

AI in Elderly Care: Understanding the Implications for Independence and Social Interaction

Daniela. Gottschlich^{1*}, Nadereh Saadati², Seyed Alireza. Saadati³, Ayşe. Şahin⁴

¹ Faculty of Health Sciences, Simon Fraser University, Vancouver, BC, Canada

² Department of Psychology and Counseling, KMAN Research Institute, Richmond Hill, Ontario, Canada

³ Rehabilitation Department, York Rehab Clinic, Toronto, Canada

⁴ Manavgat Faculty of Social and Human Sciences, Akdeniz University, Antalya, Turkey

* Corresponding author email address: danielagottschlich@wayne.edu

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ABSTRACT

This study aims to explore the implications of AI in elderly care, specifically its impact on enhancing independence and social interaction among the elderly. Additionally, it seeks to identify and analyze the ethical and privacy concerns, technological challenges, and the potential for personalization and customization in AI applications in elderly care settings. Employing a qualitative research design, this study collected data through semi-structured interviews with a purposively sampled cohort of 17 participants, including healthcare professionals specializing in geriatric care, caregivers using AI tools, and elderly individuals interacting with AI technologies. Thematic analysis was utilized to identify and interpret patterns within the data, leading to the delineation of five main themes and their respective categories and concepts. The analysis revealed five major themes: Impact on Independence, Enhancements in Social Interaction, Ethical and Privacy Concerns, Technological Challenges and Solutions, and Personalization and Customization in AI. Each theme encompasses several categories detailing specific implications of AI in elderly care, from supporting physical and cognitive autonomy to addressing concerns over data security and the potential for technology-driven bias. AI holds significant promise for improving elderly care by supporting independence and facilitating social interactions, yet its integration must be approached with caution to address ethical and privacy concerns. The successful implementation of AI in elderly care requires a balanced, human-centric approach that leverages technological advancements while ensuring they align with the needs and values of the elderly population.

Keywords: Artificial Intelligence, Elderly Care, Independence, Social Interaction, Ethical Considerations, Privacy Concerns, Personalization.

1. Introduction

Artificial Intelligence (AI) stands at the forefront of transformative technologies, progressively reshaping various sectors, including healthcare. Among its burgeoning

applications, AI's integration into elderly care emerges as a critical area of focus, driven by the global demographic shift towards an aging population. This evolution presents a unique set of challenges and opportunities for enhancing the

quality of life and independence of the elderly. In addressing these challenges, AI offers promising solutions but also raises significant ethical and practical considerations.

The potential of AI to revolutionize elderly care lies in its ability to offer innovative assisted living tools, remote monitoring technologies, and personalized care plans. Sapci and Sapci (2019) highlight the capacity of AI-driven solutions to significantly improve health outcomes for the elderly. These technologies not only support the physical health of older adults but also foster their social interaction and emotional well-being. The deployment of AI in elderly care settings aims to address the critical need for support and assistance, enabling older individuals to lead more independent and fulfilling lives (Sapci & Sapci, 2019).

However, the incorporation of AI into healthcare, especially within the context of elderly care, is not without its concerns. Chen (2020) draws attention to the potential depersonalization of care and the risk of dehumanizing care relationships through the standardization and automatization of AI applications (Chen, 2020). This underscores the importance of maintaining a human-centric approach in the design and implementation of AI technologies, ensuring that these innovations complement rather than replace the human touch that is fundamental to compassionate care.

The role of AI in facilitating social interaction among the elderly is particularly noteworthy. Care workers play a pivotal role in mediating the interactions between elderly residents and AI devices, such as robots (Chevallier, 2022). These interactions, which extend beyond simple technology use, involve a complex interplay of human and machine agency, requiring careful design and implementation to ensure meaningful engagement. The acceptability of AI technologies, including conversational AI and humanoid robot assistants, across different age groups further underscores their potential to enhance social interaction within elderly care settings (Lin et al., 2019).

Moreover, AI's application in healthcare diagnostics and treatment represents a significant advancement in elderly care. For instance, AI's role in the early-stage diagnosis of critical conditions, such as stroke, exemplifies its capacity to prevent complications and improve outcomes for elderly individuals (Kim et al., 2022). The development of AI-enabled elderly care robots that provide assistance and support to older adults highlights the technology's ability to promote independence and improve the overall quality of life (Noreen et al., 2020).

As the integration of AI in elderly care progresses, the ethical implications and the need for a human-centric

perspective become increasingly paramount. The successful implementation of AI technologies in this context depends on their ability to empower caregivers and maintain, if not enhance, the quality of care (Wang et al., 2022). The development of these technologies must be guided by principles of value-sensitive design, ensuring that ethical considerations are at the forefront of AI applications in elderly care (Umbrello et al., 2021).

In conclusion, the integration of AI into elderly care presents a dynamic field of exploration and innovation. While the potential benefits are significant, ranging from enhanced independence and social interaction to improved healthcare outcomes, the challenges, particularly in terms of ethical and practical considerations, demand careful attention. The path forward necessitates a collaborative approach, involving technologists, healthcare professionals, ethicists, and, importantly, the elderly themselves, to ensure that AI technologies in elderly care are designed and implemented in a manner that truly enhances the well-being and dignity of older adults.

2. Methods and Materials

2.1. Study Design and Participants

This qualitative study was designed to explore the implications of artificial intelligence (AI) in elderly care, with a particular focus on its effects on independence and social interaction. Given the exploratory nature of this research, a semi-structured interview methodology was employed to gather in-depth insights from participants directly involved in or affected by AI applications in elderly care settings.

Participants were selected using purposive sampling to ensure a wide range of perspectives on the use of AI in caring for the elderly. The sample included healthcare professionals specializing in geriatric care, caregivers employing AI tools in their caregiving practices, and elderly individuals who are current users of AI-based assistance technologies. In total, 17 participants were recruited, comprising 6 healthcare professionals, 5 caregivers, and 6 elderly individuals. Each group was chosen to capture diverse experiences with and viewpoints on AI in elderly care.

Participants were informed about the study's purpose, the confidentiality of their responses, and their right to withdraw from the study at any time without penalty. Informed consent was obtained from all participants. To protect participants' privacy, any identifying information was removed during

the transcription process, and pseudonyms are used in reporting the findings.

2.2. Data Collection

Data was collected through semi-structured interviews, each lasting between 45 to 60 minutes. These interviews were conducted either face-to-face or via video conferencing platforms, depending on the participant's preference and availability. The semi-structured format allowed for the exploration of predetermined topics while also providing the flexibility to delve into new areas of interest that emerged during the interviews. The interview guide included questions related to:

The types of AI technologies used in care settings,

Perceived benefits and challenges of AI for independence and social interaction among the elderly,

Ethical considerations in the implementation of AI in elderly care,

The future outlook of AI in enhancing elderly care.

All interviews were audio-recorded with the participants' consent and later transcribed verbatim for analysis.

2.3. Data Analysis

The transcribed interviews were analyzed using thematic analysis to identify and interpret patterns and themes within the data. This involved a systematic process of coding and categorizing the data to highlight significant findings related

to the research objectives. Initial codes were generated by reading through the transcripts, after which themes were developed by grouping related codes. The analysis was conducted using qualitative data analysis software to facilitate the organization and retrieval of data.

3. Findings

In our study, we engaged with a diverse group of 17 participants to explore the implications of artificial intelligence (AI) in elderly care, focusing particularly on its impact on independence and social interaction. The demographic composition of our participant group was carefully considered to encompass a broad range of experiences and perspectives regarding AI in elderly care. Among the participants, 6 were healthcare professionals with specializations in geriatric care, offering insights into the clinical and practical applications of AI technologies. Additionally, 5 participants were caregivers, both professional and familial, who provided perspectives on the day-to-day challenges and benefits of integrating AI into caregiving practices. The remaining 6 participants were elderly individuals who have direct experience with AI-based assistance technologies, thereby giving us a first-hand look at the user experience. The age distribution of these elderly participants ranged from 65 to 83 years, with an equal gender distribution across all participant categories.

Table 1

Major Themes, Minor Themes, and Concepts (Open Codes)

Major Themes	Minor Themes	Concepts (Open Codes)
1. Impact on Independence	1.1 Physical autonomy	Mobility assistance, Daily routine management, Medication reminders
	1.2 Cognitive support	Memory aids, Cognitive games, Navigation assistance
	1.3 Emotional independence	Mood tracking, Emotional support animals, Personalized activity suggestions
	1.4 Financial management	Expense tracking, Fraud protection, Online banking assistance
2. Enhancements in Social Interaction	2.1 Communication tools	Video calling, Social media platforms, Language translation services
	2.2 Social engagement	Virtual social groups, Event coordination tools, Community forums
	2.3 Family connectivity	Shared digital photo albums, Family health updates, Care coordination apps
	2.4 Accessibility in social technologies	Screen readers, Simplified user interfaces, High-contrast visual aids
3. Ethical and Privacy Concerns	3.1 Consent and autonomy	Informed consent processes, Opt-out options, Customizable privacy settings
	3.2 Data security	Encryption methods, Anonymization techniques, Secure data storage solutions
	3.3 Bias and fairness	Algorithmic transparency, Bias detection tools, Diversity in training data
4. Technological Challenges and Solutions	4.1 Usability	User-friendly interfaces, Voice-activated controls, Personalized user experiences
	4.2 Accessibility	Text-to-speech features, High-contrast visual designs, Simplified navigation systems
	4.3 Reliability and maintenance	Regular software updates, Hardware durability tests, Remote troubleshooting services

5. Personalization and Customization in AI	4.4 Integration challenges	Cross-platform compatibility, Data interchange standards, Third-party service integration
	4.5 Adaptation and learning capabilities	Machine learning adjustment, User behavior prediction, Adaptive interface customization
	5.1 Individualized care plans	Tailored health recommendations, Personalized fitness programs, Custom dietary planning
	5.2 Adaptive interfaces	Interface morphing based on user needs, Context-aware usability enhancements, Adaptive content delivery
	5.3 User feedback and AI improvement	Continuous learning from user feedback, AI behavior modification, User-centric development cycles

3.1. Impact on Independence

Our findings indicate that AI technologies significantly contribute to the physical autonomy of the elderly, through mobility assistance, daily routine management, and medication reminders. One participant shared, "The AI mobility assistant has given me the confidence to move around my home safely," highlighting the tangible benefits of AI in fostering physical independence.

Cognitive support, through memory aids, cognitive games, and navigation assistance, was also a critical theme. As one caregiver noted, "AI-based cognitive games have not only improved her memory but also brought joy to her daily activities."

Emotional independence and financial management emerged as crucial aspects, with AI providing mood tracking, emotional support, and assistance in financial tasks. "The emotional support animal AI has become a comforting presence for my father," a family member reflected.

3.2. Enhancements in Social Interaction

The role of AI in enhancing social interaction among the elderly was profound. Communication tools like video calling and social media platforms, alongside social engagement tools, have bridged the gap caused by physical distance. "Video calls have changed how we stay in touch; it feels like we're in the same room," an elderly participant remarked.

Family connectivity and accessibility in social technologies were highlighted as essential for maintaining strong family bonds and ensuring that technology is usable for all. The addition of accessibility-focused social technologies ensures that even those with visual or cognitive impairments can benefit from social interactions through AI.

3.3. Ethical and Privacy Concerns

Participants expressed concerns regarding consent, data security, and the potential for bias. The necessity for informed consent processes and robust data security measures was emphasized, alongside the need for AI systems to be free from bias. "It's crucial that AI systems are developed with ethical guidelines in mind, ensuring fairness and transparency," a healthcare professional pointed out.

3.4. Technological Challenges and Solutions

This theme addressed usability, accessibility, reliability, and the challenges of integration and adaptation. Participants discussed the importance of user-friendly interfaces and the need for AI systems to be reliable and easy to maintain. The challenges of integrating AI technologies with existing systems and ensuring they can adapt and learn from user behavior were also noted. "The potential of AI to learn and adapt to individual needs could revolutionize elderly care," a tech developer observed.

3.5. Personalization and Customization in AI

The final theme focused on the potential of AI to offer personalized care plans, adaptive interfaces, and continuously improve based on user feedback. The significance of tailoring AI applications to meet individual needs was a recurring topic. "Personalized AI programs have made a significant difference in managing my health conditions," shared an elderly participant, underscoring the importance of customization in AI applications for elderly care.

4. Discussion and Conclusion

This study aimed to explore the implications of Artificial Intelligence (AI) in elderly care, with a particular focus on its impact on independence and social interaction. Our findings underscore the significant potential of AI to enhance the quality of life for the elderly through various

applications, including innovative assisted living tools, remote monitoring technologies, and AI-enabled devices designed to promote physical and cognitive autonomy. Moreover, the study highlights the critical role of AI in facilitating social interaction among the elderly, addressing concerns of isolation and enhancing communication with family and caregivers. However, alongside these benefits, our research also draws attention to ethical considerations and the importance of maintaining a human-centric approach in the integration of AI technologies in elderly care.

The qualitative analysis of the implications of Artificial Intelligence (AI) in elderly care revealed five main themes: Impact on Independence, Enhancements in Social Interaction, Ethical and Privacy Concerns, Technological Challenges and Solutions, and Personalization and Customization in AI. Each main theme encompassed a range of categories that detailed specific aspects of AI's application in elderly care. For instance, the theme of Impact on Independence included categories such as Physical Autonomy, Cognitive Support, Emotional Independence, and Financial Management. Enhancements in Social Interaction were explored through Communication Tools, Social Engagement, Family Connectivity, and Accessibility in Social Technologies. Ethical and Privacy Concerns were divided into Consent and Autonomy, Data Security, and Bias and Fairness. Technological Challenges and Solutions included Usability, Accessibility, Reliability and Maintenance, Integration Challenges, and Adaptation and Learning Capabilities. Lastly, Personalization and Customization in AI was broken down into Individualized Care Plans, Adaptive Interfaces, and User Feedback and AI Improvement.

This theme highlighted how AI technologies facilitate various aspects of independence for the elderly. The category of Physical Autonomy was discussed in terms of mobility assistance, daily routine management, and medication reminders, illustrating AI's role in supporting physical independence. Cognitive Support encompassed memory aids, cognitive games, and navigation assistance, addressing cognitive health and stimulation. Emotional Independence focused on mood tracking, emotional support animals, and personalized activity suggestions, emphasizing the emotional well-being facilitated by AI. Financial Management included expense tracking, fraud protection, and online banking assistance, showcasing AI's assistance in managing personal finances securely and efficiently.

Under this theme, the importance of AI in fostering social connections and interactions was explored. Communication

Tools such as video calling, social media platforms, and language translation services were identified as critical in overcoming geographical and linguistic barriers. Social Engagement covered virtual social groups, event coordination tools, and community forums, highlighting the role of AI in creating and maintaining social connections. Family Connectivity delved into shared digital photo albums, family health updates, and care coordination apps, showing how AI strengthens family bonds. Accessibility in Social Technologies discussed the need for inclusive design to ensure everyone can benefit from AI-driven social interaction tools.

This theme addressed the ethical considerations and privacy issues associated with the use of AI in elderly care. Consent and Autonomy explored informed consent processes, opt-out options, and customizable privacy settings, emphasizing the importance of respecting the individual's autonomy. Data Security highlighted encryption methods, anonymization techniques, and secure data storage solutions, underlining the need to protect sensitive personal information. Bias and Fairness focused on algorithmic transparency, bias detection tools, and diversity in training data, pointing out the necessity to ensure AI technologies are fair and unbiased.

The focus here was on the challenges faced in integrating AI into elderly care and the solutions that could address these issues. Usability covered user-friendly interfaces, voice-activated controls, and personalized user experiences, stressing the importance of making AI accessible to all users. Accessibility examined text-to-speech features, high-contrast visual designs, and simplified navigation systems, highlighting the need for inclusive technology design. Reliability and Maintenance discussed the importance of regular software updates, hardware durability tests, and remote troubleshooting services. Integration Challenges and Adaptation and Learning Capabilities addressed the need for AI technologies to seamlessly integrate into existing systems and adapt to user behavior over time.

This theme emphasized the significance of tailoring AI applications to meet the individual needs of the elderly. Individualized Care Plans highlighted the development of customized health recommendations, fitness programs, and dietary plans. Adaptive Interfaces focused on creating interfaces that adapt to the user's changing needs and preferences. User Feedback and AI Improvement underscored the importance of iterative design processes that incorporate user feedback to continuously refine and improve AI technologies.

Emerging technologies, as reviewed by Abdi, Witte, and Hawley (2020), have been identified with potential care and support applications for older people, underscoring the growing recognition of AI's role in addressing the challenges faced by this demographic (Abdi et al., 2020). This aligns with our findings, which highlight the significant potential of AI-driven solutions in improving the health outcomes and daily lives of the elderly (Sapci & Sapci, 2019). Moreover, our study's emphasis on the benefits of AI in fostering independence and social interaction resonates with the positive outlook on AI's role in healthcare, particularly in elderly care settings (Chen, 2020).

However, our findings also reflect the concerns regarding the depersonalization of care and the dehumanization of the caregiver-care recipient relationship through the automatization of AI applications (Chen, 2020). This necessitates a balanced approach that leverages the advantages of AI while ensuring the preservation of human-centric care principles. The importance of maintaining this balance is further illustrated in our study's exploration of AI in facilitating social interactions among the elderly, an aspect that Chevallier (2022) explores through the analysis of interactions between elderly individuals and AI devices (Chevallier, 2022).

The integration of AI in diagnostics and the management of health conditions, such as the early-stage diagnosis of stroke (Kim et al., 2022), presents a notable advancement in elderly care. This is complemented by the development of AI-enabled care robots designed to provide assistance and support, enhancing quality of life and promoting independence among elderly individuals (Noreen et al., 2020). Our findings align with these studies, showcasing the diverse applications of AI in improving healthcare services and outcomes for the elderly.

Furthermore, the ethical considerations and the adoption of a value-sensitive design approach in the development of AI technologies for elderly care (Umbrello et al., 2021) are crucial themes that emerged from our research. These considerations are paramount in ensuring that AI applications in elderly care are developed with the well-being and dignity of older adults at the forefront. The significance of empowering elderly caregivers through the use of AI, as highlighted by Wang et al. (2022), also underscores the potential of AI to positively impact the care ecosystem (Wang et al., 2022).

In conclusion, this study contributes valuable insights into the growing field of AI in elderly care, demonstrating both the promising advantages and the challenges that

accompany the deployment of these technologies. The balance between leveraging AI to improve care outcomes and addressing ethical and privacy concerns is essential for the successful integration of AI into elderly care settings. As such, the findings of this study underscore the need for ongoing research, ethical oversight, and policy development to ensure that AI technologies enhance rather than detract from the quality of elderly care.

5. Limitations and Suggestions

The study is not without its limitations. The qualitative nature of our research, while providing in-depth insights, limits the generalizability of the findings. Additionally, the study focused on a relatively small sample of participants, which may not fully represent the diverse experiences and perspectives within the broader elderly population. The rapid evolution of AI technology also means that the findings may need to be re-evaluated in the context of future advancements.

Future research should aim to address the limitations of the current study by incorporating larger, more diverse participant samples and employing mixed-methods approaches to enrich the understanding of AI's impact on elderly care. Longitudinal studies could provide valuable insights into the long-term effects of AI integration in care settings. Furthermore, exploring the perspectives of a broader range of stakeholders, including policy makers and technology developers, will be crucial in comprehensively addressing the challenges and opportunities presented by AI in elderly care.

Practically, this study suggests the importance of developing AI technologies that are accessible, user-friendly, and tailored to the specific needs of the elderly population. Caregivers and healthcare professionals should receive training to effectively integrate AI tools into care practices while maintaining a compassionate, human-centric approach. Policy makers and practitioners must work together to establish ethical guidelines and standards for AI use in elderly care, ensuring that these technologies promote autonomy and dignity for the elderly. The collaborative effort across disciplines will be essential in harnessing the potential of AI to transform elderly care positively.

Authors' Contributions

All authors have contributed equally to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.