

# Use of touchscreen tablet technology by people with dementia in homes: A scoping review

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## Abstract

**Background:** The aim of this scoping review was to identify the range, extent and nature of research around the use of touchscreen tablets by people with dementia in their home environment, particularly in regards to its use as a means of supporting participation in meaningful and socially connected activity.

**Methods:** A review of both peer-reviewed and grey literature was undertaken across 61 databases, along with reference list checking for articles published between 2010 and 2016.

**Results:** Twelve articles were included in this review, predominantly from Western European cultures and community-based home environments. The studies were exploratory in nature, with the majority focusing on the development of applications for people with dementia.

**Conclusions:** The study identified a range of exploratory research related to the use of touchscreen tablets by people with dementia. However, there were significant gaps within this evidence base, which provide opportunities for further research using more robust methodologies. Given the ubiquitous nature of touchscreen tablets in modern communities, further research could facilitate their use as a minimally stigmatizing and culturally appropriate form of support for people with dementia.

## Keywords

Dementia, touchscreen, iPads, apps

Date received: 1 August 2016; accepted: 4 September 2017

## Introduction

The global population is ageing, and therefore the number of people with dementia is also increasing. For example, it is estimated that 14% of the current population in Australia is aged 65 or above and that this will increase to 26% by 2051.<sup>1</sup> People with dementia live in a range of home environments, although the majority of those with moderate and advanced dementia live in residential care facilities.<sup>2</sup> A common precipitant to placement in residential care is the presence of behavioural and psychological symptoms of dementia, which are observed in virtually all people with dementia, regardless of their home environment.<sup>3</sup>

While pharmacological interventions are often used to manage the behavioural and psychological symptoms of dementia, they can have adverse effects and hence non-pharmacological approaches are now considered the first-line treatment.<sup>4</sup> Non-pharmacological

interventions include music therapy, life story work, behavioural therapy, reality orientation, aromatherapy, validation therapy and post-diagnosis/carer support work.<sup>5,6</sup> Non-pharmacological interventions also includes occupational therapy which supports people to engage in personally meaningful activity and has been found to effectively promote improved quality of life and wellbeing for people with dementia.<sup>7,8</sup>

Many of these interventions, and various activities related to participation in personally meaningful

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**Table 1.** Inclusion and exclusion criteria for this scoping review.

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> <li>• Evidence directly focused on people with dementia, living in a “home” environment (either in the community or residential care)</li> <li>• Evidence directly focused on people aged 65 years and older, including samples likely to include a significant portion of people in this age group</li> <li>• Evidence directly focused on touchscreen tablet technology</li> <li>• Peer-reviewed journal articles and full reports freely available on the internet</li> <li>• Any region or country on Earth</li> <li>• Published between 2010 and 2016</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence included people with diagnoses other than dementia</li> <li>• Evidence also focused on people aged less than 65 years</li> <li>• Evidence focused on forms of technology other than touchscreen tablets (i.e. robots, virtual reality)</li> <li>• Abstracts only, non-published conference papers or non-peer-reviewed sources</li> <li>• Use of touchscreen tablets by clinicians to screen or assess</li> <li>• No direct relevance to touchscreen tablets for people with dementia</li> </ul>

activity, are available on touchscreen tablet technology. Touchscreen tablets are a relatively low cost and accessible form of technological support. These devices are widely used in the community, thereby reducing stigma and supporting people with dementia to be socially included within modern society.<sup>9</sup> The extensive range of apps available (which increases by the day) ensures that personalized support and intervention are available, if people with dementia and the people who support them have access to appropriate information and resources.

The aim of this scoping review was to identify the range, extent and nature of research activity around the use of touchscreen tablets by people with dementia in their home environment, as a means of supporting their participation in meaningful activities.

## Method

Scoping reviews are a method for integrating knowledge, which identify gaps, set agendas and highlight the impact of decision making.<sup>10</sup> They enable the formulation of a broad overview of a topic and can be completed relatively quickly as a form of reconnaissance.<sup>11</sup> This method is used to determine the extent of existing evidence, to test the feasibility of completing a systematic review, to summarise existing evidence for dissemination and to identify avenues for future research.<sup>12</sup> This method was conducted primarily to inform a developing program of research into the use of touchscreen tablets by people with dementia in residential care homes in Australia.

While there are a number of methodologies available for the conduct of scoping reviews,<sup>13</sup> this review is based on the method proposed by Arksey and O'Malley,<sup>14</sup> which is the most well established and has been the basis of many studies over the past decade. This method proceeds through five stages:

Identifying the research question; Identifying the relevant studies; Study selection; Charting the data and Collating, summarising and reporting the results.

### *Identifying the research question*

This scoping review addresses the following research question: “What is the extent and character of the existing evidence base around using the use of touchscreen tablets by people with dementia in home environments?” To focus our identification of relevant studies, the inclusion and exclusion criteria listed in Table 1 were formulated.

### *Identifying the relevant studies*

The search study for this review began by identifying all relevant studies using the databases included in the Ebscohost platform (n=61). The reference lists of the identified articles were then searched for additional sources, and Google Scholar was used to identify further grey literature, which is a strategy that has been previously found effective in identifying non-randomised evidence.<sup>15</sup> The search was not limited to only health sources, as the use of touchscreen tablets is relevant to a broader range of disciplines. The results of the keyword searches initially undertaken are illustrated in Table 2.

This process led to the identification of 799 potentially relevant studies, which were then screened for adherence to this study's inclusion and exclusion criteria.

### *Study Selection*

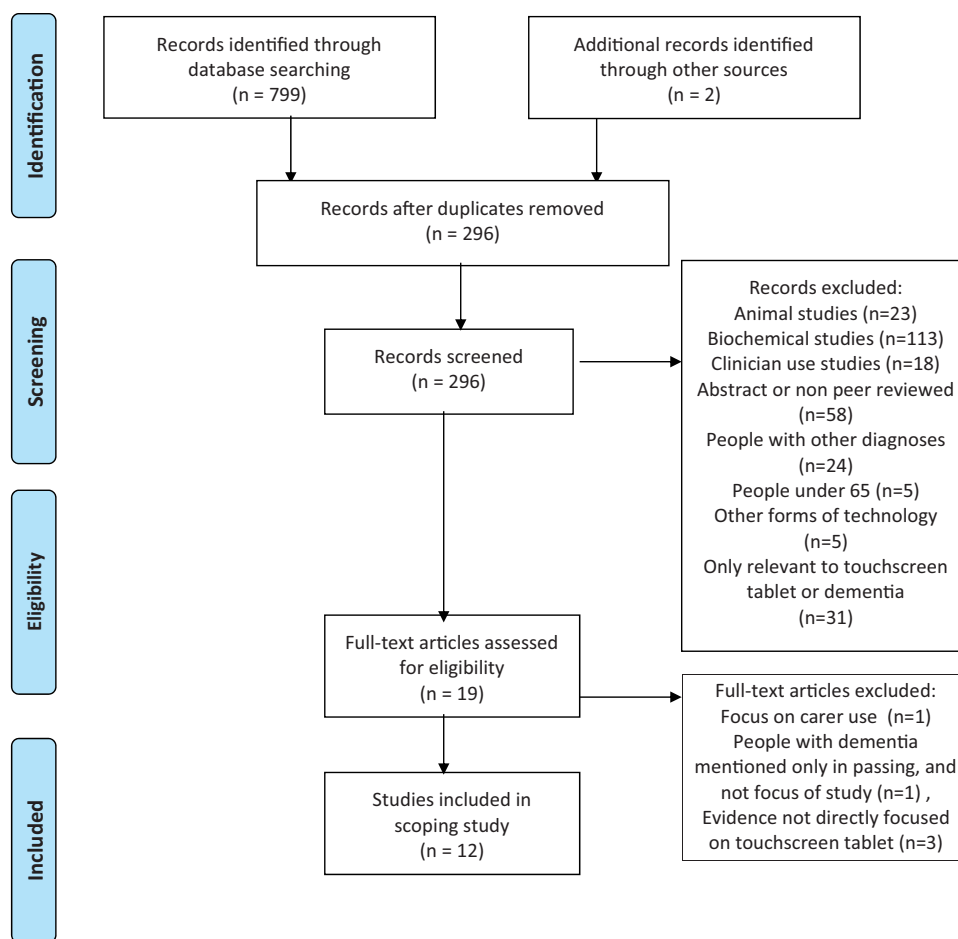
As shown in Figure 1, very few of the potentially relevant studies met the inclusion criteria for this review. The majority of the research excluded from the review

**Table 2.** Outcomes of initial database searching.

Keywords used	Number of sources identified
“touchscreen” AND “dementia”	29
“touchscreen” AND “Alzheimers”	28
“tablet*” AND “technology” AND “dementia”	44
“tablet*” AND “technology” AND “Alzheimers”	25
“iPad” AND “dementia”	94
“iPad” AND “Alzheimers”	44
“Android” AND “dementia”	28
“Android” AND “Alzheimers”	14
“apps” AND “dementia”	216
“apps” AND “Alzheimers”	277

did not meet the inclusion criteria, with many of those identified in the search being purely biological studies (n = 136) with no direct relevance to touchscreen tablets and people with dementia. Identified research also failed to meet the inclusion criteria related to diagnosis (n = 24), age group (n = 4), focus on both touchscreen tablets and dementia (n = 31) and being a peer-reviewed form of evidence published in its entirety (n = 58).

Data were then extracted by all authors (two working on each source) from each of the studies to gain a more comprehensive understanding of the available evidence on this topic. Citation Details, Evidence Type, Aims/Research Questions, Methods, Participants, Location/Setting and Relevant Outcomes were recorded, along with a level of evidence according to the Oxford Centre for Evidence-Based Medicine Levels of Evidence<sup>16</sup> and/or the Rosalind Franklin Qualitative Research Appraisal Instrument.<sup>17</sup> While levels of evidence are not usually included in scoping reviews,<sup>11</sup> this

**Figure 1.** Screening process for scoping review.

information was considered informative in relation to planning for future research and critical appraisal of the existing evidence.

### *Charting the evidence*

A series of evidence maps were produced from the data extracted, charting the available knowledge on the use of touchscreen tablets by people with dementia in their home environment, as a means of supporting their participation in meaningful activities. Evidence maps seek to chart evidence within a broad fields in user-friendly formats, to enable the identification of gaps or needs through visual depiction.<sup>18</sup> In this study, tables have been used to chart the evidence in relation to location/setting, sample size, evidence type/methods and aims. Table 3 displays a summary of all studies included in this review.

The participants in these studies were all people with dementia (as per the inclusion criteria for this study), but as illustrated in Table 3, the sample size reported varied considerably. The evidence related to the use of touchscreen tablets by people with dementia in their home environment as a means of supporting their participation in meaningful activities has used predominantly quantitative or mixed methodologies to date. The evidence reviewed for this study addressed a range of aims, although many were concerned with piloting the effectiveness of apps specifically developed for people with dementia.

## **Results**

This collation, summary and report of the results constitute the final stage of the scoping study methodology.

All but three of the identified studies originated from Western European cultures, with Europe being a particular focus of research in this area. Most of the evidence arose from community living rather than residential care, but many of the studies included in this review did not specify the home environment that provided their context. This is problematic, as the capacity and needs of people with mild dementia (who are more likely to be living in the community) are fundamentally different to those with moderate or severe dementia (who are more likely to be living in residential care). Without this contextual information, the findings and outcomes reported in these studies are extremely difficult to translate into practice. Many of the studies into the use of touchscreen tablets by people with dementia in their home environment as a means of supporting their participation in meaningful activities recruited relatively small samples, indicating that research into this topic remains at an 'exploratory' stage.

The predominately exploratory nature of this evidence base was also highlighted by the predominantly quantitative evidence and descriptive methodologies used. The other methodologies utilised, mixed methods and case studies, also rank low on traditional hierarchies of evidence.<sup>31</sup> The majority of the research published to date has focused on developing apps that target the population with dementia, which assumes that all people with this diagnosis will have similar needs and preferences. Four further studies explored the use of touchscreen tablets to support occupational participation, but one of those was for an overtly therapeutic activity rather than activities chosen for pleasure or personal meaning.

Given the focus on personally meaningful activity in the research question for this study, the lack of qualitative research in this area is surprising. Qualitative research assumes that there are multiple and individually unique realities, which reflects the naturalist or constructionist paradigm.<sup>32</sup> It tends to focus on individual experiences and meaning and often predominates when knowledge of a particular area is in an earlier stage of development.

Given the individual variability in what constitutes a personally meaningful activity and resulting focus on personalisation, it may never be appropriate to recruit large number of participants in search of broadly generalizable findings. Research in this area going forward may need to focus more closely on how to make the best match between individual and technology, rather than identifying what applications and functions might be called upon to generally meet the needs of a population.

In regards to the findings of these studies, three main themes were identified: touchscreen tablets as a compensatory measure, touchscreen tablets as a medium for therapy and participation and app accessibility.

### *Touchscreen tablets as a compensatory measure*

Mokhtari et al.<sup>25</sup> explored the challenges associated with the use of reminder functions specifically, which are available on a range of apps used via touchscreen tablets. While their mini review only focused on the activities of daily living of telephone communication and sleeping, the authors highlight the importance of context to the use of such technology. If the person with dementia was distracted by other activities, they could not effectively use the reminder function, e.g. they will not see a meal reminder if they are talking on the phone. For touchscreen tablets to be used effectively in this situation, the authors recommend the use of sensors which track the persons' activity and provide information to the app around providing, cancelling, delaying or resetting reminders.

**Table 3.** Summary of reviewed studies.

Study	Year	Location	Home environment	Sample size	Evidence type	Method	Aims
Astell et al. <sup>19</sup>	2016	United Kingdom	Residential	30	Quantitative	Descriptive	Occupational participation
Cutler et al. <sup>20</sup>	2016	United Kingdom	Community	29	Qualitative	Mixed method	Benefit identification
Griol and Callejas <sup>21</sup>	2016	Spain	Not stated	48	Quantitative	Questionnaire	Application development
Kong <sup>22</sup>	2015	United States of America	Not stated	10	Quantitative	Descriptive	Application development
Lim et al. <sup>23</sup>	2013	Australia	Community	21	Quantitative	Descriptive	Occupational participation
Loi et al. <sup>24</sup>	2016 <sup>c</sup>	Australia	Residential	15	Quantitative	Non-randomised cross over trial	Occupational participation
Mokhtari et al. <sup>25</sup>	2012	France & Singapore	Community	No stated	Framework development	Field test trials	Barrier identification
Pirani et al. <sup>26</sup>	2016	India	Community	Not Stated	Quantitative	Survey	Application development
Pringle and Somerville <sup>27</sup>	2013	United Kingdom	Residential	8	Quantitative	Descriptive	Occupational participation
Tyack et al. <sup>28</sup>	2015	United Kingdom	Not stated	24 (12 pairs)	Mixed	Descriptive	Application development
Upton et al. <sup>29</sup>	2013	United Kingdom	Residential	11 Interviews 2 Focus groups 149 Observations	Inquiry/evaluation	Multi method	Impact assessment
Zmily et al. <sup>30</sup>	2014	Jordan	Not stated	10	Quantitative	Mixed method	Application development

However, Pirani et al.<sup>26</sup> developed an app which combined reminders with a range of other functions, such as user's and carer's personal and rehabilitation centre information, location tracker, scheduling, photo gallery (of user's relatives) and games designed to promote cognitive function. A usability survey (measuring perceived ease of use and effectiveness) gave the app overall scores of 4/5, although it is not clear who this survey was conducted with or how long the users had to trial it before they provided their feedback.

### *Touchscreen tablets as a medium for therapy and participation*

In a study from the United Kingdom, Pringle and Somerville<sup>27</sup> piloted the use of memory books and touchscreen tablets to facilitate reminiscence therapy with residential home residents with dementia. Using measures of engagement time and recall ability as their outcome measures, they found that the residents were able to engage in reminiscence therapy for longer periods and had better recall using touchscreen tablets, in comparison to memory books and structured conversation. Touchscreen tablets were reported to be easy to use, and the findings of this pilot had prompted the host service to expand their program of touchscreen tablet-supported reminiscence therapy.

Communication with carers adds to the challenge of supporting people with dementia. Upton et al.<sup>29</sup> identified significant increases in communication and interaction between people with dementia and their carers, as measured by field observations of both direct and indirect interactions with carers. Using a visual analogue scales and the Quality of Life-Alzheimers Disease Tool, Tyack et al.<sup>28</sup> found general improvements in the wellbeing as a result of viewing art on touchscreen tablets. The qualitative findings of this study indicated perceived improvements in cognition, behaviour, mood and relationships as a result of participating in this activity. While further studies using more rigorous methodologies are required, the current evidence indicates that there may be improvements to the quality of life from touchscreen tablet use, partly due to the increased interaction people with dementia were having with those around them.

Three further studies focused on the use of touchscreen tablets for leisure and addressed the possible health outcomes associated with these activities. Cutler et al.<sup>20</sup> engaged people with dementia and their carers in a commercially available gaming as part of a social group, while Lim et al.<sup>23</sup> allowed participants to explore an iPad independently in their home environment. From observation and participation surveys, Cutler et al. found that touchscreen tablets supported healthy outcomes including the opportunity to learn

new tasks, and optimise their physical, social and mental stimulation, often beyond expectation. In contrast, Lim et al. reported the use of touchscreen tablets depended heavily on motivation and interest, with participants indicating via surveys that many were not able to use the device independently on a regular basis. Finally, Loi et al.<sup>24</sup> studied the impact of using iPads to engage in personally meaningful occupations on challenging behaviour. A significant decrease in total scores on the Neuropsychiatric Inventory was reported between the intervention and usual care, with qualitative feedback from staff indicating surprise at how well the residents engaged with the iPads and the apps.

### *App accessibility*

Cognitive stimulation interventions using a range of apps have also been developed, with their utility and accessibility trialled with people with dementia. Kong<sup>22</sup> reviewed the commercially available apps and conducted trials for those apps considered to be most appropriate for people with dementia. Participant surveys identified that apps that incorporated simple maths or letter de-scrambling were best suited to this population, while those with pre-set time limits, confusing directions or complex vocabulary were not appropriate. In addition, a study into whether familiarity influenced app engagement for people with dementia<sup>19</sup> discovered that novel apps lead to greater engagement than those replicating activities with which the resident was already familiar.

Zmily et al.<sup>30</sup> also trialled an app developed to improve cognitive function, comparing the ability of people with dementia to respond to text-based activities to those which were graphic interactions. Their results indicated that graphic applications are more accessible and engaging for this population, with the data gathered via a specially designed app around response times, trial and task completion times. Another potential avenue for improving the accessibility of apps on touchscreen tablets for people with dementia are mobile conversational agents. Griol and Callejas<sup>21</sup> described a framework for developing cognitive intervention apps using vocal recognition. Such apps would speak and also recognise consumers' language, thereby decreasing the complexity of the interface and improving engagement.

### **Conclusions**

The scoping review has met its aim of identifying the range, extent and nature of research activity around the use of touchscreen tablets by people with dementia in their home environment as a means of supporting their participation in meaningful activities. Given the ubiquity of this technology in broader society, there has



been surprisingly little research into its potential uses with people living with dementia in the home environment. While current evidence for the use of touchscreen tablets as a compensatory method is inconclusive, evidence that it supports meaningful engagement in occupations has produced more promising results. The evidence also indicates that support from carers and staff is essential in enabling the use of touchscreen tablets in all home environments and that this support needs to be frequent and ongoing. Some findings have indicated that the experience of facilitating the use of touchscreen tablets can improve the relationships and interaction between carer and people with dementia. However, it is important to note that the carer experience of this technology is yet to be explored in any depth. The lived experience of the people with dementia using touchscreen tablets is also largely absent from the current evidence base. Qualitative research exploring the experience and individual benefits of touchscreen tablets for people with dementia would assist in ensuring guidelines for its use are relevant and inclusive, particularly in light of some findings which indicate that motivation is a crucial factor in its ongoing use.

A significant advantage related to the use of touchscreen tablets (for both people with dementia and the wider population) is its ability to be customised to match individual interests, pursuits and skills. Much of the existing research focused on specific applications designed for an entire population, such as apps that are targeted at people with dementia. The focus on a 'one size fits all', rather than a customised approach, cannot adequately address barriers to engagement in meaningful activity for people with dementia. A shift from designing population level interventions, to exploring the means by which we properly match the technology to the individual, would be a fruitful direction for future research.

## Implications for research and practice

At present, all of the quantitative research in this area is exploratory, with less rigorous methodologies and relatively small sample sizes. Only two mixed methods and one stand alone qualitative study have been undertaken in this area, but while knowledge in this area remains formative, these methods may be more suitable to explore the use of touchscreen tablets by people with dementia. Future research should seek to use more robust methods (quantitative, qualitative and mixed) to explore (1) the effectiveness of touchscreen tablets in ameliorating the symptoms of dementia, (2) the role of touchscreen tablets in promoting participation in meaningful activity, (3) the experiences of people with dementia and their carers of the use of touchscreen tablets and (4) the cost effectiveness of touchscreen tablets use as an adjunct to existing treatment regimes.

While the use of touchscreen tablet technology is likely to continue to grow in the general community, its potential uses for people with dementia will remain unproven without a systematic approach to the research in this area. People with dementia often experience marginalisation and institutionalisation, leading to a lack of access and opportunity to engage in meaningful activities and participate in their community. The opportunity to recommend and implement meaningful activity via touchscreen tablets could be lost, if evidence that supports best practice (and overcomes barriers around funding and operational issues) is not built.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Guarantor

There is no guarantor for this project.

## Contributorship

DH and JW originated the idea for this scoping review, and completed the screening phase of this project. All authors took part in the review and critique of the articles, and the writing of this report.

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