

Redefining Elderly Care With Agentic AI: Challenges and Opportunities

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The authors also provide a companion interactive dashboard at <https://hazrat.ali.github.io/agenticai/>.

ABSTRACT The global ageing population necessitates new and emerging strategies for caring for older adults. In this article, we explore the potential for transformation in elderly care through Agentic Artificial Intelligence (AI), powered by Large Language Models (LLMs). We discuss how Agentic AI facilitates proactive, autonomous decision-making in elderly care. Personalized tracking of health, cognitive care, and environmental management, all aimed at enhancing independence and high-level living for older adults, represents important areas of application. With the potential to significantly transform elderly care, Agentic AI also raises profound concerns about data privacy and security, decision independence, and access. We share key insights to emphasize the need for ethical safeguards, privacy protections, and transparent decision-making. Our goal in this article is to provide a balanced discussion of both the potential and the challenges of Agentic AI, and to offer insights into its responsible use in elderly care, aligning it with the requirements and vulnerabilities specific to the elderly. Finally, we identify the priorities for the academic research communities to achieve human-centred advancements and integration of Agentic AI in elderly care. To the best of our knowledge, this is one of the first comprehensive studies explicitly focused on LLM-based Agentic AI for elderly care. Hence, we address the literature gap by analyzing the unique capabilities, applications, and limitations of LLM-based Agentic AI in elderly care.

INDEX TERMS Agentic AI, digital health innovations, elderly care, healthcare AI, large language models, medical artificial intelligence.

I. INTRODUCTION

The United Nations projects the global population to reach approximately 10.4 billion by 2086, before starting a slow decline to about 10.3 billion by 2100 [1]. Estimates for the near future indicate that by 2030, one in six people worldwide will be over 65, with this number expected to double by 2050 [2]. The global rise in ageing populations presents a significant challenge for healthcare and social care systems, emphasizing the urgent need for innovative solutions in elderly care.

For instance, according to the Institute for Fiscal Studies¹ report [3], the adult social care system in England faces

significant challenges that demand innovative solutions. In England, the £24.5 billion in funding allocated to adult social care for 2024-25 accounted for 40% of local authority budgets. Of this, approximately half of the budget is spent on supporting services for adults aged 65+. Demand for care services among working-age adults grew by 18% between 2014-15 and 2022-23, outpacing population growth by almost 3 times. Despite significant growth in the older population, state-funded care for older people has decreased by 10% since 2014-15 due to tightened eligibility criteria [3]. Moreover, in the United Kingdom, the number of care worker visa applications has decreased significantly, from 18,300 in August 2023 to 2,300 in August 2024, driven by the new

¹<https://ifs.org.uk/>

dynamics surrounding immigration policy for U.K. care worker visas. The Office for Budget Responsibility² projects that U.K.-wide public spending on adult social care would need to increase by 3.1% annually in real terms over the next decade.

Globally, the demographic shifts and increasing longevity are also contributing to the evolving needs of the ageing population worldwide [4]. By 2050, the global population aged 60 and above is projected to double from 1 billion to 2.1 billion, with the number of people aged 80 and above expected to triple, rising to 426 million. This demographic shift brings with it a surge in demand for comprehensive care services, as an increasing number of older adults require assistance with daily living activities and management of chronic health conditions. Notably, the majority of older adults (up to 80% by 2050) will reside in low- and middle-income countries, where healthcare infrastructure and social support systems often lag behind those in developed economies [4]. According to a recent WHO report [5], fewer than 60% of countries have integrated long-term care into their national geriatric care frameworks, leaving significant gaps in service provision. This care crisis is further exacerbated by workforce shortages and the rising number of older adults living alone, particularly in regions with shrinking family structures. As a result, millions of seniors experience unmet care needs, affecting their independence and quality of life.

These increasing challenges and concerns emphasize the urgent need for innovative AI-driven solutions that can autonomously address pervasive issues such as loneliness, cognitive decline, and complex health management in the elderly population [6]. The prevalence of mental health conditions, such as anxiety and depression, has underscored the need for innovative therapeutic interventions. Non-pharmacological treatments, including Dance Movement Therapy (DMT), have shown promise in improving mental health. Recent studies have explored the potential of non-pharmacological therapies in extended reality (XR) environments, particularly in the context of mental health. For example, in [7], the author investigates integrating the DMT into XR, aligning with our focus on immersive mental health therapies. Similarly, in [8], the author reviews various non-pharmacological interventions, reinforcing the relevance of XR technologies in providing accessible, personalized therapeutic experiences.

The growing global interest in AI for elderly care reflects a trend toward addressing elderly care challenges with AI-powered solutions. For example, the global elder care assistive robots market is projected to grow at a robust compound annual growth rate (CAGR) of approximately 14.8% from 2024 to 2030 [9]. Similarly, the AI-powered solutions segment within elderly care is expected to achieve a CAGR of approximately 9.73% from 2025 to 2030, reaching a market value of around USD 2250 million by 2030 [10]. This has resulted in a market expansion from an estimated USD 1782.60 million in 2024 to an anticipated USD 2636.08 million by 2030, as

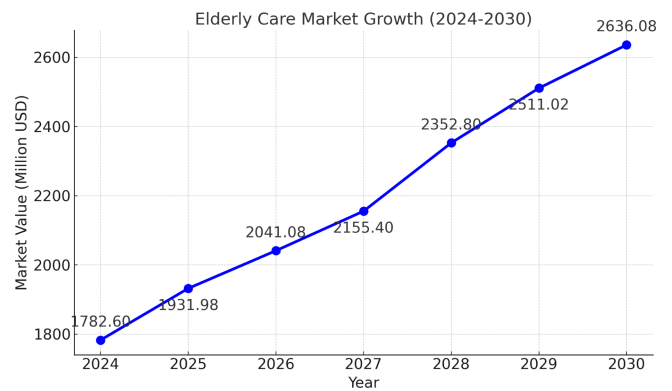


FIGURE 1. Projected growth of elderly care trends by 2030.

shown in Fig. 1. This strong growth in assistive robots is driven by caregiver shortages and by increasing investments in AI-powered robotic aides that provide mobility assistance, medication reminders, companionship, and cognitive support to the elderly. Furthermore, these trends reflect the rising demand for personalized, AI-enabled solutions for elderly care, to support the complex health needs of the ageing population.

Addressing these evolving needs requires a fundamental transformation of care systems, moving towards integrated, person-centered, and accessible solutions. The World Health Organization (WHO) calls for a radical shift in how societies value and deliver elderly care, emphasizing the importance of seamless integration between health and social services, support for informal caregivers, and accountability at all levels of governance [11]. While previous technological interventions, such as telehealth services and assistive devices, have attempted to address these challenges, they often lack the much-needed personalization and adaptability [12]. As a response, agentic AI and LLMs are being explored as viable tools to mitigate gaps by providing personalized health monitoring, cognitive support, and companionship. Agentic AI can provide personalized companionship, cognitive stimulation, and health monitoring, addressing these issues more effectively than traditional technologies. Unlike earlier interventions, Agentic AI can learn, adapt, and make autonomous decisions, offering a paradigm shift in how care is conceptualized and delivered. These systems can offer tailored support, from managing daily activities to providing cognitive engagement and health monitoring, potentially revolutionizing the approach to caring for an ageing population. Nonetheless, the successful adoption of Agentic AI must be underpinned by principles of equity, inclusivity, and responsiveness to the diverse needs and vulnerabilities of ageing populations.

A. THE AGENTIC AI REVOLUTION AND LLMs

Agentic AI revolutionizes elderly care by combining autonomy with advanced language capabilities, enabling meaningful engagement and dynamic adaptability. Unlike traditional AI, which follows predefined instructions, Agentic AI acts proactively to achieve specific goals. For instance, an Agentic

²<https://obr.uk/>

AI model can tailor its interactions to an individual's communication style while engaging in human-like conversations, fostering a personalized and empathetic relationship. Additionally, Agentic AI improves informational trustworthiness through advanced cognitive reasoning, reducing the likelihood of errors and ensuring that decisions are based on reliable data sources.

According to Taha et al. [13], by 2025, global data generation is expected to exceed 180 zettabytes, with healthcare contributing over one-third. Currently, only 3% of this data is effectively utilized, often due to system inefficiencies. A significant advantage of Agentic AI lies in its ability to process and seamlessly integrate vast amounts of healthcare data, including data from wearable devices, electronic medical records, and smart home systems. For example, it can monitor health metrics in real-time, flag critical changes, and coordinate care plans, providing caregivers with actionable insights while enhancing patient well-being. Agentic AI's chaining capabilities allow it to break down complex problems into actionable steps, offering scalable solutions in elderly care [14]. For instance, it can autonomously manage tasks like medication reminders, adjust communication styles for individuals with cognitive impairments, and notify caregivers of emerging health risks. Notably, Agentic AI may streamline care procedures and workflows by automating scheduling and triaging high-risk cases, thus potentially reducing missed care rates, as seen in oncology studies [15].

However, as Agentic AI systems grow more autonomous, the associated ethical challenges, such as accountability, privacy, and safety, also increase. Robust measures, including human-in-the-loop mechanisms and compliance with standards such as HIPAA and GDPR, must be in place to ensure reliability. With such safeguards, Agentic AI empowered by LLMs has the potential to redefine elderly care by offering a blend of personalized engagement, proactive healthcare management, and emotional support, enhancing both independence and quality of life for older adults.

Although Agentic AI is not a new concept, its recent rise in popularity can be attributed to the rapid development of LLMs, which have significantly enhanced its capabilities, particularly in healthcare [16]. These advancements allow Agentic AI systems to function as intelligent conversational agents, capable of understanding complex instructions and engaging in natural conversations. For example, a McKinsey report indicates that AI technologies, including agentic systems, could potentially create \$2.6 trillion to \$6.2 trillion in value annually in 16 business functions, including healthcare, by optimizing operations or improving patient outcomes.

Modern LLM-based platforms³ exemplify these capabilities, facilitating real-time responsiveness, adaptiveness to individual user needs and context, nuanced comprehension, and task automation. Additionally, models like Anthropic's

Claude and Meta's LLaMA are designed to understand nuanced queries and engage in more sophisticated dialogues. Furthermore, recent surveys indicate growing confidence among healthcare professionals that AI will significantly enhance their ability to provide patient care within the next five years [17]. This adaptability and responsiveness make Agentic AI an invaluable tool for improving user experiences and operational efficiency across diverse applications, particularly in the care sector, where timely, accurate information is crucial.

B. SCOPE OF THE ARTICLE

In this article, we explore the potential of LLM-based Agentic AI to revolutionize elderly care, examine its applications and challenges, and highlight its ethical implications. Specifically, we discuss the role of Agentic AI as autonomous caregivers, meeting the complex needs of older adults through personalized interactions, health monitoring, and cognitive support. The discussion encompasses both the technical aspects of LLM-based Agentic AI, including recent advancements in model fine-tuning and multimodal integration, as well as their practical applications in enhancing elderly care. Our analysis also extends to the economic and workforce landscape of the elderly care industry, highlighting how Agentic AI can help mitigate challenges such as staffing shortages and operational inefficiencies. Drawing on interdisciplinary insights and emerging evidence, we propose a balanced approach that aligns technological innovation with the specific needs and vulnerabilities of the elderly while addressing critical ethical concerns, including data privacy, algorithmic bias, and equitable access to AI-driven care solutions.

C. KEY CONTRIBUTIONS

To the best of our knowledge, this is one of the first-ever studies to present a comprehensive interdisciplinary overview of the role of LLM-based Agentic AI in elderly care. The key contributions of this work are summarized as follows:

- We present a detailed overview of LLM-based Agentic AI and its potential applications in elderly care, highlighting its autonomous and proactive decision-making capabilities for personalized health management, cognitive support, and emotional companionship for older adults.
- The adoption of Agentic AI in elderly care brings challenges for all the stakeholders. Hence, we identify and discuss key challenges and potential solutions to integrating Agentic AI into elderly care settings.
- We share key insights and lessons learned from implementing LLM-based Agentic AI in elderly care, emphasizing the need for ethical safeguards, privacy protections, and transparent decision-making.
- Lastly, we address a gap in current literature by analyzing the unique capabilities, applications, and limitations of LLM-based Agentic AI in elderly care, distinguishing it from other AI technologies.

³Few popular examples include ChatGPT, Gemini, Claude, DeepSeek, Grok. The provision of a complete listing is not the objective of this text.

- We provide an interactive companion dashboard for readers, with the intention of updating it with additional scholarly resources on agentic AI in elderly care. The dashboard is accessible at <https://hazratali.github.io/agenticaai/>

D. RELATED REVIEWS

Recent years have seen a surge in reviews exploring the intersection of AI and elderly care, reflecting the growing interest in leveraging advanced technologies to address the complex needs of ageing populations. For instance, Ma et al. [18] discuss the types of AI technologies used in elderly healthcare, such as machine learning (ML), natural language processing (NLP), and robotics, and their applications in health monitoring, smart homes, and therapeutic interventions. The survey also highlights the potential of these technologies to enhance operational efficiency, as well as the associated challenges, such as digital literacy and ethical concerns, providing a comprehensive mapping of the AI landscape in elderly care. In [19], Loveys et al. discuss the acceptability and effectiveness of AI-enhanced interventions for older people receiving long-term care services. It synthesizes evidence on interventions using social robots, environmental sensors, and wearable devices, revealing mixed outcomes across different health domains and emphasizing the need for more rigorous evaluation of user experience and clinical impact.

Exploring the human side, Wong et al. [20] discuss older adults' perspectives and acceptance of AI-driven health technologies. This survey investigates key aspects, including attitudes, facilitators, and barriers to adoption, such as perceived usefulness, ease of use, privacy concerns, and the importance of user-friendly design. Using frameworks such as the COM-B model, the study provides actionable strategies to improve technology uptake among seniors. Additionally, in a policy-focused review, Zhao et al. [21] discuss the integration of AI into social elderly care services, particularly in China. The review analyzes the current landscape, identifies key challenges in AI integration, and proposes policy recommendations to support efficient and equitable care delivery amid demographic shifts and resource constraints.

Despite the breadth of existing surveys, a notable gap remains in the literature regarding the specific role of Agentic AI in elderly care. Most prior reviews have treated AI as a broad field, without distinguishing the unique capabilities and challenges of Agentic AI - such as autonomous reasoning, proactive decision-making, and multi-agent collaboration. Our work addresses this gap by offering a focused analysis of how Agentic AI, powered by LLMs, can redefine elderly care across domains such as personalized health management, cognitive support, and companionship. We critically examine the ethical, technical, and practical challenges specific to Agentic AI and propose a framework for their responsible integration that prioritizes human-centered design and safeguards for vulnerable populations. This targeted approach not only bridges a crucial gap in the literature but also lays the groundwork for the safe and effective adoption of

Agentic AI in the care of ageing populations. Table 1 summarizes key differences between prominent related surveys and the present work.

II. APPLICATIONS OF AGENTIC AI IN ELDERLY CARE

Agentic AI is emerging as a transformative solution to the multifaceted challenges of elderly care, offering personalized, autonomous decision-making capabilities to enhance the quality of life for older adults. Advanced LLM-based chatbots utilize transformer architectures and self-attention mechanisms to generate contextually relevant, human-like language [22]. Beyond basic conversational interfaces, LLM-based Agentic AI can be fine-tuned for specialized tasks using techniques such as incremental pre-training (IPT) and supervised fine-tuning (SFT), enhancing task-specific performance in elderly care scenarios. For example, Sun et al. [23] demonstrated the fine-tuning of LLMs with IPT and SFT, achieving impressive precision and F1 scores of 86.78% and 86.21%, respectively, in elderly care tasks. Fig. 2 presents a comprehensive overview of the applications of Agentic AI in elderly care.

The integration of Agentic AI in elderly care focuses on enabling independence and fostering cognitive engagement [24]. Such systems can help older people schedule routine appointments, manage smart home controls, and access online services, thereby offering greater autonomy in activities of daily living, especially for individuals who require routine assistance [25]. Agentic AI can effectively engage older adults in interactive activities, such as storytelling, quizzes, and cognitive exercises, contributing to sustained cognitive resilience in ageing populations. For example, LLM-powered virtual assistants can deliver personalized support, offer cognitive enrichment, and even predict emotional shifts based on language patterns, which can help in tailoring care plans to individual needs [26]. These capabilities enable the development of AI-driven nursing assistants capable of real-time patient monitoring, personalized interventions, and specialized task execution.

The potential of Agentic AI in elderly care is further exemplified by its ability to provide personalized care insights, support clinical decision-making, and contribute to predictive analytics in healthcare management for older adults [27]. Building on these capabilities, recent frameworks that combine retrieval-augmented generation (RAG) with foundation model fine-tuning have shown promising results in developing Caregiving Language Models (CaLMs) tailored for dementia care [28]. These models, as promising solutions, combine the retrieval of relevant data (such as medical histories and recent research) with the generation of personalized responses or actions [29]. For example, in customized health assistance, a RAG-based model could retrieve relevant health information from a patient's records and generate tailored care recommendations based on the individual's medical history [30].

In the following subsections, we highlight the potential applications of Agentic AI in elderly care.

TABLE 1. Comparison of the Presented Work With Related Review Articles

Survey/Review Title	Focus Area	AI/LLM/Agentic AI Scope	Challenges Addressed	Key Contributions
AI in Elderly Healthcare: Scoping Review (2023) [18]	General AI applications in elderly care	Broad AI, not LLM-specific, does not cover Agentic AI	<ul style="list-style-type: none"> • Data interoperability issues • Low digital literacy among the elderly • Privacy and ethical concerns 	<ul style="list-style-type: none"> • Cataloged AI tools in elderly care • Highlighted ethical and practical barriers • Provided overview of smart homes and health monitoring
AI-Enhanced Interventions in Long-Term Care (2022) [19]	Effectiveness of AI in long-term care settings	Robotics, sensors, basic ML, does not cover LLMs or Agentic AI	<ul style="list-style-type: none"> • Workflow integration challenges • Sensor/data reliability limitations • Difficulty measuring outcomes 	<ul style="list-style-type: none"> • Synthesized evidence on AI interventions in long-term care • Evaluated user experience • Identified gaps in clinical outcomes research
Older Adults' Acceptance of AI Technologies (2025) [20]	User perspectives and adoption factors	General AI, not LLMs or Agentic AI	<ul style="list-style-type: none"> • Usability and trust issues • Cognitive and interaction barriers • Concerns over privacy and autonomy 	<ul style="list-style-type: none"> • Explored older adults' attitudes toward AI • Identified adoption barriers and facilitators • Used behavioral models for analysis
AI in Social Elderly Care Services (Policy Analysis) (2024) [21]	Regional integration of AI in social care	General AI, not LLMs or Agentic AI	<ul style="list-style-type: none"> • Policy and regulatory gaps • Resource and equity constraints • Governance and accountability issues 	<ul style="list-style-type: none"> • Analyzed policy frameworks for AI in social care • Provided region-specific recommendations • Addressed resource and governance issues
Redefining Elderly Care with Agentic AI (Ours)	Agentic AI for elderly care transformation	Agentic AI (autonomous, proactive, multi-agent), focus on LLM-based Agentic AI	<ul style="list-style-type: none"> • Reliability and misinformation risks • Data privacy, bias, and fairness • Explainability and regulatory compliance 	<ul style="list-style-type: none"> • Focuses exclusively on Agentic AI and its unique capabilities • Critically examines proactive, autonomous, and multi-agent LLM applications • Addresses specific ethical, technical, and adoption challenges of LLMs • Proposes a comprehensive, human-centered framework for responsible integration • Bridges the gap in literature by offering a forward-looking, LLM-centric perspective

A. COMPANIONSHIP AND EMOTIONAL SUPPORT

In older age, the loss of partners and friends and reduced mobility are common challenges that badly affect their mental and physical health. In such cases, companionship and emotional support are critical for maintaining their mental and emotional well-being. Recently, LLMs have been used to combat loneliness and social isolation among seniors by functioning as conversational agents. OpenAI’s ChatGPT and Google’s LaMDA are prime examples of AI tools that can engage in meaningful conversations, share stories, and even play interactive games [31]. These systems employ advanced natural language understanding techniques to recall past interactions, adjust their tone and style to the user’s preferences, and offer consistent emotional support. For instance, in [32],

ChatGPT has offered empathetic responses that are often rated higher in quality than those provided by human physicians.

One notable application is the use of Agentic AI for personalized reminiscence therapy. By integrating with datasets containing personal history or preferences, models like LLaMA can curate tailored content such as music, photos, or stories from a senior’s past. This approach not only improves mood but also enhances communication skills and fosters a sense of connection [23]. Additionally, AI-powered systems built on top of LangChain architecture have been deployed to create interactive workshops where seniors participate in group activities led by virtual assistants. These workshops stimulate cognitive function while simultaneously fostering social engagement [33].

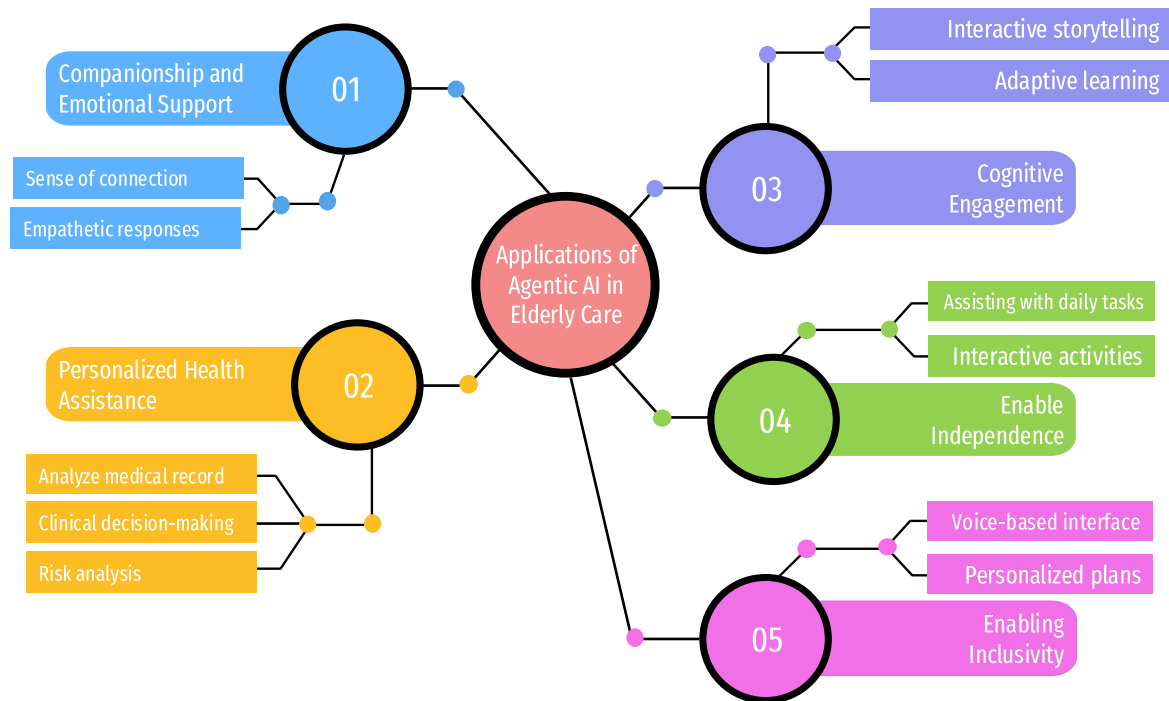


FIGURE 2. Applications of Agentic AI in Elderly Care. Applications are organized into four broad categories in the context of the activity. (i) Enabling independence, (ii) Companionship, (iii) Assistance in healthcare decision-making, (iv) Cognitive engagement, (v) Enabling inclusivity.

B. PERSONALIZED HEALTH ASSISTANCE

Agentic AI is emerging as a pivotal tool in providing personalized health assistance. Models like ChatGPT and GLM4, when fine-tuned for medical applications, can analyze medical records, monitor vital signs through wearables, and provide real-time insights into health markers [34]. For instance, ChatGPT has been utilized to support clinical decision-making around medication management for older adults. Similarly, the effectiveness of GLM4 has been demonstrated in patient monitoring tasks by leveraging supervised fine-tuning (SFT) techniques tailored for elderly care [35].

LLMs can empower Agentic AI to excel at predictive healthcare management. AlayaCare’s LLM-based intelligent assistant integrates predictive algorithms to identify patients at risk of hospitalization using clinical data such as comorbidities and prior falls [23]. This proactive approach enables caregivers to intervene early, reducing adverse events such as emergency room visits or preventing avoidable hospitalizations. Furthermore, dietary recommendations powered by LLMs can be customized for conditions like diabetes or hypertension by analyzing an elderly individual’s health profile and suggesting tailored nutritional guidance, such as recommending a DASH⁴ diet plan or maintaining the glycemic index scoring [31]. These capabilities demonstrate how Agentic AI can enhance preventive care while reducing the burden on healthcare providers.

⁴DASH: Dietary Approaches to Stop Hypertension

C. COGNITIVE ENGAGEMENT

LLMs are enhancing cognitive stimulation for the elderly through personalized activities designed to maintain mental sharpness. Models like OpenAI’s ChatGPT have been used to create interactive storytelling sessions where seniors contribute to narratives or solve puzzles collaboratively [31]. These activities target specific cognitive functions, such as memory retrieval and problem-solving, while entertaining. Additionally, the LLM-based agents have been employed to develop adaptive learning modules that adjust difficulty levels based on the user’s cognitive performance [23].

Another innovative application is the use of Agentic AI tools in enabling context-aware social engagement, for example, through virtual book clubs or discussion groups. For example, Meta’s LLaMA can facilitate discussions about literature or current events, tailoring the conversation’s complexity to participants’ cognitive abilities. This not only stimulates intellectual engagement but also fosters social interaction among group members [36]. Moreover, Agentic AI can assist in memory therapy by curating multimedia content from a senior’s life history, such as photos, music, and personal autobiography notes, helping them reconnect with memories and delay cognitive decline. Similarly, for cognitive engagement, RAG models can retrieve cognitive exercises or activities that align with the elderly person’s cognitive state and preferences, thus ensuring a more engaging and personalized experience [37].

D. ENABLING INDEPENDENCE

Agentic AI is empowering seniors to maintain independence by assisting with daily tasks and decision-making. Multimodal AI systems integrate voice, text, and visual inputs to create intuitive interfaces that cater to diverse needs [38]. For example, these systems can help seniors schedule appointments, manage medication reminders, or navigate online services with minimal assistance. A notable development is the integration of Agentic AI with smart home technologies. By connecting to the Internet of Things (IoT) devices, platforms such as AlayaCare's smart assistant enable dynamic environmental control, such as lighting or temperature adjustments based on real-time preferences and behavioral cues [39]. Additionally, these systems can proactively identify needs, for instance, ordering groceries when supplies are low, or guide seniors through complex tasks, such as online banking, using step-by-step instructions. Such applications not only enhance day-to-day autonomy but also serve to narrow the digital divide, empowering older adults to engage confidently with technology. For example, if a senior experiences discomfort due to room temperature, the Agentic AI can automatically trigger temperature adjustments, offering comfort and convenience.

The agentic capabilities of Agentic AI in elderly care go beyond environmental control, encompassing proactive health monitoring and decision-making. These systems can analyze data from wearable devices and home sensors to detect potential health anomalies, automatically scheduling medical appointments or alerting caregivers when unusual patterns are detected [40]. Services like SeaX Voice AI demonstrate how AI can conduct thousands of automated check-in calls, monitor seniors' well-being, and provide immediate follow-up when responses are received. Furthermore, Agentic AI is revolutionizing cognitive engagement for seniors by creating personalized mental stimulation activities tailored to individual cognitive abilities and interests. These AI systems can design interactive storytelling sessions, memory games, and adaptive learning experiences that help maintain mental acuity and potentially slow cognitive decline [41]. By remembering past interactions and preferences, Agentic AI can create increasingly sophisticated and meaningful engagement strategies that not only provide mental stimulation but also offer emotional support. As these technologies continue to evolve, they promise to enhance the independence, safety, and overall quality of life for older adults, addressing critical challenges in elderly care such as social isolation, healthcare management, and maintaining cognitive function.

E. ENABLE INCLUSIVITY

AI voice agents, powered by LLMs, are poised to revolutionize elderly care by enabling natural, real-time conversational interactions that extend the reach and capacity of healthcare systems [42], thus enabling inclusivity. Unlike traditional scripted chatbots, these agents generate context-sensitive, personalized responses by integrating

extensive medical knowledge, patient histories, and dynamic task lists, allowing them to handle complex clinical nuances and unexpected questions with natural speech [43]. Such capabilities are particularly well-suited for the elderly, many of whom encounter barriers to digital technology and find promise in voice-based interfaces that lower the threshold for engagement, and offer a more **accessible means of interaction** while providing **companionship, health guidance, and administrative assistance**.

A promising application of AI voice agents in elderly care is chronic disease management and early symptom triage. These agents conduct regular check-ins to monitor changes in symptoms or mood, enabling timely detection of clinical deterioration and reducing unnecessary hospitalizations [44]. In addition, they support medication adherence, provide tailored health education, and escalate urgent concerns to clinicians when needed. On the operational side, AI voice agents automate appointment scheduling, prescription refills, insurance verification, and transportation coordination, alleviating caregiver burden and improving healthcare access [45], [46]. Conclusively, these systems can adapt communication style and language to match patients' health literacy and cultural background, enhancing inclusivity and reducing disparities in underserved elderly populations [44].

Many seniors face challenges such as declining vision, hearing loss, reduced mobility, or cognitive impairments, making it essential for AI-driven solutions to offer accessible interfaces and adaptive features. Agentic AI excels in this regard by personalizing care plans, reminders, and health interventions in real time, taking into account each individual's unique needs and preferences [47]. For example, agentic systems can integrate voice commands, large text displays, and simplified navigation to accommodate users with visual or dexterity limitations, while also providing multilingual support and culturally sensitive content to enhance comfort and acceptance among diverse populations. This adaptability not only improves user experience but also empowers seniors to maintain independence and engage more fully with their care routines.

III. CHALLENGES AND POTENTIAL SOLUTIONS

In this section, we outline the key challenges that arise when integrating Agentic AI into elderly care and highlight potential solutions to address these challenges. As the following subsections detail, it is essential to balance rapid technological innovation with strong ethical safeguards, particularly regarding the privacy and security of elderly healthcare data. Ensuring the accuracy and trustworthiness of AI-generated information is critical to prevent the spread of misinformation, which can have serious consequences in healthcare settings. Additionally, inclusivity must be prioritized so that solutions are accessible and usable for older adults with diverse abilities/needs and varying levels of digital literacy. By systematically addressing these challenges, we can pave the way for more reliable, equitable, and human-centered deployment of Agentic AI in elderly care.

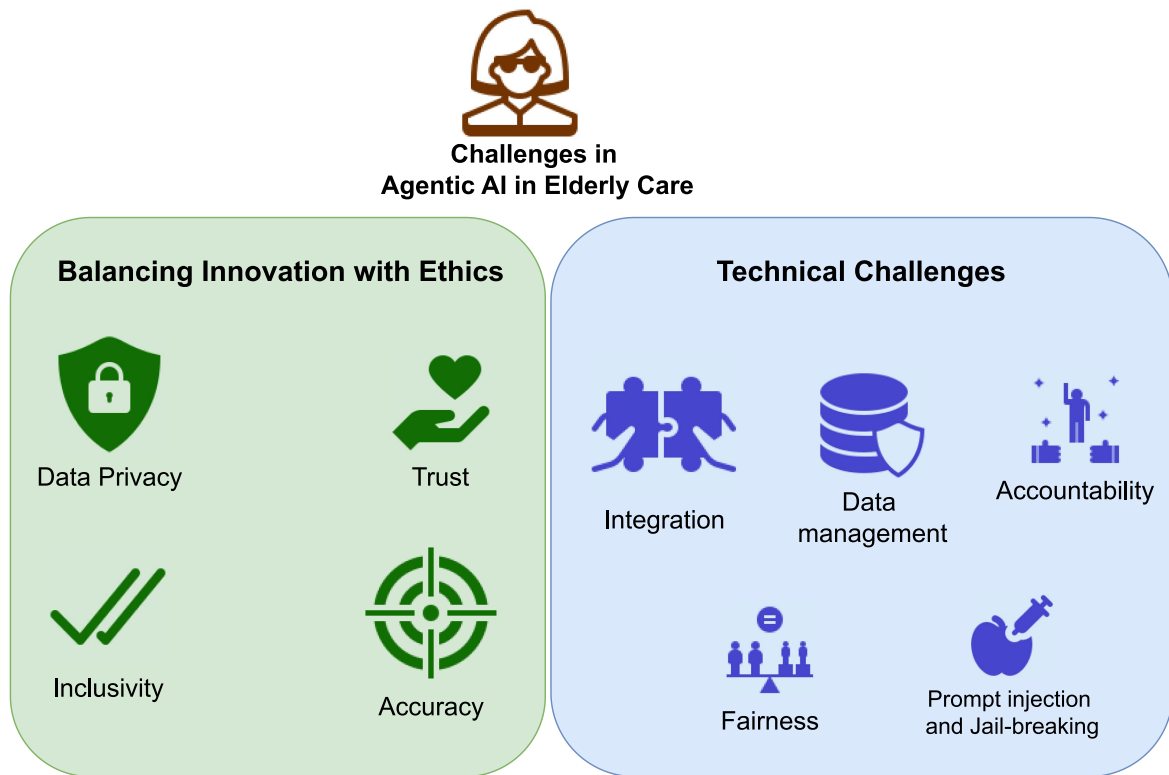


FIGURE 3. Challenges associated with Agentic AI in Elderly Care. The challenges can be broadly categorized as: (i) the challenge of balancing innovation with ethics, and (ii) technical challenges.

A. BALANCING INNOVATION WITH ETHICS

The rapid integration of agentic LLMs into elderly care creates two main priorities. First, technological innovation is needed to improve care. Second, it is crucial to maintain robust ethical standards to safeguard vulnerable populations [48], [49], [50]. Agentic AI systems are becoming increasingly autonomous, able to make proactive decisions and handle complex tasks with minimal human intervention. This autonomy brings numerous benefits, enhancing operational efficiency, minimizing administrative tasks, and providing personalized support to older adults [49], [51]. However, greater autonomy also brings greater risks, including issues of data privacy, security, and accountability, which have become increasingly severe. It is crucial to ensure that innovation does not outpace ethical safeguards using Agentic LLMs, which often process sensitive health data [50], [52]. They connect to many digital systems, increasing the risk of data breaches and unauthorized access. There is also a risk of misinformation, as AI-generated outputs may contain errors or hallucinations, which can be particularly hazardous in healthcare settings [50], [52], [53], [54]. Fig. 3 categorizes the key challenges associated with Agentic AI in elderly care, distinguishing between the challenge of balancing innovation and ethics and the technical challenges of accuracy, inclusivity, and data management.

To address these challenges, a multi-layered approach is needed, utilizing technical safeguards such as differential privacy and federated learning, which are essential [48], [48],

[49], [49], [55]. Transparent decision-making and human-in-the-loop validation help build trust and ensure safety. Inclusivity is also a vital aspect of AI solutions that must be accessible and equitable for all older adults, regardless of their abilities or digital skills [56], [57]. By balancing ethics and technology, agentic LLMs can responsibly transform elderly care. This approach helps protect the dignity, independence, and well-being of the aging population [49], [51].

1) DATA PRIVACY AND SECURITY

Balancing innovation with ethics, data privacy, and security is one of the key challenges in elderly care [58], [59]. Agentic AI-based applications are designed to act autonomously, making decisions and executing tasks with minimal human intervention. However, this increased autonomy also introduces new risks related to data privacy and security. Agentic AI often processes sensitive patient data and interacts with multiple external systems, expanding the potential attack surface for cyber threats. The shift to Agentic AI can streamline a healthcare call center's operations, but only if robust safeguards are in place to prevent data breaches and unauthorized access [15]. In this regard, various techniques such as differential privacy, federated learning (FL), and secure multi-party computation are being explored to enhance data protection, while metrics like mean time to detect (MTTD) and mean time to respond (MTTR) to security incidents are becoming benchmarks for evaluating system resilience [60]. Ethically, the deployment of Agentic AI requires transparent

decision-making processes and clear accountability. According to Andy et al. [61], the risk of misinformation remains significant, with recent estimates placing LLM hallucination rates at 5% -30% as of March 2025. This underscores the need for multi-agent consensus mechanisms and human-in-the-loop validation to ensure the accuracy and trustworthiness of AI-generated outputs.

Furthermore, the financial implications of Agentic AI adoption are substantial. Consumption-based pricing models for healthcare AI agents range from \$4.02 to \$5.99 per successful outcome, with the cost of building digital teammates estimated at between \$500,000 and \$1 million per use case [62].⁵ Also, Agentic AI systems autonomously plan and take actions to meet user-defined goals. Offering the promise of a virtual workforce that can offload and augment human work, Agentic AI is expected to revolutionize industries, including elderly care. Gartner predicts that by 2028, at least 15% of day-to-day work decisions will be made autonomously through Agentic AI, up from 0% in 2024. These investments can yield significant returns by optimizing resource allocation and improving patient satisfaction. Also, they can necessitate rigorous oversight to ensure that cost savings do not come at the expense of privacy or ethical standards. The integration of Agentic AI in elderly care presents both transformative opportunities and complex challenges. By implementing advanced technical safeguards, adopting transparent and accountable governance frameworks, and continuously monitoring key metrics such as hallucination rates [63], security incident response times, and user satisfaction, healthcare organizations can harness the benefits of Agentic AI while upholding the highest ethical, privacy, and security standards.

2) ACCURACY AND TRUSTWORTHINESS

Accuracy and trustworthiness are critical concerns in deploying Agentic AI for elderly care, as LLM-based tools are prone to generating misinformation, commonly known as hallucinations. Misinformation in LLMs can manifest in several forms, including fabricated facts, misleading claims, out-of-context information, and even biased or fabricated citations [64], [65]. Alarming, recent analyses estimate hallucination rates for LLMs to range between 5% and 30% as of early 2025 [61]. In healthcare settings, such errors can have severe consequences. For instance, if an LLM provides incorrect medication dosage information or misinterprets a user's symptoms, it could result in harm or delayed medical care [66]. This underscores the need for multi-agent consensus mechanisms and **human-in-the-loop** validation to ensure the accuracy and trustworthiness of AI-generated outputs. The challenge is compounded by the fact that LLMs often present both accurate and erroneous content with similar levels of confidence and fluency, making it difficult for users, especially older adults who may lack technical expertise, to discern truth from error [67]. Furthermore, the potential misuse of Agentic AI by malicious actors

⁵We acknowledge that the numbers and projections are reported as per the available literature and may change over time as the field advances.

to intentionally generate plausible-sounding but factually incorrect medical information further undermines public trust and increases the risk to vulnerable populations. Similarly, user acceptance and trust are critical to the sustained use of generative AI voice agents by older adults.

3) INCLUSIVITY

Inclusivity is a cornerstone in the design and deployment of Agentic AI for elderly care, ensuring that technological advancements benefit all older adults regardless of their abilities or digital literacy levels [68]. However, bridging the digital divide requires more than just developing accessible technology; it demands robust training, ongoing support, and active community engagement. Many elderly individuals may be unfamiliar or uncomfortable with new digital tools, so offering step-by-step tutorials, responsive help desks, and caregiver involvement is vital for fostering confidence and sustained use [69]. Technical solutions must incorporate adaptive interaction modalities, such as voice recognition, gesture control, and simplified graphical user interfaces, to accommodate users with visual, auditory, or motor impairments [70], [71].

Furthermore, AI systems should employ personalization algorithms that dynamically adjust content delivery and interaction complexity based on the user's abilities and preferences [72]. Equally important are robust training programs and ongoing technical support. Studies show that step-by-step tutorials, context-aware help systems, and caregiver or family member involvement can significantly enhance technology adoption and sustained engagement among the elderly [69], [73]. Community engagement initiatives, such as peer-led digital literacy workshops and participatory design sessions, further empower older adults by incorporating their feedback into system refinement.

4) POTENTIAL SOLUTIONS TO BALANCE INNOVATIONS

The integration of Agentic AI in elderly care requires robust technical safeguards to protect sensitive health data. Implementing end-to-end encryption combined with federated learning architectures ensures data privacy while maintaining model performance [74]. Multi-agent consensus mechanisms coupled with human-in-the-loop validation can reduce hallucination rates below 5% by cross-verifying outputs through specialized sub-agents like Validator and Critic models [17], [42]. Adaptive interfaces using contrastive learning approaches enable multilingual support and cultural customization, particularly crucial for diverse ageing populations [10], [75]. Blockchain-integrated logging systems create immutable audit trails for accountability, while real-time bias-detection algorithms, paired with automated fairness reports, help caregivers monitor equity in AI recommendations [76], [77].

Mitigating the risks of misinformation and hallucinations requires a multi-layered approach. Technically, strategies such as integrating real-time fact-checking, using external and up-to-date data sources, and employing multi-agent consensus

mechanisms can help reduce the rate of hallucinations and misinformation [77]. For example, recent research shows that advanced LLMs like GPT-4.5 and Claude 3.7 have lower hallucination rates than earlier models, but no model is entirely immune to error. Prompt engineering, careful configuration settings, and continuous fine-tuning with domain-specific data are also crucial for improving output reliability [78].

On the user side, clear disclaimers, transparency about model limitations, and human-in-the-loop validation—where caregivers or clinicians review and approve critical outputs—are essential safeguards. Establishing universal guidelines for the validation and auditability of AI-generated health information, along with regular monitoring of hallucination rates and user feedback, can further enhance trustworthiness and safety in agentic LLM-driven elderly care systems [64]. Table 2 outlines the main challenges encountered during the integration of Agentic AI into elderly care, along with potential solutions to address them, including data privacy, system interoperability, and bias mitigation.

To address inclusivity challenges, feedback mechanisms and user-centric design approaches enable developers to continuously refine agentic AI solutions based on real-world experiences, ensuring that evolving needs and challenges are promptly addressed. Community partnerships and collaboration with caregivers help tailor solutions to specific cultural contexts and daily realities, further enhancing inclusivity and adoption. By prioritizing accessibility, training, and feedback, Agentic AI can help close the digital gap, reduce social isolation, and ensure that the benefits of AI-powered elderly care are equitably distributed across all segments of the ageing population.

B. TECHNICAL CHALLENGES

1) DATA INCONSISTENCIES AND INTEGRATION WITHIN THE EXISTING SYSTEMS

The integration of Agentic AI into elderly care brings a complex set of technical challenges that must be addressed to unlock its true potential. One of the foremost issues is ensuring seamless interoperability with the existing healthcare infrastructure. Many elderly care facilities rely on a fragmented ecosystem composed of electronic medical records (EMRs), diagnostic tools, appointment scheduling platforms, and billing systems, many of which are legacy systems that were not designed with advanced AI integration in mind [55]. Furthermore, realizing the full utility of Agentic AI requires adherence to standardized data formats (e.g., HL7, FHIR), and real-time synchronization pipelines. Technical hurdles such as data silos, inconsistent data quality, and system incompatibility can hinder the deployment of Agentic AI and limit its ability to deliver holistic, personalized elderly care [79].

2) DATA MANAGEMENT AND SECURITY

Another critical technical challenge is robust data management and the preservation of security and privacy when deploying LLM-based Agentic AI in elderly care.

These models must continuously process and analyze large volumes of sensitive information—including health records, data from wearable devices, and even genetic profiles—to deliver personalized services and timely interventions [55]. To meet the stringent requirements of regulations such as HIPAA (U.S.) and GDPR (EU), robust technical measures must be implemented at every stage of data handling. This includes the use of advanced encryption protocols, secure storage architectures, and real-time monitoring systems to detect and prevent unauthorized access [69]. Additionally, LLM-based Agentic AI should be engineered to facilitate transparent data usage and support dynamic consent management, enabling elderly users and caregivers to control, audit, and revoke data permissions as needed. Addressing these technical aspects is essential to safeguard privacy, build trust, and ensure the sustainable integration of Agentic AI in elderly care.

3) BIAS MITIGATION AND FAIRNESS

Bias and fairness present additional technical obstacles. Agentic AI systems are only as reliable as the data on which they are trained. If these datasets are unrepresentative or contain historical biases, the resulting models may perpetuate or even amplify inequities in care delivery [55]. This is particularly concerning in elderly care, where disparities in health outcomes can be exacerbated by algorithmic bias. Rigorous dataset curation, ongoing bias audits, and the use of fairness metrics are necessary to ensure equitable outcomes. Technical solutions, such as adversarial debiasing and explainable AI, can further help identify and mitigate sources of bias, thereby fostering trust and inclusivity in AI-driven elderly care.

4) ACCOUNTABILITY AND RELIABILITY

The autonomous and adaptive nature of Agentic AI introduces challenges related to oversight, accountability, and system reliability. While these models can make proactive decisions and adapt care plans in real time, there must be precise mechanisms for human oversight and intervention, especially in high-stakes scenarios. Developing transparent logging, audit trails, and fail-safe protocols ensures that caregivers can review, validate, or override AI-driven recommendations when necessary [80]. Additionally, maintaining and updating these complex systems requires specialized technical expertise and ongoing evaluation to ensure that Agentic AI remains accurate, secure, and aligned with evolving clinical standards. Addressing these technical challenges is crucial to safely scale Agentic AI in elderly care and maximize its benefits for both patients and providers. For instance, safety concerns for AI voice agents are significant. Patients may treat AI-generated medical advice as definitive, risking harm if urgent conditions are missed. To address this, robust clinical safety mechanisms are essential, including domain-specific training to recognize red flags, uncertainty monitoring, and automatic escalation to human clinicians [42], [91].

TABLE 2. Challenges and Potential Solutions for Agentic AI in Elderly Care

Challenge	Impact on Elderly Care	Example Scenario	Potential Solutions	References
Interoperability with Legacy Systems	Limits care coordination and system adoption across healthcare infrastructure	LLM agent fails to access or update patient EMR due to format mismatch	FHIR/HL7-compliant APIs, automated schema mapping, middle-ware platforms	[55], [79]
Data Privacy & Security	Risk of data breaches and loss of trust in AI-powered systems	Sensitive health data leaked due to unsecured cross-system communication	End-to-end encryption, federated learning, secure multiparty computation, real-time monitoring	[15], [58], [60]
Bias & Fairness	Perpetuates healthcare inequities by reinforcing biased recommendations	Minorities receive less evidence-based suggestions than majority cohorts	Diverse training datasets, fairness audits, adversarial debiasing, explainable AI	[55], [72], [80]
System Reliability & Hallucinations	Reduced trust due to clinical inaccuracies and hallucinated outputs	LLM provides fabricated dosage instructions, misinterprets health queries	Multi-agent validation, domain-specific fine-tuning, clinical safety nets, transparent disclaimers	[17], [61], [64], [66], [67]
Scalability & Real-Time Responsiveness	Limits use in urgent care conditions due to latency or compute bottlenecks	High delay in fall detection or medication reminders	Lightweight models, edge computing, attention pruning, MobileLLM distillation	[15], [81], [82]
Financial Constraints & Resource Management	Limits adoption in resource-constrained settings like senior clinics	High upfront costs of building/maintaining LLM agents (\$500K–\$1M per case)	Consumption-based pricing, hybrid cloud-edge infrastructure, agentic workload optimization	[15], [60]
Multi-Agent Coordination	Conflicting outputs from agents cause confusion	Critic model and Health Assistant offer contradictory care suggestions	Hierarchical role-based architecture, consensus checks, agent specialization (Teacher, Validator, Critic)	[17], [48], [64]
Prompt Injection & Jail-breaking Vulnerabilities	Malicious prompts could override safeguards, leak data, or deliver harmful advice	Adversary triggers jail-broken LLM to reveal private medical history or unsafe suggestions	Input sanitization, role-based access, red-teaming tools, audit logging, adversarially robust architectures	[23], [53], [64], [83], [84]
Human-in-the-Loop Oversight	Autonomous LLMs make critical decisions without user review	Medication or emergency response recommendation issued without caregiver involvement	Override mechanisms, confidence thresholds, human approval checkpoints, audit trails	[15], [58], [69]
Adaptive Interface & Inclusivity	Elderly users with impairments face engagement difficulties	AI interface too complex for voice-impaired or low-digital-literacy users	Voice/gesture/UCR input, adaptive difficulty models, multilingual GUI, progressive disclosure design	[68], [69], [70], [73]
Synthetic Data Generation & Privacy Preservation	Lack of shareable training data stalls personalization while risking privacy breach	LLM cannot access adequate real-world data due to privacy laws	Use of differential privacy, GANs, neural diffusion models to synthesize shareable, anonymized datasets	[85], [86], [87], [88], [89]
Ethical & Regulatory Compliance	Risk of violating user autonomy, legal uncertainties across jurisdictions	LLM operates beyond patient consent; audit trails missing during legal queries	Built-in consent flows, explainable AI, logging via permissioned blockchain, compliance auditing	[15], [76], [80], [90]

5) CHALLENGES IN JAIL-BREAKING LLMs: PROMPT INJECTION AND SECURITY RISKS

As discussed, LLMs have demonstrated significant potential in transforming elderly care through agentic AI. However, a critical technical vulnerability lies in their susceptibility to prompt injection and jail-breaking attacks. Prompt injection occurs when adversaries manipulate model inputs—either directly via user interaction or indirectly through compromised data sources—to override system instructions and elicit unauthorized or harmful outputs [64], [83]. Jail-breaking is a related phenomenon in which carefully crafted adversarial prompts bypass built-in safety mechanisms, enabling the model to generate responses that violate ethical, privacy, or regulatory guidelines [53], [92].

In the context of elderly care, these vulnerabilities can have severe consequences. For example, successful prompt injection could lead to the disclosure of sensitive health information, dissemination of misinformation, or execution of unauthorized actions, thereby endangering user safety and eroding trust in AI-driven care [53], [92]. The autonomous and adaptive nature of LLM-based agentic AI exacerbates the challenge, as attackers may exploit conversational interfaces to manipulate medication reminders, alter health advice, or access private user data [23]. Moreover, distinguishing between legitimate and adversarial inputs is particularly difficult for elderly users with limited digital literacy.

Addressing these weaknesses demands robust input validation, continuous monitoring for adversarial behaviors, and human-in-the-loop oversight to ensure that LLM-driven systems remain safe, reliable, and aligned with ethical standards [23], [64]. Recent research emphasizes the need for adversarially robust model architectures, multi-agent consensus mechanisms, and transparent audit trails to mitigate risks associated with prompt injection and jail-breaking [84]. As agentic AI becomes more prevalent in elderly care, prioritizing security and resilience against such attacks is essential to safeguard vulnerable populations.

6) POTENTIAL SOLUTIONS FOR TECHNICAL CHALLENGES

FHIR/HL7-compliant APIs with automated schema mapping enable seamless integration with legacy EHR systems through middleware solutions [10]. Hybrid cloud-edge architectures that employ lightweight model distillation techniques, such as MobileLLM, optimize computational efficiency without sacrificing accuracy [81]. Differential privacy-preserved synthetic datasets generated via generative models (Generative Adversarial Networks [87], Neural Diffusion Models [85], [86]) address data scarcity issues while maintaining patient confidentiality [88]. Hierarchical agent architectures implement role-based task allocation, separating clinical decision-making from administrative functions [17], [75]. Quantum-resistant encryption protocols future-proof sensitive health data against emerging cryptographic threats [93], [94].

Moreover, a multi-layered defense strategy is essential to mitigate the risks of jail-breaking and prompt injection in

LLMs. Key solutions include robust input validation and sanitization to filter out potentially malicious prompts before they reach the model, as well as strict output formatting and semantic filters to detect and block unsafe or unauthorized responses [63]. Defining clear system prompts and enforcing strict adherence to context can help constrain the model's behavior. At the same time, privilege control—such as role-based access controls and least-privilege principles—limits the potential damage from successful attacks. Incorporating human-in-the-loop oversight for high-risk or sensitive operations adds a safeguard, ensuring that critical actions require human approval. Regular adversarial testing, including automated red-teaming and fuzzing, is vital for identifying new vulnerabilities and stress-testing model defenses [95].

IV. FUTURE DIRECTIONS AND RESEARCH PRIORITIES

The rapid evolution of Agentic AI in elderly care necessitates forward-looking research priorities that address both technical innovation and ethical responsibility [90]. As these systems become more autonomous and pervasive, it is crucial to establish robust frameworks that ensure safety, inclusivity, and continuous improvement. This section outlines key future directions and research priorities for the responsible integration of Agentic AI in elderly care. Table 3 outlines the key future research directions and priorities for Agentic AI in elderly care, focusing on areas such as the development of standardized guidelines, integration of multi-modal information, addressing ethical concerns, and ensuring adversarial robustness.

A. DEVELOPMENT OF STANDARDIZED GUIDELINES AND PROMPT DESIGN

One of the most immediate research imperatives is the development of standardized guidelines for prompt design and system validation protocols explicitly tailored for elderly care applications [96]. Current approaches often rely on ad-hoc prompt engineering, which usually lacks reproducibility and introduces variability in performance [96], [97]. Structured and transparent prompt design standards are essential to ensure that Agentic AI generates accurate, safe, and contextually appropriate outputs, mainly when used by informal caregivers or older adults without clinical expertise [97]. This includes stress-testing under edge cases (e.g., rare diseases, cognitive impairments, atypical language use) and simulating interactions with users from diverse linguistic, cultural, and socioeconomic backgrounds [18]. Validation protocols should incorporate not only technical metrics, such as accuracy and latency, but also user-centered metrics, including perceived trust, usability, and risk perception [98].

Furthermore, comprehensive system validation frameworks are needed to test Agentic AI for accuracy, safety, and appropriateness in various elderly care scenarios. These frameworks should include stress testing with edge cases (e.g., rare diseases, cognitive impairments, atypical language use) and simulating interactions with users from diverse linguistic, cultural, and socioeconomic backgrounds [18]. Regular updates

TABLE 3. Future Research Directions and Priorities for Agentic AI in Elderly Care

Research Direction	Focus Areas	References
Development of Standardized Guidelines and Prompt Design	Creation of reproducible and transparent prompt engineering standards; validation protocols for elderly-specific scenarios; training programs for caregivers	[18], [96], [97], [98], [99]
Integration of Multi-modal Information and Features	Use of voice, visual, and sensor data for improved interactions; real-time monitoring from wearables and IoT devices	[40], [101], [102], [103], [104]
Addressing Ethical Concerns	Development of AI ethics frameworks; safeguards for privacy, fairness, consent, and algorithm transparency	[83], [84], [105], [106], [107],
Adversarially Robust Agentic AI	Defense against prompt injection, jail-breaking, and misinformation; secure model architectures and explainability	[84], [90]
Proactive and Personalized Support	Predictive interventions; learning from user behavior to tailor reminders, care plans, and engagement strategies	[90], [101], [103], [104]
Standard Evaluation Frameworks	Development of benchmarking protocols; inclusion of user feedback and longitudinal outcomes tracking	[18], [83], [98], [99],

and revisions to these guidelines will be necessary as both the technology and the regulatory landscape evolve. The goal is to build trust among users and stakeholders by demonstrating that Agentic AI is not only robust but also reliable and safe for vulnerable populations [98].

Finally, ongoing education and training programs are crucial for caregivers and healthcare professionals to interact effectively with these systems, understand their limitations, and recognize situations requiring human intervention [99]. Standardized training materials, supported by practical examples and case studies, can help bridge the gap between technological innovation and real-world application, ensuring that Agentic AI is used to its full potential while minimizing risks.

B. INTEGRATION OF MULTI-MODAL INFORMATION AND FEATURES

The integration of multi-modal information and features is a critical frontier for Agentic AI in elderly care. Unlike LLM-based tools for text processing, which rely heavily on text, the development of vision-language models opens frontiers for future developments that can leverage voice, vision, and sensor data to create more intuitive and accessible interfaces [40]. For example, integrating voice recognition and synthesis can make systems more user-friendly for older adults with limited digital literacy or physical impairments. Visual aids, such as diagrams or interactive tutorials, can further enhance comprehension and safety for complex care tasks [100].

Multi-modal integration also enables Agentic AI to provide more comprehensive support. By processing data from wearable devices, smart home sensors, and electronic health records, these systems can offer real-time health monitoring, early warning of potential issues, and personalized recommendations [101]. For instance, an agentic LLM could detect a fall using motion sensors, assess vital signs via wearables, and immediately notify caregivers or emergency services.

Such capabilities can significantly improve the independence and safety of older adults living alone [102].

Moreover, the fusion of diverse data modalities enables more nuanced, context-aware interactions. Agentic AI can adapt its communication style to a user’s emotional state, cognitive abilities, and cultural background, making the technology more inclusive and effective [103].

C. ADDRESSING ETHICAL CONCERNS

As Agentic AI becomes more autonomous and influential in elderly care, the need to balance innovation with ethical considerations grows increasingly urgent [104]. The rapid pace of technological advancement must be matched by robust ethical frameworks that prioritize the rights, dignity, and well-being of older adults. For example, Agentic AI often processes sensitive health information, raising concerns about data security and the potential misuse or unauthorized access [105].

To address these challenges, research should focus on developing and refining ethical guidelines for the deployment of Agentic AI in elderly care. These guidelines emphasize the importance of informed consent, data minimization, and the right to explanation [106]. Additionally, mechanisms for human oversight and intervention should be built into the design of these systems, ensuring that critical decisions are always subject to review by qualified professionals. Transparent logging and audit trails can help maintain accountability and build trust among users and stakeholders [107].

Another critical aspect is mitigating algorithmic bias in Agentic AI-based solutions for elderly care. Agentic AI is only as fair and inclusive as the data on which it is trained. Biases in training data can lead to unequal care recommendations or the perpetuation of existing health disparities [108]. Future work should prioritize the development of diverse and representative datasets, as well as tools for ongoing detection and mitigation of bias. By embedding ethical principles into every stage of development and deployment, Agentic AI can

help ensure that the benefits of AI-driven care are equitably distributed across all segments of the ageing population.

D. ADVERSARIALLY ROBUST AGENTIC AI

The increasing autonomy of Agentic AI in elderly care makes them attractive targets for adversarial attacks, where malicious actors attempt to manipulate or deceive the system for harmful purposes [83]. Especially the susceptibility of LLMs to injection and jail-breaking attacks is a big concern in sensitive applications like healthcare. Ensuring the robustness of these models against such attacks is a critical research priority. Adversarial robustness involves designing LLMs that can withstand attempts to inject misleading information, exploit vulnerabilities in prompt engineering, or bypass security safeguards [84].

Research in this area should focus on developing advanced techniques for detecting and mitigating adversarial inputs. For example, multi-agent consensus mechanisms can be used to cross-verify outputs and identify inconsistencies or anomalies [90]. Additionally, continuous monitoring and model fine-tuning can help maintain their resilience in the face of evolving threats. The integration of explainable AI techniques can further enhance robustness by making it easier to understand and audit the decision-making processes of Agentic AI [84].

Another critical aspect of adversarial robustness is protecting sensitive data. Agentic AI must be designed to prevent unauthorized access or leakage of personal health information. Techniques such as federated learning, differential privacy, and secure multi-party computation can help safeguard data while preserving the utility of the models [84]. By prioritizing adversarial robustness, the elderly care community can build trust in Agentic AI and ensure their safe and responsible use.

E. PROACTIVE AND PERSONALIZED SUPPORT

One of the most promising aspects of Agentic AI in elderly care is its move toward proactive, personalized support. Traditional care systems often react to problems as they arise, but Agentic AI has the potential to anticipate needs and intervene before issues become critical [90]. For example, by analyzing patterns in health data, social interactions, and daily activities, these systems can identify early warning signs of cognitive decline, social isolation, or physical health deterioration [102].

Personalization is key to Agentic AI's effectiveness. Each elderly individual may have unique needs, preferences, and challenges, and care solutions must be tailored to meet them [103]. Future research should focus on developing adaptive algorithms that can learn from ongoing interactions and adjust their support strategies in real-time. This includes personalized reminders, cognitive exercises, and social engagement activities tailored to the individual's abilities and interests.

Moreover, proactive support can extend beyond health monitoring to include assistance with daily living tasks, such as medication management, scheduling appointments, and

managing home automation. Agentic AI can integrate with smart home technologies to automate routine tasks, provide step-by-step guidance for complex activities, and even facilitate social connections through virtual companions [100]. The ultimate goal is to empower older adults to maintain their independence and quality of life for as long as possible while providing peace of mind to caregivers and family members.

F. STANDARD EVALUATION FRAMEWORKS

The successful integration of Agentic AI into elderly care depends on establishing standardized evaluation frameworks to assess its performance, safety, and impact [18]. Current evaluation methods are often short-term, fragmented, and inconsistent, making it difficult to compare different systems or accurately measure their real-world effectiveness. Standard frameworks should define clear metrics for accuracy, reliability, user satisfaction, and clinical outcomes, as well as procedures for ongoing monitoring and improvement [98].

Moreover, longitudinal studies are required to assess the effectiveness and identify the consequences of Agentic AI in elderly care. Such studies can track outcomes across domains such as cognitive health, emotional well-being, societal and economic impact, and, last but not least, capture metrics related to trust and digital inclusion.

Evaluation frameworks should also incorporate mechanisms for user feedback and participatory design, ensuring that the voices of older adults and caregivers are central to the evaluation process. For example, regular surveys, focus groups, and usability testing can help identify areas for improvement and ensure that the technology remains aligned with user needs [99]. Additionally, evaluation frameworks should include provisions for auditing and accountability, such as transparent logging and independent review.

Ultimately, standard evaluation frameworks must be adaptable enough to keep pace with rapid technological advancements [107]. As Agentic AI evolves and new applications emerge, evaluation criteria and methodologies should be updated accordingly. By establishing robust, adaptable frameworks, the elderly care community can ensure that Agentic AI delivers sustained value and continues to meet the complex, evolving needs of the ageing population.

V. CONCLUSION

Agentic AI represents a significant leap forward in the evolution of elderly care, enabling personalized, adaptive, and proactive support for older adults. By combining autonomous reasoning, contextual understanding, and multi-agent collaboration, these systems have the potential to address the complex and dynamic needs of ageing populations, achieving improvement and scalability. The integration of Agentic AI can enhance care coordination, empower caregivers, and foster greater independence and well-being among seniors. Yet the transformative promise of Agentic AI will only be realized through a thoughtful, collaborative approach. Researchers,

developers, healthcare professionals, caregivers, and policy-makers must collaborate to ensure that these technologies are developed and deployed ethically, inclusively, and with profound respect for privacy and human dignity. Addressing challenges, such as data security, algorithmic fairness, and accessibility, must remain at the forefront of innovation. The future of elderly care lies in harnessing the strengths of Agentic AI while remaining vigilant to its risks and limitations. By prioritizing human-centered design, transparent evaluation, and ongoing collaboration across disciplines, we can build a future where advanced AI not only augments healthcare delivery but also enriches the lives of older adults, making care more compassionate, equitable, and responsive for generations to come.

As this survey highlights, Agentic AI has promising potential in elderly care, particularly through the use of LLMs for personalized health assistance, cognitive engagement, and companionship. While challenges such as data privacy, hallucinations, and ethical considerations remain, the technology is poised to significantly improve the quality of life for elderly individuals. For practitioners and policymakers looking to deploy Agentic AI in elderly care, we recommend the following prioritized actions over the next few years:

- Focus on establishing standardized protocols to ensure the ethical use of AI in elderly care, particularly regarding data privacy and consent management.
- Ensure that AI solutions are compatible with existing healthcare infrastructures and legacy systems to facilitate seamless integration.
- Support research and development in multimodal integration to combine AI with physical and cognitive interventions, providing a holistic approach to elderly care.

By prioritizing these steps, stakeholders can ensure that the deployment of Agentic AI in elderly care is both practical and sustainable in the near future.

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REFERENCES

- [1] J. R. Guillemot, X. Zhang, and M. E. Warner, "Population aging and decline will happen sooner than we think," *Social Sci.*, vol. 13, no. 4, 2024, Art. no. 190.
- [2] U. Nation, "World population prospects 2022," 2022. Accessed: Dec. 16, 2024. [Online]. Available: www.un.org.development.desa.pdf/files/wpp2022_summary_of_results.pdf
- [3] A. Bancalari and B. Zaranko, "Adult social care in England: What next?" 2024. Accessed: Jan. 15, 2025. [Online]. Available: <https://ifs.org.uk/publications/adult-social-care-england-what-next>
- [4] World Economic Forum, "Could these old and new ideas be the future of social care for the elderly," 2023. Accessed: May 15, 2025. [Online]. Available: <https://www.weforum.org/stories/2023/08/elderly-social-care-dementia-villages/>
- [5] H. Hasan-WHO, "Who calls for urgent transformation of care and support systems for older people," 2024. Accessed: Jul. 11, 2025. [Online]. Available: <https://tinyurl.com/498ytc2x>
- [6] E. Soubutts, "Aging in place together: Journeys towards adoption and acceptance of smart home healthcare technology," Ph.D. dissertation, Univ. of Bristol, Bristol, U.K., 2023.
- [7] P. Radanliev, "Dance sport movement therapy in the metaverse: A new frontier for alternative mental health therapies," *Digit. Health*, vol. 10, 2024, Art. no. 20552076241258273.
- [8] P. Radanliev, "Dance as a mental health therapy in the metaverse: Exploring the therapeutic potential of dance movement therapy as a non-pharmacological treatment in the metaverse," *Front. Comput. Sci.*, vol. 6, 2024, Art. no. 1334027.
- [9] "Elder care assistive robots market size, share report, 2030," 2024. Accessed: Jun. 14, 2025. [Online]. Available: <https://www.grandviewresearch.com/industry-analysis/elder-care-assistive-robots-market-report>
- [10] "How agentic AI is transforming healthcare: Benefits & use cases," 2025. Accessed: Jun. 14, 2025. [Online]. Available: <https://www.accelerate.com/agentic-ai-in-healthcare/>
- [11] W. Health Organization, "WHO calls for urgent transformation of care and support systems for older people," 2024. Accessed: May 15, 2025. [Online]. Available: <https://www.who.int/news/item/01-10-2024-who-calls-for-urgent-transformation-of-care-and-support-systems-for-older-people>
- [12] R. Retiwalla, "Demystifying agentic AI: How AI agents can change healthcare efficiency now," 2024. Accessed: Dec. 16, 2024. <https://www.productiveedge.com/blog/demystifying-agentic-ai-how-ai-agents-can-change-healthcare-efficiency-now>
- [13] T. Kass-Hout and D. Sheeran, "How agentic AI systems can solve the three most pressing problems in healthcare today," 2024. Accessed: Dec. 26, 2024. [Online]. Available: <https://www.gehealthcare.co.uk/insights/article/how-agentic-ai-systems-can-solve-the-three-most-pressing-problems-in-healthcare-today>
- [14] B. Marr, "Agentic AI: The next big breakthrough that's transforming business and technology," 2024. Accessed: Dec. 28, 2024. [Online]. Available: <https://www.forbes.com/sites/bernardmarr/2024/09/06/agentic-ai-the-next-big-breakthrough-thats-transforming-business-and-technology/>
- [15] T. A. Nasir and T. Haslam, "Inside agentic AI: Reshaping decisions and orchestration in life sciences," 2025. Accessed: May 16, 2025. [Online]. Available: <https://www.iqvia.com/blogs/2025/02/inside-agentic-ai-reshaping-decisions-and-orchestration-in-life-sciences>
- [16] A. Bohr and K. Memarzadeh, "The rise of artificial intelligence in healthcare applications," in *Artificial Intelligence in Healthcare*. Amsterdam, Netherlands: Elsevier, 2020, pp. 25–60.
- [17] M. Chui et al., "The economic potential of generative AI: The next productivity frontier," 2024. Accessed: Jun. 2024. [Online]. Available: <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier>
- [18] B. Ma et al., "Artificial intelligence in elderly healthcare: A scoping review," *Ageing Res. Rev.*, vol. 83, 2023, Art. no. 101808.
- [19] K. Loveys et al., "Artificial intelligence for older people receiving long-term care: A systematic review of acceptability and effectiveness studies," *Lancet Healthy Longevity*, vol. 3, no. 4, pp. e286–e297, 2022.
- [20] A. K. C. Wong, J. H. T. Lee, Y. Zhao, Q. Lu, S. Yang, and V. C. C. Hui, "Exploring older adults' perspectives and acceptance of AI-driven health technologies: Qualitative study," *JMIR Aging*, vol. 8, 2025, Art. no. e66778.
- [21] Y. Zhao and J. Li, "Opportunities and challenges of integrating artificial intelligence in China's elderly care services," *Sci. Rep.*, vol. 14, no. 1, 2024, Art. no. 9254.
- [22] L. N. Blog, "Ai helpers for seniors: How large language models are lending a hand in long-term care," 2024. Accessed: Dec. 15, 2024. [Online]. Available: <https://www.ltcnews.com/articles/ai-helpers-seniors-large-language-models-long-term-care>
- [23] Q. Sun, J. Xie, N. Ye, Q. Gu, and S. Guo, "Enhancing nursing and elderly care with large language models: An AI-driven framework," in *Proc. 31st Int. Conf. Comput. Linguistics*, O. Rambow, L. Wanner, M. Apidianaki, H. Al-Khalifa, and B. Schockaert, Eds., Abu Dhabi, UAE, Association for Computational Linguistics, Jan. 2025, pp. 10083–10090. [Online]. Available: <https://aclanthology.org/2025.coling-main.673/>

- [24] P. M. Abadir, A. Battle, J. D. Walston, and R. Chellappa, "Enhancing care for older adults and dementia patients with large language models: Proceedings of the national institute on aging—Artificial Intelligence & technology collaborative for aging research symposium," *Journals Gerontol., Ser. A, Biol. Sci. Med. Sci.*, vol. 79, no. 9, 2024, Art. no. glae176.
- [25] R. A. Khalil, E. Jones, M. I. Babar, T. Jan, M. H. Zafar, and T. Alhusain, "Speech emotion recognition using deep learning techniques: A review," *IEEE Access*, vol. 7, pp. 117327–117345, 2019.
- [26] J. Roberts, L. Roberts, and A. Reed, "Supporting the digital autonomy of elders through LLM assistance," in *Proc. AAAI Symp. Ser.*, 2024, vol. 4, no. 1, pp. 182–186.
- [27] Z. Momand, P. Mongkolnam, J. H. Chan, and N. Charoenkitkarn, "Integrating sensor data with large language models for enhanced elderly care: A methodological framework," *Sensors Mater.*, vol. 37, 2025, Art. no. 1099.
- [28] B. Parmanto et al., "A reliable and accessible caregiving language model (CaLM) to support tools for caregivers: Development and evaluation study," *JMIR Formative Res.*, vol. 8, 2024, Art. no. e54633.
- [29] M. Alkhalaf, P. Yu, M. Yin, and C. Deng, "Applying generative AI with retrieval augmented generation to summarize and extract key clinical information from electronic health records," *J. Biomed. Inform.*, vol. 156, 2024, Art. no. 104662.
- [30] Y. Miao, Y. Zhao, Y. Luo, H. Wang, and Y. Wu, "Improving large language model applications in the medical and nursing domains with retrieval-augmented generation: Scoping review," *J. Med. Internet Res.*, vol. 27, 2025, Art. no. e80557.
- [31] K. Fear et al., "Shaping the future of older adult care: Chatgpt, advanced ai, and the transformation of clinical practice," *JMIR Aging*, vol. 6, no. 1, 2023, Art. no. e51776.
- [32] J. Armbruster, F. Bussmann, C. Rothhaas, N. Titze, P. A. Grützner, and H. Freischmidt, "Doctor ChatGPT, Can you help me? The patient's perspective: Cross-sectional study," *J. Med. Internet Res.*, vol. 26, 2024, Art. no. e58831.
- [33] Y. Duan, S. Lin, X. Liu, Z. Huang, H. Su, and Y. Bai, "ElderQA-GPT: A large language model for online Q&A on geriatric diseases based on BGE semantic vector knowledge base and Langchain architecture," in *Proc. 5th Int. Symp. Artif. Intell. Med. Sci.*, 2024, pp. 9–15.
- [34] TechTarget, "LLMs may enhance geriatric polypharmacy management in primary care," 2024. Accessed: Jan. 21, 2025. [Online]. Available: <https://www.techtarget.com/healthtechanalytics/news/366589996/LLMs-may-enhance-geriatric-polypharmacy-management-in-primary-care>
- [35] DIGITAL, "Managing hospitalization risk & better home care delivery using LLMs," 2024. Accessed: Jan. 19, 2025. [Online]. Available: <https://www.digitalsupercluster.ca/projects/managing-hospitalization-risk-better-home-care-delivery-using-llms/>
- [36] M. S. Treder, S. Lee, and K. A. Tsvetanov, "Introduction to large language models (LLMs) for dementia care and research," *Front. Dement.*, vol. 3, 2024, Art. no. 1385303.
- [37] V. Crista, D. Martinho, and G. Marreiros, "A multi-agent system approach with generative AI for improved elderly daily living," in *EPIA Conf. Artif. Intell.*, 2024, pp. 128–140.
- [38] S. Code, "Embracing generative AI and large language models in senior care," 2024. Accessed: Jan. 21, 2025. [Online]. Available: <https://healthtechmagazine.net/article/2024/04/embracing-generative-ai-and-large-language-models-senior-care>
- [39] Newo.AI, "How AI enhances elderly care: Monitoring and assistance technologies," 2024. Accessed: Dec. 17, 2024. [Online]. Available: <https://newo.ai/insights/how-ai-enhances-elderly-care-monitoring-and-assistance-technologies/>
- [40] X. Jin, X. Hu, X. Wei, and M. Fan, "Synapse: Interactive guidance by demonstration with trial-and-error support for older adults to use smartphone apps," *Proc. ACM Interactive, Mobile, Wearable Ubiquitous Technol.*, vol. 6, no. 3, pp. 1–24, 2022.
- [41] K. Koebel, M. Lacayo, M. Murali, I. Tarnanas, and A. Çöltekin, "Expert insights for designing conversational user interfaces as virtual assistants and companions for older adults with cognitive impairments," in *Proc. Int. Workshop Chatbot Res. Des.*, 2021, pp. 23–38.
- [42] S. J. Adams, J. N. Acosta, and P. Rajpurkar, "How generative AI voice agents will transform medicine," *npj Digit. Med.*, vol. 8, no. 1, pp. 1–4, 2025.
- [43] L. T. Car et al., "Conversational agents in health care: Scoping review and conceptual analysis," *J. Med. Internet Res.*, vol. 22, 2020, Art. no. e17158.
- [44] M. Bhimani et al., "Using a multilingual AI care agent to reduce disparities in colorectal cancer screening: Higher fit test adoption among spanish-speaking patients," 2025.
- [45] Hyro, "Unburden your staff, unblock access to care," 2025. [Online]. Available: <https://www.hyro.ai>
- [46] Orbita, "We make navigating healthcare easy," 2025. [Online]. Available: <https://orbita.ai>
- [47] A. Edge, "Agentic AI in home care: Transforming caregiving through autonomous intelligence," 2025. Accessed: May 16, 2025. [Online]. Available: <https://automationedge.com/home-health-care-automation/blogs/agentic-ai-in-home-care/>
- [48] I. Ferri-Molla, J. Linares-Pellicer, C. Aliaga-Torro, and J. Izquierdo-Domench, "Multi-agent AI system for adaptive cognitive training in elderly care," in *Proc. 17th Int. Conf. Agents Artif. Intell.*, 2025, pp. 937–947. [Online]. Available: <https://www.scitepress.org/Papers/2025/133970/133970.pdf>
- [49] H. Yuan, "Agentic large language models for healthcare: Current progress and future opportunities," *Med. Adv.*, vol. 3, no. 1, pp. 37–41, 2025.
- [50] Anonymous, "7 key ways agentic AI is shaping patient care," Plivo, 2025. [Online]. Available: <https://www.plivo.com/blog/agentic-ai-in-healthcare/>
- [51] Anonymous, "Revolution in elderly care: How AI and automation are changing lives," Beam AI, 2025. [Online]. Available: <https://beam.ai/agentic-insights/revolution-in-elderly-care-how-ai-and-automation-are-changing-lives>
- [52] Anonymous, "The impact of agentic AI on data privacy," StatusNeo, 2025. [Online]. Available: <https://statusneo.com/the-impact-of-agentic-ai-on-data-privacy/>
- [53] T. Han et al., "Medical large language models are susceptible to targeted misinformation attacks," *npj Digit. Med.*, vol. 7, no. 1, 2024, Art. no. 288.
- [54] L. Zhu, W. Mou, and P. Luo, "Potential of large language models as tools against medical disinformation," *JAMA Intern. Med.*, vol. 184, no. 4, pp. 450–450, 2024.
- [55] Accelerate, "How agentic AI is transforming healthcare: Benefits & use cases," 2025. Accessed: May 18, 2025. [Online]. Available: <https://www.accelerate.com/agentic-ai-in-healthcare/>
- [56] V. Bhamidipaty et al., "Revolutionizing healthcare: The impact of AI-powered sensors," in *Generative Artificial Intelligence for Biomedical and Smart Health Informatics*, New York, NY, USA: Wiley, 2025, pp. 355–373.
- [57] C. H. Chu et al., "Digital ageism: Challenges and opportunities in artificial intelligence for older adults," *Gerontologist*, vol. 62, no. 7, pp. 947–955, 2022.
- [58] D. Ramel, "Agentic AI named top tech trend for 2025," 2025. Accessed: May 16, 2025. [Online]. Available: <https://campustechnology.com/Articles/2024/10/23/Agentic-AI-Named-Top-Tech-Trend-for-2025>
- [59] K. Adams, "Inside healthcare's hottest new AI category: Agentic AI," 2025. Accessed: May 16, 2025. [Online]. Available: <https://medcitynews.com/2025/03/healthcare-agentic-ai-hospital/>
- [60] D. McDaniel, "RSA conference 2025: How agentic AI is redefining trust, identity, and access at scale," 2025. Accessed: May 16, 2025. [Online]. Available: <https://blog.gitguardian.com/rsa-conference-2025/>
- [61] A. Hayler, "Agents of change or agents of chaos? The reality of agentic AI," 2025. Accessed: May 16, 2025. [Online]. Available: <https://bloorresearch.com/2025/04/23/agents-of-change-or-agents-of-chaos-the-reality-of-agentic-ai/>
- [62] Orlando, "Gartner identifies the top 10 strategic technology trends for 2025," bloor Research, 2025. [Online]. Available: <https://www.gartner.com/en/newsroom/press-releases/2024-10-21-gartner-identifies-the-top-10-strategic-technology-trends-for-2025>
- [63] E. Asgari et al., "A framework to assess clinical safety and hallucination rates of LLMs for medical text summarisation," *npj Digit. Med.*, vol. 8, no. 1, pp. 1–15, 2025.
- [64] H. Ali, J. Qadir, T. Alam, M. Househ, and Z. Shah, "ChatGPT and large language models in healthcare: Opportunities and risks," in *Proc. IEEE Int. Conf. Artif. Intell., Blockchain, Internet Things*, 2023, pp. 1–4.

- [65] Promptfoo, "Misinformation in LLMs—causes and prevention strategies," 2025. Accessed: May 16, 2025. [Online]. Available: <https://www.promptfoo.dev/blog/misinformation/>
- [66] A. Andrew, "Potential applications and implications of large language models in primary care," *Fam. Med. Community Health*, vol. 12, no. Suppl 1, 2024, Art. no. e002602.
- [67] C. Chen and K. Shu, "Combating misinformation in the age of LLMs: Opportunities and challenges," *AI Mag.*, vol. 45, no. 3, pp. 354–368, 2024.
- [68] B. B. Neves and F. Vetere, "Ageing and digital technology," in *Designing and Evaluating Emerging Technologies for Older Adults*. Berlin, Germany: Springer, 2019, pp. 1–14.
- [69] J. Anglen, "AI revolution: Redefining elderly care for a graying world," 2025. Accessed: May 16, 2025. [Online]. Available: <https://www.rapidinnovation.io/post/ai-for-elderly-care>
- [70] L. Kane, "Usability for older adults: Challenges and changes," 2019. [Online]. Available: <https://www.nngroup.com/articles/usability-for-senior-citizens/>
- [71] M. A. Stein and J. Lazar, *Accessible Technology and the Developing World*. Oxford, U.K.: Oxford Univ. Press, 2021.
- [72] P. Rashidi and A. Mihailidis, "A survey on ambient-assisted living tools for older adults," *IEEE J. Biomed. Health Inform.*, vol. 17, no. 3, pp. 579–590, May 2013.
- [73] T. L. Mitzner et al., "Older adults talk technology: Technology usage and attitudes," *Comput. Hum. Behav.*, vol. 26, no. 6, pp. 1710–1721, 2010.
- [74] TechNexion, "AI at the Edge: The Silent Guardian of Modern Healthcare Systems," 2025. [Online]. Available: <https://www.technexion.com/resources/ai-at-the-edge-the-silent-guardian-of-modern-healthcare-systems/>
- [75] T. Nasir and T. Haslam, "Inside agentic AI in life sciences," 2025. [Online]. Available: <https://www.iqvia.com/agentic-ai>
- [76] Newo AI, "How AI enhances elderly care monitoring and assistance technologies," 2025. [Online]. Available: <https://newo.ai/insights/how-ai-enhances-elderly-care-monitoring-and-assistance-technologies/>
- [77] S. Kaliappan, A. S. Anand, K. Saha, and R. Karkar, "Exploring the role of LLMs for supporting older adults: Opportunities and concerns," 2024, *arXiv:2411.08123*.
- [78] S. Murugesan, "The rise of agentic AI: Implications, concerns, and the path forward," *IEEE Intell. Syst.*, vol. 40, no. 2, pp. 8–14, Mar./Apr. 2025.
- [79] NuAIG, "The intelligent future of care: Exploring agentic AI for healthcare providers," 2025. Accessed: May 18, 2025. [Online]. Available: <https://www.nuaig.ai/ai-in-action/agentic-ai-for-healthcare-providers/>
- [80] B. Kumarappan, "Agentic AI: Transforming healthcare through autonomous technology," 2025. Accessed: May 18, 2025. [Online]. Available: <https://www.mindsprint.com/insights/articles/agentic-ai-transforming-healthcare-through-autonomous-technology.html>
- [81] R. G. Gomes et al., "A mobile-optimized artificial intelligence system for gestational age and fetal malpresentation assessment," *Commun. Med.*, vol. 2, no. 1, p. 128, 2022.
- [82] X. Mattick et al., "Design for older people: Improving the usability of mobile apps through targeted design recommendations," in *Proc. 36th Australas. Conf. Human-Comput. Interact.*, 2024.
- [83] Y. Yang, Q. Jin, F. Huang, and Z. Lu, "Adversarial attacks on large language models in medicine," 2024, *arXiv:2406.12259*.
- [84] G. Lin, T. Tanaka, and Q. Zhao, "Large language model sentinel: LLM agent for adversarial purification," 2025, *arXiv:2405.20770*.
- [85] J. Ho, A. Jain, and P. Abbeel, "Denosing diffusion probabilistic models," in *Proc. Adv. Neural Inf. Process. Syst.*, 2020, vol. 33, pp. 6840–6851.
- [86] H. Ali, S. Murad, and Z. Shah, "Spot the fake lungs: Generating synthetic medical images using neural diffusion models," in *Proc. Ir. Conf. Artif. Intell. Cogn. Sci.*, 2022, pp. 32–39.
- [87] H. Ali, C. Grönlund, and Z. Shah, "Leveraging gans for data scarcity of COVID-19: Beyond the hype," in *Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit.*, 2023, pp. 659–667.
- [88] C. Yan, Z. Zhang, S. Nyemba, and Z. Li, "Generating synthetic electronic health record data using generative adversarial networks: Tutorial," *Jmir Ai*, vol. 3, 2024, Art. no. e52615.
- [89] A. Gonzales, G. Guruswamy, and S. R. Smith, "Synthetic data in health care: A narrative review," *PLOS Digit. Health*, vol. 2, no. 1, 2023, Art. no. e0000082.
- [90] I. Ferri-Molla, J. Linares-Pellicer, C. Aliaga-Torro, and J. Izquierdo-Domenech, "Multi-agent ai system for adaptive cognitive training in elderly care," in *Proc. 19th Int. Conf. Inform. Control, Automat. Robot.*, 2025, pp. 941–950. [Online]. Available: <https://www.scitepress.org/Papers/2025/133970/133970.pdf>
- [91] A. D. S. et al., "Autonomous ai systems in the face of liability, regulations and costs," *npj Digit. Med.*, vol. 6, 2023, Art. no. 185.
- [92] The Information Difference, "Agents of change or agents of chaos? The reality of agentic AI," 2025. [Online]. Available: <https://www.informationdifference.com/the-reality-of-agentic-ai/>
- [93] O. Freyer et al., "Quantum cryptography and data protection for medical devices before and after they meet Q-Day," *npj Digit. Med.*, vol. 8, p. 620, 2025.
- [94] C. Tana et al., "Smart aging: Integrating AI into elderly healthcare," *BMC Geriatrics*, vol. 25, no. 1, p. 1024, 2025.
- [95] A. Korinek, "Generative AI for economic research: Use cases and implications for economists," *J. Econ. Literature*, vol. 61, no. 4, pp. 1281–1317, 2023.
- [96] C. Pérez-Esteve et al., "AI in home care—Evaluation of large language models for future training of informal caregivers: Observational comparative case study," *J. Med. Internet Res.*, vol. 27, 2025, Art. no. e70703.
- [97] E. Laviola, "Prompt engineering in healthcare: Best practices, strategies & trends," *HealthTech Magazine*, 2025. [Online]. Available: <https://healthtechmagazine.net/article/2025/04/prompt-engineering-in-healthcare-best-practices-strategies-trends-perfcon>
- [98] E. Asgari, "Clinical safety of llms," *npj Digit. Med.*, vol. 8, 2025, Art. no. 274.
- [99] Various, "Clinician voices on ethics of LLM integration in healthcare," *npj Digit. Med.*, vol. 79, 2024, Art. no. glae176. [Online]. Available: <https://pubmed.ncbi.nlm.nih.gov/39001657/>
- [100] M. E. C. S. M. P. Team, "Multimodal elderly care systems (MECS)," Department of Informatics, University of Oslo, 2016. [Online]. Available: <https://www.mn.uio.no/ifi/english/research/projects/mecs/>
- [101] Various, "Integrating AI with wearable sensors for optimal elderly care," *J. Prevention, Treat. Community Psychol.*, 2024. [Online]. Available: <https://www.jptcp.com/index.php/jptcp/article/view/6450>
- [102] Y. Zhang, W. Liu, and J. Tang, "AI-driven multimodal sensing for proactive elderly care," *IEEE J. Biomed. Health Inform.*, vol. 28, no. 3, pp. 1456–1467, 2024.
- [103] N. Barla, "What are agentic LLMs? a comprehensive technical guide," Adaline Labs, 2025. [Online]. Available: <https://labs.adaline.ai/p/what-are-agentic-llms-a-comprehensive>
- [104] J. He, "AI robots in elderly care: Opportunities, challenges, and ethical concerns," *J. Technol. Social Sci.*, 2024. [Online]. Available: <https://escholarship.org/uc/item/4fd0925v>
- [105] T. Mirzaei, L. Amini, and P. Esmailzadeh, "Clinician voices on ethics of LLM integration in healthcare: A thematic analysis of ethical concerns and implications," *BMC Med. Inform. Decis. Mak.*, vol. 24, no. 1, 2024, Art. no. 250.
- [106] Various, "The unintended consequences: AI and ageism in aged care," *FHG*, 2024. [Online]. Available: <https://fhg.com.au/artificial-intelligence-aged-care/>
- [107] P. M. Abadir, A. Battle, J. D. Walston, and R. Chellappa, "Enhancing care for older adults and dementia patients with large language models," *Journals Gerontol., Ser. A, Biol. Sci. Med. Sci.*, vol. 79, no. 9, 2024, Art. no. glae176.
- [108] Various, "The ethical pitfall: Biased algorithms in aged care," *FHG*, 2024. [Online]. Available: <https://fhg.com.au/artificial-intelligence-aged-care/>