

Ethical Risks and Regulatory Approaches in the Application of Embodied Intelligence in Nursing Practice

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Abstract: As China enters a stage of moderate ageing, the number of elderly people with disabilities will continue to rise, and a serious shortage of nursing staff is emerging; embodied intelligence, which is based on artificial intelligence and has an autonomous closed-loop "perception-decision-action" system that can interact with the physical environment in real time, has broad application prospects in various elderly care scenarios, such as daily life assistance, health monitoring and wellness support, emotional companionship, and social participation, thus providing a technological path to address the supply-demand imbalance of care services. However, there are also risks in the technological empowerment. This paper studies the technical characteristics of embodied intelligence-based nursing and identifies three main features: an autonomous closed-loop system, all-encompassing sensitive data collection, and human-centered relational intervention; these correspond to various ethical risks, including harm to personal safety and privacy, emotional dependence and alienation in human-machine relationships, and responsibility attribution versus human autonomy. From the perspective of care ethics, this paper indicates a structural defect: although nursing robots can carry out the practical tasks of care, they are unable to provide the necessary bidirectional emotional response required for genuine care. Based on the above analysis, the paper establishes a basic ethical boundary defined as "machine-assisted, human-led, and non-fully replaceable". From a governance perspective, this paper explains the legal and institutional foundations for an ethics-first approach and outlines domestic and foreign soft-law and hard-law standards and governance frameworks, including initiatives and frameworks such as the Measures for the Review of Science and Technology Ethics (Trial), the ISO 13482 safety standard, the IEEE Ethical Consensus Design, the EU's AI Act, and China's Ethical Guidelines for Next-Generation Artificial Intelligence. Based on the above, this paper puts forward an embodied intelligent nursing ethics governance system based on three core attributes: intelligence, fairness and human-centredness; it aims to promote the development of technological innovation while protecting human dignity, and thus provides a solid theoretical foundation for the construction of institutional

frameworks in this field.

Keywords: embodied intelligence; elderly care; ethical risks; regulatory approaches; care ethics

Introduction

At present, Artificial Intelligence (AI) generally refers to a field of theoretical, methodological and applied technological science that studies how computer systems can learn from and imitate human behaviour and speech to interact with the physical world and its environment. Embodied Intelligence started as Artificial Intelligence, and although most traditional AI generally involves disembodied decision-making, Embodied Intelligence focuses on the embodied nature by using a "perception-decision-action" system to highlight the interaction and real-time response of a physical object in its environment^[1]. This way, the scope of artificial intelligence will be expanded, and many applications in healthcare, such as smart hospitals, intelligent factories, self-driving cars and elderly care robots, will become possible. In the 2026 Government Work Report, Embodied Intelligence was listed as one of the national strategic directions for fostering and developing future industries, along with quantum technology, biomanufacturing, brain-computer interfaces and 6G technology^[2].

As China enters an older age, according to the "China Statistical Yearbook 2025" released by the Ministry of Civil Affairs, by the end of 2025, the number of people aged 60 and over will reach about 320 million, making up 23.0% of the total population; the number of people aged 65 and over nationwide will be around 220 million, accounting for 15.9% of the total population^[3], which is the highest level since the start of statistical record-keeping. With the increase in the proportion of older people in China, the number of older adults with disabilities is also rising; according to research, by 2030, the proportion of older adults with partial disabilities will reach 17.44%, and by 2050, it will be as high as 22.06%^[4]. On the other hand, there is a severe shortage of nursing personnel; according to data from the National Health Commission, by the end of 2023, there were about 5.63 million registered nurses across the country, and the nurse-to-patient ratio was approximately 1:1.18^[5], which had not reached the goal of 1:1.2 set by the 14th Five-Year Plan; experts believe that the national nursing workforce deficit is close to 4 million. The "Opinions of the Central Committee of the Communist Party of China and the State Council on Deepening the Reform and Development of Elderly Care Services"^[6] also calls for strengthening care for older people with disabilities. At the same time, there is a shortage of care services in some areas. At present, technology can be used to build robots for various purposes in older adults' daily lives, such as providing safe daily care, medication reminders, fall detection, health monitoring, helping older adults live independently, and safety supervision^[7]. Embodied intelligence can use technology to provide all kinds of care services in various circumstances efficiently, such as daily living, medical and health care, emotional support, safety protection, and social participation, thus offering a technological path to alleviate the nursing workforce shortage and improve service efficiency.

However, the power of change that technology has introduced is also associated with

risks. Embodied intelligent care nursing faces many problems in terms of security and privacy, human-machine empathy, responsibility boundaries, and ethical review^[8]. Unlike traditional static monitoring devices, embodied intelligence can autonomously move and interact with the environment; although the current legal system still classifies such robots as assistive tools (legal objects), in practice they have the ability to intervene in or affect the behaviour of older people. The difference between their actual power to affect and their legal status is a particular ethical risk in the context of embodied intelligent elderly care applications^{[9][10]}.

Therefore, research is needed on the ethical risks and regulatory paths for embodied intelligence in elderly care to provide a foundation for the safe, healthy and sustainable development of such technology. Based on the previous studies, this paper uses a care ethics perspective to explore the ethical deficiencies of nursing robots and, in line with the latest policy systems, regulatory requirements and standard-setting initiatives, puts forward an ethical governance system for embodied intelligence in nursing care to provide a theoretical basis for the construction of institutional frameworks in this field.

1. Application Landscape of Embodied Intelligence in Elderly Care Settings

1.1 Primary application types of embodied intelligence in nursing care

The development of artificial intelligence has generally gone through four stages: symbolic reasoning, machine learning, deep learning, and large language models and embodied intelligence. Taking the application of large language models in nursing as an example, their use is mainly concentrated in nursing education (48.49%), clinical nursing (42.42%), nursing research (3.03%), and comprehensive applications (6.06%); these applications include various scenarios such as professional examination assessments, instructional writing, construction of clinical simulation scenarios, development of nursing care plans, patient condition management, and information support^[11]. Embodied intelligence in nursing is not a single, fixed kind; rather, it varies gradually according to different nursing requirements and includes both low-level physiological care and high-level psychological and social care. Therefore, the applications of this technology in older people's daily lives can be divided into the following categories:

The most basic level of application is assistance with daily living, such as eating, washing, dressing, toileting, etc.; these activities require close contact with people's bodies and are relatively fragile, so safety must be guaranteed at all times. Embodied intelligence can use multiple types of perception and human-machine cooperation to help people live independently, manage their health, and learn rehabilitation. A transfer-assistance robot is used as an example; it has force-sensing and compliant control functions to safely help elderly people with mobility problems get out of bed and into a wheelchair, thus reducing the physical strain on nurses during daily care^[12]. These applications involve high-frequency, close-range physical contact with the human body, so they are the domain where embodied intelligence is most prominent and where the risks to human safety are highest.

The first type is a health monitoring system that can wear out sensors and perform self-cleaning. These systems have added wearable sensors and environmental sensors

to conduct continuous health monitoring, fall detection, medication reminders, early warning of abnormal changes, etc., and can also connect to telemedicine platforms. Compared with static monitoring devices, these embodied forms can conduct proactive patrols and offer close, personal follow-up care by automatically detecting falls or other signs of illness in older adults and providing initial assistance or calling for help^[13]. Rehabilitation training robots, on the other hand, use exoskeletons or guided movement to help elderly patients recover from stroke or post-fracture surgery regain mobility^[14]. The ethical problem of such applications is that they are based on continuous and large-scale collection of data during operation.

One place where ethical problems are more likely to arise is in embodied intelligence designed for emotional companionship; such robots provide emotional support and social interaction for older people living alone through voice dialogue, changes in facial expressions, and tactile feedback. Robots such as the seal-shaped PARO^[15] and various humanoid companion robots have been developed to provide emotional support, conversational companionship and cognitive stimulation for older adults living alone or people with dementia by using voice interaction, facial expression recognition and other human-like functions, thus reducing feelings of loneliness, depression and cognitive decline. Research shows that companion AI systems can serve as virtual companions, acting as toys, friends or confidants in interactive communication, and can also function as compensatory support for people who are lonely, stressed or emotionally distressed^{[16][17]}. With the addition of large language models, the dialogue of these systems has become more human-like and thus more comforting; however, it has also given rise to new problems, such as emotional dependence and a sense of alienation in relationships.

Finally, socially participatory and environment-interacting applications can help older adults bridge the digital divide by assisting them in accessing services such as video calls and information retrieval^{[18][19]}, expanding their social circles^[20], and thus promoting the goal of active ageing.

1.2 Technical Characteristics and Ethical Considerations in Embodied Intelligent Nursing

Embodied intelligence is not a traditional type of digital AI; rather, it can live in and interact with the real world physically. The IEEE P3707 Standard for an Application Framework for Embodied Artificial Intelligence in the Elderly Care Domain^[21] defines the main attributes of embodied intelligence systems as follows: embodied functional capabilities (environmental perception, tactile interaction, autonomous navigation, adaptive service execution), safety and risk governance, data and privacy protection, human-machine interface standards, ethical considerations (decision-making transparency, accountability for embodied behaviour), and interoperability with existing nursing IT ecosystems. Ethical risks of embodied intelligence in nursing stem from its technical characteristics and are not the same as those of traditional information systems; these risks can be summarized as follows.

First, the autonomous closed-loop system of "perception–decision–action". At the core of embodied intelligence is the agent's capacity to integrate perception, decision-making and action through real-time interaction with the environment via its physical embodiment, and continuously learn and evolve through trial and error and feedback. In other words, the robot's behaviour is not entirely determined by a fixed program; it also has some level of context-aware autonomy and is inherently

unpredictable. If the autonomy of close-range interaction with older adults deviates from expectations, it may directly cause harm to the person; furthermore, due to the "black-box" nature of the robot's deep learning decision-making process ^[22], post-hoc root-cause analysis and liability determination are extremely difficult.

Secondly, broad-ranging data collection has occurred in private life. For high-precision care, robots need to continuously collect very sensitive personal data on older people, such as their physiological data, behaviour patterns, home surveillance videos and even emotions, and this data collection will extend to very private areas (e.g., bedrooms and bathrooms) and happen almost constantly ^{[23][24]}.

Third, the relational engagement fostered by personification-based interaction. Embodied Forms and Personification-based Interactions have been employed to make robots less like passive tools and more like quasi-subjects in nursing relationships. Older people may develop feelings of trust, attachment or other emotions towards these robots ^[25], and as a result, the robots can be used to guide, persuade or even influence the behaviour of older people. However, this automated execution is constrained by the basic algorithms and safety rules; it lacks the contextual adaptability of human caregivers (which stems from empathy and moral awareness), and thus cannot perform active control or coercive intervention over the passive assistance model of traditional nursing.

2. A Multi-dimensional View of Ethical Risks

2.1 Personal Safety and Privacy Protection Risks

Personal Safety is a prerequisite for embodied intelligence-based nursing care. Traditional AI systems only process data; embodied intelligence directly interacts with the physical world and the human body, and its mechanical movements, application of force, and autonomous mobility all carry real risks of causing harm. The patients receiving such care are mainly older adults with disabilities, partial disabilities or cognitive impairments; they often have reduced sensory perception, slow reaction times and fragile bones, and are therefore very easily injured by sudden movements of robots. Loss of force control during high-contact operations (e.g., transfer and bathing), falls caused by misplanning of movement paths, or loss of control due to hardware/software failure or malicious cyberattacks can all result in permanent injury.

Therefore, the International Organisation for Standardization (ISO) has issued ISO 13482 – "Robots and robotic systems – Safety requirements for personal care robots" ^[26] – which is the first dedicated safety standard in the world for personal care robots. This norm will regulate hazards in mechanics, electricity, electromagnetic compatibility and human factors during close human-robot interaction, and address the previous deficiency of only general mechanical safety standards and significant residual risks for manufacturers. By 2026, this standard will be in its final draft stage; its title will have been changed to "Robots and robotic systems – Safety requirements for service robots" ^[27], the category of "personal passenger robots" will have been removed, and new clauses on cybersecurity and data protection will have been added to better cover all types of modern service robots. However, the existence of this standard does not mean that the risk has been eliminated; rather, as AI and technology have advanced rapidly, so too have the behaviour and requirement standards set by this standard. The traditional model of a single safety certification for static systems is

no longer suitable for dynamic intelligent systems, and the behaviour boundaries set by today's certification may not align with those required for tomorrow's autonomous-learning systems.

Privacy risks are a type of security risk but are generally less apparent. To provide personalised care, robots collect a large amount of data on older people in many different situations and in very private environments; if this data is leaked, misused or used for other purposes, it will seriously harm the personal dignity of older people. Furthermore, older people generally lack data literacy; most are unaware of the consequences of informed consent, how their data will be used, or what risks are involved in doing so, and individuals with cognitive impairments may be unable to give effective consent^[28], thus making the traditional framework of informed consent-based protection largely ineffective in this situation. The vulnerability of data subjects, the inherent sensitivity of the data itself, and the continuous and pervasive nature of data collection are all high-risk factors for personal information protection in elderly care, and traditional data protection frameworks are no longer suitable.

2.2 Emotional dependence and the risk of alienation in human-machine relationships

Ethical problems associated with companion-based embodied intelligence are especially severe. Human-like robots can show emotions through faces and voices, and provide context-aware responses to help reduce the loneliness and anxiety of older people to some extent^[25]. However, this kind of empathy is in fact an algorithm's recognition and interpretation of emotional signals; the robots do not genuinely understand or feel the pain of older people. They are pre-written responses that do not stem from genuine feelings of care.

On the one hand, when embodied intelligence reaches a certain level of personification and, with the support of large language models, can engage in natural and fluent conversations, older adults living alone or with cognitive impairments are likely to mistake robots for real companions and turn their emotions towards cold robots and large language models instead of their families and society^[29]. Although this empathetic attachment may reduce the elderly person's loneliness and distress, it can also make them reluctant to participate in real-life social activities and thus more isolated.

On the other hand, when companion-based embodied intelligence is introduced into households, families and society may reduce actual visits and emotional interaction with older adults on the basis that "robots can now provide companionship"^[30]; as a result, caregiving will shift from a human-centered model to one where people delegate their care to machines. As a result, the elderly, who need care and attention the most urgently, are neglected by their families from a humanitarian perspective. This technological development does not promote well-being; instead, it encourages the absence of family ties and is thus contrary to the humanistic spirit of caregiving. Embodied intelligence is also often used improperly to replace human emotions instead of being used in conjunction with them.

2.3 Responsibility Attribution and the Crisis of Human Autonomy

The Autonomy of embodied intelligence presents a problem for the traditional system of accountability. If a nursing robot causes harm due to an autonomous decision, who will bear the legal responsibility? If the responsibility lies with the developer of the underlying algorithm, the manufacturer of the hardware, the elderly care facility that

deployed and operated the robot, the family members who issued the instructions, or the robot itself? Under the current doctrinal system of civil law, embodied intelligence is neither an independent civil subject nor a qualified guardian subject^[31]; therefore, its legal status should be limited to that of an instrument extending the capacity of a guardian. However, the difference between the actual capacity of embodied intelligence to intervene and exercise control and this legal characterisation is the reason for the problem in determining liability.

At the same time, human autonomy will decline. Based on the above studies, excessive reliance on artificial intelligence by doctors may lead to a decline in their clinical skills^[32, 33], and a similar risk of automation bias exists in nursing care. The behaviour of older adults living at home is also affected by embodied intelligence, such as receiving medication reminders, being prompted to get up, being advised against dangerous behaviour, or having mobility restricted due to abnormal behaviour detection^{[28][34]}. The above arrangements may reduce or even eliminate the elderly's capacity for independent decision-making in practice.

2.4 Structural Limitations from a Care Ethics Perspective

Nel Noddings^[35] and others have developed care ethics; they have placed interpersonal relationships at the centre of ontology and believe that care is the basis of morality. According to Noddings, genuine care is a mutually fulfilling relationship built on emotion between the "caregiver" (one-caring) and the "person being cared for" (cared-for): the caregiver needs to embrace the other with "engrossment", empathize with their circumstances, and undergo a "motivational shift"; at the same time, the person being cared for must be able to feel and respond to this care. Only when both sides are willing to be vulnerable will the relationship of care be genuine. According to the four moral components of care proposed by J., attention, responsibility, ability and response. Tronto and others^[36] have conducted several studies comparing the differences between robotic nursing and human nursing, and found that the core of care for older adults is not to carry out nursing tasks by robots, but rather to show genuine concern for their vulnerability and dignity, as well as to support the social strategy of active aging^[37].

The problem is that although robots can perform some practical caregiving work well, such as basic food preparation, cleaning, health monitoring, etc., they cannot provide the necessary emotional support and two-way interaction that real care requires. Lacking an intrinsic motivation for care, the care provided by these robots is merely simulated, and their responses are pre-programmed; therefore, they cannot establish a genuine, reciprocal care relationship with older people in the way Carole Nottingham proposes. No matter how advanced the algorithms are or how lifelike the human-like behaviour appears, robots are still at the level of providing care rather than offering genuine care.

Therefore, care ethics sets a clear ethical boundary for governance: nursing robots can and should serve as aids and extensions to human caregivers by undertaking physically demanding and repetitive practical tasks; thus, human caregivers are freed from such labour-intensive work to focus on emotional care and interpersonal relationships that machines cannot replicate, but they must never be used as a complete replacement for human care.

3. Ethical-Prioritized Governance Logic

3.1 The Legal Theoretical Foundation and Institutional Implications of "Ethics First"

Given the above multi-dimensional risks, should we take a passive "develop first, regulate later" approach, or a proactive "develop and regulate simultaneously" or even "regulate before addressing risks" approach? China's Institutional Choice Prioritises Ethics. In March 2022, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council jointly issued "Opinions on Strengthening the Governance of Science and Technology Ethics" ^[38], which put forward five basic requirements: placing ethics first, complying with laws and regulations, agile governance, alignment with national conditions, and open cooperation, and also put forward five science and technology ethics principles: enhancing human well-being, respecting the right to life, upholding fairness and justice, exercising reasonable risk control, and maintaining openness and transparency. "Ethics first" means that ethical considerations should be given top priority in science and technology activities, rather than serving as a reactive correction mechanism after harm has already occurred.

At the institutional level, scientific and technological ethics reviews are employed to achieve this end. The Measures for the Review of Scientific and Technological Ethics (Trial) ^[39], released in September 2023 and published in October 2023, explicitly state that institutions engaged in scientific and technological activities, especially those in areas such as life sciences, medicine and artificial intelligence where research involves sensitive issues of scientific and technological ethics, must establish a Scientific and Technological Ethics (Review) Committee; furthermore, the annex to these Measures lists "the development of human-machine integration systems that significantly impact human subjective behaviour, psychological state and health" as one of the scientific and technological activities requiring ethical review and re-evaluation. The embodied intelligent nursing system directly impacts the physical, mental and other health conditions of older people; as a typical high-sensitivity human-machine integration system, it should be included in the scope of ethical review.

The ethical-oriented theoretical foundation of law is that when scientific and technological activities involve issues of human dignity or personal safety, remedial measures taken after the fact are often unable to fully compensate for the harm caused. Physical harm to older adults caused by errors in robot operation, loss of dignity due to data breaches, and psychological damage from emotional dependence are often irreversible; only by adding a future-looking ethical assessment and review mechanism can these risks be effectively reduced. This way is in line with the "focus on vulnerability" promoted by scholars such as Nel Noddings in the ethics of human care.

3.2 The Development of Global Standardisation Initiatives and Governance Frameworks

Ethical governance of embodied intelligent care is a global problem, and many countries and regions have taken different paths to address it; generally speaking, these paths fall into two categories: the "soft law initiative" and "hard legal regulation".

At the level of the soft-law initiative, IEEE's Ethical Consistent Design ^[40] has proposed an ethical system for autonomous and intelligent systems that prioritises the well-being of people, stresses accountability and transparency, ensures trustworthiness, and advocates integrating human values into technological design to promote human well-being and environmental sustainability. Although these initiatives do not have legal force, they offer some direction for technological design and industry self-regulation.

At the level of strict regulation, the EU's Artificial Intelligence Act ^[41], which took effect in 2024, has established a four-tier risk classification and supervision system: "unacceptable – high – limited – low", and will apply differentiated regulatory supervision at all stages of the life cycle of AI systems, from research and development to end-of-life. Notably, this Act specifically lists AI practices that "exploit the vulnerabilities of natural persons due to their age, disability or particular socio-economic circumstances to substantially distort their behaviour and cause or potentially cause serious harm" as "unacceptable risks", thus providing explicit protection for vulnerable groups such as older adults; on the other hand, AI systems used in health and nursing decision-support generally fall under the "High Risk" category and are subject to strict obligations, such as conducting all-round risk assessments and mitigation measures, using high-quality datasets, keeping activity records and traceability, ensuring appropriate human supervision, and maintaining high levels of robustness, security and accuracy, and are subject to continuous assessment throughout their operation.

Back in China, there has been the construction of an all-weather governance system. In 2019, the document "Principles for the Governance of Artificial Intelligence – Developing Responsible Artificial Intelligence" ^[42] put forward eight guiding principles: harmony and friendliness; fairness and justice; inclusivity and shared benefits; respect for privacy; security and controllability; shared responsibility; open collaboration; and agile governance. In 2021, the Ethical Guidelines for Artificial Intelligence – Next Generation ^[43] added more ethical requirements to the whole life cycle of AI and proposed six basic ethical imperatives: promoting human well-being; promoting fairness and justice; protecting privacy and security; ensuring controllability and trustworthiness; strengthening accountability; and fostering ethical literacy.

4. Legal Framework for Ethical Governance of Embodied Intelligent Nursing Care

4.1 Intelligence: Institutional Embedding into Full-Lifecycle Governance

Bodied intelligent care ethics governance should take the entire life cycle as its core system and cover 11 stages: pre-design, design, development, evaluation, testing, deployment, use, sales, procurement, operation and decommissioning. The first type of governance in this model is to apply ethical considerations at all stages of the development and application of technology, rather than addressing problems after they have occurred.

At the design stage, the R&D team should be subject to a scientific and technological ethics review that expressly excludes adverse objectives, such as inducing excessive care or substituting human judgment, and strengthen training for data management to

ensure the compliance and quality of the data. At the time of approval, a multi-disciplinary joint assessment mechanism should be established to include clinical experts, information centre staff, legal advisors and representatives of the ethics committee for a joint evaluation; a single-vote veto system will be used, and products with data security risks or algorithmic non-explainability will not be approved for deployment, with periodic dynamic re-evaluations. If the system has multiple serious operational errors, significant algorithmic drift or data leakage occurs, it should be taken offline immediately and switched to a manual-care mode.

The problem of full-life-cycle management is the lack of standardised assessment tools. A ready-for-ethical-governance assessment scale for embodied intelligence-based nursing care could be developed to turn ethical compliance into a quantifiable and auditable indicator system that serves as a reference for healthcare institutions' procurement decisions.

4.2 Fairness: Protecting the Rights of Digital Vulnerable Groups

Elderly care recipients are generally at a disadvantage in terms of cognitive function, digital literacy and bargaining power; applying the same rules to the general public may seem fair, but it actually shifts more risk to the vulnerable group. Therefore, the governance system should provide particular support for digitally excluded groups.

First, considering that older adults may have difficulty understanding, age-appropriate informed consent should be obtained: provide all-encompassing explanations of the scope and risks of data collection in simple terms and through multiple channels, and allow for tiered, revocable consent^[44]; for older adults who are unable to give informed consent due to cognitive decline^[39], an alternative consent and "best interests" review mechanism should be established, involving family members or guardians and overseen by an ethics committee, to prevent consent from being merely a formality.

Secondly, special protection measures need to be introduced for personal information; physiological, imaging and emotional data collected in elderly care institutions should be regarded as highly sensitive personal information and subject to the strictest protection. In accordance with the principles of purpose limitation, minimal necessity and localisation, secondary use of such data for other purposes, such as commercial insurance or targeted marketing, is strictly prohibited; thus, the profit-seeking chain that facilitates data misuse will be broken.

Finally, we need to avoid algorithmic discrimination against older adults in the allocation of care resources or risk assessment due to bias in the training data; at the same time, the institutional system should specify that technology is to be used to supplement, not replace, human care, and families and care institutions should not use technology as an excuse to avoid their responsibilities for visitation and emotional support^[45]. The first type of fairness is to ensure that the benefits of new-age technologies are distributed fairly and reach the people who need them most, without creating new divisions among society.

4.3 Human-centered approach: Clear delineation of rights and responsibilities between humans and machines

At the bottom of the governance system is the protection of the humanistic spirit of care. Therefore, we need to define the scope of rights and obligations for people and machines more clearly, and translate the ideas of care ethics into institutional systems.

First of all, it is necessary to establish a clear basic idea of human-centred care for machines that serve as support tools. Robots can handle physically demanding work such as feeding, cleaning and observing; however, core aspects of care that require emotional support, respect for human dignity and relational companionship must still be provided by people. The institutional system should explicitly forbid using robots to replace human care entirely. The appropriate role of technology is to relieve the heavy physical workload of human caregivers and allow them to concentrate more on emotional care that machines cannot replicate; thus, technology should enhance rather than replace human care.

Second, we need to build an open-source system of responsibility assignment. Although robots are still considered legal subjects, a tiered, attributable liability system needs to be established to address the problem of misalignment between their "de facto control" and their "legal status": this system should specify the respective obligations of developers for algorithmic security and explainability, manufacturers for hardware security, operating entities for deployment and maintenance, and users for compliant operation. For high-risk embodied intelligent healthcare products, risk-sharing mechanisms can be established, such as product liability systems, mandatory liability insurance and damage compensation funds, to ensure that elderly beneficiaries are promptly compensated for harm caused by such products and are not left without recourse due to the absence of any responsible party.

From an institutional perspective, we need to implement the principle of ensuring controllability and trustworthiness as proposed in the Ethical Guidelines for Artificial Intelligence – New Generation^[43], institutionalise safeguards for the autonomy and exit rights of older adults, genuinely grant older adults (and their guardians) the substantive right to be informed, to make choices, to refuse, to terminate and to withdraw^[46], and ensure that these rights are truly accessible through user-friendly, age-appropriate operational design.

5. Conclusion and Outlook

Bodied intelligence has an autonomous closed-loop framework of "perception-decision-action" and is being applied to elderly care services to provide a tangible technological solution for the imbalance between the supply and demand of care for disabled older adults in China's aging society and the severe shortage of nursing staff; thus, it has broad application prospects. However, the three main technical features of autonomous closed-loop systems, all-encompassing data collection and human-centered relational engagement have also raised many ethical problems, such as personal safety and privacy protection, emotional dependence and relational alienation, as well as questions of responsibility attribution and human autonomy.

Given the above risks, the "Ethics First" approach is a proactive rather than a reactive governance system; the development of scientific and technological ethics review, safety standards, and domestic and foreign governance frameworks has provided the institutional support for this development. Based on the above, this paper puts forward an ethical governance system with three attributes: intelligence, fairness and human-centered design, and aims to balance technological innovation with human dignity. Looking ahead, for the healthy development of embodied intelligent nursing, continuous efforts will be needed to strengthen areas such as special legislation,

refinement of age-friendly standards, operationalisation of ethical review processes, and interdisciplinary collaborative governance. Technological progress should ultimately aim to improve the quality of life and protect human dignity; it should be an extension of human care, not a replacement for it.

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