

Better self-management and meaningful activities thanks to tablets? Development of a person-centered program to support people with mild dementia and their carers through use of hand-held touch screen devices

Yvonne J. F. Kerkhof,^{1,2} Maud J. L. Graff,³ Ad Bergsma,¹ Hilde H. M. de Vocht¹
and Rose-Marie Dröes²

¹Center for Nursing Research, Saxion University of Applied Sciences, Deventer/Enschede, the Netherlands

²Department of Psychiatry, Alzheimer Center, EMGO Institute for Health and Care Research, VU University medical center, Amsterdam, the Netherlands

³Donders Institute for Brain, Cognition and behaviour, Scientific Institute for Quality of Healthcare, Radboud Alzheimer Center, Radboud University Medical Center, Nijmegen, the Netherlands

ABSTRACT

Background: To offer good support to people with dementia and their carers in an aging and Internet society the deployment of hand-held touch screen devices, better known as tablets, and its applications (apps) can be viable and desirable. However, at the moment it is not clear which apps are usable for supporting people with dementia in daily life. Also, little is known about how people with dementia can be coached to learn to use a tablet and its apps.

Methods: A person-centered program, with tools and training, will be developed that aims to support people with mild dementia and their (in)formal carers in how to use the tablet for self-management and meaningful activities. The program will be developed in accordance with the Medical Research Council's (MRC) framework for developing and evaluating complex interventions and the study will cover the following phases: a preclinical or theoretical (0) phase; a modeling phase (I) and the exploratory trial phase (II). The users (people with dementia and their carers) will be involved intensively during all these phases, by means of individual interviews, workshops, focus groups, and case studies.

Discussion: The iterative process inherent to this framework makes it possible to develop a user-oriented intervention, in this case a person-centered program, for the use of tablets in dementia care. Preparatory work will be done to perform a methodologically sound randomized controlled trial (RCT) in the near future, which aims to investigate the contribution of this person-centered program for tablet use to the quality of life of people with dementia and their carers.

Key words: dementia, person-centered program, self-management, meaningful activities, tablet, apps, MRC framework

Introduction

In 2013, 44 million people worldwide lived with dementia and this number is expected to rise to 76 million in 2030 and 135 million in 2050 (Alzheimer's Disease International, 2013). In the early stages of the disease people may experience an "informational and support gap." Medical components of care such as diagnostic

tests and prescribing medications are generally delivered adequately, but the counseling and educational aspects of living with dementia are often neglected (Mountain, 2006; Mountain and Craig, 2012) or seen as not feasible for people with dementia (Martin *et al.*, 2012). As a result, meaningful life roles are lost and the quality of life deteriorates. Self-management can be defined as: "an individual's ability to manage the symptoms, treatment, physical and psychological consequences, and life style changes inherent to living with a chronic condition" (Barlow *et al.*, 2002). Dealing with the loss of memory and other abilities requires self-management skills that

Correspondence should be addressed to: Yvonne JF Kerkhof, Centre for Nursing Research, Saxion University of Applied Sciences, Handelskade 75, 7417 DH Deventer, the Netherlands. Phone: 0031612373111. Email: y.j.f.kerkhof@saxion.nl. Received 11 Jan 2016; revision requested 5 Mar 2016; revised version received 4 Jun 2016; accepted 8 Jun 2016.

deteriorate in people with dementia at the same time because of the disease itself (Mountain, 2006). People with dementia therefore need self-management support to be able to carry on living and potentially delay further progression of losses (Quinn *et al.*, 2015). That the support received is not always satisfactory is demonstrated by the unmet needs people with dementia (and carers) experience regarding, for example, memory, psychological distress, social contact/company, and meaningful activities (Van der Roest *et al.*, 2009; Castillo *et al.*, 2010; 2013; Black *et al.*, 2013). Recently, it has been acknowledged that in case of elderly people living with a chronic condition, healthcare should focus more on empowering people in their personal strength and abilities rather than focusing on deficits (Huber *et al.*, 2011; Martin *et al.*, 2012).

Technology potentially can support people in their ability to manage life despite chronic diseases (Huber *et al.*, 2011). It is generally expected that eHealth can stimulate self-management among users and cut healthcare costs (Krijgsman *et al.*, 2013). EHealth is defined as: “the deployment of information and communication technologies (ICT) to support or improve health and healthcare” (Krijgsman *et al.*, 2012). The development of eHealth resulted in the availability of new applications (apps) in the field of health and social care (Marceglia *et al.*, 2012). In the case of the early stages of dementia, information and communication technology may compensate for some of the cognitive losses and offer functional support. A Pictoplanner for example, can help to structure the day and prompt behavior for people who are no longer able to get through the day independently (Kerkhof *et al.*, 2016).

Touch screen devices, such as tablets, provide a good interface for eHealth purposes, they are user-friendly, and the development of apps for these tablets is relatively simple. Based on the first positive results with tablets in the elderly care (Stunnenberg and Adriaansen, 2015), healthcare organizations have become interested to extend the use of tablets to specific target groups, such as people with dementia. Because of its intuitive interface, the tablet and its apps may be useful in supporting self-management (Upton *et al.*, 2011; Marceglia *et al.*, 2012), although people with dementia will need support to learn how to use the touch screen and its applications (Dröes *et al.*, 2010a; Upton *et al.*, 2011; Meiland *et al.*, 2012; Lim *et al.*, 2013; Nijhof *et al.*, 2013; Groenewoud and de Lange, 2014; Kerkhof *et al.*, 2015).

Three case-studies involving nine participants with mild cognitive impairment (MCI) and mild dementia living at home, demonstrated that people

with MCI and mild dementia were able to learn to use the tablet and its apps, and that it had a positive influence on their self-confidence and involvement in society (Bello *et al.*, 2013; Meussen *et al.*, 2014; Vegterlo *et al.*, 2014). Self-confidence or self-efficacy is an important basis for self-management abilities (Quinn *et al.*, 2015). Several, mainly qualitative, studies showed that people with dementia who used touch screen technology and its applications, evaluated it as user-friendly and experienced it as valuable (Riley *et al.*, 2009; Astell *et al.*, 2010; Upton *et al.*, 2011; Meiland *et al.*, 2012; Leuty *et al.*, 2013; Lim *et al.*, 2013; Nijhof *et al.*, 2013; Pringle and Somerville, 2013; Groenewoud and de Lange, 2014; Kerkhof *et al.*, 2015; Astell *et al.*, 2016).

Existing apps, and apps specifically developed for people with dementia, could support the five targets of self-management identified by Martin *et al.*, (2013), i.e. (1) relationship with family/friend/carer e.g. CIRCA (Astell *et al.*, 2010) and apps to provide care at a distance e.g. the PAL4 dementia system (Nijhof *et al.*, 2013); (2) maintaining an active lifestyle e.g. the TalkMeHome Service (Nauta *et al.*, 2013); (3) psychological well-being e.g. apps for leisure activities (Smith and Mountain, 2012), such as music (Riley *et al.*, 2009), reminiscence (Pringle and Somerville, 2013), art (Leuty *et al.*, 2013), gaming (Groenewoud and de Lange, 2014; Astell *et al.*, 2016); (4) techniques to cope with memory losses e.g. the COGKNOW Day Navigator (Meiland *et al.*, 2012) and the Pictoplanner (Kerkhof *et al.*, 2016); and (5) information about dementia e.g. the PAL4-dementia system (Nijhof *et al.*, 2013).

Self-management in the context of dementia refers to dealing with, and adapting to, the changes dementia brings in the person’s life, and preserving a good quality of life (Dröes *et al.*, 2011a; 2010b). Apps to support self-management should therefore not be limited to compensation for deficits, but also promote meaningful positive experiences (Martin *et al.*, 2012). Engaging people with dementia in meaningful activities which are still possible by stimulating the use of remaining capacities and compensating for deficits will contribute to their quality of life (Graff *et al.*, 2006a; Vernooij-Dassen, 2007; Kielhofner, 2008). Meaningful activities can be defined as: “the spectrum of occupations a person performs in his or her everyday life and that are perceived as significant to the person” (Phinney *et al.*, 2007). For people with dementia in particular, activities are expected to be meaningful when they result in: experiencing pleasure and enjoyment; feelings of connection and belonging; and retaining a sense of autonomy and personal identity (Phinney *et al.*, 2007). Meaningful

activities have a specific value for an individual person and can be all types of daily activities in the areas of self-management, household, or leisure activities (Graff *et al.*, 2010). Thus, most apps mentioned above could also be of benefit to stimulate meaningful activities in people with dementia.

When introducing the tablet to people with dementia, it is important to take into account some specific preconditions, e.g. related to their cognitive decline and context. Careful consideration is required to select usable apps for the target group. Usable refers to the extent to which an app is useful, user-friendly, easy to learn, and satisfying (Lund, 2001). The present study intends to develop a person-centered tablet program that will help individual people with dementia and their carers to select and use apps for self-management and meaningful activities that match their needs, wishes, and functional abilities. An individual-based approach is necessary because what activities are meaningful or supportive for self-management is different for each person. The person-centered tablet program will consist of:

1. a requirements-based assessment tool to select usable apps that match the individual needs, wishes, and functional abilities of people with dementia;
2. a training for people with dementia to learn how to use the tablet; and
3. a training for professionals and informal carers (including volunteers) to support/coach people with dementia in using the tablet.

The expected results of this person-centered tablet program for self-management and meaningful activities is to improve their self-management ability of people with dementia and to promote their engagement in meaningful activities and participation in daily and social life. It is expected that the program will contribute to the quality of life of people with dementia and their carers.

Methods

Design

As the person-centered tablet program can be viewed as a complex intervention, we will use the Medical Research Council (MRC) framework for the development and evaluation of complex interventions to better define the problem/needs the program is directed at, how to model the intervention, and to prepare and execute the evaluation in an exploratory trial (Campbell *et al.*, 2000; 2007). This paper describes the methods used in these first three phases of the

MRC framework (Figure 1) i.e.: the preclinical or theoretical phase (0); the modeling phase (I) and the exploratory trial (II).

In the theoretical phase, an explorative study will be done to develop, or adapt existing tools and training for the person-centered tablet program. Next, in the modeling phase, the successful components of the program, the usability and feasibility of the program will be explored and evaluated. In an exploratory trial, the intervention and the measurement instruments will then be pilot-tested on feasibility, and the intervening factors for measuring the effectiveness of the program will be evaluated. Mixed methods, i.e. both qualitative and quantitative research methods, will be used for designing and evaluating the program. After these three phases are concluded, the effect of the program can be evaluated in an RCT (phase III) and, when effective, the program can be further implemented (phase IV). The execution of the RCT and (possible) further implementation are beyond the scope of the present study.

Below, the aim, research questions, methods, analysis strategies, and expected results are outlined for each phase. The rationale of the study will be described in the first phase. According to the MRC framework, the progression from one phase to another, especially in the first three phases, may not be linear but can be conducted in an iterative process (Campbell *et al.*, 2000; Campbell *et al.*, 2007; Craig *et al.*, 2013), i.e. return to an earlier phase of the development e.g. from the modeling phase back to the theoretical phase, or from the exploratory trial back to the modeling phase, based on feedback or new information collected in a later phase. This provides the possibility to constantly optimize the person-centered tablet program, i.e. to adjust it to the needs of users and their context. Using “participatory designs”, user needs are inventoried and integrated in the person-centered tablet program (Steen *et al.*, 2007; Meiland *et al.*, 2010; Pratesi *et al.*, 2013). In all phases of the development of the program, we will involve users, i.e. clients and carers, by means of individual interviews, workshops, focus groups, and case studies. In the end, the intervention will be offered to community-dwelling people with mild dementia. The MMSE score (Folstein *et al.*, 1975) in combination with the Global Deterioration Scale (Reisberg *et al.*, 1982) will be used to determine the sample and people with mild dementia with scores for cognitive functioning between 18 and 24 (MMSE) and stage 4 (GDS) will be included in the modeling phase and exploratory trial. In addition to people with mild dementia, people with mild cognitive decline or MCI could be

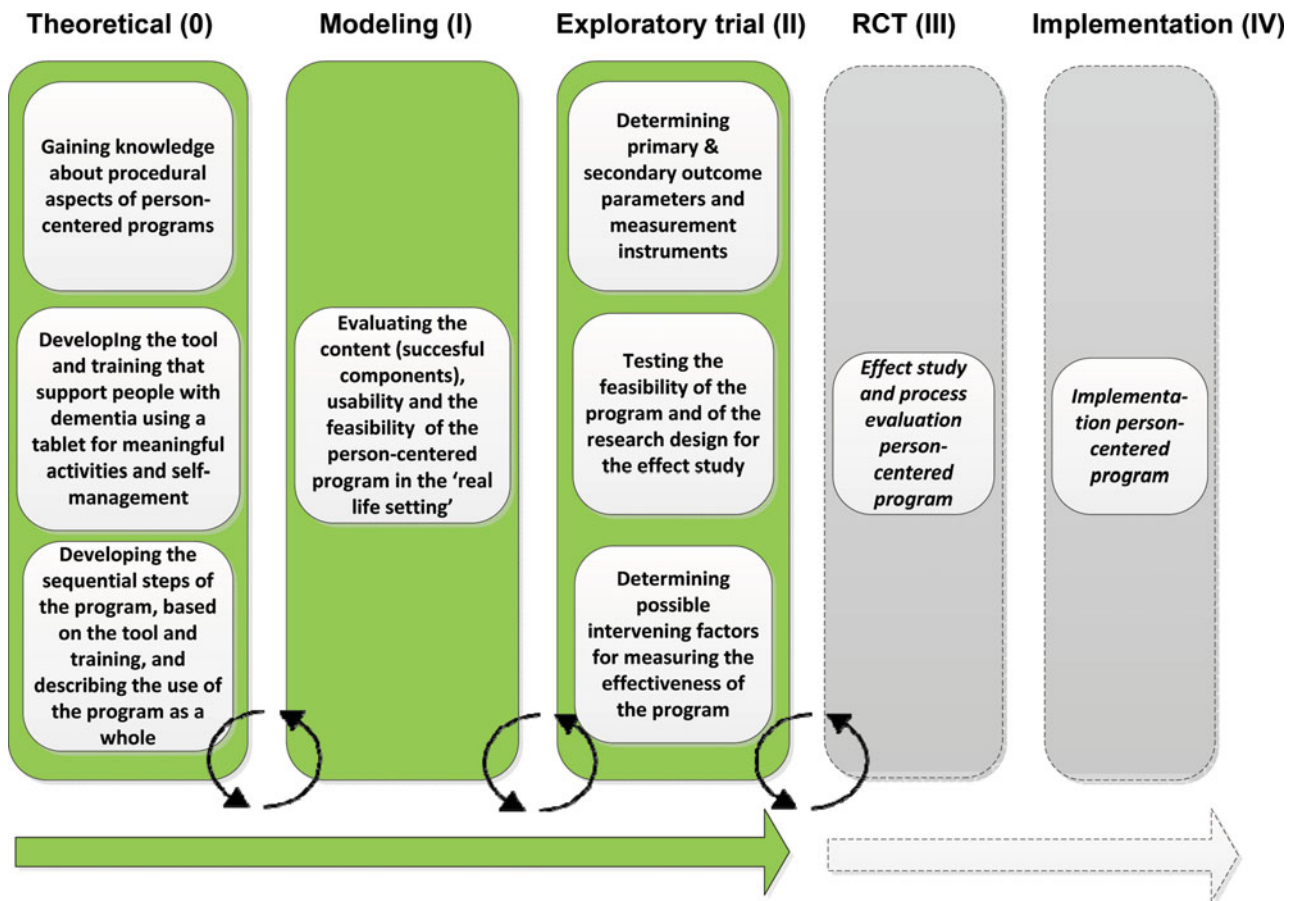


Figure 1. First phases of development and testing of a person-centered tablet program according to the MRC framework.

included in the theoretical phase (MMSE 24–27 and GDS stages 2 or 3) of the development of the tool for selecting usable apps as representatives for the future needs and wishes of people with mild dementia (de Boer *et al.*, 2007). In this phase, people will be individually (apart from carers) involved fulfilling the roles as informants and advisors (Abma and Broerse, 2007). In the modeling phase and exploratory trial they will be involved as dyads fulfilling the roles as informants and research subjects (Abma and Broerse, 2007). However, to gain a comprehensive insight into their needs, (group) interviews in these phases will be conducted with persons with dementia apart from informal carers as we know that the needs reported by persons with dementia can differ from those mentioned (about the person with dementia) by carers (Van der Roest *et al.*, 2009; Black *et al.*, 2013; Castillo *et al.*, 2013). Because we only include community-dwelling participants, the recruitment will take place via health and homecare organizations, day centers, and meeting centers for people with dementia and their informal carers.

Ethical considerations

The Medical Ethics Committee of the VU University Medical Center in Amsterdam approved the study protocol. The ethical principles; respect for autonomy, beneficence, non-maleficence, and justice (Haigh, 2008) will be taken into account during recruitment, data collection, analysis, and reporting. During all the phases special attention will be paid to the informed consent of people with dementia by performing an on-going consent procedure in order to ensure that participation is voluntarily (Murphy *et al.*, 2015). Furthermore, strategies for the meaningful inclusion of people with dementia such as, creating a safe environment, spending time by getting to know them, emphasizing the importance of their participation, and recognizing signs of discomfort, will be taken into consideration (Murphy *et al.*, 2015).

Methods of Preclinical or theoretical phase (phase 0)

The aim of the theoretical phase is to explore relevant theory that will guide the best choice of

intervention (Campbell *et al.*, 2000). The following research questions will be addressed in this phase:

1. What are important procedural aspects (e.g. recruitment, inclusion, process and effect evaluation, and implementation issues) of person-centered programs for people with dementia to take into account in the development of the person-centered tablet program?
2. What needs, wishes, and abilities of people with dementia should be taken into account when selecting usable apps on the tablet with regard to self-management and meaningful activities?
3. How to design and develop a requirements-based assessment tool for usable apps with regard to self-management and meaningful activities that matches with the individual needs, wishes and abilities of people with dementia?
4. What training or coaching intervention(s) on how to use the tablet and its applications is/are most appropriate and/or effective for people with dementia and informal and professional carers?
 - i. Rationale and methods related to procedural aspects of person-centered programs (question 1):

In recent decades psychosocial interventions are promoted to improve the quality of life of people with dementia (Moniz-Cook *et al.*, 2011). Many of these interventions have been shown to be effective (Olazaran *et al.*, 2010; Dröes *et al.*, 2010b; Vernooij-Dassen *et al.*, 2010; Dröes *et al.*, 2011a). However, psychosocial interventions that are tailored to specific needs, wishes, and abilities of people with dementia and their carers are more beneficial than non-tailored interventions, and their use and development should therefore be stimulated (O'Connor *et al.*, 2009; Vernooij-Dassen *et al.*, 2010; Dröes *et al.*, 2011a). Moreover, in a review on psychological interventions in dementia it is found that personalized dyadic programs are effective (Van't Leven *et al.*, 2013). This development of tailored interventions is in accordance with the principles of person-centered care (Kitwood, 1997; Brooker, 2003). In this study, existing person-centered psychosocial interventions (Testad *et al.*, 2014) and programs that focuses on both the person with dementia and their informal carer (Graff *et al.*, 2006a; Gitlin *et al.*, 2008; Graff *et al.*, 2010; Dröes *et al.*, 2011b) will be explored, and an additional literature study will be performed to gain knowledge about the procedural aspects of these interventions.

- ii. Rationale and methods for assessing the individual needs, wishes and abilities of people with dementia (question 2):

Due to the wide variety of available and limited apps specifically developed for people with dementia (Smith and Mountain, 2012) careful

consideration is required to select usable apps for people with dementia. It is therefore essential to develop a requirements-based assessment tool that will help people select usable apps in the domains of self-management and meaningful activities. Although there are several studies done and underway that focus on identifying usable apps for people with dementia (Upton *et al.*, 2011, Groenewoud and de Lange, 2014, Astell *et al.*, 2016), there is no tool available specifically for people with dementia yet. The tool has to match individual needs, wishes and abilities of people with dementia to important features of apps so that tailored apps can be selected. To develop this tool it is important to get an understanding of the needs, wishes, and abilities of people with dementia with regard to their choice and use of apps so that user requirements for the tool can be identified.

To ensure that the desired activities in the context of self-management and meaningful activities of people with dementia are adequately identified and supportive, the methodology of the OPHI-II-NL will be applied (Baaijen *et al.*, 2008; Graff *et al.*, 2010). The OPHI-II-NL is a narrative interview that focuses on the identification of meaningful activities and the experiences of these activities in the past, the present, and what this means for the future. To get a comprehensive understanding of individual needs, wishes, and experiences as well as capabilities, despite existing impairments, two focus groups with people with mild dementia and two focus groups with informal carers will be conducted, based on the OPHI-II-NL interview (Graff *et al.*, 2006b; Baaijen *et al.*, 2008; Graff *et al.*, 2010). This will help to gain insight into the target group relevant self-management activities and other meaningful activities, so that user requirements for the tool to select apps can be identified.

In addition, two focus groups sessions with people with cognitive decline, MCI and mild dementia and two focus groups sessions with informal carers, with a two weeks period in between, will take place to explore their needs, wishes, and abilities in their current use of apps and new introduced apps. To avoid embarrassment among participants due to memory problems, participants will be asked to bring their tablet to capture experiences while using different kind of apps. As a result, additional user requirements with regard to the use of apps can be identified and user requirements with regard to choices of apps can be complemented.

An inductive content analysis, based on principles of grounded theory (Corbin and Strauss, 2008), will be performed on the verbatim transcriptions of the focus groups. The procedure of "open coding", "axial coding," and "selective coding" will

be performed to identify themes with regard to choices and use of apps of people with dementia. Based on these findings user requirements for the tool will be listed. These requirements are expected to contribute to the selection of the best usable apps for people with dementia, attunable to their individual needs, wishes, and abilities

- iii. Rationale and methods related to the design and development of a requirements-based assessment tool (question 3):

After the identification of user requirements, the tool will be designed and developed in close cooperation with the users and other important stakeholders such as formal carers and experts (designers, developers and researchers) to ensure its user-friendliness. Inspired by the work of Nijland, (2011), van Gemert-Pijnen *et al.*, (2011), Span *et al.*, (2014) three iterations will take place whereby the users will be invited in several rounds to test whether the prototypes match with their expectations.

First, focus group sessions with people with cognitive decline, MCI and mild dementia and sessions with informal carers and sessions with formal carers will take place. Mock-ups will be created and discussed with the users and the first prototype will be refined (Nijland, 2011; Span *et al.*, 2014). Secondly, based on the feedback of the mock-ups, the first interactive prototype will be built and tested in a cognitive walkthrough session with experts (designers, developers, and researchers) (Nijland, 2011; Span *et al.*, 2014). The participants will test the tool and perform tasks in a think aloud session (Hak *et al.*, 2008) to identify potential usability problems (Nijland, 2011; Span *et al.*, 2014). Third, based on the results of the cognitive walkthrough, we will test the usability with an adapted prototype aiming at a further refinement of the tool and to make the tool ready to use it in the next phase (modeling) of the study (Span *et al.*, 2014). The quality of the tool will be assessed with the help of Three-Step Test-Interviews (TSTI) first with people with cognitive decline and MCI and later on with people with mild dementia and interviews with informal and formal carers. The TSTI consists of three steps: respondent-driven, observation of response behavior including “say aloud what you think”; interviewer-driven, retrieval of additional data by follow-up probing aimed at remedying gaps in observational data and validation by interviewer-driven debriefing aimed at eliciting experiences and opinions (Hak *et al.*, 2008).

During the three iterations a deductive content analysis, based on the framework analysis (Ritchie and Spencer, 1994), will be performed on

the verbatim transcriptions of the focus groups sessions, the cognitive walkthrough session and the interviews. Main themes will be identified with regard to three quality levels of the design: system quality (user-friendly and safe), content quality (understandable and meaningful) and service quality (adequately) (Nijland, 2011; van Gemert-Pijnen *et al.*, 2011; Span *et al.*, 2014).

- iv. Rationale and research methods related to the training and coaching interventions (question 4):

After the selection of usable apps, people with dementia will be taught to use the tablet and apps. Training or coaching interventions are defined as: any strategy or rehabilitation technique that stimulates the procedural (implicit) memory and that explicitly targets the use of the tablet and its applications by individuals with dementia. Progress has been made in the field of successful training or coaching interventions for people with dementia, for example: Errorless Learning (EL), Errorful Learning (EF), Space Retrieval Training (SRT), and Method of Vanishing Cues (MVC) (Clare, 2008). However, the findings of previous reviews on cognitive interventions for people with dementia (Clare and Jones, 2008; Hopper *et al.*, 2013; Oren *et al.*, 2014) provide insufficient information to determine what training or coaching intervention(s) is/are most effective for people with dementia to learn how to use the tablet and its applications. Most reviews concentrate on *cognitive stimulation* in general which aims to improve cognition, behavior and quality of life, and on *cognitive training* which aims to improve the performance on specific cognitive tasks (Clare, 2008). However, from the perspective of developing a training or coaching intervention, we are particularly interested in how to teach people with dementia new skills rather than to improve their cognitive performance. Kessels and Banningh (2008) describe that new skills can be taught to people with dementia via their implicit memory. Our research question therefore, better fits the scope of *cognitive rehabilitation* (Clare, 2008). Within this concept, individually designed compensatory interventions are aimed at addressing specific practical difficulties with daily activities, identified by the person with dementia and/or the family carer, that are relevant to everyday life and are related in some way to cognitive impairment. The overall aim is to support aspects of everyday functioning and well-being by compensating for disabilities (Clare, 2008). Teaching people with dementia to use the tablet and its applications by means of a person-centered program is in line with the rehabilitation concept.

It is necessary to investigate what training or coaching intervention(s) is/are most effective to support the procedural (implicit) memory in learning new skills. A systematic literature review will be conducted to explore the effectiveness of such training or coaching interventions. A systematic search of the literature will be performed in the electronic databases PubMed, PsycINFO, and Cinahl. An independent assessment of the methodological quality of the included articles based on appropriate guidelines (Higgins and Green, 2011) will be performed by two researchers. How to summarize the results depends on the variation of the included studies. A quantitative analysis (statistical pooling of results) is possible depending on the level of homogeneity. If there is too much variation a qualitative analysis can be conducted. In any case, the most important characteristics of the studies will be described including: the authors of the study; the aim of the study; characteristics of the population; research method and the outcome (primary and secondary outcome parameters and follow-up time).

This phase will result in a theoretical framework for the person-centered tablet program and its sequential steps. The program as a whole will be described and this will result in a digital practical manual/guide for person-centered use of the tablet and its apps. This forms the basis for the next phase.

Methods of modeling phase (phase I)

The aim of this phase is to evaluate the content, usability, and feasibility of the person-centered tablet program in the “real life setting”. The following research questions are addressed in this phase:

1. What are the experiences of people with dementia and their carers with the content of the person-centered tablet program (successful components)?
2. How do people with dementia and carers appreciate the usability of the person-centered tablet program?
3. Is the person-centered tablet program feasible in practice?

A pilot with case studies will be conducted in a “real life setting” with the objective of comparing cases of participants with mild dementia ($n = 5$) to gain insight into the experiences with the content of the program, and to identify, based on these experiences, the most important and successful components of the program; the usability of the program; and the feasibility of the program. With regard to the feasibility of the program it is important to explore the facilitating and impeding factors in the execution of the

program: what works/does not work in practice (practical applicability). We furthermore want to gain knowledge about any important adaptations necessary to make the program fit for different contexts and to explore the mechanism of how the program brings change (Moore *et al.*, 2015).

For this study, primarily qualitative research methods will be used, as most of the research questions require an in-depth understanding. Various data sources: documents, interviews, (participant) observation of behavior of people with mild dementia and their carers will be used to get this in-depth understanding of the situation/context. The case-study method is used to understand complex social phenomena influencing the usability of the program and will allow the researchers to observe the holistic meaningful characteristics of real-life events, such as the context in which behaviors take place (Yin, 2003). The case studies will be divided into three phases (Graff *et al.*, 2006b): (i) the situation before the start of using the person-centered tablet program; (ii) the process of using the person-centered tablet program; (iii) the situation at the end of the intervention.

In addition, quantitative research methods will be used to get additional information from the cases, such as: background characteristics (like age, gender, type, and stage of dementia, tablet experience), context characteristics (living alone or together, support from informal carers), and user behavior characteristics in relation to the intervention (amount of time interacting with the tablet and its apps, amount of time needing support by carers, kind of apps used). This information is necessary to gain insight into the characteristics of the research population and the way they use the tablet, and to take these characteristics into account in the next phase of the MRC framework: the exploratory trial. Furthermore, the Use questionnaire (Lund, 2001) will be used to collect additional quantitative data about the usability of the person-centered tablet program. This questionnaire consists of four topics regarding usefulness, ease of use (user-friendliness), ease of learning, and satisfaction (Lund, 2001).

An inductive content analysis, based on principles of grounded theory (Corbin and Strauss, 2008), will be performed to identify successful components, usability, and feasibility of the program. Characteristics of the study population and data about the usability of the program will be analyzed by means of descriptive statistics (means and standard deviations for interval variables, and numbers and percentages for nominal and ordinal data).

The outcomes of this phase are used to refine the person-centered tablet program and identify

the most important and successful components of the program. Furthermore, the conditions that have to be met for adequate application of the program and the practical difficulties/consequences of the program will become evident. All together this will provide insight into the feasibility of the program. A higher feasibility will contribute to more treatment fidelity in case the program effectiveness is tested in an RCT (Vernooij-Dassen and Moniz-Cook, 2014). Low treatment fidelity (or implementation error) refers to the circumstance that the application of the intervention differs considerably from the original plan. This is a serious threat to the validity of the study when investigating the effectiveness of psychosocial interventions for people with dementia (Vernooij-Dassen and Moniz-Cook, 2014).

Methods of exploratory trial (phase II)

The aim of this phase is to determine the primary and secondary outcome parameters and the instruments to measure these outcome parameters, as well as to test the feasibility of the intervention and the research design for a future RCT. The following research questions will be addressed in this phase:

1. Which primary and secondary outcome parameters are suitable to measure the effect of the person-centered tablet program and which measuring instruments are suitable to measure the selected primary and secondary outcome parameters?
2. What is the feasibility of the person-centered tablet program and what factors can potentially influence the effect and implementation of the program from the perspective of the client (background, context, and user behavior characteristics of the intervention), carers (adherence, treatment fidelity), and organization prerequisites (shared vision, readiness for change, financial aspects).
3. Is the research design for the RCT feasible with regard to: the recruitment of respondents, inclusion criteria, the burden on the participants (in relation to the number of measuring instruments, duration of the tests), “sensitivity to change” of the instruments for this target group, the expected size of effects of this program, the identification of potential subgroups for subgroup-analysis in the RCT, etc.?

In the exploratory randomized trial, the person-centered tablet program will be offered to people with mild dementia ($n = 12$) and their carers ($n = 12$) to test the feasibility of the program and to collect practical information which can be applied in a future RCT in phase III. In addition, a control group will be used which will be offered care as usual. In this phase a combination of quantitative and qualitative research methods will be used.

Based on the knowledge gathered in the preceding phases and on an additional literature search with regard to relevant measuring instruments, the primary and secondary outcome parameters and measuring instruments will be selected for the effect study. Obviously, instruments specifically applicable for this target group will be used in this phase. Potential primary outcome parameters for people with dementia are sense of self-efficacy, self-confidence, self-management ability, engagement in meaningful activities, and participation in daily and social activities. Potential secondary outcome parameters are quality of life of people with dementia and their carers and sense of competence of informal carers.

The results from the theoretical and modeling phase will both provide information about the amount of time required to demonstrate effects of the intervention. Three assessments of participants are planned, at baseline (T0), directly after the program has been offered (T1), and at follow-up (T2) (time depends on information from theoretical and modeling phase). MMSE (Folstein *et al.*, 1975) will be administered at baseline to measure the severity of cognitive impairment.

Information will be collected with regard to: available number of eligible participants, willingness of participants to participate, and cooperation of professionals to identify and recruit participants, drop-out rates, and compliance with the intervention and completion of questionnaires, standard deviation of change in the outcome measures and effect sizes which can be used in the power calculation of the RCT, time investment of participants, time needed to collect and analyze the data.

Alongside this pilot-testing of the research design a qualitative process evaluation will be performed. Interviews with people with mild dementia and their carers will take place aiming to:

1. Determine factors that may influence the effect of the program on the client, carer, and organization level. This information will be useful to gain insight into important additional preconditions when performing an RCT.
2. Gain insight into possible barriers and facilitators for implementation.
3. Gain insight into the feasibility of the tailor-made program.
4. Gain insight into the context of the intervention and how this may influence the implementation and the intervention effect.

To guarantee the internal validity, we will analyze the process data before analyzing the effects (Leontjevas *et al.*, 2013). A deductive content

analysis, based on the framework analysis (Ritchie and Spencer, 1994), will be performed to analyze the findings from the process evaluation, as we are particularly interested in the above-mentioned topics. Baseline characteristics of the participants will be analyzed by means of descriptive statistics (percentages for nominal variables and means and standard deviations for interval variables). To test the differences between the groups on the outcome measures, depending on whether the data meet the assumption of a normal distribution, either analysis of covariance (ANCOVA) or a Mann–Whitney U test will be conducted.

The results of this exploratory trial phase are selection of the primary and secondary outcome parameters and measuring instruments, a description of the intervention and prerequisites for implementation, and the research design for a definite RCT.

Discussion

It is generally assumed that people with dementia are not capable, or will have much difficulty, learning how to use new technologies, because they are complicated to operate and especially older people will not have been familiar with them before the onset of dementia (Orpwood *et al.*, 2010; Naumann *et al.*, 2011). Several studies conducted in the last decade; however, showed that people with mild dementia are able to learn how to use everyday technologies and new technologies, such as smartphones and a digital organizer (Lekeu *et al.*, 2002; Thivierge *et al.*, 2008; Imbeault *et al.*, 2014). Smith and Mountain (2012) argue that when people with dementia integrate the use of tablets in their daily lives, this will help focus on intact abilities instead of the constant attention to deficits, and this may also counteract the stigmatization of people with dementia regarding their incapacity to use technology and ICT.

The deployment of tablets for the use in everyday life is increasing among older people to approximately 56% of the total elderly population (GfK, 2014). As in several other European countries, the Dutch government further stimulates this development through the implementation of eHealth services (Krijgsman *et al.*, 2013). For example, health and social care organizations in some cases offer tablets to their customers to promote eHealth services in practice e.g. care at a distance. Hence, in line with these developments, the number of people with mild dementia who use, or are willing to learn how to use, the tablet and its apps can also be expected to increase, especially because it may offer the potential to engage in

enjoyable social and leisure time activities, enabling feelings of inclusivity (Smith and Mountain, 2012).

We will develop a person-centered tablet program to support people with mild dementia in the effective use of the tablet for self-management and meaningful activities. Our expectation is that it can improve, among other things, the self-management ability, engagement in meaningful activities, and the quality of life of people with dementia (and their carers). Because of the complex nature of this new intervention we will develop and evaluate the feasibility of this program according to the MRC framework for complex interventions. The iterative process of this framework, in especially the first three phases, will make it possible to constantly optimize the person-centered tablet program according to the needs of users and its practical feasibility, and this will contribute to a tailored and easy-to-implement intervention. In addition, this study will prepare for a methodologically sound RCT to be conducted after this study (Campbell *et al.*, 2000; Campbell *et al.*, 2007).

To date, systematic research regarding technological applications for people with dementia is very limited. The majority of the studies included small samples, and focused primarily on development rather than evaluation (Riley *et al.*, 2009; Astell *et al.*, 2010; Meiland *et al.*, 2012; Leuty *et al.*, 2013; Nijhof *et al.*, 2013; Pringle and Somerville, 2013; Kerkhof *et al.*, 2015). Large-scale studies and RCTs, preferably in “real-life settings”, are necessary to stimulate the further development and use of touch screen technology for people with dementia. We therefore plan to conduct an RCT after the present modeling and exploratory study in order to investigate the effectiveness of the intervention. This will contribute to the further acceptance and dissemination of touch screen technology among this target group.

It is important to take into account some potential threats while performing the development and feasibility study. First, the current availability of sufficient apps for meaningful activities and self-management that match the individual needs, wishes, and abilities of people with dementia may be limited. Although an explorative search of the current supply resulted in enough variation of apps in several areas of self-management and meaningful activities, the extent to which these apps are usable will depend on the person’s cognitive deficits. On the other hand, there is a growing number of projects that may result in the identification and development of usable apps for people with dementia. For example, the project In Touch (Groenewoud and de Lange, 2014; Astell *et al.*, 2016) which focuses on the identification

and development of happy games for people with dementia (see www.actodementia.com), and the project Memory apps for dementia, in association with the University of Worcester, and Alive which also inventoried usable apps for people with dementia (Upton *et al.*, 2011) (see <http://memoryappsfordementia.org.uk/>).

A second potential risk is that independent use of the tablet may be difficult for people with dementia and consequently may lead to new demands placed on their informal and professional carers (e.g. those working in day care centers or meeting centers for people with dementia and their carers). This could increase their burden instead of relieving it. The iterative process of the MRC framework and the involvement of users in all phases of development will allow us to identify such consequences at an early stage and to find practical solutions.

Third, investigating the conditions for performing an RCT after this project requires that several methodological threats are taken into account: insufficient recruitment of people with dementia in the experimental and control group may result in insufficient statistical power to test differences between groups; and the burden as a result of participating in the research may be a motive to withdraw from the study or result in low treatment fidelity. To prevent recruitment problems, preparatory actions are required to identify health and social care organizations that already use this kind of eHealth services for their clients in practice. Also, optimal transfer of knowledge about the new person-centered tablet program is essential. Actions to decrease the burden for participants and to increase treatment fidelity will be explored in the modeling and the exploratory trial phases of our study by means of process analysis. The identification of practical difficulties in these phases will help to design the evaluation study and to develop a dedicated user-oriented implementation strategy (Vernooij-Dassen and Moniz-Cook, 2014). The importance of “hand in hand” technological development and implementation strategies is also acknowledged by (Kerkhof *et al.*, 2016), who developed a memory application to support the independence of clients with dementia or intellectual disabilities.

Finally, tailoring the intervention to needs, wishes, and abilities of individual clients, which is the core of a person-centered approach, may threaten the standard conditions for testing an intervention in an RCT. To gain insight into the effects of the intervention in subgroups that differ on background, context characteristics, and user behavior characteristics, subgroup-analyses will be performed. Which subgroup-analyses may be

appropriate will be determined in the exploratory trial.

By developing the person-centered tablet program in a user-centered and iterative way, taking into account the existing theoretical knowledge, and by testing its feasibility in practice, we expect to deliver a well-defined intervention to promote the use of apps for self-management and meaningful activities by people with dementia. When proven effective in the RCT, this person-centered tablet program can be implemented as a new service in dementia care.

Conflict of interest declaration

None.

Description of authors' roles

All authors contributed to the study design. Y.J.F. Kerkhof wrote the initial draft of the paper. Y.J.F. Kerkhof, M.J.L. Graff, H.M. de Vocht and R.M. Dröes designed the study and all authors including A. Bergsma participated as assessors in the review process and critically reviewed the paper.

References

- Abma, T. and Broerse, J. E. W.** (2007). *Zeggenschap in wetenschap. Patiëntenparticipatie in theorie en praktijk* [Control in science. Patient participation in theory and practice]. the Netherlands: Den Haag: Lemma.
- Alzheimer's Disease International** (2013). *Policy Brief for Heads of Government: the Global Impact of Dementia 2013–2050*, London: Alzheimer's Disease International. Available at: <http://www.alz.co.uk/research/GlobalImpactDementia2013.pdf>.
- Astell, A. J., Ellis, M. P., Bernardi, L., Alm, N., Dye, R., Gowans, G. and Campbell, J.** (2010). Using a touch screen computer to support relationships between people with dementia and caregivers. *Interacting with Computers*, 22, 267–275.
- Astell, A. J., Jodrell, P., Groenewoud, H., de Lange, J., Goumans, M., Cordia, A. and Schikhof, Y.** (2016). Does familiarity affect the enjoyment of touchscreen games for people with dementia?. *International Journal of Medical Informatics*, 91, e1–e8.
- Baaijen, R., Boon, J. and Tichelaar, E.** (2008). *De Nederlandse samenvattende handleiding van de OPHI-II (versie 2.1.) Occupational Performance History Interview-II NL.*, The Netherlands: Amsterdam: Hogeschool van Amsterdam, Expertise Centrum Ergotherapie.
- Barlow, J., Wright, C., Sheasby, J., Turner, A. and Hainsworth, J.** (2002). Self-management approaches for people with chronic conditions: a review. *Patient Education and Counseling*, 48, 177–187.

- Bello, G., Bouwmeester, F. and Westerik, E.** (2013). Make my iDays, onderzoeksverslag hbo-v [research report Bachelor of Nursing]. Bachelor of Nursing, Saxion University of Applied Sciences, Deventer/Enschede.
- Black, B. S., Johnston, D., Rabins, P. V., Morrison, A., Lyketsos, C. and Samus, Q. M.** (2013). Unmet needs of community-residing persons with dementia and their informal caregivers: findings from the maximizing independence at home study. *Journal of the American Geriatrics Society*, 61, 2087–2095.
- Brooker, D.** (2003). What is person-centred care in dementia?. *Reviews in Clinical Gerontology*, 13, 215–222.
- Campbell, M. et al.** (2000). Framework for design and evaluation of complex interventions to improve health. *British Medical Journal*, 321, 694–696.
- Campbell, N. C. et al.** (2007). Designing and evaluating complex interventions to improve health care. *British Medical Journal*, 334, 455–459.
- Castillo, C. M., Woods, B. and Orrell, M.** (2010). People with dementia living alone: what are their needs and what kind of support are they receiving?. *International Psychogeriatrics*, 22, 607–617.
- Castillo, C. M., Woods, B. and Orrell, M.** (2013). The needs of people with dementia living at home from user, caregiver and professional perspectives: a cross-sectional survey. *BMC Health Services Research*, 13, 43.
- Clare, L.** (2008) Neuropsychological rehabilitation and people with dementia. *Neuropsychological Rehabilitation: A Modular Handbook Hove*. New York: Psychology Press.
- Clare, L. and Jones, R. S.** (2008). Errorless learning in the rehabilitation of memory impairment: a critical review. *Neuropsychology Review*, 18, 1–23.
- Corbin, J. and Strauss, A.** (2008). *Basics of Qualitative Research: Techniques for Developing Grounded Theory* (p. 379). Thousand Oaks, CA: Sage publication.
- Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I. and Petticrew, M.** (2013). Developing and evaluating complex interventions: the new medical research council guidance. *International Journal of Nursing Studies*, 50, 587–592.
- De Boer, M. E., Hertogh, C. M. P. M., Dröes, R.-M., Riphagen, I. I., Jonker, C. and Eefsting, J. A.** (2007). Suffering from dementia – the patient’s perspective: a review of the literature. *International Psychogeriatrics*, 19, pp. 1021–1039.
- Dröes, R. M., Bentvelzen, S., Meiland, F. and Graig, D.** (2010a). Dementia-related and other factors to be taken into account when developing ICT support for people with dementia lessons from field trials. In M. D. Mulvenna and C. D. Nugent (eds.), *Supporting People with Dementia using Pervasive Health Technologies* (pp. 113–127). London: Springer.
- Dröes, R. M., Meiland, F. J. M., Schmitz, M. J. and Van Tilburg, W.** (2011b). How do people with dementia and their carers evaluate the meeting centers support programme. *Non-Pharmacological Therapies In Dementia*, 2, 19–39.
- Dröes, R. M., van der Roest, H. G., van Mierlo, L. and Meiland, F. J.** (2011a). Memory problems in dementia: adaptation and coping strategies and psychosocial treatments. *Expert Review of Neurotherapeutics*, 11, 1769–1781.
- Dröes, R. M., Van Mierlo, L. D., Van der Roest, H. G. and Meiland, F. J. M.** (2010b). Focus and effectiveness of psychosocial interventions for people with dementia in institutional care settings from the perspective of coping with the disease. *Non-Pharmacological Therapies in Dementia*, 1, 139–161.
- Folstein, M. F., Folstein, S. E. and McHugh, P. R.** (1975). “Mini-mental state”: a practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189–198.
- GfK** (2014). Evenveel Nederlanders met tablet als vaste computer. Nieuwe meting GfK trends in digitale media [Dutch use a tablet as often as a computer. New measurement GfK trends in digital media]. Available at: <https://www.gfk.com/insights/press-release/evenveel-nederlanders-met-tablet-als-vaste-computer/>; last accessed 05 February 2015.
- Gitlin, L. N., Winter, L., Burke, J., Chernett, N., Dennis, M. P. and Hauck, W. W.** (2008). Tailored activities to manage neuropsychiatric behaviors in persons with dementia and reduce caregiver burden: a randomized pilot study. *The American Journal of Geriatric Psychiatry*, 16, 229–239.
- Graff, M. J. L., Vernooij-Dassen, M. J. M., Thijssen, M., Dekker, J., Hoefnagels, W. H. L. and Rikkert, M. G. M. O.** (2006a). Community based occupational therapy for patients with dementia and their care givers: randomised controlled trial. *British Medical Journal*, 333.
- Graff, M. J. L., Vernooij-Dassen, M. J. M., Zajec, J., Olde-Rikkert, M. G. M., Hoefnagels, W. H. L. and Dekker, J.** (2006b). How can occupational therapy improve the daily performance and communication of an older patient with dementia and his primary caregiver? A case study. *Dementia: The International Journal of Social Research and Practice*, 5, 503–532.
- Graff, M., van Melick, M., Thijssen, M., Verstraten, P. and Zajec, J.** (2010). Ergotherapie bij ouderen met dementie en hun mantelzorgers [Occupational therapy for dementia patients and their primary caregivers]. the Netherlands: Houten: Bohn Stafleu van Loghum.
- Groenewoud, J. H. H. and de Lange, J. J.** (2014). Evaluatie van individuele happy games op de iPad voor mensen met dementie [evaluation of personalised happy games on the iPad for people with dementia]. Rotterdam: Kenniscentrum zorginnovatie, Hogeschool Rotterdam.
- Haigh, C.** (2008). Research governance and research ethics. In R. Watson, H. McKenna, S. Cowman and J. Keady (eds.), *Nursing Research: Designs and Methods* (pp. 125–135). Edinburgh: Churchill Livingstone Elsevier.
- Hak, T., van der Veer, V. D. K. and Jansen, H.** (2008). The Three-Step Test-Interview (TSTI): an observation-based method for presenting self-completion questionnaires. *Survey Research Method*, 2, 143–150.
- Higgins, J. P. T. and Green, S.** (2011). Handbook for systematic reviews of interventions version 5.1.0. The Cochrane Collaboration.
- Hopper, T. et al.** (2013). An evidence-based systematic review on cognitive interventions for individuals with dementia. *American Journal of Speech-Language Pathology*, 22, 126–145.

- Huber, M. et al.** (2011). How should we define health?. *British Medical Journal*, 343, d4163. doi: [10.1136/bmj.d4163](https://doi.org/10.1136/bmj.d4163).
- Imbeault, H. et al.** (2014). Electronic organiser and Alzheimer's disease: fact or fiction?. *Neuropsychological Rehabilitation*, 24, 71–100.
- Kerkhof, Y. J. F., den Ouden, M. E. M., Ben Allouch, S., Soeteman, S., Scholten, A. and Willems, C. G.** (2016). Development of a memory application to support independence of clients with dementia or intellectual disabilities. *International Journal of Mobile Human Computer Interaction*. Submitted: June 2016.
- Kerkhof, Y. J. F., Rabiee, F. and Willems, C. G.** (2015). Experiences of using a memory aid to structure and support daily activities in a small-scale group accommodation for people with dementia. *Dementia: The International Journal of Social Research and Practice*, 14, 633–649.
- Kessels, R. P. C. and Joosten-Weyn Banningh, L.** (2008). Het impliciete geheugen en de effectiviteit van foutloos leren bij dementie [The implicit memory and the effectiveness of error-free learning in dementia]. *Gedragstherapie*, 41, 91–103.
- Kielhofner, G.** (2008). *A Model of Human Occupation: theory and Application*. Baltimore, MD: Lippincott Williams & Wilkins.
- Kitwood, T.** (1997). *Dementia Reconsidered: the Person Comes First* (p. 160). Buckingham: Open University Press.
- Krijgsman, J., Bie de, J., Burghouts, A., Cath, G. J., Gennip van, L. and Friele, R.** (2013). eHealth, verder dan je denkt: eHealth-monitor 2013 [eHealth further than you think: monitoring eHealth 2013], Den Haag, Utrecht: Nictiz, NIVEL. Available at: <http://www.nivel.nl/nieuws/ehealth-verder-dan-je-denkt>.
- Krijgsman, J., Klein, and Wolterink, G.** (2012). Ordering in the wereld van eHealth [Organisation in the world of eHealth]. Available at: <https://www.nictiz.nl/SiteCollectionDocuments/Whitepapers/Whitepaper%20Ordering%20in%20de%20wereld%20van%20eHealth.pdf>.
- Lekeu, F., Wojtasik, V., Van der Linden, M. and Salmon, E.** (2002). Training early Alzheimer patients to use a mobile phone. *Acta Neurologica Belgica*, 102, 114–121.
- Leontjevas, R., Gerritsen, D. L., Smalbrugge, M., Teerenstra, S., Vernooij-Dassen, M. J. F. J. and Koopmans, R. T. C. M.** (2013). A structural multidisciplinary approach to depression management in nursing-home residents: a multicentre, stepped-wedge cluster-randomised trial. *The Lancet*, 381, 2255–2264.
- Leuty, V., Boger, J., Young, L., Hoey, J. and Mihailidis, A.** (2013). Engaging older adults with dementia in creative occupations using artificially intelligent assistive technology. *Assistive Technology*, 25, 72–79.
- Lim, F. S., Wallace, T., Luszcz, M. A. and Reynolds, K. J.** (2013). Usability of tablet computers by people with early-stage dementia. *Gerontology*, 59, 174–182.
- Lund, A. M.** (2001). Measuring Usability with the USE Questionnaire. *STC Usability SIG Newsletter*. Available at: <http://hcibib.org/perlman/question.cgi>; last accessed 05 March 2009.
- Marceglia, S., Bonacina, S., Zaccaria, V., Pagliari, C. and Pinciroli, F.** (2012). How might the iPad change healthcare?. *Journal of the Royal Society of Medicine*, 105, 233–241.
- Martin, F., Turner, A., Wallace, L. M. and Bradbury, N.** (2013). Conceptualisation of self-management intervention for people with early stage dementia. *European Journal of Ageing*, 10, 75–87.
- Martin, F., Turner, A., Wallace, L. M., Choudhry, K. and Bradbury, N.** (2012). Perceived barriers to self-management for people with dementia in the early stages. *Dementia: The International Journal of Social Research and Practice* 12, 481–493.
- Meiland, F. J. M. et al.** (2010). User-participatory development of assistive technology for people with dementia—from needs to functional requirements. First results of the COGKNOW project. *Non-Pharmacological Therapies in Dementia*, 1, 73–93.
- Meiland, F. J. M. et al.** (2012). Usability of a new electronic assistive device for community-dwelling persons with mild dementia. *Aging Mental Health*, 16, 584–591.
- Meussen, E., Wensink, K., Bannink, L., Nagtzaam, N. and Steghuis, V.** (2014). Make my iDays, onderzoeksverslag hbo-v [research report Bachelor of Nursing]. Bachelor of Nursing, Saxion University of applied sciences, Deventer/ Enschede.
- Moniz-Cook, E., Vernooij-Dassen, M., Woods, B. and Orrell, M.** (2011). Psychosocial interventions in dementia care research: the INTERDEM manifesto. *Aging & Mental Health*, 15, 283–290.
- Moore, G. F. et al.** (2015). Process evaluation of complex interventions: medical research council guidance. *British Medical Journal*, 350, h1258. doi: [10.1136/bmj.h1258](https://doi.org/10.1136/bmj.h1258).
- Mountain, G. A.** (2006). Self-management for people with early dementia. An exploration of concepts and supporting evidence. *Dementia: The International Journal of Social Research and Practice*, 5, 429–446.
- Mountain, G. A. and Craig, C. L.** (2012). What should be in a self-management programme for people with early dementia?. *Aging & Mental Health*, 16, 576–83.
- Murphy, K., Jordan, F., Hunter, A., Cooney, A. and Casey, D.** (2015). Articulating the strategies for maximising the inclusion of people with dementia in qualitative research studies. *Dementia: The International Journal of Social Research and Practice*, 14, 800–824.
- Naumann, A. B., Hurtienne, J., Göllner, S., Langdon, P. M. and Clarkson, P. J.** (2011). Technology supporting the everyday life of people with dementia. *Proceedings of the Conference on Inclusive Design – The Role of Inclusive Design in Making Social Innovation Happen*, London.
- Nauta, J. M., Brangert, J., Roest, M., Janssen, R. and Hettinga, M.** (2013). TalkMeHome: an in situ evaluation of a service to guide a lost person with dementia home safely. *Journal of the International Society for Telemedicine and eHealth*, 1, 54–61.
- Nijhof, N., van Gemert-Pijnen, J. E. W. C., Burns, C. M. and Seydel, E. R.** (2013). A personal assistant for dementia to stay at home safe at reduced cost. *Gerontechnology*, 11, 469–479.
- Nijland, N.** (2011). Grounding eHealth: towards a holistic framework for sustainable eHealth technologies. PhD Thesis, University of Twente.
- O'Connor, D. W., Ames, D., Gardner, B. and King, M.** (2009). Psychosocial treatments of behavior symptoms in

- dementia: a systematic review of reports meeting quality standards. *International Psychogeriatrics*, 21, 225–40.
- Olazaran, J. et al.** (2010). Nonpharmacological therapies in Alzheimer's disease: a systematic review of efficacy. *Dementia and Geriatric Cognitive Disorders*, 30, 161–78.
- Oren, S., Willerton, C. and Small, J.** (2014). Effects of spaced retrieval training on semantic memory in Alzheimer's disease: a systematic review. *Journal of Speech Language, and Hearing Research*, 57, 247–70.
- Orpwood, R. et al.** (2010). Designing technology to improve quality of life for people with dementia: user-led approaches. *Universal Access in the Information Society*, 9, 249–259.
- Phinney, A., Chaudhury, H. and O'connor, D. L.** (2007). Doing as much as I can do: the meaning of activity for people with dementia. *Aging and Mental Health*, 11, 384–393.
- Pratesi, A., Sixsmith, J. and Woolrych, R.** (2013). Genuine partnership and equitable research: working “with” older people for the development of a smart activity monitoring system. *The Innovation Journal: The Public Sector Innovation Journal*, 18, 1–17. Available at: http://www.innovation.cc/scholarly-style/18_3_6_pratesi_partner-equal-research.pdf.
- Pringle, A. and Somerville, S.** (2013). Computer-assisted reminiscence therapy: developing practice. *Mental Health Practice*, 17, 34–37.
- Quinn, C., Toms, G., Anderson, D. and Clare, L.** (2015). A review of self-management interventions for people with dementia and mild cognitive impairment. *Journal of Applied Gerontology*, Epublished ahead of print, doi: [10.1177/0733464814566852](https://doi.org/10.1177/0733464814566852).
- Reisberg, B., Ferris, S. H., de Leon, M. J. and Crook, T.** (1982). The global deterioration scale for assessment of primary degenerative dementia. *The American journal of psychiatry*, 139, 1136–1139.
- Riley, P., Alm, N. and Newell, A.** (2009). An interactive tool to promote musical creativity in people with dementia. *Computers in Human Behavior*, 25, 599–608.
- Ritchie, J. and Spencer, L.** (1994). Qualitative data analysis for applied policy research In Bryman, and Burgess, (eds.), *Analyzing Qualitative Data* (pp. 173–194). London: Routledge.
- Smith, S. K. and Mountain, G. A.** (2012). New forms of information and communication technology (ICT) and the potential to facilitate social and leisure activity for people living with dementia. *International Journal of Computers in Healthcare*, 1, 332–345.
- Span, M. et al.** (2014). An interactive web tool to facilitate shared decision making in dementia: design issues perceived by caregivers and patients. *International Journal On Advances in Life Sciences*, 6, 107–121.
- Steen, M., Kuijt-Evers, L. and Klok, J.** (2007). Early user involvement in research and design projects—A review of methods and practices'. The 23rd EGOS Colloquium (European Group for Organizational Studies), Vienna.
- Stunnenberg, L. and Adriaansen, M.** (2015). Zorg op afstand. De oplossing in een kantelende zorgomgeving? [Care at a distance. The solution for reforms in long-term care?]. *TvZ Tijdschrift Voor Verpleegkundig Experts*, 4, 48–52.
- Testad, I. et al.** (2014). The value of personalized psychosocial interventions to address behavioral and psychological symptoms in people with dementia living in care home settings: a systematic review. *International Psychogeriatrics*, 26, 1083–1098.
- Thivierge, S., Simard, M., Jean, L. and Grandmaison, É.** (2008). Errorless learning and spaced retrieval techniques to relearn instrumental activities of daily living in mild Alzheimer's disease: a case report study. *Neuropsychiatric Disease and Treatment*, 4, 987–999.
- Upton, D., Upton, P., Jones, T., Jutila, K. and Brooker, D.** (2011). Evaluation of the impact of touch screen technology on people with dementia and their carers within care home settings, Worcester: University of Worcester. Available at: <http://memoryappsfordementia.org.uk/wp-content/uploads/University-of-Worcester-iPad-report-2011.pdf>.
- Van der Roest, H. G. et al.** (2009). What do community-dwelling people with dementia need? a survey of those who are known to care and welfare services. *International Psychogeriatrics*, 21, 949–965.
- Van Gemert-Pijnen, E. W. C. J. et al.** (2011). A holistic framework to improve the uptake and impact of ehealth technologies. *Journal of Medical Internet Research*, 13, e111. doi: [10.2196/jmir.1672](https://doi.org/10.2196/jmir.1672).
- Van't Leven, N., Prick, A. E. J., Groenewoud, J. G., Roelofs, P. D., de Lange, J. and Pot, A. M.** (2013). Dyadic interventions for community-dwelling people with dementia and their family caregivers: a systematic review. *International Psychogeriatrics*, 25, 1581–1603.
- Vegeterlo, C., Folkers, I., van der Zee, D. and Grunder, W.** (2014). Make my iDays, onderzoeksverslag hbo-v [research report Bachelor of Nursing]. Bachelor of Nursing, Saxion University of Applied Sciences, Deventer/ Enschede.
- Vernooij-Dassen, M.** (2007). Meaningful activities for people with dementia. *Aging & Mental Health*, 11, 359–360.
- Vernooij-Dassen, M. and Moniz-Cook, E.** (2014). Raising the standard of applied dementia care research: addressing the implementation error. *Aging & Mental Health*, 18, 809–814.
- Vernooij-Dassen, M., Vasse, E., Zuidema, S., Cohen-Mansfield, J. and Moyle, W.** (2010). 'Psychosocial interventions for dementia patients in long-term care. *International Psychogeriatrics*, 22, 1121–1128.
- Yin, R. K.** (2003). Case study research. *Design and Methods*. Thousand Oaks, CA: Sage Publications.