high staff turnover, perceived work and time pressures and being involved in several projects (Chapter 3).

2. *What is the quality of a complex intervention using PAR, tailoring and guided implementation with an external coach, followed by the implementation of tailored action- and implementation plans, and what are the barriers and facilitators to implementation of this intervention?*

A process evaluation showed that the relevance and feasibility of the RID intervention was relatively high (Chapter 4). PAR, tailoring, and guided implementation were often viewed to facilitate implementation, although the RID intervention was also viewed as time consuming and complex. In spite of these central elements, suboptimal

execution of the necessary actions occurred in some nursing homes. These extent of performance differences between participating nursing homes may have reduced effectiveness of the RID intervention. Hence, sensitivity analyses were considered appropriate in the effect analysis of the trial. Reorganizations, staff shortages, staff turnover, lack of management support, unclear expectations, and limited self-reflection were perceived barriers. Implementation depended on the involvement and skills of key stakeholders. Readiness to change and good communication were found to be important facilitators. Future trials could emphasize a broader range of outcomes such as knowledge, multidisciplinary collaboration, or use of person centered interventions.

3. *What are the effects of a complex intervention using PAR, tailoring and guided implementation with an external coach, followed by the implementation of tailored action- and implementation plans, on inappropriateness and frequency of psychotropic drug use in nursing home residents with dementia?*

No reduction of inappropriate psychotropic drug use was found at 8 and 16 months after implementation of the RID intervention. Compared to baseline, frequency of psychotropic drug use was significantly reduced at 8 months in the intervention group compared to the control group (care as usual). Compared to baseline, effects on frequency of psychotropic drug use at sixteen months were even larger for both intervention groups[*]. Effects were especially found regarding anxiolytic and antidepressant use (Chapter 5).

[*] The stepped-wedge design had an overall duration of 16 months and comprised two 8-months phases. In phase two, half of the nursing homes crossed over from control group to the RID intervention group and the other nursing homes continued with the RID intervention.

Reducing (inappropriate) psychotropic drug use in perspective

Choice of intervention and outcome

Most studies regarding the management of NPS with psychotropics for nursing home residents with dementia focus on reducing the frequency of psychotropic drugs. Fewer studies seem to take into account inappropriateness of psychotropic drug use covering several domains.[1] When designing the RID study, there was some debate about which outcome would be most important. When primarily targeting

inappropriateness, frequency of use can still be high. When focusing on reducing the frequency of use, psychotropic drugs can still be inappropriately prescribed. We also considered having NPS as the primary outcome as a measure of a more patient-centered outcome, but feared that prescriptions of psychotropic drugs would rise to achieve less NPS. Ultimately, inappropriate use of psychotropic drugs was chosen as the main outcome and preferred above frequency of use, as inappropriate use was common and we figured that a focus on appropriateness could also result in a reduction of frequency of use. Frequency of use may be strongly related to appropriateness. When prescriptions are appropriate it is neither excessive nor insufficient. Moreover, by focusing on appropriateness, attention is being paid to effectiveness and potential negative side effects, thereby addressing resident well-being. [1–9] To that end, the choice for (inappropriate) psychotropic drug use can be considered relevant and justified. Yet, theoretically speaking, it might be possible that nursing homes may have low prescription levels and psychotropic drug use may be considered appropriate but at the same time provide poor quality NPS-care. Ultimately, psychotropic drug use is rather a means to achieve a higher goal such as less (severe) NPS, thereby contributing to enhanced quality of life or well-being. Prevalence of NPS and quality of life were measured as secondary outcomes in the RID-study, but effects of the RID intervention on these outcomes fall outside the scope of this thesis. Yet, this does not mean that they are less relevant: A focus on NPS, quality of life or well-being represents relevant, patient centered outcomes. Achieving an effect on these outcomes may be challenging, as this likely depends on several other factors besides (appropriate) psychotropic drug use. When aiming for improved quality of life or well-being, it may therefore be necessary to maintain a specific operationalization that is close to the research question. Future studies may emphasize outcomes such as improvements in knowledge amongst nursing home staff, improved multidisciplinary collaboration or use of person-centered interventions.

As was discussed in Chapter 5, the implemented actions by the nursing homes largely comprised of psychosocial interventions for managing NPS to compensate for use of psychotropic medication rather than of interventions targeted at quality of prescribing. As a result, the chosen and implemented interventions in our study had a distance to our primary aim.

In the PROPER study, a structured medication review was implemented. That study found minor effects on appropriateness of psychotropic drug use, [10] but failed to demonstrate a reduction in the prevalence of psychotropic drugs. [11] An explanation

may be that the PROPER study explicitly targeted appropriateness and therefore, achieved better prescriptions of psychotropic drugs. This is opposite to our findings. The fact that no psychosocial interventions were implemented in that study may have contributed to this. Perhaps the lesson learned regarding the choice of outcomes is that when appropriateness of psychotropic drugs is the main outcome, interventions should target prescription hereof and the prescribing physicians, not necessarily the implementation of psychosocial interventions. Hence, we could have addressed our primary aim more prominent and a medication review could have been a mandatory part of the intervention, even if this would have meant letting go of the principles of PAR and creating less freedom of choice regarding choice of intervention. As was also pointed out by Smeets et al. [11] it may be useful to make a medication review mandatory when appropriateness is one of the aims. Nonetheless, not as a single intervention but rather as one element of a set of interventions. It is too simplistic to assume that merely focusing on physicians and their prescribing behavior is the solution. We believe that it is inevitable to find and implement psychosocial interventions for managing NPS. This addresses the fact that managing NPS is a multidisciplinary problem -and not of one discipline- and includes a broad approach of staff training and education, and use of psychosocial interventions. Prescribing psychotropic drugs can also be part of this, as a second-line treatment. Considering the limited evidence for psychotropic drugs on NPS and possible side effects that may affect resident well-being, [12–16] appropriate use needs specific attention and to have a place in the larger picture of the approach to NPS for people with dementia in the nursing home, ultimately aimed at the well-being of the resident with dementia. [13,17–21] In the end, it should be clear that managing NPS calls for addressing all of these aspects.

Another lesson learned regards the choice of outcomes using PAR. An option can be to let go of fixed outcome measures. For example, researchers may consider stopping predefining outcomes. Perhaps for studies using PAR, it is suitable for local practice to choose relevant outcomes themselves, thereby possibly preventing a mismatch between outcome and implementation of actions. This suggestion is also fitting with our finding of the process evaluation (Chapter 4) that nursing home practice experienced various improvements related to multidisciplinary collaboration that were not captured in our study. One potential way to achieve this is through goal planning and attainment. According to Rietkerk et al., the incorporation of collaborative goal planning methods is a way to achieve person-centered care suitable for both local practice and outcome measures in research. After scoring the severity of a problem, people can set goals and measure their

degree of goal attainment over time. [22] What makes this idea challenging is how to determine effects. Comparing results may be complex with several outcome measures depending on potentially different aims. Establishing effectiveness may become subjective and there is the risk for using surrogate outcomes. For example, poor multidisciplinary collaboration may be identified as contributing factor to the insufficient use of psychosocial interventions and ultimately as the major reason for inappropriate use of psychotropic drugs. Nursing homes may thereto focus on improving this multidisciplinary collaboration and they may succeed in this, with the potential risk that no effects are being found in terms of appropriateness, use of psychosocial interventions and well-being of residents. Hence, on the level of the goal attainment scale targets are being achieved, but no progress is made on the transcendent outcomes. Viewed in this light, goal attainment scaling should be combined with outcomes such as appropriateness or neuropsychiatric symptoms, so that it can be measured whether these internal goals lead to improvement outcomes directly relevant to the resident. Another alternative is to incorporate a weighted composite outcome measure. In the Netherlands, Hofman et al., designed such a measure in order to be able to compare effectiveness of various intervention projects in older adult care. Their developed composite outcome accounts for the relative importance of different outcomes based on the preferences of older persons and informal caregivers. [23] For the RID study, such an outcome could consist of appropriateness of psychotropic drug use, frequency of use, frequency and severity of NPS and quality of life. It is known to be challenging to capture results of multiple aspects and combine these into a composite outcome, but this outcome is likely able to capture a more holistic understanding as opposed to a single outcome. [23] More specifically, the RID study aimed for reductions of inappropriate psychotropic drug use, but without increasing NPS. It is standard practice to choose one primary outcome, but this may not do justice to the fact that this comprises a complex problem, as was outlined above.

Guided implementation: externally or internally oriented

Our RID intervention comprised guided implementation with external coaches. The rationale behind using external coaches was amongst other things that these persons would not have a blind spot for certain organizational matters. As was mentioned in Chapter 4, the added value of the external coach differed between nursing homes. External coaches sometimes faced complicated group dynamics, feelings of resistance and felt like they were treated as an outsider, thereby facing

problems in their tasks of creating commitment or bringing about change. External coaches acted largely upon personal insights and experience and therefore it is likely that there was a substantial degree of interpersonal variance. It would have been relevant to know whether the coach acted more directively by dictating nursing homes in what to do and how to do it or whether they only made suggestions. It is also relevant to consider whether choices for the tailored interventions were determined by consensus or by a few members of the project team. It can be stated that our study lacked this information and in retrospect, we share the vision by Moore et al.: it must be clear within a team who has which role, who will make decisions on adaptations, when and how. By agreeing on principles for leadership and decision making and anticipated outcomes for all stakeholders in an early stage, the risk of later disagreements might be reduced. [24] In sum, there remains a certain ''black box'' as to what actually happened within the PAR process and in decision making, but it seems that external coaches not always succeeded in executing their role for various reasons. As a result, one might wonder whether an alternative could be used for external coaches. One such alternative is the use of ambassadors which are often individuals from within the organization that are provided with training for becoming an internal implementation specialist, thereby facilitating implementation.

Literature is not clear whether making use of external coaching or internal ambassadors is more favorable in terms of effectiveness, as findings are mixed. The MOSART$^+$ study used internal ambassadors and their intervention was able to effectively reduce staff-reported levels of NPS in nursing home residents with dementia. [25] Several studies concerning dementia care mapping (DCM) have been done, some of which used external approaches and others with internal ambassadors, and studies have yielded heterogenous results. [26,27] One of the earlier DCM studies used two research-allied DCM experts that performed the DCM intervention in all participating units and they found effects. [28] In a DCM study in Dutch nursing homes ten nursing staff members from the care homes were trained to perform the DCM intervention, but they were not able to replicate outcomes. [29] This may then argue in favor of the external approach but of course, it cannot be concluded with certainty that these differences are due to the more internal versus externally oriented approach as there were more differences between both studies. [29] A suggestion is combining the best of both by using pairs of internal ambassadors and external facilitators. Although this may be a costly implementation strategy, a recent study found that replicating effective programs combined with an external facilitator who is supported by an internal facilitator may be cost-effective. [30] Nevertheless, the most cost-effective

implementation support consists of a step-up strategy which begins with a less intensive and less costly strategy initially and increases as needed to enhance intervention uptake. [30]

Regardless of an internally or externally focused approach, we should bear in mind that such keypersons must possess relevant skills, as was described in Chapter 4. Our results are consistent with other research that suggests organizations must ensure to carefully consider which person can fulfill such an important facilitating role, as it is known that attracting strong champions is essential for successful implementation. [31] The MOSART+ study also endorsed the importance of having ambassadors that need to have certain requirements, including that they should be professionals with acknowledged authority, had relevant education or work-related experience, and were familiar with nursing team dynamics. [25] This is indeed important because these keypersons have a large responsibility and not an easy task. In each organization there will be enthusiastic people, the so-called early adapters. In particular, the challenge for these keypersons is to examine and address the motivations of the persons that are more skeptical or reluctant to innovation, the laggerds. [32] There may be multiple reasons, for example negative prior experiences or a certain weariness for innovation, not feeling responsible and not seeing why the problem regards them. [33] In addition, taking into account that dealing with barriers such as staff turnover would require long-term efforts to ensure that both old and new staff are engaged and supported, utilizing key persons from within an organization is essential.

Methodological considerations

Choice of study design

Several study designs may be suitable for evaluating complex interventions targeting NPS and/or (inappropriate) use of psychotropic drugs. The RID intervention with its three central elements was a cluster randomized controlled trial. Many studies perform randomized controlled trials (RCTs) as this type of design remains the most robust to find the real effect of an intervention by determining whether a cause-effect relation exists between an intervention and an outcome. [34] Most RCTs regard a single intervention [34] and in order to compare results, the intervention and control group should be similar to each other. Nevertheless, even after randomization, it is never fully possible to achieve the required high level of control and the generalizability of findings is limited for RCTs. [35] In the RID intervention, we allowed nursing homes to adjust intervention and implementation to local contexts. This relatively high

degree of freedom contradicts the assumption of highly controlled conditions. Also, for complex intervention studies it is difficult to have an appropriate comparison group. Although being known for being very robust, RCTs have limitations in practical and ethical respects as they are often invasive, costly and participants have a fifty percent chance to not receive the intervention. [36,37] To allow all nursing homes to take part in the RID intervention, we have incorporated a stepped-wedge design. Using a stepped wedge design within a cluster RCT is frequently used in general research, [38] but also specifically in complex intervention studies that target management of NPS and/or (inappropriate) use of psychotropic drugs. [39–41] However, we used a special case of a stepped-wedge design with only one step, while these designs in general consist of a sequential roll-out of an intervention to participants (individuals or clusters) over a number of time periods. This offers a number of opportunities for data analysis, particularly for modelling the effect of time on the effectiveness of an intervention. [42] Incorporating more steps was not feasible as this would have required a longer study duration and even more work and pressure for nursing home staff, whilst they already struggled with implementation. Furthermore, a longer study duration with more study arms would mean a longer period of time in the control condition for some nursing homes, with chances being that people lose interest in the study. Given these considerations, only the current mini stepped-wedge design was attainable. There are also less invasive and more feasible alternatives to RCTs. Another often used type of research-design is a so-called pragmatic RCT. Pragmatic RCTs aim to better address evidence about real-world situations and to inform decision making in daily practice. Compared to standard RCTs - which examine efficacy in an ideal setting with a strictly imposed intervention -, pragmatic RCTs answer the question whether the intervention that is allowed a certain amount of flexibility, does work in normal practice. [43,44] The abovementioned characteristics of a pragmatic trial are in some respects applicable to the RID study, and probably to other studies into complex interventions as well. Nevertheless, the RID study used external coaches and researchers which was quite invasive and costly, and may therefore not be realistic for daily practice. Another alternative can be found in multiple baseline designs. This is a form of single-case experimental design that evaluates causal relations through multiple baseline-treatment comparisons with phase changes using a small number of participants, at potentially lower costs. [36,37] This design however does pose some threats to internal validity that should require attention, including maturation, testing experience and coincidental events. [37] In sum, each study design for evaluating complex interventions has their advantages and disadvantages and

choosing a study design requires a thorough assessment of these pros and cons. Using a cluster randomized controlled trial with a stepped wedge design may be feasible for evaluating complex interventions and this adds a certain robustness of study design. However, as RCTs generally regard a single intervention with highly controlled conditions, applying this design in a complex intervention study may prove challenging. These studies are likely to face difficulties to determine what was successful of the intervention given the multiple interacting components and also considering the importance to tailoring to local contexts. For complex interventions, it is recommended to conduct a process evaluation in order to properly interpret the results of the intervention. Process evaluations provide information on the effective elements of an intervention and on the local context by addressing implementation barriers and facilitators. A process evaluation of the RID study was performed and this indeed provided relevant information.

Blinding

The importance of double- or even triple blinding in RCTs to treatment allocation in order to protect the internal validity of a study is well known. [45,46] In the RID study, nursing home staff, researchers and external coaches were aware whether they were in the intervention or control group. This could not be prevented given the nature of the intervention and it is very often in complex intervention studies that this assumption cannot be met. [34] This is unfortunate as it can introduce bias, which may also have occurred in the RID study. Where possible, studies should then try to maintain single blinding, with the researcher or outcome assessor remaining without information of group allocation. [34] In the RID study, this bias was minimized by blinding the statistician, which prevented bias during treatment allocation and data analysis.

Time investment

The three measurements in which a large amount of data was collected placed high demands on nursing staff. This might have negatively influenced implementation and could also have resulted in heightened awareness for the study, also known as the Hawthorne effect. [34] It is important to carefully consider which data should be collected. The RID intervention using PAR, tailoring and external coaching was also experienced as a complex and time consuming process. As a result, nursing homes perceived delays in implementation and argued that the implementation periods were too short (Chapter 4). Hence, a longer period of time might have been

appropriate given the complexity of the RID intervention. However, this may also lead to loss of motivation. It will be a matter of finding a balance between sufficient time for implementation but also preventing intervention fatigue.

PAR: freedom versus control

The original idea for the toolkit was that it should contain a variation of evidence-based interventions on different outcomes, targeting (appropriate) psychotropic drug use but also NPS and quality of life. These interventions included for example Act in case of Depression, GRIP and Proper. [10,40,41] The toolkit was supplemented with other, non-evidence-based interventions at the request of the participating organizations. We considered this to be fitting within PAR but it also limited the focus and the evidence-based content of the toolkit. This calls for a more limited choice of actions that have a certain probability to be effective on inappropriate psychotropic drug use. Findings of our process evaluation (Chapter 4) indicated that interventions sometimes were perceived as lacking relevance to (appropriateness of) psychotropic drug use and that nursing homes tried to implement too many interventions. Apparently, external coaches did not always adequately act on this. It could also be that expressed concerns by external coaches and researchers and directives to aim for fewer interventions were not always taken seriously. From a practical point of view, a more pronounced restriction on the number of interventions that a nursing home could implement would have been helpful, as it is better to successfully implement one or two interventions rather than several interventions only partially. Overall, the PAR as we designed it within the RID study can be viewed as rather restrictive, for example by predefining the research outcomes. However, the abovementioned matters seem to underline the need for a version of PAR that may be even more directive in terms of clear agreements and requirements.

Promoting appropriate prescription of psychotropic drugs

The APID index, which was used to assess this outcome, relies on information from electronic medical files that must be extracted by third parties, possibly posing validity issues. Also, the APID index is too complex for everyday use in clinical practice in its current form. In order to provide physicians with a more practical instrument to promote guideline adherence and increase appropriate prescribing, a smartphone application was designed that evaluated appropriateness of psychotropic drug prescriptions and provides elderly care physicians with recommendations regarding their prescribing behavior. [47] Despite that the application needs to be further

optimized, there is no doubt that such practical, relatively new initiatives are very relevant, as our study has shown how difficult it is to reduce inappropriate prescribing of psychotropic drugs. To date, it is not uncommon for studies to have incorporated information technology in health care, such as this example of a mobile phone app or by using devices equipped to record and transmit real-time data. Technological interventions may also be used to engage social support systems such as relatives in the care of residents. Perhaps even recent developments in the field of artificial intelligence may contribute. [48]

Implications for clinical practice

It is important to note that aiming for reducing (inappropriate) psychotropic drug use in a sense asks for a culture change and changing an existing culture is difficult and takes time. Over the years, steps have been taken in the right direction when it comes to reducing absolute use. [49,50] A further decline of psychotropic drug use is worth pursuing, but does not change the fact that psychotropic drug use remains necessary in a number of situations, for example in the case of severe or acute NPS. [3] As it is unknown what a minimum of use may consist of, we advocate to critically examine whether use of psychotropic drugs is appropriate and if so, to carefully monitor any side effects and whether it has the desired effect, thereby addressing at least two domains of appropriateness, indication and evaluation. In addition, it should not be forgotten that nurses face NPS on a daily basis when caring for residents with dementia. Agitation and aggression are most prevalent and dealing with this may cause high levels of distress. [51] It is adequately documented that there may be an acceptance of long-term psychotropic drug use among nursing home staff, relatives or by residents themselves. Furthermore, psychosocial interventions are not always available or accepted as a proper alternative. [52] The idea of de-prescribing may lead to feelings of anxiety, especially amongst nursing home staff, indicating that attitude is an important component. [53] Therefore, when aiming for reductions of (inappropriate) psychotropic drug use, it remains highly important to include relatives and nursing home staff and address their possible concerns in this regard. Also, the availability of feasible psychosocial interventions should be ensured, both directly targeting resident well-being by means of person-centered care but also multicomponent interventions for nursing home staff, aiming for improved management of NPS.

Both the systematic review (Chapter 3) and the process evaluation of the RID study (Chapter 4) have made it clear that implementation of a complex intervention

requires a lot of effort of nursing home staff, especially in these times in which all care organizations face inevitable barriers such at staff shortages, staff turnover and high perceived work pressure. The challenge lies in learning to implement new strategies in a changing context. Our results indicated that some nursing homes faced more difficulties as a result of these barriers than others, depending on coping strategies of staff or the presence of facilitating factors that can reduce the influence of a barrier. Therefore, we underscore the need to identify any modifiable barriers and facilitators, to adapt implementation to the specific needs of a nursing home and to take into account an organization's readiness to change. In particular, an important task lies ahead for keypersons within nursing homes. For example, staff turnover implies dealing with new staff and this requires an enormous and continuous effort to get them on board, convinced of the relevance of an intervention. Staff turnover is a given fact that is hard to control, but what can be done is continuously investing in connecting and engaging new staff to have a support base and to ensure a certain sustainability for implementation. Persons who are capable to convey enthusiasm and motivation from within an organization are key in long-term innovation initiatives.

Recommendations for future research

In general and ideally, it should be the case that nursing homes take the lead in these large and complex innovation initiatives in practice and that they feel ownership. To facilitate implementation, expertise on how to implement complex interventions in dynamic organizations may be of added value. Nursing homes could either ensure this by using internal ambassadors or they may involve external implementation specialist.

We would also like to underline the importance of completing the steps and agreements in the PAR process as strictly and thoroughly as possible. Future research aiming for a collaboration with local practice might pay explicit attention on how to make organizations responsible, comply with the agreements made and how to make individuals accountable for their role. It may be helpful to accurately monitor what happens, for example through mandatory logbooks (to be completed by the external coach) or by having an independent observer and to distribute responsibilities in advance.

Future studies could consider using less time-consuming research designs and examine research designs that allow for continued conduct of robust research, for example by using a multiple baseline design. [36,37]

Also, future studies should carefully consider the number of measurements that are needed and in particular the amount of data to collect. This may be helpful regarding time investment and could prevent implementation fatigue.

Our findings have led to generic factors that may facilitate implementation of all kinds of initiatives striving for a form of complex change, including management with a clear vision (policy), adequate leadership and capable keypersons who are able to translate the added value of a new intervention to the team level. Yet, considering that managing NPS may lead to distress (as was described in the paragraph above), it may be extra relevant for future studies to incorporate attitudes towards the management of NPS and psychotropic drug use and to examine how attitude affects compliance.

Furthermore, future studies might consider aiming for NPS, quality of life or well-being of residents as they represent relevant, patient centered outcomes. This suggestion may do justice to what perhaps is the underlying foundation of this topic: care for nursing home residents with dementia should be person-centered, aimed at quality of life and promoting well-being and optimizing daily functioning. [17]

Nevertheless, appropriateness of psychotropic drug use will remain an important outcome in the future, as psychotropic drug use cannot and should not always be avoided. [3] Future studies may examine whether appropriateness of psychotropic drug prescription may be improved by including smart information as a standard tool within electronic medical files. For example, information regarding indication combined with effectiveness of a psychotropic drug could automatically generate signals or pop-ups regarding appropriateness and list timepoints for evaluation. Data-informed decision making may support elderly care physicians with prescribing psychotropic drugs.

Finally, it may be clear that more research is needed to achieve further improvements in the management of NPS and in order to optimize resident well-being within nursing homes. After the RID study, the STIP-Method was developed and their future results could be interesting. [54] Where the RID study had a distance to the primary outcome and included also non-evidence based interventions, the STIP method integrates three proven effective methods for managing NPS into a single intervention. It includes clinical reasoning combined with stepped-care interventions and it is supported by a web application. [54] Moreover, they also used PAR and any barriers and facilitators to implementation were examined. It might be relevant to compare similarities and differences between our studies. This could possibly lead to new, interesting insights.

Conclusions

Although the RID intervention was not able to enhance appropriateness, the frequency of psychotropic drug use was reduced. Nursing home staff should benefit from adequate and practically feasible psychosocial interventions, including (multicomponent) multidisciplinary interventions tailored to the local setting as well as person-centered approaches directly aimed at the resident. Future studies might consider aiming for resident quality of life and well-being, which may pose relevant, patient centered outcomes, as opposed to the more indirectly relevant outcomes as used in the RID study. This may call for a specific operationalization of quality of life that is closely related to the research question. Using outcomes such as improved multidisciplinary collaboration or utilization of person-centered interventions could be emphasized as well. Several factors should be taken into account when targeting management of NPS and (inappropriate) psychotropic drug use, but attitudes of nursing home staff and maybe even relatives might be one of the most important ones to address, as managing NPS may lead to distress. As psychotropic drugs shall remain part of managing NPS, prescribing physicians should critically examine whether psychotropic drug use is indicated, effective and outweighs any side effects. Ongoing research developments, for example in the field of information technology, may provide future opportunities to support physicians in prescribing psychotropic drugs more appropriately. Nursing home practice should continuously invest in engaging new staff in initiatives to minimize the influence on implementation of a common barrier such as staff turnover. A combination of pairs of internal ambassadors and external facilitators might be a good strategy for implementation, although for long-term and sustainable implementation a key role for strong and skilled champions within an organization would possible be more practically feasible. Using a stepped-wedge cluster RCT had several advantages. Nevertheless, future studies might consider using less time-consuming research designs and examine research designs that allow for continued conduct of robust research. It is recommended to conduct a process evaluation in order to properly interpret the results of a complex intervention. Several of the well-known benefits of PAR were also applicable to the RID study. Nevertheless, future studies might do well by proposing a more strict and directive approach to PAR as compared to ours. Finally, the management of NPS and reduction of (inappropriate) psychotropic drug use will remain a complex topic as it is a multifactorial matter that necessitates the involvement of multiple disciplines within the complex nursing home setting.

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APPENDICES

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Nederlandse samenvatting

Achtergrond

Een meerderheid van de mensen met dementie die in een verpleeghuis wonen ervaart één of meerdere neuropsychiatrische symptomen (NPS). De behandeling van NPS zou volgens de richtlijnen allereerst gericht moeten zijn op het inzetten van psychosociale interventies. Pas wanneer deze onvoldoende effect bieden of wanneer er sprake is van acuut en ernstig probleemgedrag kan de inzet van psychofarmaca worden overwogen. De reden is dat de effectiviteit van psychofarmaca gering tot matig is en het gebruik ervan kan leiden tot significante bijwerkingen. In de afgelopen jaren zijn er vele psychosociale interventies ontwikkeld. Desondanks zien we dat psychofarmaca gebruik veel voorkomt en dat veel psychofarmaca niet passend zijn voorgeschreven als het gaat om indicatiestelling, evaluatie, therapieduur, dosering of om de aanwezigheid van duplicaties of contra-indicaties. Het doel van dit proefschrift is bij te dragen aan passend gebruik van psychofarmaca en te komen tot een daling van de frequentie van psychofarmaca bij mensen met dementie die in een verpleeghuis wonen met neuropsychiatrische symptomen. De aanleiding, achtergrond en vraagstellingen van deze studie worden beschreven in **hoofdstuk 1**.

Hoofdstukken

De relevantie en opzet van de RID studie (Reducing Inappropriate psychotropic Drug use) wordt beschreven in **hoofdstuk 2.** Passend bij de visie dat niet-medicamenteuze, psychosociale interventies de voorkeursbehandeling zijn voor NPS en om te komen tot een vermindering van (niet passend) psychofarmaca gebruik, zijn er de afgelopen jaren vele interventies ontwikkeld. Dit kunnen interventies zijn die zich direct richten op de bewoner met dementie, passend bij diens behoeften. Het betreft echter veelal ook meer overkoepelende interventies gericht op de disciplines die werkzaam zijn in het verpleeghuis, zoals interventies gericht op het adequaat signaleren, analyseren en behandelen van NPS en de evaluatie hiervan. Helaas is de effectiviteit van deze complexe, multidisciplinaire interventies die zijn gericht op de behandeling van NPS veelal beperkt door suboptimale implementatie als een gevolg van barrières die een rol spelen in de de lokale praktijk. Uit de literatuur is gebleken dat het belangrijk is om zowel interventie als implementatie aan te laten sluiten bij de lokale praktijk van een verpleeghuis omdat er geen uniforme oplossing is die voor iedereen werkt. Daarnaast wordt het belang onderstreept van actieve betrokkenheid van professionals in het verpleeghuis, in het bijzonder mensen die kunnen fungeren als

'kartrekker'. De veronderstelde hypothese bij het ontwikkelen van een interventie was dat een effectieve, multidisciplinaire interventie passend moet zijn bij de lokale situatie van een verpleeghuis en dat implementatie bevorderd zou kunnen worden door ondersteuning te bieden. De RID interventie is gebaseerd op de barrières zoals die zijn gevonden in eerdere studies en dit heeft geleid tot een interventie met 3 centrale elementen:

- Participatory action research (PAR), waarin diverse disciplines uit de praktijk actief samen met onderzoekers werken om te komen tot passende oplossingen voor de lokale situatie
- Op maat gemaakte (tailored) interventie en implementatie: een probleemanalyse gericht op de behandeling van NPS en inzet van psychofarmaca is de basis voor een op maat gemaakt interventie- en implementatieplan en feedback gedurende implementatie
- Gefaciliteerde implementatie door ondersteuning en begeleiding van externe coaches

De hypothese was dat deze RID interventie zou leiden tot een vermindering van niet passend psychofarmacagebruik en een reductie van de frequentie van gebruik. De RID studie was cluster gerandomiseerd en heeft gebruik gemaakt van een stepped-wedge design.

In **hoofdstuk 3** hebben we een systematisch overzicht van de literatuur gerapporteerd om een nog uitgebreider beeld te krijgen van de bevorderende en belemmerende factoren van de implementatie van complexe interventies gericht op de behandeling van NPS en psychofarmacagebruik in de langdurige zorg. Vijftien studies voldeden aan de inclusiecriteria. De meerderheid daarvan heeft een combinatie van verscheidene interventies en zorgprogramma's geïmplementeerd en er zijn diverse implementatie- strategieën gebruikt. Uit dit onderzoek kwam naar voren dat belangrijke factoren voor succesvolle implementatie zijn: sterk leiderschap, ondersteuning door kartrekkers/pleitbezorgers binnen de organisatie, goede communicatie en coördinatie tussen disciplines, ondersteuning door het management, voldoende beschikbare middelen en een organisatiecultuur die gericht is op leren en open staat voor verandering. Factoren die implementatie belemmeren omvatten personeelsverloop, hoge werkdruk en ervaren tijdsdruk, renovaties en verbouwingen en verandering naar zelfsturende teams. De resultaten van dit onderzoek tonen de complexiteit aan van implementatie van multicomponent interventies in de langdurige zorg. Deze resultaten pleiten ervoor implementatie

aan te laten sluiten bij de behoeftes en kenmerken van een organisatie. Om implementatie te optimaliseren zouden organisaties kritisch moeten kijken welke personen de capaciteit en eigenschappen hebben om kartrekkers te zijn van een interventie of innovatie. De toepassing van geleerde acties en kennis in de praktijk zal implementatie mogelijk verder verbeteren.

Vervolgens hebben we in **hoofdstuk 4** een uitgebreide procesevaluatie van de RID studie beschreven, die werd uitgevoerd naast een effectstudie. Het doel van deze (mixed methods) procesevaluatie was om inzicht te krijgen in de 'credibility' van de studie en de daadwerkelijke bijdrage van de RID interventie aan de lokale praktijk. Tevens was het belangrijk om te begrijpen waarom de RID interventie wel of niet succesvol was en hoe deze geoptimaliseerd zou kunnen worden. Er is gekeken naar kwaliteit van de RID interventie, bestaande uit de relevantie en geschiktheid en de mate waarin de RID interventie is geïmplementeerd in de praktijk. Daarnaast zijn belemmerende en bevorderende factoren voor implementatie van de RID interventie in kaart gebracht. Respondenten gaven aan dat de RID interventie in algehele zin positief gewaardeerd werd, maar dat deze ook tijdrovend en complex was. De lokale probleemanalyse zorgde vaak voor een impuls tot actie. Daarnaast werd de actieve betrokkenheid van veel medewerkers als essentieel bestempeld, maar was het tegelijkertijd ook een vertragende factor. Het maken van het op maat gemaakte interventie- en implementatie plan werd als ingewikkeld ervaren. Hoewel externe coaches implementatie stimuleerden en zij vaak een rol hadden bij het verzachten van de effecten van enkele van de barrières die we tegenkwamen, werd de toegevoegde waarde ervan verschillend beoordeeld door de verpleeghuismedewerkers. De mate waarin de RID interventie was geïmplementeerd verschilde tussen verpleeghuizen. Vertragingen in implementatie en suboptimale uitvoering van de acties hebben mogelijk de effectiviteit van de RID interventie in sommige verpleeghuizen negatief beïnvloed. Belemmerende factoren voor implementatie waren reorganisaties, personeelsverloop, communicatieproblemen, onduidelijke verwachtingen en waargenomen tijdsdruk. Mate van implementatie was ook afhankelijk van de betrokkenheid, capaciteit en vaardigheden van kartrekkers/pleitbezorgers en van de bereidheid van verpleeghuismedewerkers om te veranderen. Uit deze procesevaluatie concluderen we dat de RID studie te maken heeft gehad met alomtegenwoordige barrières zoals personeelsverloop en reorganisaties in de dagelijkse praktijk die niet eenvoudig verholpen kunnen worden. Daarom moeten toekomstige implementatie strategieën gericht zijn op innoveren binnen een veranderende context. De uitdaging is om goed te kijken waar

mogelijkheden liggen om in te grijpen en zo de invloed van barrières te verminderen. De mate waarin verpleeghuismedewerkers open stonden voor verandering was verschillend en vaak werd waargenomen tijdsdruk als argument gebruikt voor beperkte implementatie. Hoewel dit zeker een rol speelt gaven externe coaches aan dat dit ook iets zegt over dat de RID interventie niet belangrijk genoeg werd gevonden en geen prioriteit was. Het is belangrijk dat verpleeghuismedewerkers een bepaalde urgentie tot verandering voelen. Aansluitend op de bevindingen van hoofdstuk 3 (systematische literatuur overzicht) pleiten ook de resultaten van de procesevaluatie ervoor om meer aandacht te besteden aan het aanwijzen van competent en geschikt personeel die verandering binnen de organisatie kunnen versterken, zoals een rolmodel wiens mening en advies wordt geaccepteerd door collega's. Door de variatie in de mate van implementatie tussen verpleeghuizen zijn sensitiviteitsanalyses geïndiceerd bij analyses van de effecten van de RID studie. Deze analyses zouden vooral rekening moeten houden met hoe lang verpleeghuizen hun op maat gemaakte interventie- en implementatieplan aan het implementeren zijn op het moment van de effectmeting en de mate waarin de daarin benoemde acties zijn uitgevoerd zoals bedoeld.

In **hoofdstuk 5** presenteren we de uitkomsten van de effectiviteit van de RID studie. De onderzoeksopzet omvatte twee periodes van elk acht maanden. Voorafgaand aan periode 1 werden verpleeghuizen willekeurig toegewezen aan de controle groep (reguliere zorg) of aan de RID interventie (PAR, op maat gemaakte interventie en implementatie, en ondersteuning bij implementatie door een externe coach). In periode 2 stapten de verpleeghuizen die in de controle groep zaten over naar de RID interventie. De verpleeghuizen die de RID interventie al waren gestart in periode 1 kregen ook de RID interventie in periode 2 (verlengde interventie). De drie centrale elementen van de RID interventie leidden tot de implementatie van een op maat gemaakt interventie en implementatieplan, met als doel te komen tot meer passend psychofarmacagebruik en een vermindering van de frequentie van gebruik. Metingen werden gehouden op baseline, na 8 maanden, en na 16 maanden. De primaire uitkomst, passend psychofarmaca gebruik, werd gemeten met de Appropriate Psychotropic Drug Use in Dementia [APID] index en geanalyseerd door middel van multilevel models. De secundaire uitkomst, frequentie van psychofarmaca gebruik, omvatte het percentage bewoners dat één of meer middelen regulier gebruikte. Deze analyses werden gedaan met behulp van generalized estimation equation (GEE) models. De RID interventie leidde niet tot meer passend voorschrijven van psychofarmaca op 8 (0.564; 95%

betrouwbaarheidsinterval [BI], -2.449–3.577; p = 0.71) of 16 maanden (2.165; 95% BI, -1.113–5.443; p = 0.20). De RID interventie leidde wel tot een vermindering van het percentage psychofarmacagebruik op 16 maanden (OR 0.654; 95% BI, 0.481–0.889; p = 0.007). Effecten werden vooral gevonden op 16 maanden voor de subgroepen anxiolytica (OR 0.573; 95% BI, 0.382–0.859; p = 0.007) en antidepressiva (OR 0.678; 95% BI, 0.475–0.968; p = 0.033). Hieruit kunnen we concluderen dat de RID interventie, met PAR, op maat gemaakte interventie en implementatie en ondersteuning door een externe coach, niet tot meer passend psychofarmacagebruik heeft geleid. Wel is de frequentie van het gebruik gedaald door de RID interventie. Bewoners zijn met name minder anxiolytica en antidepressiva gaan gebruiken. Vermoedelijk zijn er evenveel passend - als niet passend voorgeschreven psychofarmaca gestopt gedurende de studie. De resultaten zijn mogelijk te verklaren doordat er vooral is gefocust op het implementeren van psychosociale interventies om te compenseren voor gebruik en niet op passend voorschrijven. Hopelijk moedigen deze resultaten aan om daar waar mogelijk te komen tot een verdere daling van psychofarmaca gebruik en meer passend voorschrijven. Toekomstige studies gericht op het terugdringen van (passend) psychofarmacagebruik doen er goed aan een combinatie na te streven van multicomponent en multidisciplinaire psychosociale interventies, maar zich ook rechtstreeks te richtten op het veranderen van het voorschrijfgedrag van artsen.

Tot slot staat in **hoofdstuk 6** de algehele discussie beschreven. Hierin worden de belangrijkste bevindingen samengevat en wordt passend psychofarmaca gebruik in perspectief geplaatst. Tevens worden methodologische overwegingen besproken en wordt ingegaan op de implicaties voor de (klinische) praktijk en worden aanbevelingen gedaan voor toekomstig onderzoek.

Conclusie en aanbevelingen

Hoewel de RID interventie niet heeft geleid tot meer passend psychofarmaca gebruik, is de frequentie van het gebruik wel gedaald. Verpleeghuismedewerkers moeten de beschikking hebben over adequate en praktisch haalbare psychosociale interventies, waaronder (multicomponent) multidisciplinaire interventies die zijn toegesneden op de lokale setting, evenals persoonsgerichte benaderingen die rechtstreeks op de bewoner zijn gericht. Toekomstige studies zouden kunnen overwegen om te focussen op direct relevante uitkomsten voor bewoners zoals kwaliteit van leven en welbevinden, in tegenstelling tot de meer indirect relevante uitkomsten zoals gebruikt in de RID studie. Dit vraagt vermoedelijk wel om een specifieke operationalisatie van kwaliteit van leven die gerelateerd is aan de

onderzoeksvraag. Ook zou overwogen kunnen worden gebruik te maken van uitkomsten zoals verbeterde multidisciplinaire samenwerking of gebruik van persoonsgerichte benaderingen. De behandeling van NPS en het terugdringen van (niet passend) psychofarmaca gebruik zal een complex onderwerp blijven, omdat het een gevoelige en multifactoriële kwestie is die de betrokkenheid van meerdere disciplines binnen de complexe verpleeghuisomgeving noodzakelijk maakt. Rekening zal gehouden moeten worden met de verschillende factoren die hierin een rol kunnen spelen, maar de attitude van beroepsbeoefenaren in de gezondheidszorg en van familieleden zou één van de belangrijkste factoren kunnen zijn om aan te pakken. Omdat psychofarmaca onderdeel zullen blijven van de behandeling van NPS, is belangrijk dat voorschrijvende artsen kritisch bekijken of het gebruik ervan geïndiceerd en effectief is, en of het opweegt tegen eventuele bijwerkingen. Doorgaande ontwikkelingen binnen onderzoek, bijvoorbeeld op het gebied van de informatietechnologie, kunnen in de toekomst kansen bieden om artsen te ondersteunen bij het juister voorschrijven van psychofarmaca. Verpleeghuizen doen er goed aan voortdurend te investeren in het betrekken van nieuw personeel bij interventies en initiatieven om de invloed van personeelsverloop op implementatie te minimaliseren. Een combinatie van interne ambassadeurs met externe personen in een sleutelrol zou een goede implementatiestrategie kunnen zijn. Toch zou voor duurzame, lange termijn implementatie een sleutelrol voor sterke ambassadeurs van binnen de organisatie meer praktisch haalbaar zijn. De combinatie van een cluster gerandomiseerde studie met een stepped-wedge opzet had verschillende voordelen. Desalniettemin zouden toekomstige studies minder tijdsintensieve onderzoeksopzetten kunnen overwegen en kunnen zoeken naar onderzoeksontwerpen die het mogelijk maken om gedegen onderzoek uit te blijven voeren. Het is nodig bij complexe interventies een procesanalyse te doen om de resultaten van de interventie goed te kunnen duiden. Verschillende van de bekende voordelen van PAR waren ook van toepassing op de RID studie. Wellicht zouden toekomstige studies baat hebben bij een strengere en meer directieve benadering van PAR dan de onze.

Dankwoord

"As 't neet geet zoals 't mot, dan mot 't mar zoals 't geet." – Achterhoeks gezegde

Dit gezegde drukt uit dat, wanneer de omstandigheden niet verlopen zoals gepland, het verstandig is om zich aan te passen aan de situatie en voort te gaan met moed. Het is een toonbeeld van de nuchterheid, het pragmatisme en de veerkracht waar Achterhoekers vaak om bekend staan. Mensen die mij kennen zullen zeggen dat deze karaktereigenschappen ook zeker aan mij als rasechte Achterhoekse zijn toe te schrijven. Met enige regelmaat heb ik de afgelopen jaren waarin ik bezig was met mijn proefschrift, aanspraak moeten maken op deze vaardigheden. Nu ik aan het einde ben gekomen van deze reis overheerst dankbaarheid en een tevreden gevoel. Natuurlijk zijn er een heleboel mensen die hebben bijgedragen aan de totstandkoming van dit proefschrift, waarvoor ik enorm dankbaar ben. Daarover later meer.

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Katja. De eerste stappen op onderzoeksgebied hebben we samen gezet. Een gezamenlijke afstudeerscriptie op het HBO gevolgd door een master psychologie aan de Universiteit Twente. Ik denk met veel plezier terug aan de tijd in Enschede, waar we veel lol hebben gemaakt maar ook heel wat uurtjes serieus hebben gestudeerd met name op statistiek vakken. Ik ben ervan overtuigd dat jij op die manier hebt bijgedragen aan mijn keuze om te starten met een promotietraject.

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Curriculum Vitae

Claudia Groot Kormelinck was born on December 12, 1988 in Eibergen, the Netherlands. After completing secondary education at the R.K.S.G. Marianum in Groenlo in 2006, she studied the bachelor program drums at the ArtEZ Conservatory in Enschede for one year. In 2008, she started the bachelor program Social work at Saxion Hogeschool in Enschede, for which she obtained her degree in 2012. In 2013, she studied the pre-master Psychology at the University of Twente in Enschede for which she obtained her degree in 2014. This was followed by the master Health Psychology. In 2015, she graduated cum laude with a master thesis on shared decision-making in palliative cancer care from a life span perspective, which was performed at the Medisch Spectrum Twente, Enschede. This awoke a growing interest in performing research.

During those years of study, she gained work experience in facilities for the treatment of addiction as well as proving care for residents in nursing homes. For over four years, Claudia has worked with severe intellectual disabled persons with behavioral problems (also referred to as neuropsychiatric symptoms) at the Twentse Zorgcentra in Enschede.

After finishing her master Health Psychology, she decided to pursue a PhD position. In 2016, she started the PhD trajectory at the Department of General Practice and Elderly Care Medicine (now renamed the Department of Primary and Long-term care) of the University Medical Center Groningen (UMCG), resulting in this thesis. She studied the management of neuropsychiatric symptoms in nursing home residents with dementia, and in particular (appropriate) use of psychotropic drugs under supervision of Prof. dr. S.U. Zuidema, Prof. dr. M. Smalbrugge and Prof. dr. D.L. Gerritsen. Claudia presented her work at several (inter)national conferences.

Since 2020, she has been working for the training program Elderly Care Physician at the Department of Primary and Long-term care of the UMCG. She works as a behavioral scientific teacher and provides coaching and support for physicians in training. She is involved in the selection of new candidates and she performs quality assessments and coordination tasks.

LIST OF PUBLICATIONS

Groot Kormelinck, C., Teunenbroek, van, C., Kollen, B., Reitsma, M., Gerritsen, D., Smalbrugge, M., & Zuidema, S. (2019). Reducing inappropriate psychotropic drug use in nursing home residents with dementia: protocol for participatory action research in a stepped-wedge cluster randomized trial. BMC Psychiatry, 19(1), Article 298. https://doi.org/10.1186/s12888-019-2291-4

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