SCHOLARLY REVIEW JOURNAL

E-ISSN: 2996-8380
Published by Leadership & Innovation Lab

SUMMER 2026

Artificial Intelligence Interventions for Alzheimer's Disease Caregivers

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ABSTRACT

Caregivers of Alzheimer's Disease (AD), a neurological disorder, are often family members or close friends who experience constant emotional and psychological burdens. To address this problem, researchers have recently explored artificial intelligence (AI)-based interventions as a means to improve caregivers' well-being. This review examines AI applications, with a focus on three key domains: companionship, learning, and decision support. Based on recent studies, it can be concluded that AI tools, including socially assistive robots (SARs), virtual reality (VR), and conversational robots, help AD caregivers both emotionally and educationally through easier access to information in tough situations. However, limitations persist, including cultural diversity, data privacy, and risk of human judgment and emotional substitution. This paper highlights the importance of personalization and ethical design, particularly associated with AI approaches, to ensure trust and long-term adoption. Overall, the paper claims that when thoughtfully integrated, AI can reduce caregiver stress and enhance caregiving experience without undermining the essential human aspects of care.

Keywords: *Alzheimer's disease, caregiver burden, artificial intelligence, robots, virtual reality, conversational chatbots, stress, data privacy.*

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INTRODUCTION

Caring for a person with Alzheimer's disease (AD) is a demanding, continuous, and emotionally taxing responsibility. As the biological changes of AD progress, daily functioning declines, placing increasing emotional and logistical strain on caregivers.

Symptoms such as loss of cognitive functioning (thinking, memory, and reason) and change in behavioral abilities (daily tasks) begin to progress; individuals with AD require increasing assistance with daily activities, supervision, and emotional support, and usually this crucial job ends up in the hands of either family or professional caregivers.

There are three leading causes of AD: aging (usually, people who are 65 or older have more age-related brain changes that may contribute to Alzheimer's damage); genetics (ε4, a form of the gene apolipoprotein E (APOE), increases the risk of AD); and environmental factors (mainly, maintaining a healthy lifestyle is key) (NIH, 2024). The combination of beta-amyloid plaques and neurofibrillary tangles made from tau proteins in the brain is the main cause of brain cell death (Sehar et al., 2022). These cells are unable to replicate, so as their number decreases, brain activities cannot function properly and thus cause the brain disorder (Wang et al., 2021).

AD caregivers take on the emotional, physical, and time-intensive responsibilities of supporting someone losing their memory and independence. According to Vu et al. (2022), the majority of caregivers are family members or close friends (78%), and they report a significant personal impact: 58% describe extreme stress, 47% report reduced sleep, and 43% feel more socially isolated. In addition to managing patients' daily lifestyles, they also face work pressures, such as switching to a part-time job, leaving early, and taking absences. Most of them are from the middle generation, with parents to take care of and children to look over. There is not much prevalence in the ethnicity of the caregivers, and as the amount of income increases, the likelihood of becoming a caregiver themselves decreases, from 43% of low-income families to 34% of middle- and 23% of high-income families (Vu et al., 2022).

Having recognized the crucial tasks of caregivers, it is essential to consider the strategies that can best support their well-being and reduce severe physical, mental, and social repercussions, which will also ultimately benefit the patients. The complexity and intensity of AD caregiving have led researchers and health technologies to explore how artificial intelligence (AI) could help ease these challenges.

Recent studies have explored AI-based tools designed to support caregivers through emotional assistance, information delivery, and monitoring of daily challenges. For example, Shi et al. (2025a) conducted a

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E-ISSN: 2996-8380
Published by Leadership & Innovation Lab

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study on an AI-based chatbot named Carey, which aims to provide informational and emotional support to caregivers. As stated in the paper, Human-Computer Interaction (HCI) can support their mental health challenges (Shi et al., 2025a). Second, Hasan et al. (2024) explore an innovative approach to optimizing conversational AI for caregivers of individuals with AD and Related Dementias (ADRD), specifically for those without formal medical training. According to Hasan et al. (2024), AI can quickly access and share vast amounts of information about the disease, underlying the benefit and assistance opportunities if this chatbot were possessed by targeted users. Finally, in Subramanian (2024)'s paper, he discussed advancements in technologies for promising ways for AD intervention, including deep learning (DL: analyze complex patterns from large datasets), vision transformers (ViT: for AD detection), natural language processing (NLP: to understand and generate personalized narratives, reminders, and instructions for patients), and machine learning techniques (ML: to make predictions and decisions through data analysis). He also touched on some conversational interventions to address cognitive decline, maximize functional independence, and enhance quality of life. Examples given are a socially assistive robot (SAR), electronic memory aids, mobile health applications, Global Positioning Systems (GPS) tracking devices, and Virtual Reality (VR) (Subramanian et al., 2024). Collectively, these studies all focused on some versions of interactive AI technologies.

However, AI is not good at detecting psychological distress or maintaining memory over time (Shi et al., 2025a). Across studies, there is a risk that increasing reliance on AI tools may unintentionally substitute for human judgment or emotional attunement rather than complement it. Most of the samples are small and tend to generalize their results, making it unclear which caregiving domains are most vulnerable, most in need of support, and most suitable for AI intervention. To address this gap, this review focuses on the question: What are the most promising ways to incorporate AI to reduce mental health and stress in caregivers? By identifying the caregiving tasks and contexts where AI can offer the greatest benefit, this study aims to inform the development of AI or related advancements that truly enhance the caregiving experience.

METHODOLOGY

A systematic literature review was adopted to select papers exclusively retrieved from Google Scholar within a five-year publication timeframe spanning from 2020 to 2025 to ensure recency and updated research findings. Core search keywords included flexible combinations between "Alzheimer's disease," "AI tools," "caregivers," and "AI." The initial literature screening was conducted via abstract evaluation, which yielded a little over 20 relevant papers for full-text assessment. Further rigorous full-text filtering resulted in fewer than 15 papers that were divided into three thematic domains—AI for companionship, learning, and decision support—followed by an evaluation, adhering to a requirement of a minimum of three papers per section.

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AI for companionship

Caregivers of AD commonly experience emotional exhaustion, loneliness, and persistent stress due to continuous supervision and labor. As a result, researchers have explored companionship AI technologies—robots.

A Socially Assistive Robot (SAR) is an AI-powered robot used in healthcare for patients and cargivers (fig. 1). By integrating AI systems into its robotic platform, robots can help automate reminders, encourage engagement in activities, and detect early signs of behavioral shifts associated with worsening dementia. These robots can also use various electronic memory aids such as digital calendars and reminders (Subramanian et al., 2024).

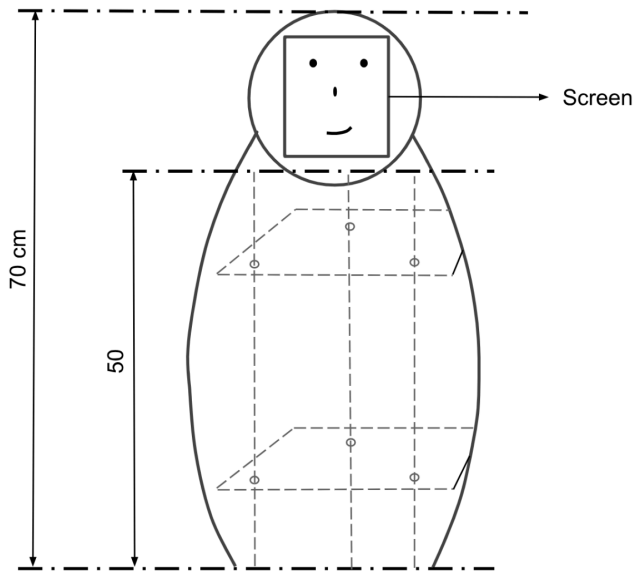

Figure 1. Socially Assistive Design Sketch. Adopted from Koutentakis et al. (2020).

SARs come in various forms and operations, including the NeCoRo, which is a furry cat-like robot that responds to touch, and the Artificial Intelligence Robot (AIBO), which is a non-furry dog robot that operates via voice commands. But these simple pseudo-animal robots made of metal or synthetic fur did not succeed much, as their effects were comparable to just a simple toy inhibiting simple behaviors (Koutentakis, 2020). A

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E-ISSN: 2996-8380
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more successful similar implementation is Paro, which is a robotic baby harp seal. Unlike the previous ones, this robot is equipped with various sensors that allow it to respond to various types of interactions with caregivers and AD patients. Other forms of SAR include the humanoid chassis Nao, the Ryan Companion-bot (Koutentakis, 2020), and Pepper, a 1.2 m tall robot with a tablet in its chest; the psycho-education program combined with a range of sensors and 6 modules—AD and caregiving, safety information, healthy lifestyle guide, stress and relaxation, caregiving challenges, and local resources—makes it appropriate and acceptable (Yuan et al., 2021).

SARs with more human-like features tend to receive higher user acceptance, likely because they are physically more closely relatable and technologically better programmed to support emotional engagement and sustained interaction, which are critical for both patients and caregivers (Koutentakis, 2020).

Robots, specifically SARs (*see* Table 1), reduce the emotional and supervisory demand placed on caregivers, allowing them moments of rest and reducing their overall stress. Being always available, they also become a reliable source of help and a trustworthy buddy.

Table 1. Comparison between different SARs.

	Appearance	**Interaction Style**	**Level of Engagement**	**General Effectiveness**
NeCoRo (Koutentakis 2020)	Furry, cat-like	Touch-based	low	Effects similar to simple toys, minimal therapeutic benefit
AIBO (Koutentakis 2020)	Non-furry, dog-like	voice commands	low	
Paro (Koutentakis 2020)	Soft, baby harp seal	multi-sensor	moderate	Widely accepted, showing a reduction in stress levels
Pepper (Yuan et al., 2021)	1.2 m tall, humanoid	multi-sensor	high	Highly accepted, supports care and engagement

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AI for learning

Training and ongoing learning are essential for AD caregivers, who constantly adapt to changing behavior, safety needs, and emotional challenges. Traditional training methods, such as in-person lectures, books, and video tutorials, are often passive and poorly matched to real-life caregiving scenarios. AI, particularly through virtual reality (VR) learning environments and chatbot guidebooks, offers a more dynamic and immersive approach to caregiver education.

VR offers immersive environments primarily tailored to caregivers' emotional well-being and learning. VR can mimic real-life situations in a familiar, personally connected environment, sparking conversation, lifting mood, and strengthening identity when caregivers recognize and learn from them. By creating interactive environments, VR replicates daily life activities and enhances cognitive stimulation and relaxation (Subramanian et al., 2024). Furthermore, VR offers caregivers temporary immersion in controlled environments that can reduce acute stress and support emotional regulation, particularly during periods of heightened caregiving strain. This AI tool also provides opportunities for empathy-building training—allowing them to simulate what it feels like to live with dementia—ultimately improving the quality of care they provide. According to Al-Rajab et al. (2025), training on the platform that used VR tools shows a potential reduction of isolation and a boost in engagement, as participants reported around 30% higher session duration and overall performance.

Other than VR, there are also chatbots developed using a large language model. These chatbots, designed mainly for caregivers' educational purposes, consist of a 30-day guidebook—a resource based on a validated training manual for dementia caregivers—that enhances the quality of answers and trust among users; instead of being involved in decision-making, they simply provide information and advice (Cheng & Ng, 2025). The study by Cheng and Ng (2025) reported that positive dementia caregiving in 30 days (PDC30) supported caregivers in situations of human unavailability, thereby giving caregivers moments to improve the overall rhythm of care. And thus, offering them a basic understanding of emergencies.

In conclusion, AI (*see* Table 2) can connect therapeutic and social support all within a secure and data-protected platform by simulating exercise tasks and providing resources.

Table 2. Comparison between two AI tools for learning.

	VR (Subramanian et al., 2024) and (Al-Rajab et al., 2025)	**AI Chatbots (Cheng & Ng, 2025)**
Purpose	Training and stress relief	Education and guidance

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E-ISSN: 2996-8380
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Interaction	Immersive, simulated experiences	Text-based conversation
Learning style	Experiential	Informational
Emotional support	High: relaxation and empathy-building	Moderate: reassurance and advice
Accessibility	Require VR	Easy access on common devices
Overall benefit	Improves empathy and engagement	Provides continuous support and knowledge

AI for decision support

Caregivers of individuals with AD regularly face complex decisions involving behavioral management, safety risks, medication routines, and emotional crises. Since many lack professional training, AI-based decision support systems emerge as powerful tools that provide timely help and effective advice, providing caregivers with emotional and informational support.

The first example of conversational AI for caregivers is the chat platform Carey, a GPT-4o-based chatbot designed specifically for family caregivers of people with dementia. It supports by providing practical strategies during crisis management and offers specialized guidance during moments of emergency and confusion (Shi et al., 2025a). As a result of the study (Shi et al., 2025a), it was shown that nearly all participants, 93.75%, found the prototype Carey to be very helpful in addressing mental health challenges, one of the priorities of health problems regarding caregivers. The chart (*see* Table 3) illustrates that emotional distress is the most popular reason why participants interacted with Carey. Underscoring their desire for AI tools that are not only empathetic but also trustworthy.

Table 3. Summary of participants' interaction with Carey (adopted from Shi et al., 2025a).

Scenario	# Participants	# Interactions
Lack of support	2	4
Low self-efficacy	3	6
Relationship tensions	5	11

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E-ISSN: 2996-8380
Published by Leadership & Innovation Lab

SUMMER 2026

Emotional distress	12	28
Compassion fatigue	4	9
Lack of self-care	5	8

Similarly, the conversational AI system ADQueryAid can address diverse real-world caregiving challenges through tailored and contextually relevant support. It combined personalized patient information from a knowledge graph with its programmed knowledge to formulate the best recommended solution (Hasan et al., 2024). Furthermore, the comparison of the usability chart between ADQueryAid and ChatGPT (Table 4) reveals that overall, the former received a more positive user experience, especially excelling in key areas of usability aspects, including personality, purpose clarification, and response quality (Hasan et al. 2024).

Table 4. Usability comparison based on Chatbot Usability Questionnaire (adopted from Hasan et al., 2024).

Question	**ChatGPT 3.5**	**ADQueryAid**
Q1: The chatbot's personality was realistic and engaging	3.5	4.4
Q2: The chatbot seemed too robotic	2.4	1.7
Q3: The chatbot explained its scope and purpose well	3.7	4.3
Q4: The chatbot was easy to navigate	4.2	4.5
Q5: The chatbot understood me well	3.8	4.5
Q6: The chatbot failed to recognize a lot of my inputs	2.0	1.5
Q7: Chatbot responses were irrelevant	2.4	1.7
Q8: The chatbot was very complex	1.9	1.6

Bosco et al. (2025) conducted a test around Lola, a system that includes three different models of interaction: a touch screen app format, texting with an AI chatbot, and a voice assistant. This application facilitates access to information and text inputs and concludes with themes related to multimodality and cultural specificity. So, for example, Black American caregivers need equitable access to what generative AI tools offer. This multimodality would bring in a larger audience, allowing various users to choose their own

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contextually and culturally relevant ADRD information that is specific to their communities and personalized based on their needs and preferences.

These chat platforms lighten caregivers' burden by offering guidance when professional help isn't immediately available and companionship when they feel isolated from society. One of the most important needs of these tools is that they have to be trustworthy, personalized, and transparent in design to ensure that they can truly support caregivers rather than putting them on human judgment.

Table 5. Comparison between AI tools that help decision-making.

Platform	**Carey (Shi et al., 2025a)**	**ADQueryAid (Hasan et al., 2024)**	**Lola (Bosco et al., 2025)**
Primary Role	Supports caregivers during crises and emotional distress	Provides personalized caregiving recommendations	Improves access to caregiving resources
Interaction Format	Text-based conversational AI	Conversational AI integrated with patient data	App interface, text chatbot, and voice assistant
Type of Support	Emotional reassurance and practical coping strategies	Informational and decision-support guidance	Informational and navigational support
Key Advantage	High user trust and strong mental health support	High usability and tailored, context-aware responses	Multimodal access and cultural inclusivity

EVALUATION

Although AI technologies show strong potential to support AD caregivers, the current level of research reveals significant limitations and important considerations for future development.

Many existing AI tools focus primarily on assistance in daily living activities; however, a limited number of specific activities are targeted. In papers, qualitative research methods such as interviews and observations prevail over data evidence. From the 30 studies, Xie et al. (2020) found that even though many accepted AI

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tools, they still reported finding those tools challenging to use at a larger scale. Despite promising usability, SARs face significant barriers to long-term adoption, including cost, commercial viability, and sustained caregiver engagement in home-based settings, which is the reason why they are still under current research and refinement (Subramanian et al., 2024).

Another concern of AI applications is information quality and reliability. Shi et al. (2025a) caution that chatbots may introduce biases that could lead to unequal and inappropriate guidance, especially when applying them in diverse populations with differing cultural and linguistic needs. Saha et al. (2025) further emphasize that current AI systems often lack personal narratives, shared experiences, and meaningful back-and-forth conversations, which limit their usefulness, especially for caregivers' emotional support.

Shi et al. (2025b) also identify several essential features that AI caregiving tools must have to be effective: affordability and accessibility, usability and personalization, and credibility. Without these elements, caregivers may struggle to fully integrate AI tools into their daily routines. This aligns with broader findings that personalization is crucial. However, Milella et al. (2023) worry about the potential of AI solutions bringing in security and privacy issues, specifically thinking about all the data that the AI is collecting from the users. This also connects with what Koutentakis et al. (2020) said about robots that must include facial expression recognition so that they are able to respond to emotions accordingly.

In the future, improvements can be made through considerations of programming AI in a more human-resemblant way, such that it is more personalized. Take Subramanian et al.'s (2024) discussion about the explainable AI (XAI) techniques, which aim to provide transparent models and insights into how they help clinicians and researchers. Different from normal AI, XAI methods provide more comprehensive interpretations. Being more emotional and more personal, XAI is more likely to gain trust when in application (fig. 2) because the kind of response it gives is more first-person and shows more empathy rather than just asking monotonous questions.

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E-ISSN: 2996-8380
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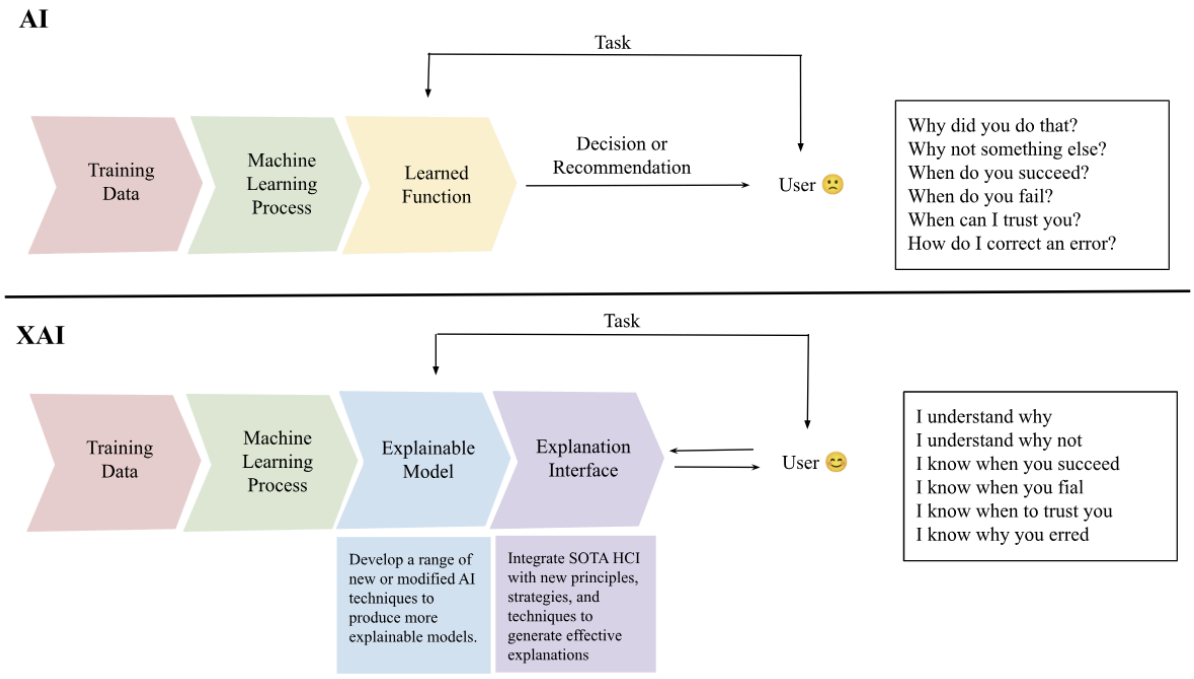

Figure 2. Comparison between AI and XAI where a health worker gains trust with XAI. Adopted from Subramanian et al. (2024)'s paper.

AI can enhance daily productivity, quality of life, and well-being while reducing burden. Beyond technical optimization, future research required expanded and systematic investigation to address current research gaps. First, most existing AI tools are only tested in limited home care scenarios, so further research should promote the validation of these interventions in wider caregiving environments. Second, current studies rely too heavily on small-scale qualitative feedback, and therefore future research should collect large-scale multidimensional user data to optimize AI inclusion in caring. And most importantly, the usability experience reported should expand to long-term psychological outcomes through follow-up evaluations of key caregiver health indicators, including stress and depression levels, sleep quality, and anxiety symptoms, all of which are a comprehensive assessment of the practical effect of AI interventions. Future research needs to be done with the help of caregivers because they are able to provide feedback (Habibi et al., 2024).

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E-ISSN: 2996-8380
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CONCLUSION

The paper focused on AI interventions for AD caregivers, emphasizing the burdens they encounter while going through the caregiving journey. I divided the papers read into three main subtopics: companionship, learning, and decision support. Each of them contributes to strengthening the emotional well-being of the caregiver by offering consistent companionship and support, intellectual resources, and practical guidance; however, ongoing research still has to go forward to better match caregivers' needs. This study aims to solve or at least reduce the stress and emotional disruption of caregivers, putting focus on AI interventions specifically. In summary, while current AI tools demonstrate promising auxiliary effects to caregivers, subsequent research should broaden application scenarios, enrich multi-source user data collection, and carry out long-term psychological outcome assessments. As AI continues to develop, future research must prioritize caregiver-centered design to ensure these technologies meaningfully support human care rather than complicate it.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my research supervisor. Dr. Jamie Knight (instructor and researcher, University of Victoria, Canada) and research advisor Sultan Mussakhan (Ph.D. candidate, Brock University, Ontario, Canada).

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