

REVIEW
DERLEME

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Artificial Intelligence in Older Adults' Healthcare: Applications and Ethical Considerations

Yaşlı Sağlığında Yapay Zeka: Uygulamalar ve Etik Sorunlar

ABSTRACT

With the global and national rise in the population of older adults, there has been a concurrent increase in chronic diseases, disease-related complications, care requirements, and the need for social support. The use of technology-assisted applications in the diagnosis, treatment, follow-up, and self-management processes of chronic diseases is becoming increasingly widespread. In older adults, artificial intelligence-based applications play a pivotal role across healthcare processes—spanning diagnosis, follow-up, treatment, adaptation, and rehabilitation—by addressing the physical and psychosocial changes associated with aging and chronic illness. These applications increase patient activity in self-management processes with many positive effects such as providing individualised care, detecting current and possible risks, facilitating the diagnosis process of diseases, supporting the process of treatment compliance, providing psychosocial support, strengthening the rehabilitation process. However, despite these benefits, the integration of artificial intelligence-based applications into older adults' healthcare and their adaptation to these systems come with certain challenges and ethical concerns. Issues such as data privacy, algorithmic bias, digital literacy, and accessibility must be carefully considered to ensure the effective and equitable use of these technologies in the care of older adults. This review aims to comprehensively examine the role, efficacy, and potential of AI-driven applications in the management of chronic diseases among older adults, while also exploring the ethical and practical challenges that may arise. It is intended to guide healthcare professionals and researchers in developing ethically sensitive, person-centered, and accessible artificial intelligence-based strategies for optimizing the health and well-being of older adults.

Keywords

Artificial intelligence, ethics, health care delivery, older adults

ÖZ

Dünyada ve ülkemizde yaşlı nüfus artışı ile birlikte kronik hastalıklar, hastalıklarla ilişkili komplikasyonlar, bakım ihtiyacı ve sosyal destek ihtiyacı artış göstermektedir. Kronik hastalıkların tanı, tedavi, takip ve öz yönetim süreçlerinde teknoloji destekli uygulamaların kullanımını gittikçe yaygınlaştırmaktadır. Yaşlılarda kronik hastalıklar ile birlikte yaşlılığa bağlı gelişen fiziksel ve psikososyal değişikliklerin tanı, takip, tedavi, uyum ve rehabilitasyon gibi sağlık bakım süreçlerinde yapay zeka destekli uygulamalar önemli bir rol oynamaktadır. Yapay zeka uygulamaları bireyselleştirilmiş bakım hizmeti sunma, mevcut ve olası riskleri saptama, hastalıkların tanılama sürecini kolaylaştırma, tedaviye uyum sürecine destek olma, psikososyal destek sağlama, rehabilitasyon sürecini güçlendirme gibi pek çok olumlu etkisi ile birlikte öz yönetim süreçlerinde hasta aktifliğini artırmaktadır. Ancak, tüm bu faydalarına rağmen, yapay zeka destekli uygulamaların yaşlı bireylerin sağlık hizmetlerine entegrasyonu ve bu sistemlere uyum sağlamaları sürecinde bazı zorluklar ve etik kaygılar da bulunmaktadır. Veri gizliliği, algoritmik önyargılar, dijital okuryazarlık ve bu teknolojilere erişilebilirlik gibi konuların ele alınması, yaşlı bakımında bu uygulamaların etkili ve adil bir şekilde kullanılmasını sağlamak açısından kritik önem taşımaktadır. Bu derleme, yaşlı bireylerin kronik hastalık yönetiminde yapay zeka destekli uygulamaların rolünü, etkinliğini, sunduğu olanakları ve karşılaşılabilecek etik ve uygulamaya yönelik zorlukları bütüncül bir şekilde ele almayı amaçlamıştır. Sağlık bakım profesyonellerine ve araştırmacılara, yaşlı bakıma yönelik yapay zeka temelli çözümleri değerlendirirken etik duyarlılığı yüksek, birey odaklı ve erişilebilir yaklaşımlar geliştirmeleri konusunda yol gösterici olabileceği düşünülmektedir.

Anahtar Kelimeler

Yapay zeka, etik, sağlık hizmeti sunumu, yaşlı

What is known about the field

- With the increasing older population in Türkiye and worldwide, the need for care is growing, and AI applications are being utilized in various areas such as diagnosis, treatment, management, monitoring, psychosocial support, and rehabilitation.
- In the healthcare of older adults, artificial intelligence offers advantages such as personalized care, early disease detection, chronic disease management, and remote monitoring, while ethical, security, and privacy concerns must also be addressed.

Contribution of the article to the field

- This article is a review that examines the application areas and benefits of artificial intelligence-based technologies used in healthcare services for older adults, along with the ethical issues associated with these artificial intelligence-based applications.
- This review article offers a general overview of ethical issues that may arise in the design, development and implementation of artificial intelligence-based applications used in the holistic care of older adults, such as personalized care, chronic disease management and psychosocial support, as well as potential solutions to these issues.
- This article aims to guide future quantitative and qualitative research designed to assess older adults' adaptation processes to artificial intelligence-based applications, the barriers encountered during usage, their readiness levels, perceptions and attitudes toward such technologies, digital literacy levels, and awareness of artificial intelligence

INTRODUCTION

Although the global population continues to grow, the rate of growth is slowing due to declining fertility rates, while life expectancy at birth is increasing worldwide, leading to a growing proportion of older adults. The proportion of the population aged 65 and older is projected to reach 16% globally and 27.8% in developed countries by 2050, while the population aged 80 and above is anticipated to grow even more rapidly, reaching 460 million by the same year (1).

Life expectancy at birth is on the rise in Türkiye, accompanied by an aging population. According to the Address Based Population Registration System (ABPRS) of the Turkish Statistical Institute (TurkStat), the median age was 34 years in 2023 and is projected to increase to 44.8 years by 2050, 51.5 years by 2075, and 52.2 years by 2100 under the main scenario. The population of older adults now exceeds 10%

of the total, with baseline projections estimating it will reach 23.1% by 2050, 31.7% by 2075, and 33.6% by 2100 (2). Furthermore, the TurkStat Türkiye Older Adults Profile Survey reports that 78.7% of people aged 65 and older suffer from chronic illnesses (3).

The growth of the older adult population has led to a significant increase in chronic diseases and related complications. This situation also increases the self-care needs of older adults. The prevalence of chronic conditions such as hypertension, diabetes and heart failure increases with age, requiring more complex self-management strategies to maintain health and prevent complications (4,5). In this context, the utilization of technology-based applications in diagnosis, treatment management, and care processes of chronic diseases is increasingly expanding. Artificial intelligence (AI) facilitates analytical insights in healthcare, including clinical predictions, diagnosis, disease assessment, drug development, personalized healthcare services, and risk prevention (6,7).

The widespread adoption of smart devices and AI-based care systems is driving a transformation in healthcare. Moreover, the integration of AI and robotics enables the use of robots capable of learning and prediction, providing social support to vulnerable groups (such as children, older adults, and the people with disabilities) (6). The advancement of technology plays a crucial role in enhancing the quality of care provided to older adults (7).

The integration of AI applications into the care of older adults is becoming increasingly critical for societies trying to cope with the challenges of an aging population. AI technologies have the potential to enhance quality of life by offering personalized care solutions, optimizing healthcare, and supporting older adults in maintaining independent living. For instance, AI-based systems such as humanoid robots and smart wearable biometric trackers that utilize machine learning analytics can continuously monitor individuals' health status, predict potential risks, and provide emotional support through intelligent care robots, thereby helping to reduce loneliness and depression among older adults living alone (8,9). Moreover, the integration of AI in healthcare settings can enhance process efficiency, reduce the workload of caregivers, and facilitate communication between healthcare professionals and older adults (10,11).

The COVID-19 pandemic we have faced in the past years has also revealed the importance of AI applications in maintaining the well-being of older adults, through tools such as AI-powered virtual assistants, remote health monitoring systems, and predictive models that helped manage health risks and reduce social isolation. (12). AI-based technologies play a

critical role in minimizing the risks associated with social distancing measures while making it easier for older adults to receive timely medical care. Furthermore, smart home systems supported by AI can provide safer living environments for older adults, enabling them to maintain their independent lives, while enabling them to get help quickly when they need it (13). As the demand for care continues to increase with the growing population of older adults, the impact of AI in this field will continue to expand, paving the way for the development of innovative solutions that meet both physical and psychosocial needs (14,15).

The results of a bibliometric analysis study evaluating the general situation of AI-focused research in the field of health in the national literature in our country reveal that the interest in AI is gradually increasing, there is an increase in nursing studies, and AI has become the center of research in specialties such as cardiology, urology, cancer and neurosurgery. However, compared to the international literature, research on ethical, legal, and safety issues has been largely neglected (16).

The Twelfth Development Plan (2024-2028) of the Presidency of the Republic of Türkiye's Strategy and Budget Directorate has also identified many policies and measures for older adults. The Twelfth Development Plan includes the development of health technologies offered to older adults, the dissemination of health literacy, financial literacy, digital literacy and technology usage trainings for older adults, the use of information and communication technologies, the enhancement of older adults' digital skills, and the adaptation of digital devices and applications to the physical skills of older adults (1). In addition, it has been stated that AI applications in the field of health can be related to SDG3: Healthy and Quality Life, SDG10: Reducing Inequalities and SDG11: Sustainable Cities and Communities from the Sustainable Development Goals (17).

The aim of this narrative review is to provide an overview by examining national and international literature to identify the areas of application of AI in the healthcare of older adults, assess the opportunities offered by these technologies, and evaluate the ethical problems encountered.

Artificial Intelligence in the Diagnosis of Aging-Related Diseases

AI applications in the diagnosis of age-related diseases are revolutionizing the healthcare services provided to older adults. As the prevalence of age-related diseases such as diabetic retinopathy, macular degeneration and osteoporosis increases, AI technologies are being utilized to enhance diagnostic ac-

curacy and improve process efficiency. For instance, deep learning algorithms have shown high sensitivity and specificity in detecting diabetic retinopathy and macular edema, significantly improving the early diagnosis and treatment outcomes of these diseases (18). Furthermore, the ability of AI systems to analyze large amounts of medical imaging data rapidly identifies disease patterns that may be overlooked by humans, thus facilitating timely interventions that can prevent the progression of these diseases (19).

The role of AI extends beyond ophthalmology; it is also being utilized in predicting conditions such as osteoporosis through machine learning models that analyze computed tomography scans (20). Such developments are of great importance as they address the growing demand for effective diagnostic tools in the face of an aging population. The integration of AI into clinical practice not only aids in the accurate identification of diseases, but also reduces the cognitive load on healthcare professionals, allowing them to focus more on patient care (19).

Artificial Intelligence in Chronic Disease Management

AI plays an increasingly important role in monitoring and managing chronic diseases in older adults, providing innovative solutions that enhance patient care and improve health outcomes. Chronic diseases such as diabetes, hypertension and heart disease are prevalent in the older adult population and require continuous monitoring and management to prevent complications of these diseases. AI technologies, including wearable devices and remote monitoring systems enable real-time monitoring of vital signs, allowing healthcare professionals to intervene quickly when necessary (21). For instance, applications powered by AI can analyze sensor data to detect abnormalities in a patient's health, alerting medical professionals or caregivers of potential problems before they become more severe (22).

AI-powered chatbots are becoming more and more popular as tools to help older adults manage chronic diseases. By offering personalized medical recommendations, medication reminders, and educational resources, these systems can help patients become more involved in their own care (23,24). AI can also help healthcare professionals and patients communicate more effectively as well, which can help close gaps in care services, particularly for those who have transportation or mobility limitations (25). AI's integration into the management of chronic diseases not only improves the standard of care but also promotes older adults to retain independence, allowing them to effectively manage their diseases and maintain a higher standard of living (26).

Artificial Intelligence in Cognitive and Mental Health Support

AI is revolutionizing cognitive and mental health support for older adults, tackling the distinct challenges this population encounters. As cognitive disorders like dementia and Alzheimer's disease become more widespread, AI-driven technologies are being designed to improve early detection and intervention methods. For example, AI algorithms can process neuroimaging data to recognize patterns associated with cognitive decline, potentially diagnosing these conditions years ahead of conventional diagnostic techniques (9,27). This early intervention is essential, as it enables timely therapeutic actions that can help slow disease progress and enhance the quality of life for those affected.

Additionally, AI-driven applications are being employed to support mental health through interactive platforms like chatbots and cognitive training games. These tools deliver personalized cognitive exercises that adjust to the user's skill level, fostering mental stimulation and cognitive improvement (28). Furthermore, AI chatbots can act as easily accessible mental health tools, offering emotional support and therapeutic interventions through conversational platforms. Studies have shown that these AI-driven agents can significantly alleviate feelings of loneliness and anxiety in older adults, providing a judgment-free space for them to share their concerns and receive guidance (29,30). The integration of AI in mental health care not only improves access to support services but also enables older adults to actively participate in managing their cognitive health, ultimately promoting a sense of autonomy and well-being.

Artificial Intelligence in Enhancing Mobility and Rehabilitation

The role of AI in mobility and rehabilitation is becoming increasingly important, especially for older adults, who frequently encounter mobility challenges due to age-related conditions or disabilities. AI technologies, such as wearable robotic exoskeletons and smart sensors, are being developed to improve rehabilitation processes and mobility outcomes. For instance, AI-driven wearable robotic exoskeletons have demonstrated potential in aiding upper limb rehabilitation, allowing individuals to carry out therapeutic exercises more easily and effectively. These devices use artificial neural networks to adjust to the user's movements, offering real-time feedback and assistance that can greatly enhance the rehabilitation process (31).

Moreover, AI is being integrated into remote monitoring systems that support rehabilitation for patients recovering from neurological conditions like strokes. Machine learning algorithms can evaluate data gathered from wearable devices to assess arm function and predict rehabilitation progress, enabling healthcare professionals to customize interventions based on each patient's individual recovery (32). This tailored approach not only enhances rehabilitation strategies but also empowers patients by actively involving them in their recovery journey. Furthermore, AI technologies are being applied in virtual reality (VR) rehabilitation programs, which create immersive environments for patients to participate in therapeutic exercises, further boosting motivation and adherence to rehabilitation protocols (33). As AI continues to advance, its applications in mobility and rehabilitation are expected to expand, providing innovative solutions that improve the quality of life for older adults and encourage greater independence.

Artificial Intelligence in Enhancing Social and Emotional Well-being

AI is gaining recognition for its ability to improve social and emotional well-being among older adults, addressing the crucial need for companionship and emotional support in this group. With loneliness and social isolation being common challenges for older adults, AI technologies like social robots and virtual companions are being created to offer meaningful interactions and emotional connection. These AI-driven systems are designed to mimic human-like conversations and emotional reactions, helping to reduce feelings of loneliness and enhance overall mental health (34,35). For instance, social robots with emotional AI features can detect and respond to human emotions, fostering a more interactive and supportive environment for older adults (36).

AI, which analyzes data obtained from wearable devices and smart home technologies, can detect changes in mood or behavior and alert formal and informal caregivers when necessary (37). Additionally, AI facilitates access to mental health services by offering personalized support through chatbots and virtual therapy sessions. This feature is particularly beneficial for older adults who face difficulties in accessing traditional mental health services (38). The development of these technologies serves as a bridge not only for a better quality of life for older adults but also for stronger social connections.

Barriers to Artificial Intelligence Integration in Older Adults' Care

The integration of AI into older adults' care presents several challenges and constraints that need to be overcome to guarantee its effective adoption

and implementation. One key obstacle is the acceptance of AI technologies by both older adults and their caregivers. Many older adults might have limited exposure to technology, resulting in hesitance or opposition to using AI-based solutions. This reluctance can stem from concerns about being replaced by machines or doubts regarding the dependability of AI systems in delivering care (39,40). Moreover, caregivers might be reluctant to embrace AI tools due to limited knowledge of how these technologies function and the advantages they offer, which could hinder the broader acceptance of AI in healthcare environments (41).

Another major obstacle is the integration of AI systems into established healthcare frameworks. Many healthcare institutions struggle with ensuring interoperability between AI technologies and their existing systems, potentially resulting in inefficiencies and disjointed care (42). Effectively implementing AI demands more than just technological compatibility; it also requires a cultural shift within healthcare institutions to fully embrace these advancements. This involves providing comprehensive training for healthcare professionals to ensure they can efficiently use AI tools and grasp their impact on patient care (40,43). Furthermore, ethical and legal challenges related to AI in healthcare, including concerns about data privacy and accountability for AI-driven decisions, add another layer of complexity to the integration process (44).

Technological limitations also present major obstacles to the broad implementation of AI in older adults' care. Many AI systems rely on high-quality data input, which may not always be accessible in every healthcare setting. Variations in data recording practices and the absence of standardized protocols can reduce the efficiency of AI algorithms (42,45). Furthermore, the digital gap between urban and rural regions can deepen inequalities in access to AI technologies, restricting their advantages to specific populations (46). Overcoming these technological barriers is vital not only for the effective implementation of AI in older adults' care but also for ensuring that these solutions are accessible to all segments of society equally. Finally, it is crucial to consider broader societal and ethical issues. The presence of biases in AI algorithms, which can perpetuate inequalities based on factors such as race, gender, and socioeconomic status, necessitates careful oversight and regulation of these technologies in healthcare (43,47).

Artificial Intelligence and Ethics

AI technologies show a wide range of applications as they are used in many areas of daily life. With the rapid advancement of technology, the ethical issues surrounding AI have become increasingly evident

(48). Before the sectoral development and implementation of AI technology, it is crucial to establish a framework grounded in ethical principles. Although ethical principles and moral values vary across ethnic groups, nations and countries with different norms, there is a common idea of universal values such as honesty, integrity, transparency, benevolence, respect for autonomy and non-maliciousness (6,48). In this context, it will be possible to design, develop, and implement AI technology in a user-centered manner aligned with an ethical perspective (6). AI technologies have significant potential in improving health and social services for older adults. However, realizing this potential depends on technologies not exacerbating age discrimination or creating new forms of discrimination. To facilitate the inclusion of older adults in the design of AI technologies, data science teams should be age-diverse and utilize datasets that accurately represent all age groups. Furthermore, it is important to protect the rights of older adults to use, consent and object to AI technologies and to enhance their digital literacy. After the development of an AI technology, its potential positive and negative impacts on older adults should be systematically evaluated (49).

In 2021, the World Health Organization published comprehensive guidance on AI ethics and governance for health. In this guide, while identifying both the benefits and risks of using AI in healthcare, it highlighted six principles that should underpin the policies and practices of AI developers and providers. These principles;

- Protect autonomy,
- Promote human well-being, human safety and public interest,
- Ensure transparency, explainability and intelligibility,
- Foster responsibility and accountability,
- Ensure inclusiveness and equity,
- Promote AI that is responsive and sustainable (50).

Regarding the ethical dimension and management of AI in healthcare, different ethical risks are involved in the development, provision and deployment phases of AI. The development phase of AI applications involves ethical risks such as bias, privacy, labor concerns, carbon and water footprints, misinformation or disinformation, security and cybersecurity, human epistemic authority. The ethical risks in the provision phase are listed as system-wide bias, false information or misinformation, manipulation, privacy and automation bias. Finally, inaccurate or false responses, bias, privacy, accessibility and affordability, labor and employment, automation bias, quality of patient-professional interaction were identified as ethical risks that may arise during the deployment phase of AI applications (50). Data privacy has become a fundamental concern in AI ethics, as the regulation of data

collection, storage, and usage is directly linked to the protection of personal privacy. Similarly, fairness and discrimination represent another critical ethical challenge in AI ethics. While AI aims to improve efficiency and accuracy, the data and algorithms it relies on can be biased. These biases can arise from inequities in the data or imbalances that arise during algorithm design and training. Transparency and the attribution of responsibility in AI technologies are crucial concepts in AI ethics. Additionally, issues such as employment and labor displacement are also important considerations that need to be addressed in AI ethics (48).

Various actions can be taken by developers to address existing risks, including implementing training and certification programs for programmers, conducting data protection impact assessments, ensuring transparency in datasets, involving diverse stakeholders in the AI design phase, guaranteeing fair remuneration and support services, aligning AI design with ethical norms, and enhancing the energy efficiency of models. Actions have been identified for governments, including ensuring transparency, enforcing data protection laws, mandating ethical and human rights standards, enacting laws that require public assessments, and implementing consumer protection laws. In addition, several action plans for deployers and governments were presented, such as promoting accessibility and affordability, sharing risks, errors and harms with clear warnings and precautions, holding developers or providers accountable for inaccurate or harmful information, ensuring operational transparency, educating health professionals, data sharing, social/cultural acceptability, improving AI literacy and engaging with society to understand appropriate use (50).

CONCLUSION

The integration of AI into older adult care presents transformative opportunities to improve healthcare delivery, enhance the quality of life, and promote overall well-being among older adults. AI-driven technologies, such as social robots, virtual companions, and real-time health monitoring systems, offer effective solutions to critical challenges, including loneliness, mental health issues, chronic disease management, and caregiver burdens. By enabling early diagnosis, personalized care, and predictive analytics, AI not only improves health outcomes but also encourages older adults to take a more active role in managing their own health. Furthermore, AI facilitates continuous monitoring, real-time interventions, and strengthened communication between older adult patients and healthcare professionals, thereby establishing a comprehensive support mechanism in older adult care.

However, several key barriers must be addressed to ensure the successful adoption of these technologies. Technological resistance, data privacy concerns, ethical issues, and the need for comprehensive training for caregivers and healthcare professionals are among the primary challenges that may hinder the widespread implementation of AI. Therefore, it is crucial to design AI solutions with ethical sensitivity, minimize algorithmic biases, and ensure equal access to these innovations. When developed with a responsible and inclusive approach, AI not only has the potential to impact on elder care, but also contributes to a healthier and more sustainable society. In this context, further research and development in AI applications for older adult care are essential to fully realize its potential.

Based on the findings of this review, several recommendations are provided for researchers, healthcare professionals, and institutions/policymakers.

Recommendations for researchers include the following:

- To plan studies that examine the adaptation processes of older adults to AI-based applications and identify potential barriers.
 - To conduct systematic evaluations of potential ethical risks that may arise in AI-based care practices and to propose appropriate solutions.
 - To design both quantitative and qualitative studies to assess the levels of digital literacy and AI awareness among older adults.
 - To evaluate the effectiveness of educational and intervention programs aimed at empowering older adults to engage with AI-based technologies.
 - To investigate the challenges encountered during the integration of AI-based programs into institutional healthcare services for older adults.
- Recommendations for healthcare professionals include the following:
- To use AI-based technologies in older adult care in accordance with ethical principles, and to increase awareness regarding ethical considerations among healthcare professionals.
 - To take an active role in the development and system integration of AI-based technologies used in healthcare services.
 - To participate in training programs focused on the use of AI-based technologies in clinical practice.

- To collaborate with older adults during the implementation of AI-based technologies.

Recommendations for institutions and policymakers include the following:

- To establish ethical guidelines, standards, and monitoring mechanisms for AI-based technologies developed for older adults.
- To develop public policies aimed at reducing inequalities in access to digital health services among older adults.
- To promote infrastructure investments that ensure the safe, accessible, and inclusive implementation of AI-based technologies in institutions providing older adult care services.
- To integrate digital health technologies and artificial intelligence literacy into the educational curricula of healthcare professionals through relevant institutional initiatives.

Conflicts of interest

The authors declare no conflict of interest.

Author contribution

Idea/Concept: EGŞ, AT Design: EGŞ, AT Analysis/Comment: EGŞ, AT Literature Review: EGŞ, AT Manuscript preparation: EGŞ, AT Critical Review: EGŞ, AT

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