

Tapping Into the Future - Touchscreen Technology for People with Dementia: A Scoping Review

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Abstract

This scoping review examines the impact of mainstream touchscreen technologies on people with dementia, exploring both the benefits and challenges of their use. While previous reviews have focused on tablet-based interventions to support social connections and behaviour management in care settings, and other broader reviews have considered technology use in dementia more generally, there remains limited synthesis dedicated specifically to the design and adaptation of mainstream touchscreen devices such as smartphones, tablets, and smartwatches. This study conducts a thematic analysis of 18 studies, identifying three key themes: barriers to digital inclusion, recommendations for dementia-friendly touchscreen design, and the potential of personalised interfaces. Findings suggest that there may be moments, such as during stress, frustration, or fatigue, where human–computer interaction could be improved by systems naturally adapting to the user. However, future research is needed to understand how this can be implemented in a balanced way, ensuring personalisation features are attuned to the needs and circumstances of the person with dementia, without overwhelming or restricting them. The review emphasises the necessity for ongoing research to understand which interaction variables change over time in people with dementia and how interfaces could proactively adapt to their changing abilities.

Keywords

dementia, touchscreen technology, human-computer interaction, accessibility, digital inclusion, personalised interfaces, assistive technology

1 Introduction

Over 55 million people worldwide are diagnosed with dementia, of which 60% live in low- and middle-income countries (World Health Organization, 2023). Dementia is a deterioration of the brain that progressively affects a range of abilities such as thinking, memory and communication (Kimbarow and Wallace, 2023). Additionally, people may experience changes in personality, behaviour, mood (Dementia UK, 2023), and sensory perception (Dixon and Lazar, 2020). Symptoms of dementia vary between people, as the condition's progression is influenced by both the person and the specific type of dementia. As a result, individuals exhibit different symptoms and require support tailored to their unique needs (Scourfield, 2022).

The field of Human-Computer Interaction (HCI) has increasingly turned its focus toward designing and developing technologies that address the diverse needs of people with dementia (Lazar et al., 2017). Designing for and with this population has created opportunities to develop new technologies that offer insights into their lived experiences (Morrissey et al., 2017). For example, the interactive sound cushion, known as 'Vita', was found to stimulate playfulness and connection between residents with advanced dementia (Houben et al., 2020). The 'Tumbler', a tangible sound interface, was created to enhance the well-being of couples by encouraging meaningful activities at home (Houben et al., 2022). Similarly, Foley et al. (2019) developed a receipt-based print media device called 'Printer Pals', to support conversations and active participation in care home settings.

Despite these advancements, challenges remain, particularly in designing assistive technologies (AT) that accommodate the diverse needs, emotional experiences, and abilities of people with dementia (Meiland et al., 2017). Dixon and Lazar (2020) highlight the potential of scalable, personalised solutions through mainstream technology to address these challenges. Widely available devices such as smartphones, tablets, and smartwatches are already recognised as cost-effective tools for enhancing independence and well-being among individuals with disabilities (Harris, 2010). In the UK, touchscreen devices are among the most used mainstream technologies (Statista, 2024), and the adoption of mobile technology is nearly three times higher than desktop computers in low- and middle-income countries (Barbareschi et al., 2019).

As populations age, touchscreen devices are expected to play an increasingly important role (Wilson et al., 2023). Earlier diagnoses of Mild Cognitive Impairment (MCI) and early-onset dementia (those diagnosed between the ages of 30 and 64 years) are increasing the number of individuals experiencing the initial symptoms while still active in the workforce (Shastri et al., 2021). Recent figures show that in the UK alone, 70,800 people are currently living with early-onset dementia, signifying a 69% rise since 2014 (Dementia UK, 2022). Young people with dementia are distinct from those with late onset conditions due to their stage of life at diagnosis, which can impact work, social and family roles (Carter, 2022). Recent research also found clear generational distinctions in social media usage, with younger-onset individuals posting more frequently and across a wider range of platforms (Kohl et al., 2023). Consequently, people with dementia will increasingly include those who have relied on touchscreen devices as an integral part of their daily routine for decades (Wilson et al., 2023).

Touchscreen interfaces serve as both a display and an input device (Orphanides & Nam, 2017). The screen presents a graphical interface, and a person's physical touch on the screen is recognised as input or interaction at the point of contact. Both the interface and interaction design of touchscreen devices can be adjusted for inclusivity (Orphanides & Nam, 2017), but there is limited information regarding the specific adjustments required to improve the usability for people with dementia.

While several reviews have explored touchscreen technologies in dementia care, their scope differs from our study. Hung et al. (2020) conducted a scoping review on touchscreen tablets to support

social connection and reduce responsive behaviours in care settings, emphasising psychosocial outcomes within institutional contexts. Joddrell and Astell (2016) provided an overview of studies involving people with dementia and touchscreen technology, focusing on usability, design considerations, and engagement outcomes, but did not systematically examine interface adaptation or personalisation. Tyack and Camic (2017) and Hitch et al. (2017) reviewed touchscreen interventions targeting well-being, engagement, and daily living support, yet these works do not isolate touchscreen-specific design features in detail or fully address barriers to digital inclusion. In contrast, this scoping review concentrates on mainstream touchscreen devices (smartphones, tablets, and smartwatches) and specifically investigates how these interfaces are designed and adapted through human-centred approaches to meet the evolving needs of people with dementia. By focusing on usability, accessibility, and personalisation, this review contributes a distinct perspective that complements earlier work while advancing understanding of the design challenges and opportunities unique to touchscreen interfaces.

2 Methodology

The aim of this review is to identify the benefits and challenges of touchscreen interfaces for people with dementia and how such interfaces are specifically designed and adapted to accommodate the unique cognitive, sensory, and functional needs of this population.

The following research questions were developed to guide the search strategy:

RQ1: What are the benefits and challenges of touchscreen interfaces for people with dementia?

RQ2: How are touchscreen interfaces adapted to meet the needs of those with dementia?

To achieve these aims and answer the research questions a scoping review was conducted. A scoping review serves as a rigorous and transparent method of identifying and mapping the available evidence within a specific body of literature (Munn et al., 2018). This approach was chosen to effectively summarise and disseminate findings, enabling the identification of gaps in the evidence base to guide potential directions for future research (Arksey & O'Malley, 2005). The scoping review followed the five structured stages of the framework outlined by Arksey and O'Malley (2005): stage 1: identifying the research question, stage 2: identifying relevant studies, stage 3: study selection, stage 4: charting the data, and stage 5: collating, summarising, and reporting the findings.

2.1 Identification

The identification and screening of relevant studies were conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach (Page et al., 2021), as shown in Figure 1. A search was conducted across five electronic databases: CINAHL via EBSCOhost, ACM Digital Library (DL), IEEE Xplore Digital Library, Scopus and Web of Science. Papers published from 1st January 2013 to 31st October 2024 were searched. In 2013, sales of inter-connected smartphones surpassed that of basic handsets for the first time, accounting for more than half of the global mobile market (Thomas, 2013). Therefore, the period starting from 2013 was chosen as it marks a significant period of advancement and adoption of mainstream touchscreen devices.

The keyword search terms were iteratively refined to target studies that employed a human-centred design approach (Norman, 2021) and focused on the requirements of people with dementia. Human-centred design is a method for developing interactive systems that prioritises usability and usefulness by focusing on users, their needs, and requirements (British Standards Institution, 2019). The final search terms were applied across databases, appearing in either the title or abstract: (“dementia” OR “alzheimer’s” OR “people with dementia”) AND (“touchscreen” OR “smartphone” OR “mobile phone” OR “tablet” OR “smartwatch”) AND (“user-centred” OR “human-centred”). Search results were filtered to research articles published in English, as well as peer-reviewed journal

and conference proceedings. In developing the search strategy, we limited terms to “dementia” and “Alzheimer’s” to ensure that included studies explicitly involved participants with a dementia diagnosis. This focus was chosen to synthesise findings directly related to people living with dementia. While studies examining cognitive impairment symptoms without a formal diagnosis provide valuable perspectives, they were considered outside the scope of this review.

Several variations of the search string were piloted prior to finalisation. The version reported here was selected because it consistently produced the most relevant and focused results across databases, balancing comprehensiveness with precision. Alternative spellings (e.g., touch screen, tablet, iPad, iPhone) and broader human-centred design terms (e.g., UX and HCI) were tested but found to introduce a high volume of irrelevant results.

To assess the eligibility of full-text papers, the following inclusion and exclusion criteria were established collaboratively among the research team:

Inclusion
<ul style="list-style-type: none"> • Papers were included if they involved mainstream touchscreen devices that matched the keyword search terms: smartphones/mobile phones, tablets, and smartwatches. • To align with the review's objective, studies needed to feature a user study, prototype, or system that involved people with dementia as participants. • A human-centred or user-centred approach was required, emphasising the iterative design of solutions, systems, or prototypes that prioritise users' needs, preferences, and experiences.
Exclusion
<ul style="list-style-type: none"> • Studies were excluded if they were review articles, theses, or published in a language other than English. • Further exclusion criteria included studies primarily focused on early detection interventions for individuals with dementia or the use of immersive technologies, as these fell outside the scope of this research.

Table 1: Inclusion and exclusion criteria

Table 1 Alt Text: Studies included or excluded from the review based on device type, participant group, study design, and research focus.

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2.2 Study Selection

The initial search yielded 69 research articles from CINAHL via EBSCOhost, 490 from ACM DL, 46 from IEEE Xplore Digital Library, 30 from Scopus and 5 from Web of Science. The search results were consolidated in an online tool called Rayyan, where a total of 6 duplicates were removed before the screening process began.

At the title and abstract screening stage, records (n = 581) were excluded primarily due to lack of relevance to the predefined inclusion criteria (e.g., primarily focused on early detection interventions, the use of immersive technologies, or not using a human-centred design approach). One researcher conducted the title and abstract screening of the remaining 635 records. To support reliability and reduce bias, a subset of records was independently screened by other members of the research team, and the results were compared to ensure consistency of decision making.

The lead author reviewed all 54 papers and applied the eligibility criteria. Final decisions regarding inclusion or exclusion of papers were discussed with the wider research team to ensure consensus,

resulting in a final selection of 18 included papers. Papers were excluded for the following reasons: literature reviews (n=2), lack of focus on touchscreen interactions or being out of scope (n=23), people with dementia not included (n=6) and insufficient methodological information (n=5). The characteristics of the included studies are summarised in Table 2.

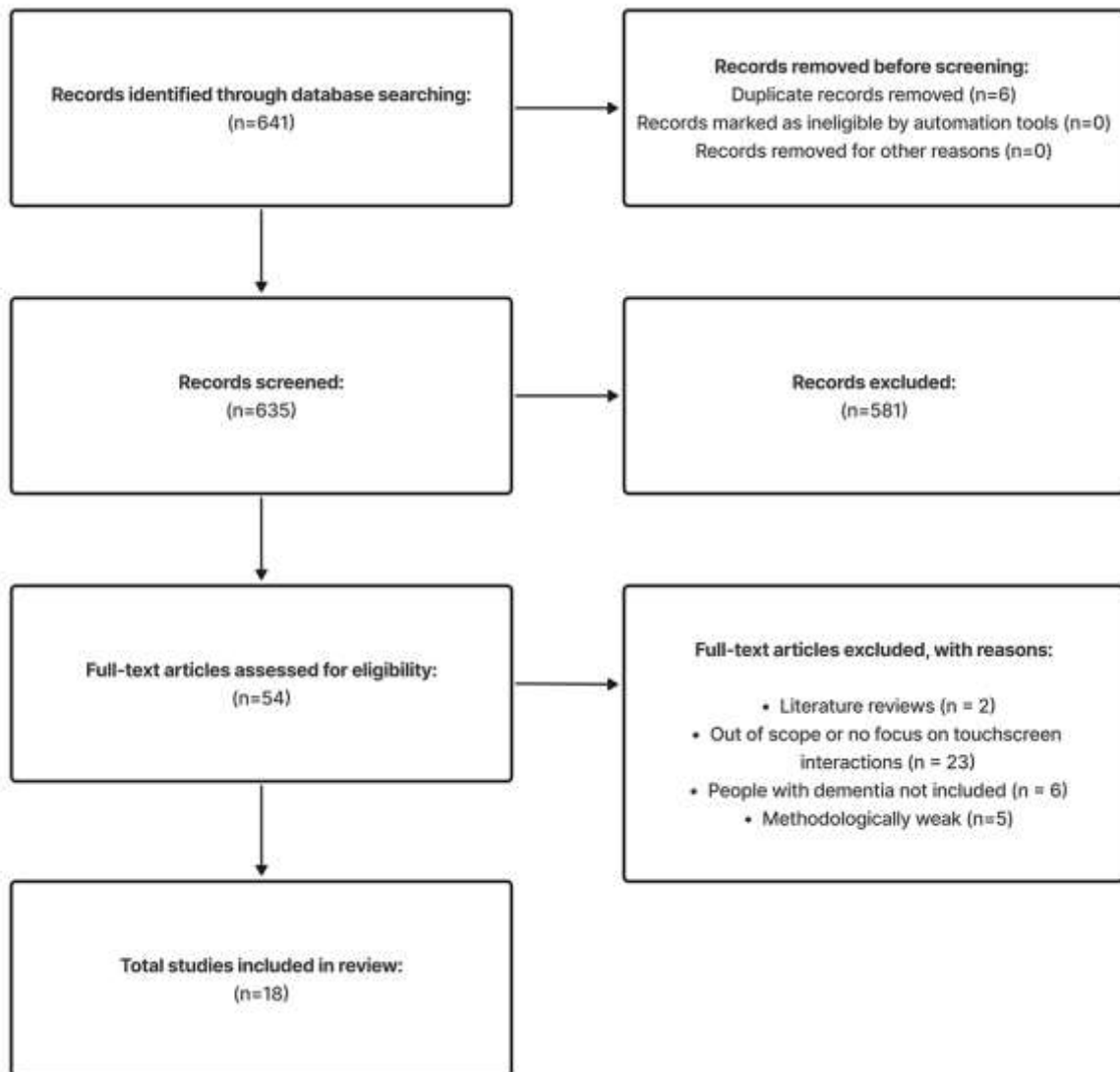


Figure 1: Literature search PRISMA flow diagram illustrating the review process

2.3 Charting the Data

The six-phase approach to thematic analysis was performed by a single researcher to uncover patterns of meaning within the data set (Braun and Clarke, 2022): (1) familiarising with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing potential themes, (5) defining and naming themes and (6) producing the report.

The process of familiarising with the data began with a thorough read of each of the 18 included papers, charting key information relevant to human-centred design activities. This included the context of use, user requirements, interface specifications, and evaluation results (British Standards Institution, 2019). The information was documented using Microsoft Excel. To enhance understanding, the papers were reviewed a second time, this time focusing on identifying text elements that aligned with the study's research questions. This step informed the initial code generation phase, where recurring concepts and relevant patterns were coded by a single researcher to ensure consistency in the coding application.

Following this, the full research team reviewed the list of codes and collaboratively discussed their organisation into broader themes. Through this process, the codes were grouped, refined, and consolidated into three overarching themes, ensuring that the thematic structure reflected multiple perspectives while maintaining consistency from the initial coding. The final reporting stage of the thematic analysis was conducted in accordance with the reporting guidelines outlined by Braun and Clarke (2024).

3 Findings

The three themes identified from the completion of the thematic analysis were 1) Considering barriers to digital inclusion, 2) Recommendations for dementia-friendly touchscreen interfaces, and 3) The future potential of personalised interfaces. These themes provide valuable insights for designers, developers, and researchers on the diverse ways individuals with dementia interact with touchscreen interfaces. These findings also highlight opportunities to improve accessibility both now and in the future.

3.1 Considering barriers to digital inclusion

People with dementia engage with touchscreen technologies in diverse ways along a broad spectrum (Holbø et al., 2013). Their position on this spectrum can influence whether they benefit from these technologies or encounter barriers to digital inclusion (Thoolen et al., 2022).

Across the included studies, touchscreen technologies were used by people with dementia for a variety of purposes that extend beyond basic interaction with the device. Common uses included communication with family members and caregivers (e.g., through messaging, video calls, or shared applications) (Thoolen et al., 2022), reminder and management tasks such as supporting medication adherence, food reminders, and scheduling (Jönsson et al., 2019; Sanchez et al., 2024), and support for independence and safety, including navigation, orientation, and reassurance in daily activities (Holbø et al., 2013; Köhler et al., 2021). Touchscreens were also reported to play a role in emotional well-being and mental health, for example by enabling self-management, reducing stress, or providing comforting connections during moments of disorientation (Dixon et al., 2022). In addition, several studies highlighted the role of touchscreen-based games, reminiscence apps, and leisure activities in promoting engagement, social interaction, and enjoyment (Westphal et al., 2017; Muñoz et al., 2021). While these purposes varied across individuals and stages of dementia, they demonstrate the wide-ranging potential of touchscreen devices to support communication, independence, safety, well-being, and meaningful activity.

At one end of the spectrum, restricted access to touchscreen technologies and limited technological support for skill development create significant barriers to use (Sanchez and Mihailidis, 2024). The upfront financial cost, along with challenges in performing tasks like charging, unlocking the device, and making calls hindered adoption in some instances (Sanchez et al., 2024). Familiarity with both hardware and software were seen as essential (Thorpe et al., 2016), yet technical issues often led to frustration, quickly undermining trust in the technology (Pigliautile et al., 2022). Individuals unfamiliar with touchscreen devices required repeated guidance and support to navigate them effectively (Khan et al., 2021). Furthermore, the progressive nature of dementia contributed to growing frustration, as changing abilities made technology increasingly difficult over time (Di Campi San Vito et al., 2024). Consequently, people with lower technical skills expressed a need for long-term technological support and training (Goerss et al., 2024). A perceived decline in technological competence could also lead people with dementia to abandon use of these devices altogether (Thoolen et al., 2022).

A strong social support network played a crucial role in determining whether technological devices were embraced or abandoned (Köhler et al., 2021). Supportive relationships were shown to improve interactions with touchscreen technology (Muñoz et al., 2021). Additionally, when cognitive abilities remained stable, social support was found to enhance a person’s ability to use technology effectively (Thoolen et al., 2022). However, for some, the fear of feeling ashamed or the desire to avoid conflicts with others created a barrier to seeking help and assistance (Köhler et al., 2021).

Beyond access to technology and skill level, the emergence of challenges at the design and interaction level emerged. There is considerable variability in how people with dementia engage with touchscreen technologies (Köhler et al., 2021). Age-related differences can impact usability (Sanchez et al., 2024) and the stage of dementia can impact the nature of interactions, ranging from independent use to passive engagement (Thoolen et al., 2022). Eye gaze tracking reveals that individuals with dementia generally exhibit longer task completion times than those without dementia, characterised by more gaze fixations and fewer saccades (Boyd et al., 2021). Additionally, even with regular use of touchscreen devices, high-stress situations, fatigue, and difficulties adjusting to changes after device updates or upgrades can affect the ability to complete tasks (Dixon et al., 2022). A correlation between better task completion rates and the frequency of prompts suggests that prompts may effectively support people with dementia to stay engaged across various interaction contexts (Boyd et al., 2021).

Access, technological support for skill development and inclusive design considerations are crucial factors in unlocking the potential of touchscreen technology to support the experiences, abilities, and well-being of people with dementia (Thoolen et al., 2022). Removing barriers to digital inclusion allows touchscreen technology to play a central role in supporting independence and self-determination (Köhler et al., 2021). For example, mobile phones were found to offer security in everyday life, assist with memory changes, support emotional regulation and productivity, and facilitate health management (Dixon et al., 2022). A key advantage of touchscreen technology is its ability to enable individuals to create self-management systems that not only give a sense of control but also allow people to anticipate and adapt these systems to future abilities (Dixon et al., 2021).

Overcoming challenges at this level often relied on the ability to customise touchscreen interfaces to accommodate individual needs (Ahmed et al., 2022). Customisations were typically aimed at simplifying the interface for easier navigation (Holbø et al., 2013) or making an interface more recognisable to the person with dementia (Jönsson et al., 2019). An example of such customisations included changing the appearance of application icons to improve recognition while navigating interfaces (Dixon et al., 2022).

3.2 Recommendations for dementia-friendly touchscreen interfaces

To reduce barriers in the use of touchscreen technologies, eight recommendations for interface design (Table 3) were developed based on commonly suggested improvements in the literature. While these recommendations are grounded in the needs of people with dementia, they also reflect broader principles of universal and inclusive design, meaning that their implementation has the potential to enhance accessibility and usability for a wider range of users beyond this population.

Touchscreen interface recommendations	
1. Integration with familiar devices and routines	(Sanchez and Mihailidis, 2024), (Sanchez et al., 2024), (Dixon et al., 2021)
2. Intuitive and familiar interface layouts	(Sanchez and Mihailidis, 2024), (Sanchez et al., 2024), (Köhler et al., 2021), (Ahmed et al.,

	2022), (Brankaert et al., 2014), (Thorpe et al., 2016), (Pigliautile et al., 2022), (Westphal et al., 2017), (Holbø et al., 2013)
3. Clear sequential tasks and/or instructions	(Sanchez et al., 2024), (Boyd et al., 2021)
4. Choose a font that enhances legibility and readability	(Sanchez et al., 2024), (Pigliautile et al., 2022), (Boyd et al., 2021)
5. Ensure content and controls are easily identifiable	(Köhler et al., 2021), (Brankaert et al., 2014), (Pigliautile et al., 2022), (Dixon et al., 2021), (Jönsson et al., 2019), (Boyd et al., 2021)
6. Navigation and orientation should be simple and intuitive	(Brankaert et al., 2014), (Thorpe et al., 2016)
7. Forms should be intuitive and easy to use	(Thoolen et al., 2022), (Boyd et al., 2021)
8. Allow switching between input methods	(Pigliautile et al., 2022), (Dixon et al., 2022), (Muñoz et al., 2021)

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Table 3: Frequently cited touchscreen interface design recommendations

Table 3 Alt Text: Key touchscreen design recommendations for people with dementia, covering integration with routines, intuitive layouts, readability, clear instructions, simple navigation, identifiable content, flexible input methods, and consistent forms, based on multiple studies from 2013–2024.

3.2.1 Integration with familiar devices and routines

Designing touchscreen technologies so that they connect smoothly with devices and practices already familiar to the user was identified as an important factor in enhancing effectiveness and usability (Sanchez and Mihailidis, 2024). When systems align with established daily routines or extend the functionality of technologies that people with dementia already know how to use, interactions become more intuitive and accessible (Sanchez et al., 2024). For example, the Apple Watch allows individuals with dementia to easily “ping” and locate their mobile devices if misplaced (Dixon et al., 2021).

3.2.2 Intuitive and familiar interface layouts

This design principle emphasises minimising complex layouts and reducing the need for users to adapt to new interface designs, making interactions more intuitive and accessible for individuals with dementia (Westphal et al., 2017). Research consistently highlighted the importance of straightforward interfaces (Sanchez et al., 2024), ease of use (Sanchez and Mihailidis, 2024), and intuitive operation (Köhler et al., 2021) as fundamental considerations in dementia-friendly design.

To support usability, some studies have focused on designing interfaces that mimic tangible and easily recognisable objects, such as a traditional paper calendar (Di Campli San Vito et al., 2024) or familiar memory aids (Sanchez and Mihailidis, 2024). Leveraging familiarity is considered essential in shaping how individuals with dementia engage with technology (Westphal et al., 2017).

3.2.3 Clear sequential tasks and/or instructions

For complex tasks, a structured, linear step-by-step approach was identified as an effective strategy for reducing cognitive load and making interactions more manageable for individuals with dementia (Boyd et al., 2021). Dividing tasks into smaller, sequential steps allows users to process information gradually, minimising confusion and cognitive overwhelm. Providing clear and specific instructions for each step helps enhance understanding and ease of use (Sanchez et al., 2024).

3.2.4 Choose a font that enhances legibility and readability

Difficulties with touchscreen interfaces were frequently linked to co-occurring conditions such as visual impairments (Köhler et al., 2021). Small font sizes were commonly identified as a key issue

(Pigliautile et al., 2022; Boyd et al., 2021), leading to iterative design consideration that emphasised the importance of adjustable font sizes to enhance readability and accessibility (Sanchez et al., 2024).

3.2.5 Ensure content and controls are easily identifiable

Large and easily identifiable icons are essential for people with dementia to ensure content is easy to read (Pigliautile et al., 2022). Screen brightness plays a crucial role in ensuring content remains clear and readable (Köhler et al., 2021), while high contrast further enhances visibility (Brankaert et al., 2014).

People with higher technology literacy may independently adjust accessibility settings, such as brightness and contrast, within device settings (Dixon et al., 2021). However, designing interfaces with default settings that prioritise high contrast can significantly improve usability. Enhancing these aspects of touchscreen interfaces can help mitigate dementia-related challenges, such as 'cognitive hysteresis' (tunnel vision), by ensuring that key elements such as call to action buttons remain prominent and easily distinguishable (Boyd et al., 2021).

3.2.6 Navigation and orientation should be simple and intuitive

Touchscreen navigation should be intuitive, with minimal reliance on deep menu structures and excessive scrolling to prevent confusion and cognitive overload (Brankaert et al., 2014). Additionally, application names and icons should be clear, recognisable, and easily understood, ensuring users can quickly identify their intended functions without unnecessary complexity (Thorpe et al., 2016).

3.2.7 Forms should be intuitive and easy to use

Input fields should be clearly distinguishable and provide strong visual cues, or "affordances," to indicate that user input is required (Boyd et al., 2021). Additionally, the interface should offer intuitive prompts, such as suggesting special characters (e.g., "@" in email fields) and providing contextual explanations to clarify the expected input format (Pigliautile et al., 2022).

3.2.8 Allow switching between input methods

Health issues affecting input methods include dexterity problems due to conditions such as arthritis, visual and hearing impairments, and loss of touch sensation (Muñoz et al., 2021). In the study by Pigliautile et al. (2022), participants with dexterity issues experienced frustration with handwriting input methods, which require a consistent writing speed that was difficult for them to maintain. Alternative input methods, such as voice-based interactions, should be considered to ease navigation and reduce dependence on fine motor skills (Dixon et al., 2022).

3.3 The future potential of personalised interfaces

Touchscreen interfaces must continuously adapt to the evolving needs and abilities of people with dementia (Köhler et al., 2021). The recognised individuality of each person with dementia highlights the need for personalised technology (Ahmed et al., 2022). Research suggests that people with dementia appreciate the potential of personalised systems and advocate for them as a focus of future studies (Pigliautile et al., 2022).

A key finding highlights the importance of proactive technological assistance that adapts as dementia progresses (Dixon et al., 2022). Features relevant in earlier stages of dementia may need to expand to address a broader range of daily life challenges in moderate stages (Sanchez et al., 2024). One approach to is to dynamically adjust display formats based on the stage of dementia (Köhler et al., 2021). Optimising task difficulty to align with technological skills and abilities can also enable a more personalised and effective user experience (Westphal et al., 2017). Additionally, integrating adaptable systems with activity-centric design could provide more intuitive support

(Dixon et al., 2022). Future systems should incorporate context-aware computing to offer proactive, real-time assistance (Dixon et al., 2022).

Another potential avenue for personalisation is the use of AI to adjust interfaces based on a person's daily mood (Di Campi San Vito et al., 2024). Future developments in voice interactions may even enable real-time emotional detection, triggering human assistance when necessary (Dixon et al., 2022). Similarly, touchscreen devices such as smartphones could proactively intervene during moments of stress, fatigue, or cognitive overload to facilitate task completion (Dixon et al., 2022).

However, achieving individualised person-centred support presents challenges, including the need for further research to understand long-term adoption patterns (Thorpe et al., 2016). Observing how people with dementia use touchscreen technologies over time could offer insights into their evolving needs (Dixon et al., 2022). Such research could inform the development of systems that are able to 'continuously calibrate' and adjust dynamically (Thoolen et al., 2022). While fine-tuning various interaction parameters requires careful consideration, a well-designed system could accommodate diverse needs within a single framework (Westphal et al., 2017).

Many future directions in touchscreen accessibility for people with dementia focus on AI and automation (Dixon et al., 2022). However, future research must consider the unique security concerns that arise with these advancements (Dixon et al., 2021). As technology becomes more proactive, there is a risk that increased automation could reduce individual autonomy, potentially creating opportunities for misuse or abuse (Dixon et al., 2022). AI integration should not only meet the highest standards of safety and effectiveness but also address the real needs and privacy preferences of people with dementia (Sanchez and Mihailidis, 2024).

4 Discussion

In this scoping review the relationship between touchscreen interface use and the needs of people with dementia has been explored through two research questions: **RQ1: What are the benefits and challenges of touchscreen interfaces for people with dementia?** and **RQ2: How are touchscreen interfaces adapted to meet the needs of those with dementia?** The analysis identified three themes: 1) Considering barriers to digital inclusion, 2) Recommendations for dementia-friendly touchscreen interfaces and 3) The future potential of personalised interfaces. These themes highlight key considerations when designing and developing touchscreen interfaces as scalable assistive technology for people with dementia, both now and in the future. A central factor across these themes is the need for technology to strike a considered balance, where human-centred technology evolves alongside the individual, adapting to their needs and circumstances without overwhelming or limiting them. The findings of this scoping review suggests that the benefits and challenges of touchscreen technology are highly individualised, shaped by each person's unique abilities and circumstances. As a result, effective design must prioritise flexibility and adaptability to ensure meaningful and supportive user experiences.

When people with dementia frequently used touchscreen technology, it was often recognised as playing a vital role in maintaining their independence and providing support during moments of disorientation (Dixon et al., 2021). Furthermore, the use of touchscreen technology, whether used independently or with assistance from social networks, was found to positively impact social connectedness (Thoolen et al., 2022) and emotional well-being (Dixon et al., 2022). By providing opportunities to engage in hobbies, maintain productivity, and explore creative outlets, touchscreen devices can help nurture a sense of purpose and fulfilment (Dixon et al., 2021). Additionally, the integration of multiple devices, such as smartphones and wearables, was discussed to create effective support systems for daily living (Thorpe et al., 2016).

However, a technological divide was evident among individuals with dementia, as some encountered significant barriers to use, including access to devices, difficulties with charging, unlocking screens, and making calls (Sanchez et al., 2024). These factors contribute to digital isolation which has been linked to a significant increase the risk of dementia in older adults (Deng et al., 2025). The early adoption of technology is considered crucial for managing the progressive symptoms of dementia and proactively planning for the future (Dixon et al., 2021). Support can then be provided from the early stages of dementia and provide continuous assistance as symptoms progress (Shastri et al., 2021).

For people with limited technical experience, using devices alongside others helped increase comfort with technology and even promoted learning (Thoolen et al., 2022). Training and support should be provided to help overcome technology divides and barriers for people with dementia (Boyd et al., 2021). The importance of training and support to ensure effective technology use has also been highlighted in the study by Talbot and Briggs (2022). Creating strategies to enhance digital literacy and provide equitable access may also effectively mitigate dementia risk in older adults (Deng et al., 2025).

Additionally, interactions with touchscreen interfaces can negatively impact people with dementia, particularly during moments of stress, pressure, or fatigue while navigating and completing tasks (Dixon et al., 2022). In these situations, an excess of functionalities, options, or information may become overwhelming, making it even more difficult to navigate the interface and perform tasks effectively (Brankaert et al., 2014). During high-anxiety moments, touchscreen interfaces often lack clear and intuitive guidance on how to interact with the device, leaving people uncertain about the next steps or how to resolve issues they encounter (Dixon et al., 2022). Repeated negative experiences with technology can also lead to a decline in confidence and adversely affect perception of their own technical abilities (Conway et al., 2023). Feelings of frustration and discouragement can ultimately lead to the disuse of touchscreen devices altogether (Sweeney et al., 2020).

Many challenges were discussed at the interface design level, leading to the iteration and customisation of interfaces to better accommodate the needs of people with dementia (Köhler et al., 2021). Accessibility settings on devices were also adjusted, such as modifications to brightness and contrast (Dixon et al., 2021). This scoping review identified eight key recommendations for improving interfaces for people with dementia. However, these suggestions are not unique; they align with the Web Content Accessibility Guidelines (WCAG) for making web content more accessible (WCAG, 2024). Many older adults also experience age-related impairments that overlap with the accessibility needs of people with disabilities (WAI, 2024). Therefore, integrating these guidelines from the outset of design and development is crucial to ensuring touchscreen interfaces are as inclusive as possible.

The findings of this scoping review build upon but also extend previous reviews, such as Hung et al. (2020), which centred primarily on tablet-based interventions in care settings. By contrast, our review takes a broader view of mainstream touchscreen technologies (including smartphones, tablets, and smartwatches) and focuses on how these devices have been adapted through human-centred design approaches to meet the evolving needs of people with dementia. This positioning highlights the novelty of our contribution, offering insights into interface-specific design challenges and opportunities that are not the focus of earlier reviews.

Research suggests that future generations will demonstrate greater familiarity with and use of touchscreen technology due to lifelong exposure (Köhler et al., 2021). However, the progressive nature of dementia remains a key challenge, as abilities and needs will continually change over time (Muñoz et al., 2021). Recognising the individualised and varying needs of people with dementia was

a common finding, highlighting the importance of focusing on personal abilities (Thoolen et al., 2022). The adaptability and personalisation of touchscreen interfaces emerged as a pivotal direction for future research to address individual requirements (Ahmed et al., 2022). This aligns with previous research that has emphasised that for technologies to be truly effective, they must not only be adaptable to changing abilities but also accessible at the right time (Lorenz et al., 2017). However, further research is needed to determine how system functionalities can be continuously calibrated and adapted with personal abilities, individual needs, and specific contexts (Thoolen et al., 2022).

Many future personalisation approaches for people with dementia focus on AI and automation (Dixon et al., 2022). These range from activity-based customisation to proactive features designed to anticipate and adapt to user abilities and needs (Dixon et al., 2022). These concepts align with the work of Kong et al. (2024), which describes an ability-based system that shifts the responsibility of adaptation onto the technology itself, rather than requiring users to adjust to the system. The system is influenced by specific contexts, activities, and environments, as it is recognised that these factors can significantly impact a user's abilities. Research from adaptive virtual reality interventions in cognitively impaired older adults has demonstrated that systems which dynamically adjust difficulty to maintain engagement can enhance cognitive and physical outcomes, highlighting the potential of adaptive, challenge-sensitive technology for supporting people with dementia (Li et al., 2025).

Another key area of research is adaptive user interfaces, which have the potential to autonomously modify interface content and layout to better suit individual users (Todi et al., 2020). However, implementing these systems requires careful consideration, particularly regarding privacy, data collection, and user consent, to prevent potential misuse and protect user rights (Dixon et al., 2022). Critical questions also remain for future research: How will adaptive technology recognise progressively changing technological abilities? How will AI detect when an interface is causing significant challenges and determine when to intervene? Most importantly, how can we ensure that a person with dementia retains control over the adaptive technology designed to assist them? AI assistance is only considered acceptable if the individual remains in control; however, maintaining this autonomy may become increasingly difficult as dementia progresses (Dixon et al., 2021).

While shared experiences exist across dementia diagnoses, people with early-onset dementia often face distinct challenges impacting their self-esteem, family roles, employment, social engagement, independence, and opportunities for meaningful activity (Harris, 2004). Despite growing recognition of technology's potential to support independence, a notable research gap remains regarding its impact on early-onset dementia, particularly across different contexts and over time (Oyebode and Rook, 2025). This limited understanding hinders the development of AI-powered touchscreen technology to meet the varied and evolving needs of people with dementia. Furthermore, increasing early diagnoses of Mild Cognitive Impairment (MCI) and early-onset dementia mean more people are navigating the initial stages while still employed (Shastri et al., 2021). Investigating how technology can better support these individuals professionally and personally at different life stages represents an important direction for future research.

5 Limitations and Future Work

This review explored the impact and adaptations of touchscreen technologies in relation to smartphones, tablets, and smartwatches.

A key limitation of this scoping review is that the primary screening, charting, and thematic analysis were conducted by a single researcher. Specifically, the title and abstract screening, as well as the initial coding of the data set, were performed by one author. Although the research team contributed to developing eligibility criteria and refining the thematic framework, the reliance on a

single individual for much of the review introduces the potential for selection bias or missed nuances. To mitigate this, subsets of records were screened by other team members to check consistency, and inclusion decisions at the full-text stage were discussed collaboratively. Similarly, while the initial codes were generated by a single researcher, the wider research team reviewed and refined these codes into broader themes through discussion and consensus. Nevertheless, the potential for bias at the early stages of screening and coding cannot be fully excluded and should be considered when interpreting the findings.

Additionally, the review was limited to English-language publications, which presents a further limitation. Future reviews would benefit from multiple independent reviewers at each stage to strengthen reliability. Although this review provides valuable insights, the findings should be interpreted with an awareness of these constraints.

This scoping review has highlighted several directions for future research which include:

- **Longitudinal studies:** Observational and longitudinal research presents an opportunity to explore how the use of touchscreen technology by people with dementia evolves over time.
- **Dynamic personalisation:** Investigate the development of systems that not only adapt to the user's current abilities but also anticipate future needs as dementia progresses, across various contexts (e.g., workplaces).
- **Ethical and privacy considerations:** Examine frameworks that balance user autonomy with safety and control, particularly in AI-driven features.

6 Conclusion

This scoping review has explored the benefits, challenges, and future potential of touchscreen interfaces for people with dementia, examining how these technologies can be designed and adapted to meet the evolving needs associated with the progression of the condition. Mainstream touchscreen technologies, such as smartphones, tablets and smartwatches have the potential to provide scalable and personalised support for people with dementia. However, the highly individual progression of dementia presents challenges for the continued use of touchscreen interfaces. Additionally, a significant digital divide exists in the technological abilities of people with dementia, which remains largely unaddressed despite the numerous benefits touchscreen technology can offer.

The use of AI to personalise touchscreen interfaces for individuals with dementia is gaining increasing focus. However, further research is needed to explore how personalisation features can be adapted and configured to enhance usability without restricting, controlling, or being misused. Ethical considerations, especially regarding privacy and autonomy, are crucial to ensuring that these technologies respect choices and promote dignity, rather than imposing limitations.

Declaration of interests

The authors declare that there is no conflict of interest.

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Table 2: Characteristics of included studies

Table 2 Alt Text: Summaries of 17 studies (2013–2024) on touchscreen and smart technologies for people with dementia, including authors, locations, aims, methods, participants, results, and discussion. Studies highlight user-centred design, independence, personalisation, and usability considerations.

Author(s), Year, Location(s)	Aim	Methods, Participants	Results	Discussion
Holbø et al., 2013 Norway	To understand how safe walking technology can be designed to meet the personal needs and preferences of people with dementia.	A participatory design approach involving interviews, workshops, and co-design activities. Three people with early-stage dementia and their primary family caregivers participated.	Participants wanted self-management and control, rather than being passive subjects of surveillance. People with dementia prefer safe walking technology that supports their independence, respects their privacy, and helps ease caregivers' concerns.	Emphasis was placed on the move from surveillance-based solutions to collaborative, empowering technologies that respect the autonomy and dignity of people with dementia.
Brankaert et al., 2014 The Netherlands	To evaluate how a smartphone interface with assistive functions could support people with dementia and their caregivers in daily life.	A field evaluation collecting both subjective feedback and objective usage data. Ten couples participated, a person with dementia and their caregiver.	All participants initially used the phones actively, but only a few continued regularly. Issues included forgetting the phone, battery life, and difficulty integrating it into daily routines. Some features were helpful while others caused confusion.	The authors highlighted that the smartphone was helpful for some participants, but design improvements and alternative solutions are needed to better suit the diverse abilities and needs of people with dementia.

<p>Thorpe et al., 2016 Denmark</p>	<p>To investigate the adoption, usability, usefulness, and acceptance of an assistive technology solution using off-the-shelf smart devices for people with mild dementia.</p>	<p>The study used a user-centred design approach to test a smartphone and smartwatch prototype through usability and field testing.</p> <p>Five people with mild dementia and their caregivers</p>	<p>Results showed some promise for technology adoption. Usability issues were identified including difficulties with swiping. Usability and usefulness were determined as key factors influencing adoption.</p>	<p>The study emphasised real-world testing and user feedback for better technology design for dementia, suggesting smartwatches for output, smartphones for input, and the importance of personalisation and familiarity.</p>
<p>Westphal et al., 2017 Singapore</p>	<p>To report the experience of designing and trialling the tablet-based game with the aim of enhancing the usability for people with dementia.</p>	<p>A tablet game was developed and iteratively refined through a series of evaluations with older adults and older adults with dementia. Input was also included from a multi-disciplinary team of occupational therapists, doctors, and geriatric psychiatrists.</p>	<p>Participant feedback from older adults and older adults with dementia informed the design and development decisions of a game using nostalgic content and tangram-style puzzles to offer cognitive challenge and promote well-being.</p>	<p>Insights gained through the project are discussed by the authors, focusing on utilising reminiscence, adapting system features, and enhancing usability in touch interaction.</p>
<p>Jönsson et al., 2019 Sweden</p>	<p>To determine how the introduction of a food reminder system, built with existing technology, can be valuable to people with dementia, and how caregivers adopted it in a real-world environment.</p>	<p>Data about usage and perception of the system is collected through observations and interviews as a case study at a care facility for people with dementia.</p> <p>Participants included caregivers, managers, and residents at the facility.</p>	<p>The iRemember system showed potential for promoting independence and positive emotions in residents, with caregivers generally open to its adoption however highlighting the need for support and awareness to ensure continued and widespread use.</p>	<p>The discussion explores the system's potential to enhance independence in residents, the complexities of technology adoption for dementia care (including UI and support), its positive impact on well-being, and the importance of caregiver attitudes and involvement.</p>

<p>Boyd et al., 2021 Northern Ireland</p>	<p>To evaluate the InspireD app's usability for people with dementia and carers, aiming to identify usability issues to inform improvements.</p>	<p>The study used a mixed-methods approach across three workshops involving user needs analysis, feedback, and usability testing with eye tracking technology. 14 participants, including people with dementia and their carers.</p>	<p>The study demonstrated the feasibility of eye tracking, identified app usability issues, revealed a correlation between task completion and prompts, and showed different eye gaze patterns between people with dementia and carers, while also gathering insights on app preferences and adjustable design elements.</p>	<p>In their discussion the authors underscore the feasibility of eye-tracking, user-centred design, and eye gaze variations in evaluating dementia app usability. It highlights the potential of eye-tracking technology to provide valuable insights into the user experience of this population.</p>
<p>Dixon et al., 2021 USA</p>	<p>To expand the way the field of HCI sees people with dementia, shifting perspectives towards understanding and viewing them as capable consumers and inventive creators of their own self-management systems.</p>	<p>Semi-structured interviews were conducted with seventeen technology-savvy people with mild to moderate dementia. The interviews focused on understanding participants' technology use in self-management.</p>	<p>The study demonstrated that participants' self-management system configurations are guided by three key considerations: a future-focused approach, socially situated awareness, and the maintenance of control. This configuration process involves addressing future needs, navigating their social world, and ensuring personal control.</p>	<p>The authors discuss broadening the notion of self-management to include future-oriented, sociotechnical, and self-determinate design. The importance of recognising people with mild to moderate dementia as inventive creators and capable actors in self-management was also emphasised.</p>

<p>Khan et al., 2021 Singapore</p>	<p>To investigate usability issues and user experience of a touchscreen-based dual-language cognitive intervention tool with older adults and older adults in early stages of dementia from multilingual backgrounds.</p>	<p>The study used a six-stage iterative process based on the Design Research Methodology (DRM) to test a dual-language tool with bilingual older adults and older adults with dementia.</p> <p>Participants included 15 older adults and 16 older adults with dementia.</p>	<p>The study highlighted several key observations regarding the usability and user experience of the touchscreen-based dual-language cognitive intervention tool, specifically related to language, motivation, and user interaction.</p>	<p>The discussion highlighted the user study observations that informed the preliminary design guidelines for language and audio interaction, motivation and engagement, and touchscreen interaction.</p>
<p>Köhler et al., 2021 Germany</p>	<p>To determine the functional and design requirements, from the perspective of future users, for technical navigation assistants that aid outdoor mobility for people with cognitive impairment.</p>	<p>A user-centred design approach, conducting semi-structured interviews.</p> <p>Participants included 14 people with mild cognitive impairment or mild to moderate dementia.</p>	<p>Results highlight that people with mild to moderate dementia value their independence and use technology in their daily lives, but face challenges with disorientation and find current navigation systems inadequate. Their feedback provides specific design and functional requirements for developing more suitable navigation assistance technology.</p>	<p>The authors underscore the importance of user-centred design, balancing autonomy, and safety, addressing specific design needs, understanding technology affinity and usage, and conducting future research to advance assistive technology for people with dementia.</p>

<p>Muñoz et al., 2021 Australia</p>	<p>To encourage positive shared experiences for people with moderate to advanced dementia and those visiting them, particularly by helping them overcome difficulties in initiating conversation and finding joint activities.</p>	<p>Evaluation of a pre-developed app with eight games over three months in care facilities in Melbourne. Tablets were used to collect observational, interview, and gameplay data, which was analysed qualitatively and quantitatively. Participants were 21 residents with dementia, their visitors, and 7 care staff.</p>	<p>The study highlighted that preferences for game activities were highly individual and closely linked the residents' personal interests and skills. Personalised game preferences were found to enhance social interaction and engagement for residents with dementia. However, the complexities of evaluating technology in this context were also discussed.</p>	<p>The authors highlight technology's capacity to promote positive social experiences for individuals with dementia. The need for personalised approaches is emphasised, and the complexities of evaluating technology within this context are acknowledged.</p>
<p>Ahmed et al., 2022 Germany, Italy, Portugal, Romania, and Spain</p>	<p>To identify the needs and requirements of potential end-users in the development of the PROCare4Life platform.</p>	<p>A mixed qualitative and quantitative study design was used. The study included 2 web-based surveys, 40 interviews, and 4 workshops.</p> <p>The study recruited 217 participants, including older adults with neurodegenerative diseases (Parkinson's and dementia), caregivers, health care professionals, and other stakeholders.</p>	<p>Participants shared experiences about neurodegenerative diseases, expressed mixed views on platform technologies (balancing acceptance with concerns about complexity and privacy), and highlighted key needs like alerts, monitoring, communication, personalisation, and usability.</p>	<p>Key needs in neurodegenerative care for an ICT-based platform were identified. Insights supported PROCare4Life's development but also revealed challenges in meeting diverse user needs. The authors emphasised a user-centred and collaborative approach for successful platform design.</p>

<p>Dixon et al., 2022 USA</p>	<p>To understand how people with mild to moderate dementia are using mobile phones, the specific challenges they have with mobile phone use, and opportunities for technology to support people with dementia when they encounter challenges.</p>	<p>The authors conducted semi-structured interviews with fourteen people with mild to moderate dementia. Participants were asked about current use, challenges, and their ideal future mobile phone experiences.</p>	<p>Participants used mobile phones meaningful activities, including productivity, health management, and connection. Challenges discussed included navigating to apps and features; time pressure, high stress and fatigue affecting task execution; and difficulty re-learning task flows after updates and upgrades.</p>	<p>Design opportunities are discussed to help achieve more accessible and supportive technology for people with dementia including customisable user interfaces, activity-based customisation, proactive technology assistance, and extended modalities for voice-based interactions.</p>
<p>Pigliautile et al., 2022 Italy, Austria, Spain</p>	<p>To assess the usability of the first Memento system prototype, designed to support the management of daily activities of people in the early and middle stages of dementia.</p>	<p>Data collected included observation methods, performance metrics (task execution time, task completion rate, need for assistance), and the System Usability Scale (SUS). 15 participants included people with dementia (PWD) or mild cognitive impairment (PWMCI) and their caregivers.</p>	<p>Participants showed initial engagement with the Memento prototype and appreciated personalised features, but usability testing revealed technical and interface challenges and a high need for assistance, underscoring the importance of design improvements.</p>	<p>The authors conclude that involving end-users early in the design process and using a combination of usability methods is essential to create intuitive, reliable, and personalised systems like Memento.</p>
<p>Thoolen et al., 2022 Denmark</p>	<p>To investigate how off-the-shelf smartphones and smartwatches can be adapted as assistive technology (AT) for people with mild dementia.</p>	<p>A user-centred design (UCD) approach was used, testing the prototype with five people with mild dementia and their caregivers in both controlled and real-world settings, using video, logs, SUS questionnaires, and interviews based on the unified theory of acceptance and use of technology (UTAUT) model.</p>	<p>The system showed promise for scheduling and communication but faced usability and adoption challenges, highlighting the importance of familiar, personalised features and the need to use smartphones for input and smartwatches for passive support.</p>	<p>The authors emphasise that early user involvement, real-world testing, and familiar, personalised features are key to creating effective, adoptable assistive technology for people with dementia.</p>

<p>Di Campli San Vito et al., 2024 United Kingdom</p>	<p>To determine the calendar usage and digital reminder entry preferences of people with dementia and their carers.</p>	<p>Two focus groups (7 participants total) explored calendar practices with people with dementia and their carers, and gathered feedback on digital calendar designs from people with dementia; discussions were recorded and analysed thematically.</p>	<p>Results showed varied calendar use, mixed input preferences, and a desire for conversational reminders, with key themes including technology comfort, management challenges, skill loss impact, and feature suggestions.</p>	<p>The discussion highlights the need for user-centred digital calendars for people with dementia that support diverse practices, prioritise comfort with technology, replicate key features of physical calendars, ensure usability, and allow customisable, conversational input.</p>
<p>Goerss et al., 2024 Germany</p>	<p>To assess the feasibility of user-centred smartwatch interventions for people with dementia and to evaluate the strengths and limitations of user feedback in guiding technological improvements.</p>	<p>Stakeholder interviews, passive observational monitoring, and an intervention using remotely triggered smartwatch prompts, with participant reactions recorded and feedback gathered via questionnaires.</p> <p>40 people with MCI or dementia were included.</p>	<p>Participants generally found the smartwatch usable and appealing, appreciating non-disruptive prompts and perceived safety benefits, and favouring simple, multimodal notifications, while suggesting improvements to prompts and screen brightness and desiring features like time display and emergency functions.</p>	<p>The study concluded that people with dementia can have positive experiences with smartwatches and provide valuable feedback. User-centred development is essential for prioritising functional and non-functional features in assistive technologies for this population.</p>
<p>Sanchez et al., 2024 Canada</p>	<p>To improve autonomy and communication for people with dementia and their caregivers at home by developing personalised, innovative memory aids.</p>	<p>The study used semi-structured interviews and qualitative analysis to explore daily challenges, memory aid use, and preferences for a prototype reminder app, with transcripts coded thematically using a mix of top-down and bottom-up methods in NVivo.</p>	<p>The results revealed diverse challenges and coping strategies highlighting the need for personalised memory aids, varied reminder preferences, the role of demographics in technology adoption, and the potential of tailored systems to boost autonomy and communication.</p>	<p>The discussion interprets the findings in relation to existing research, covering challenges for people with dementia, memory aid preferences, demographic influences on technology use, user-centred design, study limitations, and future research directions.</p>

Sanchez and Mihailidis, 2024 Canada	To develop and evaluate an AI-enhanced, home-based reminder system that supports people living with dementia and their caregivers.	Structured interviews followed by the development of a tablet-based reminder system and machine learning models to detect behavioural patterns and anomalies. 7 people living with dementia and their family caregivers.	Participants valued simplicity and customisation, and early testing indicates the system improves task management and detects meaningful behavioural patterns.	The authors highlight the importance of user-centred design practices and ethically designed AI technologies that adapt to the individual needs of people with dementia while supporting autonomy.
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About the authors

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