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A Scoping Review of Technology Acceptance Models and Theories for Sustainable Use in People With Dementia

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Abstract

Digital health technologies offer promising solutions for enhancing the quality of life for people with dementia, but they have some drawbacks. The aim of this scoping review was to explain the factors influencing acceptance of such technologies, by identifying and exploring the empirical support for different theoretical models. Following the PRISMA-ScR checklist, data were collected from PubMed, Web of Science, Scopus, PsycInfo, and IEEE Xplore. The review explored technology acceptance in people with dementia through any model or theory including the factors that could potentially determine acceptance. Thirty-one articles were included in the review. Different perspectives, approaches, and modifications of well-known technology acceptance models and theories regarding their underlying constructs were reported in the articles selected. Perceived usefulness, perceived ease of use, and social influence, the most studied constructs, have been found to have the greatest impact on the acceptance of different technologies in people with dementia.

Keywords

cognitive impairment, digital health, assistive technologies, technology acceptance model, perceived usefulness, perceived ease of use, intention to use

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What this paper adds

- Perceived enjoyment and perceived adaptivity could contribute to better understanding of the topic.
- Anxiety and other emotions may also play a relevant role, especially in the case of persons with dementia where the pathology itself may imply changes in the psychological and behavioral domains.
- Access-related factors such as price and privacy issues should be carefully addressed and discussed to avoid negative influences on acceptance.

Applications of study findings

- This scoping review highlights the need to apply user-centered methodologies to develop assistive technologies in the context of dementia/cognitive impairment.
- Consider ethical aspects such as informed consent, data management, and accessibility in a multidisciplinary approach will enable the successful implementation of digital health technologies.

Background and Objective

Alzheimer's disease and other types of neurodegenerative dementia, particularly the cognitive deterioration that characterizes these conditions and their prodromal stages, are currently considered one of the most important health challenges of the 21st century. The prevalence of these diseases is predicted to rise as the average age of the global population continues to increase, potentially leading to significant stress on health systems, social support, caregivers, and society in general (Alzheimer Disease International, 2019; Prince et al., 2015). Various aspects of providing

support for patients with dementia could be addressed by digital health technologies. Digital health technologies (DHTs), that is, the integration of digital technology and health information, comprise applications, programs, and software used in health and the health system that aim to increase the efficiency of care delivery (NICE, 2019; Yao et al., 2022).

It is important to note, however, that while digital health technologies encompass a wide range of applications aimed at supporting health promotion, disease management, and care delivery, technologies specifically designed or adapted for PwD must address additional challenges. These include memory loss, reduced attention, difficulties in learning new procedures, and the need for simplified interfaces and supportive functionalities (Lauriks et al., 2007; Topo, 2009). Distinguishing between general digital health tools and dementia-specific technologies is essential for understanding the unique determinants of usability and acceptance in this population (Olsson et al., 2013).

Thus, the adoption of DHTs by PWD and their caregivers faces several challenges, including individual factors (i.e., cognitive barriers and lack of trust), technological factors (i.e., user-friendliness and security issues), and socio-structural factors (i.e., cultural differences and economic constraints) (Boyle et al., 2022; Czaja et al., 2006; Lee & Coughlin; 2015; Parker et al., 2013).

Technology is of huge potential in the care of people with dementia, although there are also some potential problems and ethical issues that should be considered. Ethical concerns can be classified into four groups (Wangmo et al., 2019): cognitive status, data management, affordability-distribution justice, and human contact. Regarding cognitive status, it is important to consider whether or not people with cognitive impairment are able to make their own decisions about the use of DHTs. The technologies should be user-friendly and within the reach of PWD (Bennet et al., 2017; Wangmo et al., 2019). Data management must also be taken into account, particularly in regard to data access and data sharing, in order to protect the privacy and autonomy of PWD. The privacy and security of health information must be protected, and the rights and freedoms of the patients preserved. The high cost of some DHTs means that these technologies may not be equally available to potential users, leading to social disparities in access.

Another recurring ethical issue is the widespread belief that DHTs should complement, but not replace, human-delivered care. In particular, the introduction of socially assistive robots could blur the line between human and machine interactions, potentially leading to ethical dilemmas regarding patient dignity (Gkiolnta et al., 2025). Furthermore, the implementation of technology in dementia care not only involves healthcare professionals, caregivers, and technology developers but also policymakers. The success of DHTs depends on applying a multidisciplinary approach and the incorporation of strong ethical standards (Gkiolnta et al., 2025).

Designed to understand and predict people's adoption of a given technology, technology acceptance models provide relevant information in disciplines as diverse as information systems, psychology, and business. Parameters and challenges for these models/theories, which include Diffusion of Innovations (DOI) theory (Rogers, 1962), the Technology Acceptance Model (TAM) (Davis, 1989; Holden & Karsh, 2010), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003, 2012), the Senior Technology Acceptance Model (STAM) (Chen & Chan, 2011; Renaud & Biljon, 2008), the Almere Model Questionnaire (Chen & Chan, 2013; Heerink et al., 2010), and the Model for the Adoption of Technology by Older Adults (MATOA) (Heart & Kalderon, 2013; Peek et al., 2014), are summarized in Table 1. Previous systematic reviews, such as Peek et al. (2014), examined the acceptance of technology in broader aging populations and highlighted domains such as usability, privacy, cost, social influence, and perceived need as central determinants. Other reviews, including Anderson et al. (2020) and Tuena et al. (2020), examined general barriers and facilitators to technology use in dementia care and usability issues in specific technological contexts such as virtual reality. However, little is known about how these constructs apply specifically to people with dementia, a population facing unique cognitive and functional challenges.

The aim of this scoping review is to provide a broad overview of existing technologies used in the context of dementia and cognitive impairment care and support. The specific aims were (1) to account for the factors influencing technology acceptance by the study participants and (2) to identify areas for improvement in the development of technology tools for PWD. For the purpose of this study, we considered it important to examine the acceptance of different

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Table 1. Technology Acceptance Models. Parameters and challenges

Model	Parameters	Challenges
Diffusion of Innovations (DOI) (Rogers, 1962)	Relative advantage: The level to which an innovation is seen as being superior to the idea that it replaces Compatibility: The extent to which an innovation is relative to the value, past experience, and needs of the users Complexity: The level to which an innovation is regarded as being complex and hard to learn and apply by the users Trialability: The level of trial allowed for an innovation whereby some parts can be implemented on a small scale Observability: The extent of the visibility of the results of an innovation to the outside world	Does not incorporate attributes of the individual in the interacting system and pays more attention to innovation and the social system
Technology Acceptance Model (TAM) (Davis, 1989; Holden & Karsh, 2010)	Perceived usefulness (PU): The level of persuasion of a person about the use of a particular system in improving his/her performance at the workplace	Mainly only considers individual factors and fails to incorporate social influences as well as the facilitating conditions
	Perceived ease of use (PEOU): Confidence in the idea that using a certain system will not entail any effort	Does not usually consider technological usage as mandatory and is not influenced by employees' decisions
Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003, 2012)	Performance expectancy (PE): Like PU, this parameter encompasses the extent to which the use of the specific technology will result in the accomplishment of work-related tasks	Cumbersome and may warrant collection of data for all the constructs included in the model
	Effort expectancy (EE): Like PEOU, this parameter relates to the facilitation that comes with technology Social influence (SI): The level of endorsement by the individual that important referent others expect him/her to use the new system Facilitating conditions (FC): The level of faith that an individual has in the support structure for the organizing system as well as the technology it uses	May require modifications depending on the cultural setting and the type of technology being adopted
Senior Technology Acceptance Model (STAM) (Chen & Chan, 2011; Renaud & Biljon, 2008)	Perceived usefulness (PU): Comparable to TAM, it suggests the perceived usefulness of the technology in improving the user's activities	May be difficult to deal with the cognitive and physical heterogeneity of the older population in terms of the final model
	Perceived ease of use (PEOU): Expresses the extent to which the older adults think that use of the technology will be effortless Attitudes toward technology (ATT): Some of the specific learner characteristics of the older adults include their attitude towards the new technologies for learning which may be positively or negatively affected by their previous experiences and the perceived importance of the technologies Anxiety: The extent of concern or fear that older adults have about using new technologies Facilitating conditions (FCs): Environmental characteristics that would enable the older adults to use the technology (i.e., help from family members and ready availability of help)	May be difficult to address with the overall heterogeneity of the older population regarding their previous experience with technology tools

(continued)

Table 1. (continued)

Model	Parameters	Challenges
Almere Model Questionnaire (Chen & Chan, 2013; Heerink et al., 2010)	Performance expectancy (PE): People's perception that technology can assist them in attaining some goals and objectives Effort expectancy (EE): The convenience which is attached to the use of technology Social influence (SI): How other peoples' perceptions can influence the use of the technology by a particular individual Facilitating conditions (FCs): The time taken within the organizational and or community to acquire resources and support to use the technology Attitude towards technology: Attitude toward the use of the technology in general Anxiety: Anxiety or phobia which may be associated with the use of technology in any way Perceived enjoyment (PE): The enjoyment that a person gets from using a particular technology Trust: The level of confidence that the technology will work effectively and securely in the intended environment	Ensuring that the use of the questionnaire reflects the complexity of the technology used by the older population Modifying the model for different sorts of assistive technologies and cultures
Model for the Adoption of Technology by Older Adults (MATOA) (Heart & Kalderon, 2013; Peek et al., 2014)	Perceived usefulness (PU): The perceived degree to which the assistive technology is deemed to improve the quality of life and/or independence Perceived ease of use (PEOU): How far it appears that older adults can easily use the technology Compatibility: The degree to which the technology matches the older adult's lifestyle and habits at the time of its application Anxiety: Perceived risk or the degree of concern that exists when deciding to use the technology Self-efficacy: The confidence that one possesses towards the use of technology to achieve the intended goal	Further development of the model should address the peculiarities of the older adults and their requirements Achieving a balance between technological advancement and ease of use

technologies as determined by any of the acceptance models/theories mentioned above. This approach enabled us to gather diverse data based on various acceptance parameters that may be useful in understanding what works and what needs to be considered to uphold the principles of user-centered design in this context and ensure that digital-health practices focus on patients.

Research Design and Methods

The methodology used in this scoping review followed the checklist of the PRISMA Extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018). The protocol was registered with OSF (osf.io/yvzd9). The following research question was formulated using the PICO strategy (da Costa et al., 2007): "What are the technology adoption models, theories and tools used in the development of technology for individuals living with dementia?" Although the PICO framework is traditionally used in systematic reviews focusing on clinical interventions, we adapted it in this scoping review as a structured approach to help us clearly define the key elements of our research question. While the PCC (Population–Concept–Context) framework is generally recommended for scoping reviews (Prince et al., 2015), PICO provided a structured way to define both the population and the phenomenon of interest, which aligned with the goals of this review. This flexibility in framing has also been acknowledged in methodological guidance for scoping reviews (Tricco et al., 2018).

On 8 March 2024, two reviewers (A.F. and J.C.) independently searched and extracted data from PubMed, Web of Science, Scopus, PsycInfo, and IEEE Xplore. The search string constructed was related to "technology acceptance models or theories" and "dementia."

Relevant MeSH terms related to dementia, which were cross-referenced with peer-reviewed articles published on the topic, were combined with other terms related to specific types of dementia (Supplemental Table 1). Studies published in English, Portuguese, and Spanish were included. No restrictions regarding the date of publication were applied in order to maximize comprehensiveness and capture the full historical development of technology acceptance models and theories in dementia care.

The analysis was conducted in two stages. In the first stage, the search results were imported into Rayyan (Ouzzani et al., 2016), which was used to remove duplicate hits and to analyze titles and abstracts. Duplicate removal was automatic, while analysis of titles and abstracts was performed independently by two blinded reviewers by applying inclusion and exclusion criteria. In the second stage, full-text articles were reviewed, and the inclusion and exclusion criteria were re-applied. In both stages, a third reviewer (T.F.) was responsible for solving any discrepancies in the selection process. The use of independent blinded review, consensus resolution, and arbitration by a third reviewer was applied in order to maximize methodological rigor in study selection. Once the full-text articles were processed, the most relevant categories were identified according to the technology acceptance models included in each article and their relevance to the outcomes reported in each study. This categorization process was therefore inductive and developed throughout the review process.

Articles were not considered if any of the following exclusion criteria applied: (1) Absence of references to any model or theory of technology acceptance; (2) sample consisted of people without dementia or cognitive impairment; (3) sample consisted of caregivers of patients free of dementia or cognitive impairment; and (4) articles published in any language other than English, Spanish, or Portuguese.

Articles were selected when the following inclusion criteria applied: (1) Explicit reference to the model/s or theory(ies) underlying the assessment of the technology acceptance aspects/domains; (2) sample consisted of PWD; and (3) all study designs (primary studies, conceptual frameworks, and reviews).

The operational definitions of the constructs used in the coding process are provided in Supplemental Table 2. The information extracted from the studies included in the review was distributed in tables according to the type of study: original studies (Supplemental Table 3) and review articles (Supplemental Table 4). These tables ensured that data were collected in a systematic and consistent manner and facilitated the comparison and synthesis of results. Each table includes the study/article reference, study design, objective, participants, type of technology, conceptual model, main conclusions, limitations, and the constructs identified in each study. For readability, constructs are presented numerically rather than by name, thereby reflecting the coding process applied in this review. This enabled the data to be systematically represented, facilitating the comparison of results across studies, identification of patterns in the literature, and clarity in how constructs were categorized.

Results

To answer the question regarding are the models of technology adoption, theories, and tools used in the development of technology for people with dementia, a total of 370 articles were retrieved in the initial search of the five different electronic databases considered. Duplicates were removed, and the 221 remaining articles were further examined according to the inclusion and exclusion criteria. Full-text screening of the 91 articles thus selected was then conducted. The 31 articles finally selected for this scoping review include original research articles ($n = 26$) and review articles ($n = 5$) published between 2009 and 2023 (Figure 1).

Different methodological approaches were used in the original research: qualitative ($n = 9$), quantitative ($n = 4$), and mixed ($n = 13$). The sample size varied widely, ranging from 1 (Gobeil et al., 2019) to 262 participants (Larnyo et al., 2022) (only considering PWD or mild cognitive impairment). Small sample size was found to be the most common limitation of the studies, and gender imbalance and short duration of studies were also identified as recurring limitations. In the articles reviewed, different perspectives, approaches, and modifications of well-known technology acceptance models and theories were considered, such as TAM, UTAUT, DOI, and the Almere model, along with their various constructs. Descriptive data of the empirical research included in the research articles is provided in Supplemental Table 3, while data reported in the review articles are summarized in Supplemental Table 4.

For a better understanding of participants' perspectives regarding acceptance of the different technologies, the results reported in the articles reviewed are organized in this section by coding the frequency of occurrence of the different constructs.

Perceived Usefulness

Perceived usefulness, defined as the degree to which a person believes that the system would be assistive (Heerick et al., 2010), emerges as an important factor across different acceptance models.

In one study, PWD did not always see an obvious or relevant reason for incorporating the technology into their daily lives, and they therefore tended to reject it, particularly if they felt that technology did not fit into their routine or improve it in any way (Evans et al., 2020). Nonetheless, several studies reported that perceived usefulness can contribute to technology acceptance (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019; Koshla et al., 2017; Lee & Yii, 2021). Many factors associated with this perspective involve the safety and independence that the use of different systems and technologies could provide to participants (Larnyo et al., 2022; Liu et al., 2017, 2018; Mishra et al., 2023; Olsson et al., 2016; Turner & Berridge, 2023) and facilitating the initiation or maintenance of social interactions with other patients, their caregivers and family members, or their social network in general (Blok et al., 2020; Chen et al., 2021; Horn et al., 2023; Larnyo et al., 2022; Nie et al., 2020). Entertainment, cognitive stimulation, and overall physical improvement

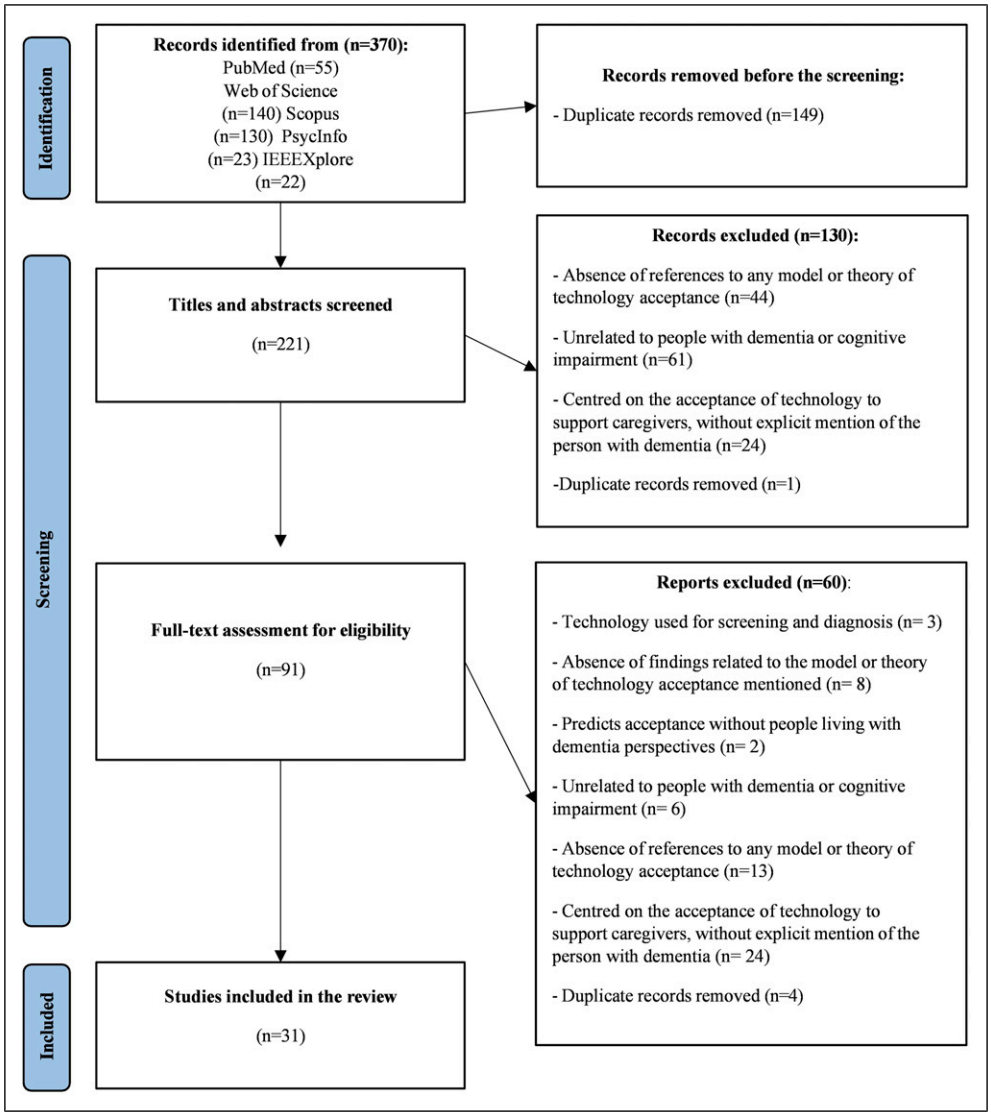

Figure 1. Article Screening Process Based on the PRISMA Flow Diagram

were also found to enhance perceived usefulness (Chen et al., 2021; Dirks & Bühler, 2018; Larnyo et al., 2022; Park et al., 2022). The capacity of a technology to enable patients to continue performing their daily activities and maintain their autonomy was also found to be intrinsically linked to perceived usefulness (Blok et al., 2020; Gobeil et al., 2019). One article reported that the use of a photo diary facilitated interactions between PWD and those around them (Karlsoon et al., 2014) and another reported the benefits of the device for patients with health or mobility issues in maintaining their social network (Nie et al., 2020). Additionally, one study concluded that reminders are considered quite useful (Thorpe et al., 2016). Another facilitating factor reported is the reduction in the burden that using certain technologies can bring to caregivers, as solutions that benefit caregivers are perceived by patients as positive and useful (Turner & Berridge, 2023).

Some devices were not considered useful (Greco et al., 2009), and for others, the main feature highlighted was their entertainment value rather than their usefulness (Dosso et al., 2022); the review clearly demonstrates that the perception of usefulness varies according to the needs of different users.

Perceived Ease of Use

Perceived ease of use is the degree to which a user believes that using a particular technology will be effortless (Davis, 1989) and has been found to be the best construct to help to understand the difficulties participants face when using different healthcare devices (Felding et al., 2023). When a device is seen as easy to use, users are more likely to adopt and continue using it, as it reduces cognitive load and increases satisfaction.

Factors influencing perceived ease of use include user interface design, clarity of instructions, and the overall usability (Venkatesh & Davis, 2000). Interest in the technology proved to be a facilitating factor for the perception of ease of use (Park et al., 2022). Another beneficial factor is the promotion of intuitive interactions between the participant and the device, especially social robots, which subsequently result in enjoyment and greater acceptance (Yamato et al., 2023). The incorporation of a step-by-step system makes devices more practical and easier to use, reducing the fear that PWD have of forgetting something important during the use of devices (Chen et al., 2021).

Several studies have reported good results regarding this construct due to the ease of learning and using the proposed system (Di Napoli et al., 2019; Dirks & Bühler, 2018; Mishra et al., 2023; Park et al., 2022). One study found that the more often PWD used a particular device, the more interesting and easier it became to use, increasing their intention to use it (Karlsson et al., 2014).

In terms of negative aspects, in the studies reviewed, two of the devices were found to have a low level of perceived ease of use (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019). Some devices were difficult to use, and the patients did not fully understand their purpose or how they worked (Liu et al., 2017). The patients felt uncomfortable using them and reported difficulties with the various functions (Mondelleni et al., 2022). Some design flaws were also reported, including incomprehensible icons (Gobeil et al., 2019; Nie et al., 2020), poor visibility and small font size (Nie et al., 2020), and interface and software problems (Gobeil et al., 2019; Nie et al., 2020). Some factors were directly related to the cognitive decline of the patients but could be mitigated by using reminders (Gobeil et al., 2019), external support from caregivers as a compensatory strategy (Blok et al., 2020; Dirks & Bühler, 2018), or learning how to use the technology prior to disease progression (Olsson et al., 2016). However, other limitations were also reported, such as the need for community integration, where visitors of PWD were required to have the application downloaded on their phones for the system to be used most efficiently. This may be inconvenient for both parties involved, as patients may feel uncomfortable "requiring" people around them to download the application (Horn et al., 2023).

Social Influence

Most of the articles reviewed reported that social influence, patient's perception that people who are important to them think they should or should not use the new system (Felding et al., 2023), plays a crutial role in acceptance (Blok et al., 2020; Larnyo et al., 2022; Liu et al., 2017; Yamato et al., 2023).

This external influence mainly had a positive role in the acceptance and use of different technologies (Liu et al., 2017; Turner & Berridge, 2023). PWD can also influence their family members and caregivers, leading to a mutual influence that benefits the adoption and use of the proposed technology (Felding et al., 2023; Karlsson et al., 2014; Liu et al., 2018). However, some studies have found that this external influence only has a moderate role in acceptance (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019; Dirks & Bühler, 2018). One article stated that because of difficulties in using the technologies, engagement from a primary caregiver helps to ensure their use, even if indirectly. However, many PWD were unable to use the technologies due to restrictions imposed by caregivers, who justified this in terms of protection, which ultimately hindered the use of the technology (Blok et al., 2020). Another article mentioned that the opinion of family members, caregivers, and other members of society plays a crucial role in the patient's decision to use a particular wearable healthcare device (Larnyo et al., 2022).

Attitudes Towards Technology

The interest in technology includes factors such as prior experience and external support. The reviewed studies indicated that increased confidence and interest in the technology/device, bolstered by social support and experience with its use, lead to higher levels of engagement and consequently greater acceptance (Blok et al., 2020; Evans et al., 2020). Several studies (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019; Koshla et al., 2017; Mishra et al., 2023; Nie et al., 2020) revealed positive attitudes towards the devices under study.

In two studies in which tablets were used, participants were initially insecure and cautious about using them, due to lack of experience and fear of damaging the devices. However, as the study progressed, the participants' curiosity about the devices and their confidence in using them increased, and their attitudes towards the technology also improved (Chen et al., 2021; Gobeil et al., 2019). Regarding social robots, "Matilda" proved to be a promising technology as participants were very positive about and comfortable with the robot's specifications (Koshla et al., 2017). Another study revealed that some participants became agitated by some of the robot actions (e.g., crying), thus exacerbating negative attitudes towards the device; when this type of behavior was controlled, a greater number of participants described positive feelings (eight rather than the five participants who initially reported a positive attitude towards the robot) (Yamato et al., 2023).

Anxiety and Other User Emotions

In this context, anxiety refers to the level of anxiety experienced by the user when utilizing or thinking about using the technology in question (Venkatesh., 2000). This negative

emotional response can slow down the adoption of technologies by reducing the perceived usefulness and enjoyment. User anxiety must therefore be considered when encouraging people to adopt new technologies (Venkatesh, 2000).

Ten of the articles addressed anxiety as a factor influencing the acceptance of different technologies from the user perspective. While a minority of the patients (less than a quarter) were comfortable with the devices, mainly social robots, and viewed them positively (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019; Dosso et al., 2022; Greco et al., 2009; Koshla et al., 2017; Mishra et al., 2023), some participants stressed that lack of comfort could negatively impact acceptance, indicating that this should be considered when developing different technologies (Larnyo et al., 2022). Additionally, the results of one study revealed that technological tools can be perceived as a reminder of the participants' disabilities, which will negatively impact acceptance and contribute to exacerbating negative emotions towards the technology (Evans et al., 2020). Nevertheless, participants demonstrated a relaxed attitude in the presence of most devices, particularly regarding "Matilda," a social robot (Koshla et al., 2017), as well as perceiving animal-like robots to have "cute" and "friendly" characteristics (Greco et al., 2009). Another positive aspect highlighted by the participants is the reduction of social stress that reminders can trigger, allowing them greater interaction with their social network (Horn et al., 2023).

Perceived Enjoyment

The reviewed articles that mention perceived enjoyment described the technologies used as fun (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019; Dirks & Bühler, 2018) and as a source of entertainment, occupation, or cognitive stimulation (Chen et al., 2021). Social robots, which could potentially raise more questions regarding interactions, were perceived as friendly (Greco et al., 2009), fun and interesting (Dosso et al., 2022), and capable of providing enjoyable interactions (Koshla et al., 2017). One of the articles reviewed reported that increased perceived enjoyment can significantly enhance user satisfaction and adoption rates (Felding et al., 2023).

Intention to Use

Intention to use, the outspoken intention to use the assistive technology over time (Whelan et al., 2018), represents the primary predictor of actual usage (Ajzen, 2005). Among the articles reviewed, one showed a direct link between the two concepts, stating that the greater the intention to adopt a wearable healthcare device, the more often it will be used (Larnyo et al., 2022). In another study, the intention to use decreased slightly after the technology was tested (Mondelleni et al., 2022). Another two articles reported a similar intention to use and actual use (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019). From another perspective, a study based on the DOI model, in which participants tested a passive positioning alarm (PPA), indicated that the decision to use this technology should be personal and individual, and stressed that the option to use it should be suggested before the disease progresses (Olsson et al., 2016). Another article reported that participants perceived the technology as useful for a future scenario in which dementia may have progressed, according to the MATOA model (Horn et al., 2023). For cognitive and physical stimulation designed to promote well-being and prevent dementia progression, participants were receptive to playing the games again in the future (Lee & Yii, 2021) or to performing similar or even more complex exercises suggested by the system (Park et al., 2022). However, one article reported that a minority of PWD said that they would want to use a robot if they owned one (Dosso et al., 2022).

Perceived Sociability

Perceived sociability refers to the user's impression of the capacity of a technology to support social interactions and community building. This capacity enhances the perceived social utility and enjoyment of the technology, thereby increasing user acceptance and encouraging continued use (Shen et al., 2008).

As shown in three articles included in this scoping review, PWD tend to readily accept technological options that provide social interactions. For instance, Robinson et al. (2009) found that technologies designed to facilitate social interaction were well received by PWD and perceived to contribute to overall well-being. Similarly, Marziali et al. (2005) demonstrated that online support groups and communication technologies could significantly enhance the social affinity and mental health of PWD and their caregivers. By contrast, Werner et al. (2014) discussed how stigma and self-perception may affect the acceptance of assistive technologies among older adults, highlighting the need for designs that minimize the visibility of cognitive support features to reduce stigma and enhance acceptance. In addition, Span et al. (2013) highlighted the importance of designing technologies that integrate seamlessly into the daily lives of PWD and that reduce the potential for stigma and thus encourage uptake of technology. This is consistent with findings stating that the inherent stigma associated with dementia and societal perception of the disease can compromise the use and acceptance of technology due to feelings of shame and discomfort, particularly when it highlights the user's cognitive impairments (Fan et al., 2017).

Three of the six articles that studied perceived sociability reported positive results, emphasizing that the use of these

technologies enhanced social interactions by the participants (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019). In another study, the removal of negative expressions during the interaction proved to be a facilitating factor for acceptance (Yamato et al., 2023). Regarding the robot "Matilda," participants' responses indicated that it did not contribute to promoting new connections and friendships, but it was beneficial for promoting participation in group activities among PWD (Koshla et al., 2017).

Social Presence

Social presence is defined as the experience of sensing a social entity when interacting with the system (Heerink et al., 2010). This sense of connection influences how users perceive the usefulness of a technology and their overall satisfaction and thus their willingness to use it (Gunawardena & Zittle, 1997).

Among the constructs described in this review, social presence was one of the factors least directly considered and was only addressed in four of the articles. Of these articles, only one reported a positive social presence, although at a low level (Di Napoli et al., 2019). The remaining studies reported a negative social presence (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Yamato et al., 2023).

Heerink et al. (2010) found that robots that did not appear realistic or behave realistically were often rejected by users, which is consistent with the idea that familiarity and relatability enhance the acceptance of technology. Similarly, Yamato et al. (2023) observed that participants stated that the low level of acceptance was due to the "strange appearance" of the robot, which did not have a face or hair. In the same study, another version of the robot that looked more like a real baby was more readily accepted, which was explained by the familiarity perceived by the participants (Yamato et al., 2023).

Perceived Adaptivity

Perceived adaptivity is related to how a user perceives the technology and how flexible the technology is to adapt to the user's preferences and needs in terms of how it is used. This factor affects perceived ease of use, which in turn affects user satisfaction and continued use (Venkatesh et al., 2003).

Adaptability to user's needs improves the acceptance and use of smart home technologies in older adults (Morris et al., 2013) and has also been shown to be important in enhancing the acceptance of and satisfaction with social robots (Heerink et al., 2010). Three of the articles included in this review directly addressed the perceived adaptivity of PWDs, who recognized the different technologies under study as being adaptable to their needs and particular conditions. In these studies, the perceived adaptivity was 60% or higher and was highlighted as an essential factor in relation to technology acceptance (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019).

Trust

Only four articles described trust, the belief that the system will perform robustly and reliably (Heenrik et al., 2010), as being a factor involved in the acceptance of different technologies, with three articles among them reporting a slightly positive level of trust (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019). However, one of the studies required a designated volunteer to be trained in using a tablet, and some initial distrust was noted, not necessarily towards the technology but towards the volunteer, who formed part of the usual social circle of the PWD (Chen et al., 2021).

Facilitating Conditions

Facilitating conditions are factors in the environment that make it easier to use the assistive technology (Whelan et al., 2018). These include the price of the technology and personal income (Larnyo et al., 2022; Nie et al., 2020; Olsson et al., 2016; Turner & Berridge, 2023) and compatibility with the daily lives of PWD (Turner & Berridge, 2023) and with their disabilities and needs (Koshla et al., 2017). Another facilitating factor is the interest in using the technology and curiosity about it, especially in the presence of a support network that motivates the PWD (Gobeil et al., 2019) or teaches them how to use the technology (Chen et al., 2021).

Moderating Factors

Moderating factors include personal characteristics such as age, gender, voluntariness, and experience that affect using of the technology (Felding et al., 2023). The reviewed articles highlight that lack of experience in using the technology and fear of the technology affect uptake by PWD (Chen et al., 2021), as well as lack of support, training, and encouragement (Chen et al., 2021; Turner & Berridge, 2023), and significant declines in cognitive function that interfere with the ability to use technology (Di Napoli et al., 2019; Gobeil et al., 2019; Mishra et al., 2023; Nie et al., 2020). Other personal factors include privacy concerns (Dosso et al., 2022; Nie et al., 2020), reduction in real and human interactions (Dosso et al., 2022), unrealistic expectations regarding the technology and its utility (Dosso et al., 2022; Larnyo et al., 2022), discomfort in using devices and impractical aspects (such as the need to charge them) (Liu et al., 2017, 2018), as well as resistance to change (Larnyo et al., 2022). On the other hand, applications and technologies that provide accurate and explicit information about dementia and cognitive impairment, as well as guidance for caregivers, were seen as likely to be

accepted because they make PWD feel safer and more comfortable with the care they receive (Conway et al., 2023).

Discussion and Implications

This scoping review identified 31 articles that examined and discussed the acceptance of various technologies used in PWD or cognitive impairment, with explicit reference to the underlying models or theories of acceptance. In order for these technologies to be accepted and incorporated into the daily lives of PWD, the reasons why potential users accept or reject different technological tools must be understood. To our knowledge, this is the first review to systematically map technology acceptance models, theories, and constructs specifically applied to dementia and cognitive impairment. Previous reviews, such as Peek et al. (2014), have examined technology acceptance in broader aging populations, including TAM and UTAUT. Since scoping reviews aim to identify and synthesize emerging or existing literature on a given topic (Mak & Thomas, 2022), the search and selection of articles did not follow any restrictions regarding publication date, type of publication, sample size, or study duration. However, 16 of the articles included were published after 2020, indicating that this area is a current subject of study and highlighting the importance of and need for this review.

We conclude that, regardless of the theoretical model used, acceptance of technologies by PWD is most strongly related to perceived usefulness, perceived ease of use, and social influence (Blok et al., 2020; D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019; Dirks & Bühler, 2018; Gobeil et al., 2019; Karlsson et al., 2014; Mishra et al., 2023; Turner & Berridge, 2023). Perceived usefulness influences how users perceive the value and practical benefits of adopting a technology, whereas factors such as efficiency gains and a greater perception of usefulness and ease of use promote a greater sense of need for the technology, ultimately resulting in increased usage and acceptance by PWD. Social influence plays an extremely important role in the use and acceptance of technologies by PWD, especially regarding the perceptions of caregivers and family members (Chen & Chan, 2011; Heart & Kalderon, 2013; Heerik et al., 2010; Mitzner et al., 2010). It is also important to note that the applicability of acceptance constructs may vary across stages of dementia. For example, intention to use may be less meaningful in advanced stages, where decision-making capacity is compromised, while constructs such as perceived ease of use and caregiver support would remain highly relevant throughout the progression of the disease. Acknowledging these differences can help tailor technology design and evaluation to the specific needs of individuals at different stages of the neurodegenerative process.

In addition, other constructs have been shown to be potentially relevant and should be considered. Anxiety and other emotions may also play a relevant role, especially in the case of PWD where the pathology itself may imply changes in the psychological and behavioral domains, so their impact should not be overlooked in technology development (Dosso et al., 2022; Koshla et al., 2017; Larnyo et al., 2022; Venkatesh, 2000). Despite the significant impact of perceived adaptability on acceptance, as shown in the studies included in this review, adaptability remains under-researched, with only three articles focusing on it (D'Onofrio, Sancarlo, Raciti, Reforgiato et al., 2019; D'Onofrio, Sancarlo, Raciti, Russo et al., 2019; Di Napoli et al., 2019). This could be a relevant construct in the acceptance of technologies by PWD, as it is a progressive disease that requires flexibility to adapt to the different needs of the person as the disease progresses. Furthermore, access-related factors such as price and privacy issues should be carefully addressed and discussed to avoid negative influences on acceptance (Dosso et al., 2022; Nie et al., 2020; Olsson et al., 2016). Beyond general recommendations regarding user-centered design, our findings suggest that certain constructs hold particular promise for guiding future technology developments in dementia care. Perceived adaptivity can be especially relevant in the context of a progressive condition, as it reflects the ability of technology to flexibly adjust to changing cognitive and functional needs. Similarly, perceived enjoyment can enhance motivation and engagement, supporting sustained use of digital tools. Developers and researchers may prioritize these constructs when designing and testing new interventions for people with dementia.

Despite its innovative nature, this scoping review has some limitations. For example, only articles published in English, Portuguese, or Spanish were eligible for inclusion, and after the review process only articles in English were finally included, which may have introduced some bias and excluded important studies published in other languages. There may also be some publication bias, as studies with positive or significant results are more likely to be published. Furthermore, the review did not include a quality assessment, potentially affecting the reliability and validity of the findings. Many of the articles reported studies with small sample sizes and cross-sectional designs, which makes it difficult to generalize the findings. Some other limitations detected included short duration of studies, issues with gender distribution, and racial homogeneity. In addition, across the included studies we noted recurrent methodological limitations such as small sample sizes, predominantly cross-sectional designs, and limited diversity of participants. These issues should be considered when interpreting the overall evidence base.

Regarding future research, some other constructs scarcely addressed in the articles reviewed may also play an important role in the acceptance of technology by PWD, including perceived enjoyment, perceived adaptability, and trust. These perspectives should therefore also be considered in more detail in future research. In addition, there is a need for larger-

scale longitudinal studies, as well as studies including groups of older adults at various stages of cognitive impairment.

In terms of policy and practical implications, this scoping review highlights the need to apply user-centered methodologies to develop assistive technologies in the context of dementia/cognitive impairment. This should promote usability and acceptability, support the processes of equitable access and dissemination of the technology, and take into account ethical aspects such as informed consent, data management, and accessibility in a multidisciplinary approach that will enable the successful implementation of DHTs.

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Declaration of Conflicting Interests

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

Data Availability Statement

The protocol was registered with OSF (osf.io/yvzd9).

Supplemental Material

Supplemental material for this article is available online.

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