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Culturally Competent AI (Artificial Intelligence) and Robots for Transnational Caregiving and End-of-Life, and Ethical, Legal, and Social Issues

Kazumi Hoshino * and Lok Siu**

Abstract
This research analyzes AI (Artificial Intelligence) and robots for transnational caregiving for older adults and end-of-life. The research discusses culturally sensitive AI and robots and examines ethical, legal, and social issues of transnational caregiving for older adults and end-of-life. Based on the literature reviews, the research demonstrates policy implications of AI and robots for transnational caregiving for older adults and end-of-life; 1) Establish AI's safety and effectiveness; 2) With the increasing availability of healthcare data and rapid progress in analytic techniques, AI tools transform healthcare sectors; 3) AI systems have access to sensitive personal information, necessitating robust legal and regulatory frameworks for safeguarding privacy, security, and integrity; 4) Control of the potentials of AI and robots; and 5) Minimize the risks of AI and robots.

Keywords: Culturally competent AI (Artificial Intelligence), Robots, Ethical, legal, and social issues, Transnational caregiving for older adults, End-of-life

Ⅰ INTRODUCTION: AI AND ROBOTS IN TRANSNATIONAL CAREGIVING FOR OLDER ADULTS AND END-OF-LIFE

Generative AI (Artificial Intelligence) is progressing rapidly and is being applied in many fields, but with the acceleration of family transnationality in super-aging international societies. Culturally competent AI (Artificial Intelligence) assistance for intergenerational support (i.e., caregiving for older adults) of transnational families, which integrates cultural competence, has been still underdeveloped and is an essential issue.

Hoshino (2024a) defines that transnational caregiving for older adults includes adult children's periodical returning to their home countries (i.e., international long-distance caregiving) and older parents' immigration to their adult children's settled countries due to caregiving for them. As Miyawaki & Hooyman (2021) addressed, research on the effects of globalization and immigration on family relationships has focused on younger families. Few studies have addressed the issue of immigrant adult children caring for their aging parents in their home country. With the increasing geographic mobility and life expectancy in both developed and developing countries, adult children have faced the high economic (e.g., travel and financial support) and emotional (e.g., worry and guilt) costs for providing care across national borders.

According to the World Economic Forum (Figure 1; 2024), unprecedented disruptions caused by the COVID-19 pandemic, followed by social, economic, geopolitical and environmental challenges, continue to place complex and interconnected threats on population health, especially impacting vulnerable populations, and increased strains on healthcare systems, particularly healthcare workers and supply of essential health products. It is important to ensure stakeholders, industries, countries, and sectors strive to achieve common health and healthcare goals and work collaboratively to do so.

AI has been applied to health care, including patient care, physician, medical imaging and diagnosis, and research and development (Figure 2; TechNet, 2024). Patient care comprises automated and assisted diagnosis and treatment, real-time patient prioritization and triage, pregnancy management, and health assistants and personal trainers. AI supports physicians, such

* Visiting Professional Researcher, School of Public Health, The University of California at Berkeley; Visiting Researcher, School of Humanities, The University of Osaka
** Associate Vice Chancellor for Research, The University of California at Berkeley; Professor, Department of Ethnic Studies, The University of California at Berkeley

Figure 1 Recent trends in global health and healthcare-while COVID-19 triggered growth, it also brought health, economic, political, and environmental challenges (World Economic Forum, 2024)

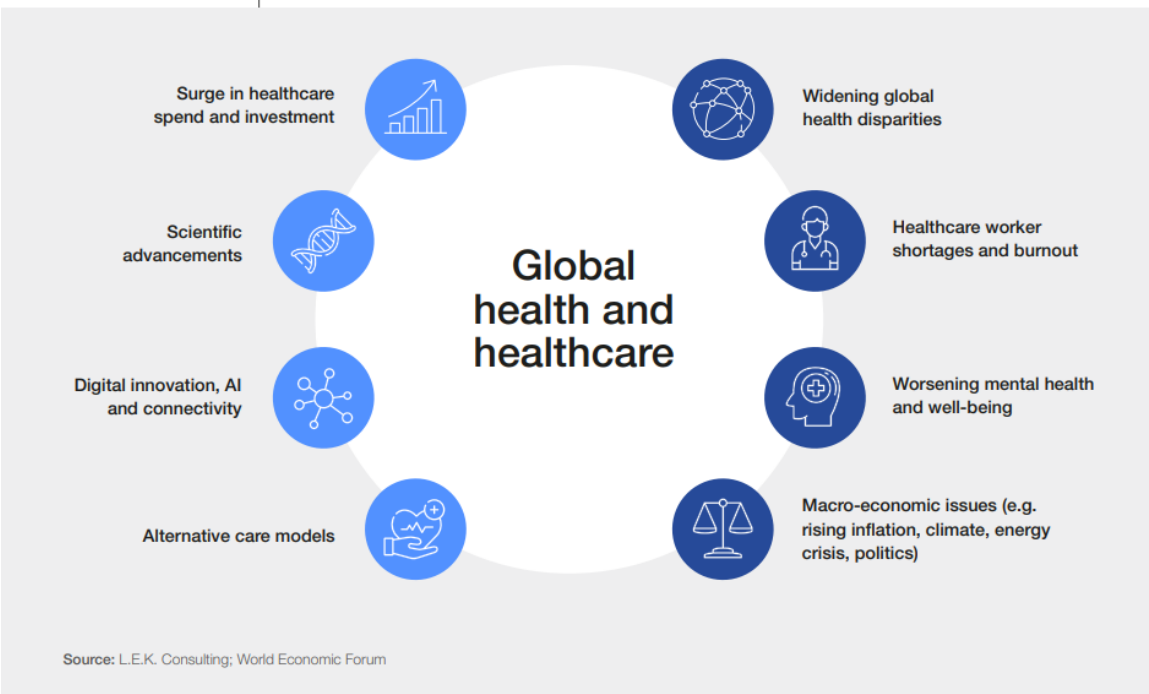
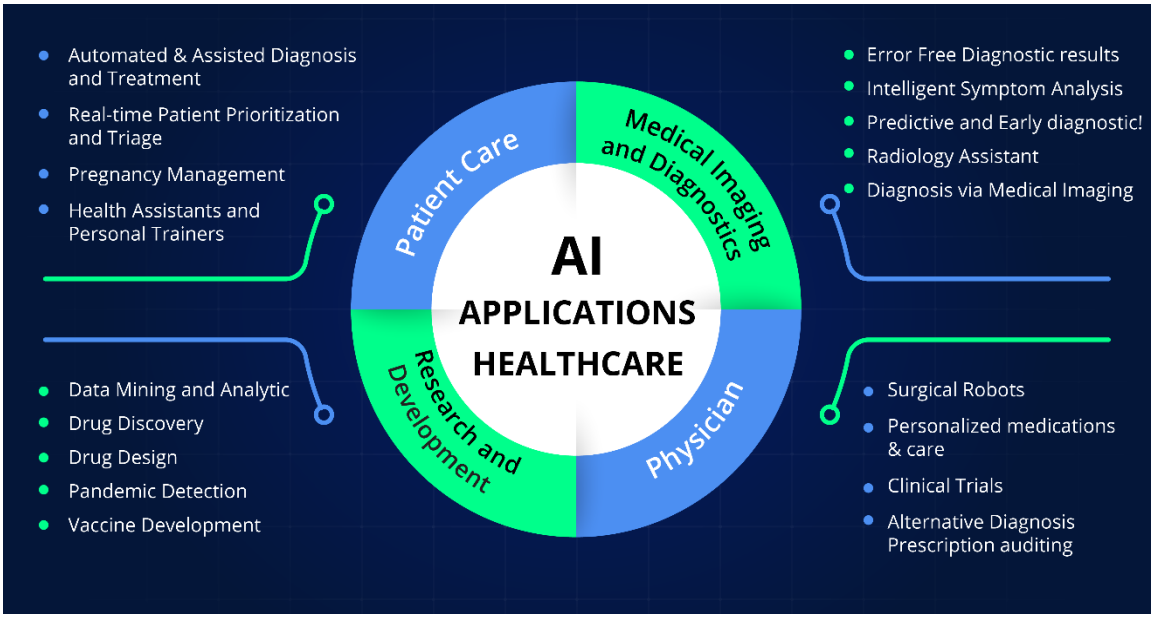


Figure 2 AI applications to healthcare (TechNet, 2024)



as surgical robots, personalized medications and care, clinical trials, and alternative diagnosis and prescription auditing. Medical Imaging and diagnostics consist of error-free diagnostic results, predictive and early diagnostic, radiology assistant, intelligent symptom analysis, and diagnosis via medical imaging. Research and development include data mining and analytic, drug discovery, drug design, pandemic detection, and vaccine development.

As Denecke & Baudoin (2022) analyzed, health care is shifting toward becoming proactive according to the concept of P5 medicine–a predictive, personalized, preventive, participatory and precision discipline. This patient-centered care heavily leverages the latest technologies of AI and robotics that support diagnosis, decision making and treatment. These technologies have already achieved notable results in the prediction of sepsis or cardiovascular risk, the monitoring of vital parameters in intensive care units, or in the form of home care robots. While much research is conducted around AI and robotics in health care, adoption in real world care settings is still limited. To remove adoption barriers, we need to address issues such as safety, security, privacy, and ethical principles; detect and eliminate bias that could result in harmful or unfair clinical decisions; and build trust in and societal acceptance of AI.

Ⅱ. AI AND ROBOTS IN TRANSNATIONAL CAREGIVING FOR OLDER ADULTS AND END-OF-LIFE

1. AI And Robots In Transnational Caregiving For Older Adults

The rise of generative AI (artificial intelligence) is said to be an innovative technological revolution, and is thought to have the potential to significantly change caregiving for older adults. Padhan et al. (2023) addressed that AI (Artificial Intelligence) and robotics have emerged as promising technologies to address these challenges by enabling independence and enhancing the quality of life for older adults. They examined the applications of AI (Artificial Intelligence) and robotics in caregiving for older adults, focusing on their role in promoting independence, monitoring health, helping, and enhancing social interaction. Padhan et al. (2023) also discussed the ethical considerations, challenges, and future directions in implementing AI (Artificial Intelligence) and robotics in caregiving for older adults.

Cortellessa et al. (2021) conducted a retrospective overview of work performed in the domain of Active Assisted Living over a span of almost 18 years (Table1). They have been creating and refining AI and robotics solutions to support older adults in maintaining their independence and improving their quality of life. Cortellessa et al. (2021) considered key points that have contributed to increase the success of the innovative solutions grounding them on known technology acceptance models. The analysis was presented with a threefold perspective: A *Technological* vision illustrates the characteristics of the support systems to operate in a real environment with *continuity*, *robustness*, and *safety*; a *Socio-Health* perspective highlights the role of experts in the socio-assistance domain to provide contextualized and personalized help based on actual people's needs; finally, a *Human* dimension takes into account the personal aspects that influence the interaction with technology in the long-term experience.

2. AI and Robots in End-Of-Life Care

In terms of AI (Artificial Intelligence) and robots in end-of-life care, according to Gajra et al. (2021), timely referral to palliative care services can ensure that end-of-life care aligns with their preferences and goals for patients with advanced cancer. Overestimation of life expectancy may result in underutilization of palliative care services, counterproductive treatment measures, and reduced quality of life for patients. Gajra et al. (2021) assessed the impact of a commercially available AI (Artificial Intelligence) tool to predict 30-day mortality risk on palliative care service utilization in a real-world setting. As a result of the intervention. deployment of an AI tool at hematology-oncology practice was found to be feasible for identifying patients at high or medium risk for short-term mortality. Insights generated by the tool drove clinical practice changes, resulting in significant increases in palliative care and hospice referrals.

Nair & Raveendran (2024) also argued the scope and challenges of improving consumer satisfaction through AI-based technology in palliative care services. Consumer satisfaction with palliative care is a critical aspect of providing high-quality end-of-life support. It encompasses various elements that contribute to a positive experience for both patients and their families. AI-

Table 1 Summary from related projects with explicit reference to AI and robotics technologies (Cortellessa et al., 2021)

Project	References	Main AI and robotics technologies
Robot-ERA	Nuovo, A.D. et al. (2015)	Ambient intelligence,
		knowledge representation and reasoning,
		automated planning
EnrichME	Cosar, C. et al. (2020)	Smart environments,
		human perception,
		advanced autonomous navigation, and
		cognitive control
CompanionAble	Merten, M. et al. (2012)	Natural language processing and
		ambient intelligence
Mobiserv	Nani, M. et al. (2010)	Ambient intelligence,
		pattern recognition, and
		cognitive game stimulation
GrowMeUP	Martins, G.S. et al. (2015)	Intelligent dialogue system,
		machine learning, and
		knowledge representation and reasoning
RAMCIP	Kostavelis, I. et al. (2016)	Machine learning,
		knowledge representation and reasoning, and
		ambient intelligence
DALI/ACANTO	DALI. Dali project. (2024)	Advanced autonomous navigation
	ACANTO. Acanto project (2024)	recommender system, and
		social context detection
Emotional and	Ferrari, E. et al. (2009)	Emotion detection,
empathic robots	Tapus, T. et al. (2007)	affective reasoning, and
		multimodal interactions
MARIO	Casey, D. et al. (2016)	Machine learning,
		semantic analysis,
HOBBIT	HOBBIT. Hobbit project (2020)	Advanced autonomous navigation,
	Fischinger, D. et al. (2016)	human/gesture recognition, and
	Pripfl, J. et al. (2016)	task reasoning
CARESSES	Papadopoulos, C. et al. (2020)	Knowledge representation and reasoning,
	Bruno, B. et al. (2019)	emotion recognition, and
		social signals

based tools and technologies can help in early identification of the beneficiaries, reduce the cost, improve the quality of care, and satisfy the patients with chronic life-limiting illnesses. However, it is essential to ensure that AI is used ethically and in a way that complements, rather than replaces, human touch and compassionate care, which are the core components of palliative care.

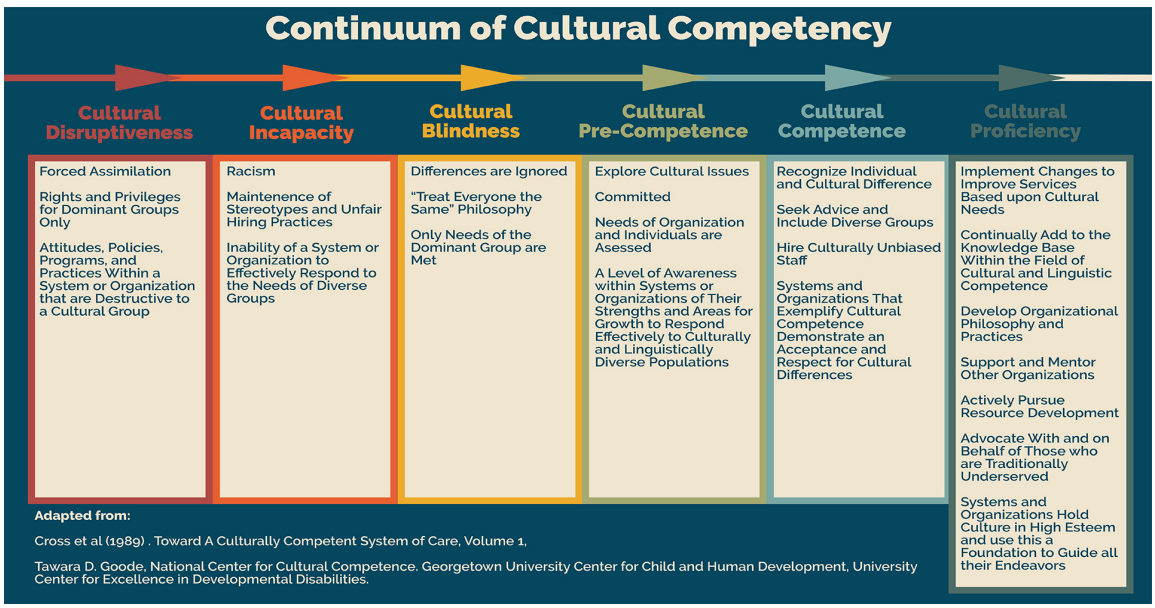
Ⅲ. CULTURALLY COMPETENT AI, AND ROBOTS IN TRANSNATIONAL CAREGIVING FOR OLDER ADULTS AND END-OF-LIFE

1. Cultural Competence

What does technology of AI (Artificial Intelligence) and robots mean for culturally sensitive care? According to Marciniak-Nuqui (2024), culturally competent care is sensitive to cultural identity of those receiving care and is closely related to patients' health status and outcomes. This includes ethnicity, nationality, religion, and sexuality, etc. The core of culturally competent care is to reduce health disparities, rooted in differences in race, ethnicity, socioeconomic status, and religion. In particular, with regard to cultural competence, it is necessary to consider adaptability and flexibility to a complex and ever-evolving culture. Also, researchers, governments, businesses, stakeholders, and communities should be involved in the development and evaluation of AI (Artificial Intelligence) tools suitable for culturally appropriate caregiving for older adults. They should address the ethical, legal and social issues (ELSI) of AI (Artificial Intelligence) and need to be continuously considered.

Cultural competence is a set of congruent behaviors, attitudes, and policies that come together in a system, agency or among professionals and enable that system, agency or those professions to work effectively in cross-cultural situations (Cross et al, 1989). The word culture is used because it implies the integrated pattern of human behavior that includes thoughts, communications, actions, customs, beliefs, values and institutions of a racial, ethnic, religious or social group. The word competence is used because it implies having the capacity to function effectively. Cultural competence is a continuum, from cultural disruptiveness, through cultural incapability, cultural blindness, pre-cultural competence, and cultural competence, to cultural fluency (Figure 3; Cross et al., 1989). Cultural competence involves fostering a system that recognizes cultural differences between individuals and societies, includes diverse groups, clearly indicates respect for cultural differences, and appropriately demonstrates cultural competence.

Figure 3 Continuum of Cultural Competence (Cross et al., 1989)



2. Culturally Competent AI and Robots

Papadopoulos et al. (2020, 2022a, 2022b) developed a culturally competent AI social robot that autonomously reconfigures the way it interacts with users, adapting it to the culture and customs of the person (Figure 4). The culturally competent AI social robots were introduced into elderly

care facilities in the United Kingdom and Japan, and the well-being of the intervention and control groups was evaluated. The results showed that emotional well-being was significantly higher in the intervention group than in the control group, supporting that the culturally competent AI social robots could improve the well-being of the older adults.

Cortellessa et al. (2021) presented Socio-technical System (Figure 5). The left side of the figure characterizes the technological perspective and depicts the needed interactions among robotics, AI (Artificial Intelligence), and ICT to properly support technological features such as continuity of use, safety, robustness, and reliability. The right side characterizes the socio-health perspective and points out the needed interactions among AI (Artificial Intelligence), robotics, and Health to properly support features such as intelligent and proactive behavior and personalization, and adaptation. The bottom side then characterizes the human perspective and points out the needed interactions among AI (Artificial Intelligence), robotics and Social Science. The contribution of Social Science is crucial to foster the development of "human-aware" and trustworthy AI technologies and effectively deal with social interaction dynamics.

In this way, it is important to strengthen culturally competent AI (Artificial Intelligence) and culturally competent robots since they can provide care recipient-centered caregiving and patient-centered care in caregiving for older adults and healthcare. While the debate on conceptualization progresses in Europe and the United States, it has not been closely examined in Japan. Experiments using random sampling, intervention research, and social implementation are still under development in the communities and healthcare settings in Japan.

Figure 4 Concept of culturally competent robot (Papadopoulos et al., 2020, 2022ab)

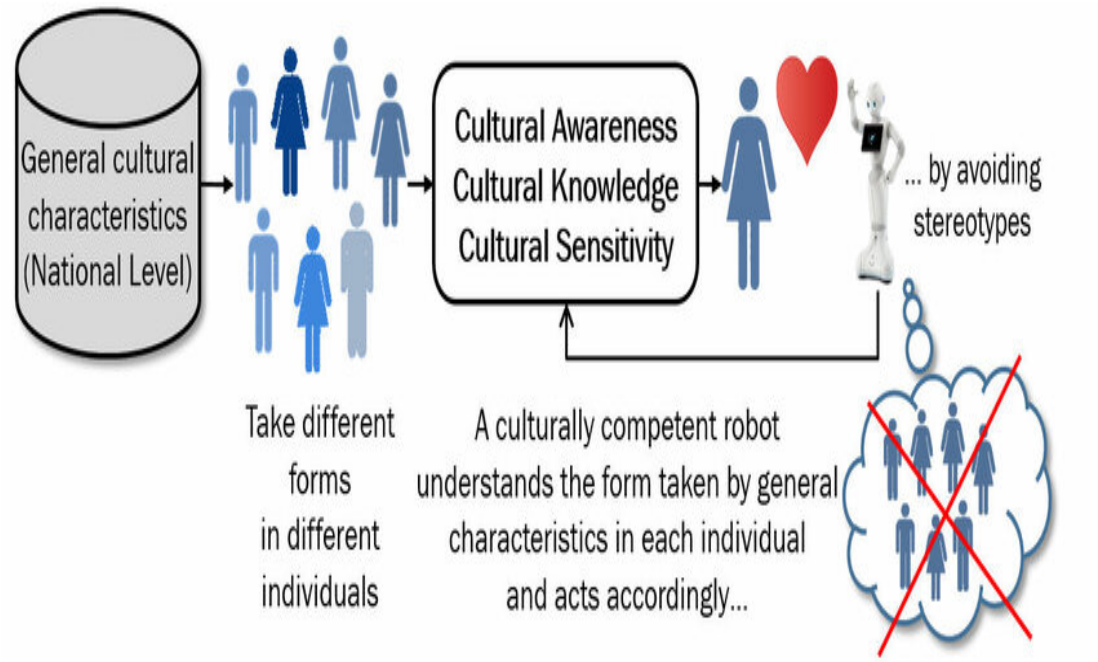
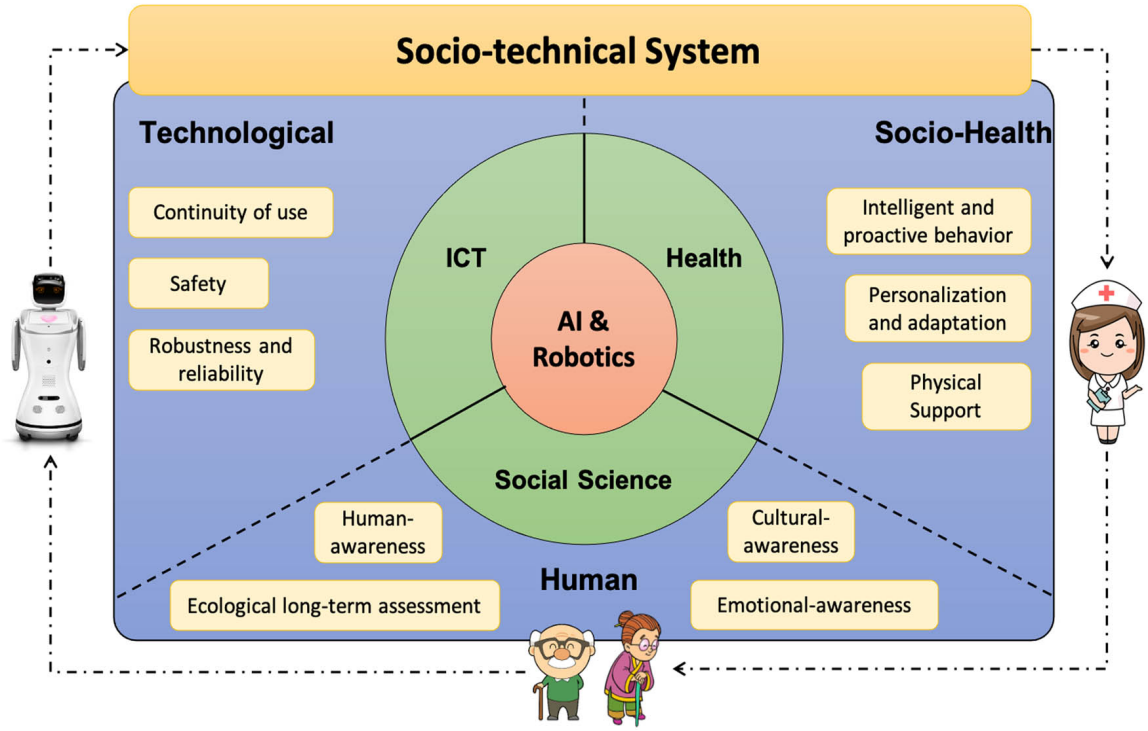


Figure 5 Multidisciplinary approach to robotic assistance (Cortellessa et al., 2021)



Ⅳ. ETHICAL, LEGAL, AND SOCIAL ISSUES IN AI AND ROBOTS

1. Ethical, Legal, and Social Issues after the COVID-19 pandemic

In this section, the research identifies ethical, legal and social issues in AI and robots for transnational caregiving for older adults and end-of-life. AI and robotics have greatly affected society, values, and human rights. We need to hold regulations on AI and robots. After the COVID-19 pandemic, the World Economic Forum (Figure 6, 2024) addressed that the strategic outlook relied on a vision for health and healthcare in 2035, formed of four main strategic pillars with equity as the foundational goal; 1) Equitable access and outcomes: Equilibrating access to determinants of health, ensuring health data is representative of the population and people with equal needs achieve equal health outcomes; 2) Healthcare system transformation: Structuring resilient healthcare systems to provide high-quality care under both expected and unexpected circumstances; 3) Technology and innovation: Cultivating an environment that supports funding, use, and implementation of innovation in science and medicine; and 4) Environmental sustainability: Reducing the healthcare industry's environmental impact, preparing for and addressing climate change for better health and wellness. For each of the strategic pillars, time health and wellness.

As the World Economic Forum (2024) discussed, while striving to achieve each of these strategic pillars, public and private stakeholders will encounter several barriers. The strategic outlook identified a range of levers available to public and private stakeholders to diminish the barriers at play across healthcare systems (Figure 7); 1) Cross-industry collaboration; 2) Digitalization, artificial intelligence and big data; 3) Global collaboration; 4) Policy and advocacy; 5) Public-private partnerships; 6) Innovative funding models; 7) Patient empowerment; and 8) Targeted/selective decentralization.

Figure 6 The vision for health and healthcare in 2035 is formed of four main strategic pillars with as the fundamental goal (World Economic Forum, 2024)

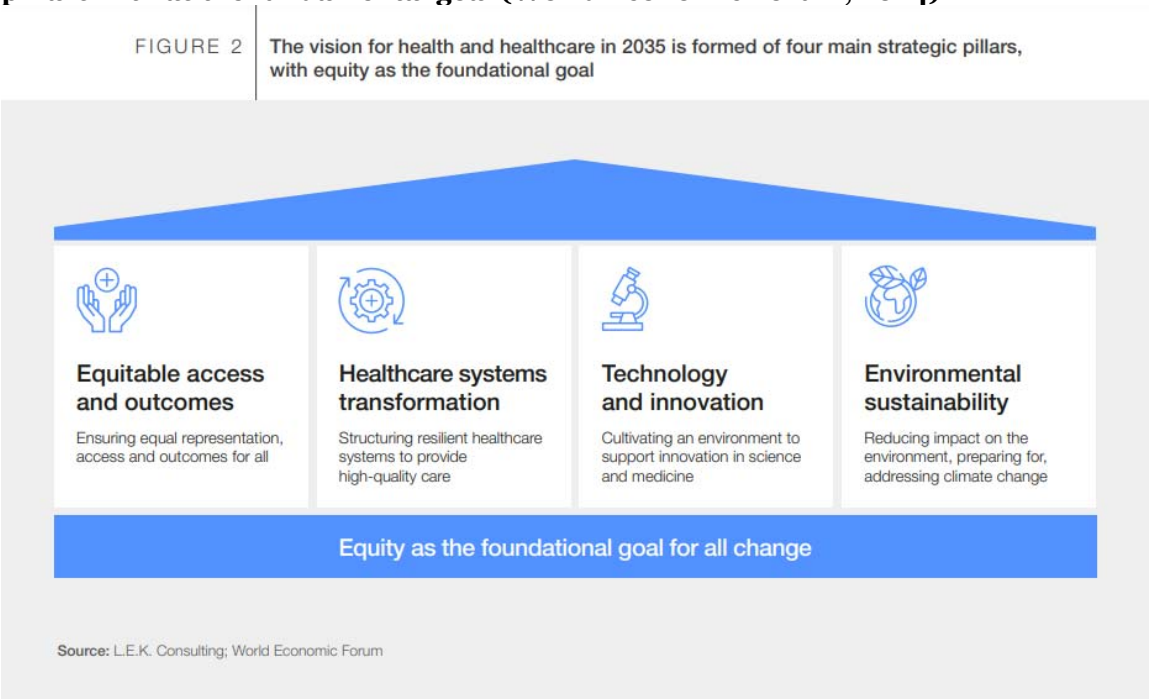
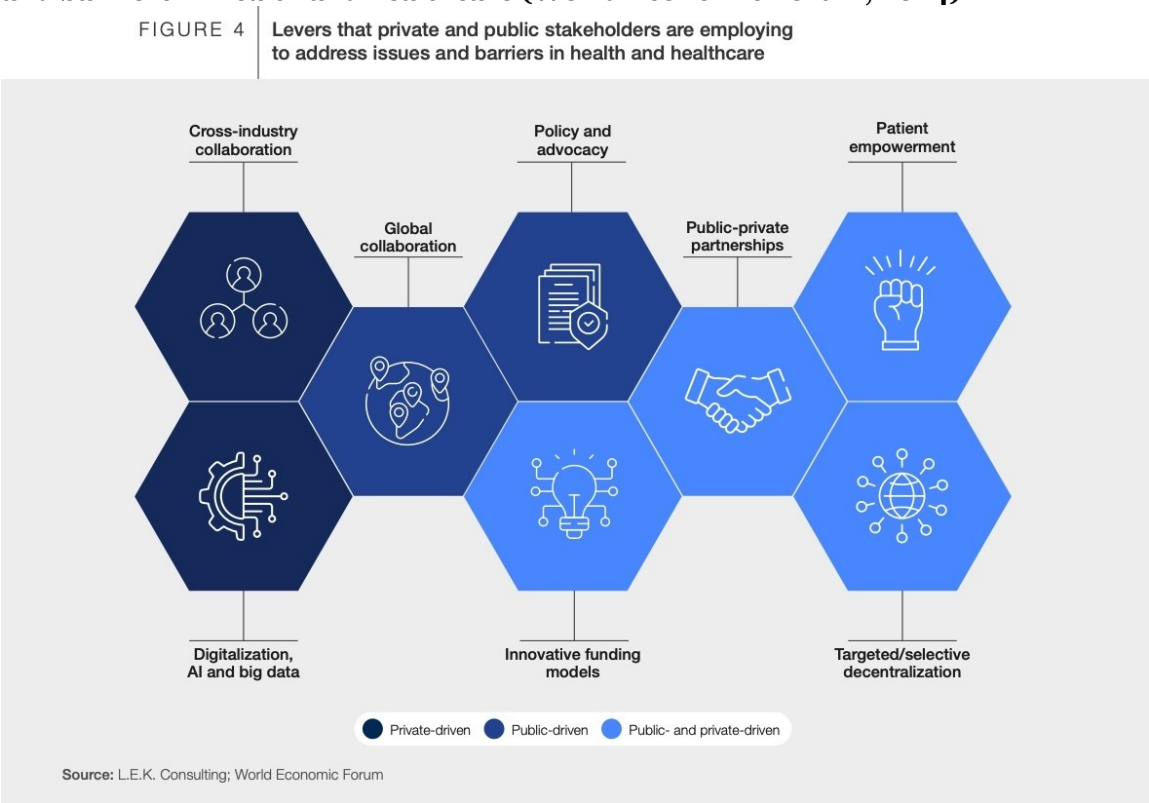


Figure 7 Levers that public and private stakeholders are employing to address issues and barriers in health and healthcare (World Economic Forum, 2024)



2. Ethical Implications of AI and Robots in Healthcare

Elendu et al. (2023) analyzed the complex ethical terrain surrounding AI and robotics in healthcare, delving into specific dimensions and providing strategies and best practices for ethical navigation (Table 2). Privacy and data security are paramount concerns, necessitating robust encryption and anonymization techniques to safeguard patient data. Responsible data handling practices, including decentralized data sharing, are critical to preserve patient privacy.

Table 2 Ethical implications of AI and robotics in healthcare (Elendu et al., 2023)

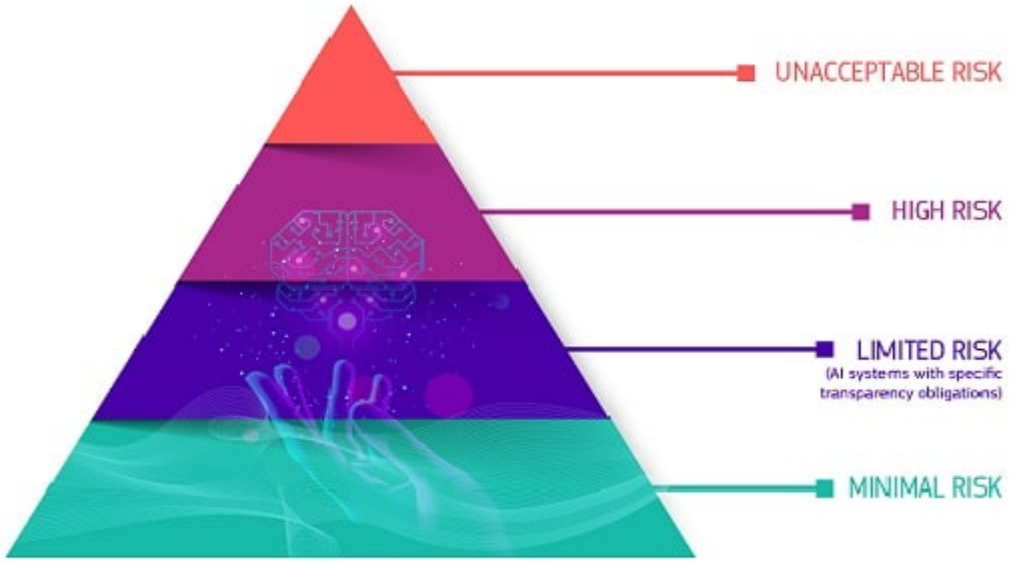
Ethical implications of AI and robotics in healthcare
1. Privacy and data security: Protecting patient data is paramount, necessitating robust data handling and storage practices to ensure privacy and security.
2. Bias and fairness: Addressing algorithmic bias is essential to prevent disparities in diagnosis and treatment, promoting fairness in healthcare decision-making.
3. Accountability and transparency: Establishing clear responsibility for AI systems' actions and transparent decision-making processes are crucial for trust and ethical use.
4. Autonomy and human oversight: Maintaining human control over AI and robotic systems while preserving patient autonomy and consent is an ethical imperative.
5. Impact on healthcare professionals: Changing roles and job displacement require ethical considerations, as does fostering effective collaboration between AI/robotics and healthcare professionals.
6. Societal implications: Ethical concerns related to accessibility, equity, and societal trust must guide the responsible deployment of these technologies.
7. Regulatory and legal challenges: Developing adaptable regulations and liability frameworks and addressing intellectual property issues are essential for ethical integration.
8. Ethical frameworks and guidelines: Existing ethical frameworks provide guidance, but healthcare-specific, adaptable guidelines are needed to navigate this evolving landscape.

Algorithmic bias poses a significant challenge, demanding diverse datasets and ongoing monitoring to ensure fairness. Transparency and explainability in AI decision-making processes enhance trust and accountability. Clear responsibility frameworks are essential to address the accountability of manufacturers, healthcare institutions, and professionals. Ethical guidelines, regularly updated and accessible to all stakeholders, guide decision-making in this dynamic landscape. Moreover, the societal implications of AI (Artificial Intelligence) and robotics extend to accessibility, equity, and societal trust. Strategies to bridge the digital divide and ensure equitable access must be prioritized. Global collaboration is pivotal in developing adaptable regulations and addressing legal challenges like liability and intellectual property. Ethics must remain at the forefront in the ever-evolving realm of healthcare technology. By embracing these strategies and best practices, healthcare systems and professionals can harness the potential of AI (Artificial Intelligence) and robotics, ensuring responsible and ethical integration benefits patients while upholding the highest ethical standards.

3. AI Regulations in Healthcare

With regard to regulations for AI and robots, the EU AI Act has been passed by the European Union Parliament in 2023 and will regulate AI (Artificial Intelligence) in the European Union by 2026 (Figure 8, Table 3). According to the European Union (2024), the AI Act provides AI (Artificial Intelligence) developers and deployers with clear requirements and obligations regarding specific

Figure 8 The EU AI Act Risk Levels (European Union, 2024)



uses of AI (Artificial Intelligence). At the same time, the regulation seeks to reduce administrative and financial burdens for business. The AI Act is part of a wider package of policy measures to support the development of trustworthy AI (Artificial Intelligence), which also includes the AI Innovation Package and the Coordinated Plan on AI. Together, these measures guarantee the safety and fundamental rights of people and businesses when it comes to AI. They also strengthen uptake, investment and innovation in AI across the European Union. The AI Act is the first-ever comprehensive legal framework on AI worldwide. The aim of the new rules is to foster trustworthy AI in Europe and beyond, by ensuring that AI systems respect fundamental rights, safety, and ethical principles and by addressing risks of very powerful and impactful AI models. The Regulatory Framework defines 4 levels of risk for AI systems; 1) Unaccepted risk; 2) High risk; 3) Limited risk; and 4) Minimal risk (Figure 8; EU, 2024).

In the United States, the Department of Food and Drug Administration (FDA) developed AI/ML-Based Software as a Medical Device Action Plan in 2021 (Table 4): 1) Develop an update to the proposed regulatory framework presented in the AI/ML-based SaMD discussion paper; 2) Strengthen FDA's encouragement of the harmonized development of Good Machine Learning Practice (GMLP) through additional FDA participation in collaborative communities and consensus standards development efforts; 3) Support a patient-centered approach by continuing to host discussions on the role of transparency to users of AI/ML-based devices; 4) Support regulatory science efforts on the development of methodology for the evaluation and improvement of machine learning algorithms; and 5) Advance real-world performance pilots in coordination with stakeholders and other FDA programs, to provide additional clarity.Department of Food and Drug Administration also updated Artificial Intelligence & Medical Products: Paper in 2023 (FDA, 2024).

In addition, the Executive Order (14110) on Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence was issued in 2023. It defines the administration's policy goals and assigns executive agencies to take actions to the goals. It is the most comprehensive governance by the federal government. Policy goals outline promoting competition in the AI industry, preventing AI-enabled threats to civil liberties and national security, and ensuring global competitiveness.

Table 3 The AI Act New Rules (European Union, 2024)

EU AI Act New Rules
1. Address risks specifically created by AI applications
2. Prohibit AI practices that pose unacceptable risks
3. Determine a list of high-risk applications
4. Set clear requirements for AI systems for high-risk applications
5. Define specific obligations deployers and providers of high-risk AI applications
6. Require a conformity assessment before a given AI system is put into service or placed on the market
7. Put enforcement in place after a given AI system is placed into the market
8. Establish a governance structure at European and national level
High Risk: AI systems identified as high-risk include AI technology used in:
1. Critical infrastructures (e.g. transport), that could put the life and health of citizens at risk
2. Educational or vocational training, that may determine access to education and professional course of someone's life (e.g. scoring of exams)
3. Safety components of products (e.g. AI application in robot-assisted surgery)
4. Employment, management of workers, and access to self-employment (e.g. CV-sorting software for recruitment procedures)
5. Essential private and public services (e.g. credit scoring denying citizens opportunity to obtain a loan)
6. Law enforcement that may interfere with people's fundamental rights (e.g. evaluation of the reliability of evidence)
7. Migration, asylum, and border control management (e.g. automated examination of visa applications)
8. Administration of justice and democratic processes (e.g. AI solutions to search for court rulings)
High-risk AI systems are subject to strict obligations before they can be put on the market:
1. Adequate risk assessment and mitigation systems
2. High quality of the datasets feeding the system to minimize risks and discriminatory outcomes
3. Logging of activity to ensure traceability of results
4. Detailed documentation providing all information necessary on the system and its purpose for authorities to assess its compliance
5. Clear and adequate information to the deployer
6. Appropriate human oversight measures to minimize risk
7. High level of robustness, security and accuracy

Table 4 FDA AI/ML-Based Software as a Medical Device Action Plan (FDA, 2021)

FDA AI/ML-Based Software as a Medical Device Action Plan
1. Develop an update to the proposed regulatory framework presented in the AI/ML-based SaMD discussion paper
2. Strengthen FDA's encouragement of the harmonized development of Good Machine Learning Practice (GMLP) through additional FDA participation in collaborative communities and consensus standards development efforts
3. Support a patient-centered approach by continuing to host discussions on the role of transparency to users of AI/ML-based devices
4. Support regulatory science efforts on the development of methodology for the evaluation and improvement of machine learning algorithms
5. Advance real-world performance pilots in coordination with stakeholders and other FDA programs, to provide additional clarity

Table 5 WHO AI Regulations for Health (2023)

WHO Regulations of AI for Health
1. Transparency and documentation
2. Risk management and AI systems development lifecycle approaches
3. Intended use, and analytical and clinical validation
4. Data quality
5. Privacy and data protection
6. Engagement and collaboration

Finally, the World Health Organization (2023) released new regulations on AI for health (Table 5).: 1) To foster trust, they stress the importance of transparency and documentation; 2) A total product lifecycle approach should be considered throughout all phases in the life of an AI system; 3) Providing transparent documentation of the intended use of the AI system, and analytical and clinical validation should be considered; 4) Developers should consider whether available data are of sufficient quality to support the development of the AI system to achieve the intended purpose; 5) Privacy and data protection should be considered during the design and deployment of AI systems; and 6) During development of the AI innovation and deployment roadmap, it is important to consider the development of accessible and informative platforms that facilitate engagement and collaboration among key stakeholders, where applicable and appropriate.

Ⅴ. CONCLUSION: POLICY IMPLICATIONS OF ETHICAL, LEGAL, AND SOCIAL ISSUES IN AI AND ROBOTS

Given these policy reviews, finally, this research presents policy implications of ethical, legal, and social issues in AI (Artificial Intelligence) and robots in transnational caregiving for older adults and end-of-life. First, establish AI systems' safety and effectiveness. Second, with the increasing availability of healthcare data and the rapid progress in analytic techniques, AI tools transform the health sector. Third, AI systems have access to sensitive personal information, necessitating robust legal and regulatory frameworks for safeguarding privacy, security, and integrity. Forth, control of the potentials of AI and robots. Fifth, minimize the risks of AI and robots.

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