

Division of Rights and Responsibilities in Artificial Intelligence-Based Elderly Care: A Dual Perspective of Law and Ethics

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Abstract

This paper focuses on the application of artificial intelligence in the field of elderly care and explores the resulting issues of rights and responsibilities division. With the acceleration of aging and the development of artificial intelligence technology, this technology has been widely used in elderly care. However, traditional legal and ethical frameworks struggle to adapt, leading to numerous predicaments. From the perspective of legal liability, the paper analyzes the ambiguity of the identification of product liability subjects, difficulties in fault determination and burden of proof in tort liability, and the application dilemmas of existing legal provisions. In terms of ethical responsibility, it discusses ethical principles for protecting the rights and interests of the elderly, considerations of algorithm ethics, and interest conflicts and review mechanisms. Using legal liability theory and ethical principal theory, it is proposed that law and ethics are complementary. Relevant laws and regulations should be improved, such as clarifying provisions in product liability and tort liability laws. At the same time, ethical supervision and norms should be strengthened by establishing supervisory institutions, formulating guidelines, and enhancing education, to fully protect the rights and interests of the elderly and ensure the healthy development of artificial intelligence technology.

Keywords

Artificial intelligence, Elderly care, Division of rights and responsibilities, Law, Ethics

Introduction

With the acceleration of the global aging process, the issue of elderly care has increasingly become the focus of social attention. According to data from the National Bureau of Statistics, by the end of 2024, the population aged 60 and above in China reached 310 million, accounting for 22% of the total population. How to ensure the quality of life, safety, and health of the elderly has become an urgent social problem. At the same time, artificial intelligence technology has developed rapidly in recent years and has gradually penetrated the field of elderly care. From smart wearable devices that monitor the health data of the elderly in real-time to intelligent robots that assist in daily care, artificial intelligence provides new solutions for elderly care, alleviating the pressure caused by population aging

to a certain extent and improving the efficiency and accuracy of care.

However, the application of artificial intelligence in elderly care has also triggered a series of complex issues, among which the division of rights and responsibilities is particularly prominent. Due to the autonomy, complexity of artificial intelligence systems, and the rapid iteration of technology, traditional legal and ethical frameworks are difficult to be directly applied to this emerging field, resulting in many predicaments such as unclear responsibility definition and ambiguous rights protection in practical applications. The effects not only relate to the vital interests of the elderly but also affect the sustainable development of artificial intelligence technology in the field of elderly care.

Therefore, it is of great theoretical and practical significance to conduct an in-depth examination of the division of rights and responsibilities in Artificial Intelligence -based elderly care from the dual perspectives of law and ethics.

Domestic and foreign research status

Privacy and data protection

Foreign research on privacy and data protection started early and is in-depth. The EU's General Data Protection Regulation (GDPR) sets strict standards for personal data protection, covering all aspects of data collection, storage, use, and sharing, requiring data controllers to ensure that data subjects are fully informed and consent to data processing. Within this framework, scholars such as Riedewald pointed out that when applying artificial intelligence in elderly care and collecting a large amount of health and lifestyle data, it is necessary to clearly inform the elderly of the purpose, storage duration, and sharing objects of the data, and the data should be anonymized or encrypted to prevent leakage [1]. Through research on intelligent elderly care projects in several European countries, they found that projects complying with GDPR principles have a higher acceptance of technology among the elderly. Scholars such as Custers further emphasized that during cross-border data transmission, it is necessary to ensure that the receiving country has an equivalent level of data protection to avoid risks to the elderly's data [2]. Domestic scholars have actively researched privacy and data protection in Artificial Intelligence-based elderly care. Zhou Hanhua pointed out that with the application of artificial intelligence in the elderly care field, the personal information of the elderly is at risk of leakage, and relevant laws and regulations should be improved to clarify data collection and use rules and strengthen supervision over data processors [3]. For example, China's "Personal Information Protection Law of the People's Republic of China" provides a basic framework for personal information protection, but in the scenario of artificial

intelligence care, it is necessary to further refine the rules to clarify the legal and compliance boundaries for elderly care institutions, technology enterprises, and other data processors when collecting sensitive information such as the health and location of the elderly.

Scholars such as Zhang Xinbao emphasized that it is necessary to strengthen the elderly's control over their data, and through the design of a concise and understandable privacy policy interface, enable the elderly to conveniently manage personal data authorization and protect their privacy rights and interest [4].

Algorithm ethics

In terms of algorithm ethics, foreign research focuses on algorithmic bias and interpretability. Barocas and Selbst pointed out that artificial intelligence algorithms used for health assessment or resource allocation of the elderly may produce biases due to biased training data, such as unfair treatment of the elderly of specific races, genders, or regions, affecting their access to appropriate care services [5]. Through analysis of intelligent elderly care service algorithms in some regions of the United States, they found that the algorithms underestimate the health status of the elderly in low-income communities, leading to insufficient resource allocation. Doshi-Velez and Kim emphasized the importance of algorithm interpretability in elderly care [6].

When artificial intelligence systems make decisions based on algorithms, such as determining the health risk level of the elderly or adjusting care plans, it is necessary to explain the decision-making basis to the elderly, their families, and caregivers to enhance trust. Some international organizations, such as the Institute of Electrical and Electronics Engineers (IEEE), issued the "Global Initiative on Ethics of Autonomous and Intelligent Systems", which regulates the ethical principles of algorithm design and promotes the practice of algorithm ethics [7].

In terms of algorithm ethics, domestic scholars pay attention to algorithm fairness and transparency.

Wang Lusheng found that in the algorithms of some intelligent in elderly care service platforms, there may be unfair phenomena due to incomplete data or unreasonable algorithm design, such as inaccurate health assessment of the elderly with rare diseases, affecting resource allocation [8]. He proposed that an algorithm fairness review mechanism should be established to conduct pre-event, in-event, and post-event reviews of algorithms used for elderly care to ensure algorithm fairness. Scholars such as Liang Li emphasized algorithm transparency, believing that the basic principles, data sources, and decision-making logic of algorithms should be disclosed to the elderly and their families, so that they can understand how the artificial intelligence system works and enhance trust in technology [9]. For example, some domestic enterprises, when developing intelligent health monitoring devices, try to add an algorithm explanation module in the APP to explain the data processing and analysis process to users.

Respect for autonomy and dignity

Foreign countries attach great importance to respecting the autonomy and dignity of the elderly in artificial intelligence care. For example, British scholar Wilkinson and others pointed out in their research that when using intelligent decision-making assistance systems to formulate care plans for the elderly, full consultation with the elderly should be conducted to allow them to participate in decision-making instead of being unilaterally decided by the system [10]. Through practical observations in several elderly care institutions in the UK, the study found that when the elderly participate in decision-making, their satisfaction with care services is higher and their quality of life is improved. The United Nations' "Principles for Older Persons" emphasizes the protection of the dignity of the elderly. On this basis, foreign scholars explore how the design of artificial intelligence products and services can avoid discrimination or insult to the elderly [11]. For example, companion robots should use respectful and gentle tones in language interaction design and avoid using

inappropriate words to maintain the dignity of the elderly. Domestic research also attaches importance to respecting the autonomy and dignity of the elderly in artificial intelligence care. Tian Haiping pointed out that when applying artificial intelligence technology, the elderly should be regarded as subjects with independent consciousness, and their wishes should be fully respected. For example, when introducing intelligent care plans, full communication with the elderly should be conducted, and the plans should be adjusted according to their feedback. [12]. In terms of dignity protection, scholars have explored how to avoid psychological harm to the elderly from artificial intelligence products. For example, in the interactive design of intelligent companion products, it is necessary to consider the psychological characteristics of the elderly and avoid functions and contents that make the elderly feel ignored or belittled, to maintain their dignity.

Attribution of responsibility

There are many discussions abroad on the attribution of responsibility of artificial intelligence in elderly care. Coeckelbergh proposed the concept of "distributed responsibility", believing that in the complex chain of development, production, and use of artificial intelligence systems, responsibility should not be borne by a single subject but by multiple parties such as developers, manufacturers, sellers, users, and regulators according to their respective roles and behaviors [13]. For example, when a smart care device malfunctions and causes injury to the elderly, developers may be responsible for algorithm design defects, manufacturers for hardware quality issues, and sellers may also bear part of the responsibility if they fail to fulfill their obligation to inform. Some countries, such as Germany, have attempted to clarify the responsibility division of different subjects in the application of intelligent technology in the elderly care field in relevant legal drafts to provide a legal basis for practice. Regarding the attribution of responsibility, domestic scholars have analyzed it from legal and ethical perspectives.

Yang Qingwang and Zhang Lei believe that artificial intelligence should be given a certain legal status through legal fiction to clarify the attribution of artificial intelligence infringement liability in elderly care, such as stipulating the responsibilities of artificial intelligence developers and users in different situations [14]. At the same time, from an ethical perspective, scholars such as Zhang Chenggang proposed the establishment of an ethical review mechanism to conduct full ethical supervision on the application of artificial intelligence in elderly care. At all stages of product development and use, if the rights and interests of the elderly are damaged due to violation of ethical principles, the relevant subjects should bear ethical responsibilities and be restrained through moral condemnation, industry self-discipline, and other means [15].

Summary of domestic and foreign research

status

Domestic and foreign research on the ethical responsibilities of artificial intelligence in elderly care has both commonalities and differences. In terms of commonalities, both attach great importance to issues such as privacy and data protection, algorithm ethics, respect for the autonomy and dignity of the elderly, and attribution of responsibility, recognizing the importance of these issues for protecting the rights and interests of the elderly and promoting the healthy development of artificial intelligence technology in the field of elderly care.

In terms of differences, foreign research started early and is more mature in some fields, such as privacy protection legislation and algorithm ethics theory construction, forming a relatively complete theoretical and practical system, and focusing on interdisciplinary research, combining sociology, psychology, and other interdisciplinary knowledge to explore ethical issues. Although domestic research started relatively late, it has developed rapidly, closely combining China's national conditions and policies and regulations, actively

exploring in improving relevant legal systems and constructing ethical review mechanisms suitable for the local context, while paying attention to the impact of traditional culture on the ethics of elderly care, and striving to develop an artificial intelligence ethical application model with Chinese characteristics.

Overall, there are still some deficiencies in current domestic and foreign research. In theoretical research, the research on the correlation between various ethical responsibility issues is not in-depth, and there is a lack of a systematically integrated theoretical framework; at the practical level, the operability of ethical guidelines and norms in practical applications needs to be improved, and there is a lack of effective supervision and evaluation mechanisms to ensure their implementation. Future research needs to strengthen interdisciplinary cooperation, further improve the theoretical system, focus on transforming theoretical results into practical applications, and establish a sound supervision and evaluation mechanism to better solve the ethical responsibility issues of artificial intelligence in elderly care.

Theoretical basis

Legal liability theory

Legal liability theory is a theoretical system that studies the mandatory consequences that legal subjects should bear for violating legal obligations. Its core is to standardize social behaviors and provide remedies by clarifying the composition of liability, principles of imputation, and forms of liability.

(1) Core Constituent Elements

The establishment of legal liability requires four elements: first, the existence of legal obligations, that is, the specific requirements of the law on the subject's behavior, such as the obligation of artificial intelligence product producers to ensure product safety; second, the existence of illegal acts, that is, the obligation subject fails to perform or improperly performs obligations, such as algorithm developers failing to fully test the elderly health monitoring

algorithm; third, the existence of damage consequences, such as the elderly suffering personal or property losses due to smart device failures; fourth, causality, that is, there is a direct connection between the illegal act and the damage consequences, such as device defects directly causing the elderly to fall and get injured.

(2) Main Principles of Imputation

Fault Liability Principle: Taking the actor's subjective fault (intent or negligence) as a constituent element of liability, applicable to traditional civil torts. In the context of artificial intelligence, if a developer causes algorithmic bias due to negligence, it constitutes fault.

Strict Liability Principle: Regardless of the actor's subjective state, if there is a causal relationship between the act and the damage, liability shall be borne, mainly applicable to high-risk fields. For example, even if an artificial intelligence medical device is not at fault, if it causes damage, the producer shall still bear liability (Article 1202 of the "Civil Code").

Fault Presumption Principle: It is presumed that the actor is at fault unless he proves that he is not at fault, reducing the burden of proof on the victim. For example, when an intelligent care robot causes damage to a person, it is presumed that the developer has design defects, and the developer needs to prove that he is not at fault.

(3) Special Application in Elderly Care

The autonomy and complexity of artificial intelligence pose challenges to traditional legal liability theory.

First, the diversification of responsible subjects, hardware manufacturers, algorithm developers, data service providers, etc., form a "liability chain", and it is necessary to clarify the rights and responsibilities of all parties through the "distributed liability" theory. Second, the difficulty in determining causality, the algorithm black box makes it difficult to trace the cause of damage, and it is necessary to establish a technologically neutral third-party identification mechanism. Third, the innovation of liability forms, in addition to

traditional compensation, it is necessary to introduce preventive liability forms such as algorithm correction and data deletion.

Ethical principal theory

Ethical principal theory is a theoretical system that explores the moral norms that human behaviors should follow. It guides behavioral subjects to pursue a higher level of legitimacy outside the legal framework by constructing value judgment standards.

(1) Four Core Principles

Principle of Autonomy: Respecting the individual's right to self-determination, requiring artificial intelligence applications to fully protect the elderly's right to know and right to choose. For example, the formulation of intelligent care plans must be approved by the elderly and cannot replace their core decisions.

Principle of Non-maleficence: Avoiding foreseeable harm to others through actions, such as algorithm design, needs to eliminate racial and regional biases to prevent underestimation of the health of the elderly in rural areas.

Principle of Beneficence: Actions should maximize the interests of the recipients, such as the interactive design of intelligent companion robots should aim to alleviate the loneliness of the elderly.

Principle of Justice: Ensuring fairness in resource allocation and rights enjoyment, for example, intelligent elderly care resource scheduling algorithms should not differentiate treatment based on the economic status of the elderly.

(2) Extension in Technical Application

Algorithm Ethics: Requires algorithm transparency (such as explaining the basis for health assessment to the elderly) and traceability (recording the algorithm decision-making process) to avoid implicit discrimination.

Data Ethics: Emphasizes the principle of minimum necessity in data collection (only collecting health data necessary for care) and the authenticity of informed consent (informing the elderly of data usage in plain language). **Human-Machine Relationship Ethics:** Balancing technical assistance

and human care, preventing intelligent devices from replacing emotional support behaviors such as children's visits and maintaining the emotional dignity of the elderly.

Synergistic relationship between the two theories

Legal liability theory emphasizes clarifying responsible subjects and scope of liability to ensure that the injured party can obtain remedies; ethical principal theory focuses on guiding behaviors from a moral perspective to protect individual dignity and rights and interests.

Legal liability theory and ethical principal theory presents a “complementary and symbiotic” relationship: law guarantees bottom-line ethics with coercive power (such as prohibiting the leakage of the elderly's privacy), and ethics provides value guidance for legal improvement (such as incorporating algorithm fairness into legislative considerations). In the context of applying artificial intelligence to elderly care, these two theories provide a key theoretical basis for analyzing the division of rights and responsibilities.

Overview of artificial intelligence

Application fields and methods

Artificial Intelligence is a new technical science that studies and develops theories, methods, technologies, and application systems used to simulate, extend, and expand human intelligence. Its core goal is to enable machines to possess intelligent behaviors like humans, such as perception, learning, reasoning, and decision-making.

The development history of artificial intelligence can be roughly divided into the following stages:

Embryonic Stage (1950s-1960s): In 1956, the concept of “artificial intelligence” was formally proposed at the Dartmouth Conference, marking the birth of the discipline of artificial intelligence. During this period, research mainly focused on general problem solvers, and some initial results were achieved, but due to technical limitations, development was relatively slow.

Trough Period (1970s-early 1980s): Due to technical bottlenecks and funding shortages, artificial intelligence research entered a “winter” with limited progress.

Renaissance Period (1980s-1990s): The successful application of expert systems brought a renaissance to artificial intelligence research, achieving certain practical value in fields such as medical care and finance, but there were still limitations.

Rapid Development Period (since the 21st century): With the breakthroughs in big data, cloud computing, deep learning, and other technologies, artificial intelligence has entered a period of rapid development, making significant progress in speech recognition, image recognition, natural language processing, and other fields, with increasingly rich application scenarios.

Application of artificial intelligence in the field of elderly care

Currently, the application scenarios of artificial intelligence in the field of elderly care are rich and diverse, with various intelligent products and services constantly emerging. In terms of health monitoring, smart bracelets, smart watches, and other wearable devices can collect real-time physiological data such as heart rate, blood pressure, and sleep of the elderly, and through data analysis, timely detect potential health risks and send early warning information to the elderly and their caregivers. For example, Huawei's smart bracelet can predict the risk of cardiovascular disease by monitoring heart rate variability, providing strong support for the health management of the elderly.

In terms of daily life assistance, intelligent robots are gradually emerging. Companion robots can talk with the elderly, play music, tell stories, etc., to alleviate the loneliness of the elderly; some robots also have simple housework assistance functions, such as helping the elderly get items, reminding them to take medicine on time, etc. In the field of safety monitoring, smart cameras, sensors and other devices can monitor the home environment of the elderly in real time, such as detecting whether there are abnormal situations such as falls, fires, gas leaks,

and timely notifying relevant personnel. Some smart door locks also have face recognition and abnormal alarm functions, enhancing the safety of the elderly at home.

In some elderly care institutions, the application of artificial intelligence technology is more extensive. By establishing an intelligent elderly care management system, the institution can conduct comprehensive information management of the elderly's daily life, health status, care needs, etc. For example, using big data analysis to formulate personalized care plans for each elderly person, reasonably arrange the work tasks of nursing staff, and improve the quality and efficiency of elderly care services.

Technical characteristics of artificial Intelligence and difficulties in division of rights and responsibilities

The application of artificial intelligence in elderly care shows unique technical characteristics, which not only bring broad application prospects but also trigger a series of difficulties in the division of rights and responsibilities.

Autonomy. With the development of machine learning, deep learning and other technologies, artificial intelligence systems can independently perceive the environment, make decisions and execute corresponding actions to a certain extent. For example, nursing robots with autonomous navigation functions can independently plan paths according to environmental changes to provide meal delivery, medicine delivery and other services for the elderly. This autonomy enables artificial intelligence to respond to various situations more flexibly in the care process, but it also blurs the traditional responsibility boundary. From the perspective of legal liability theory, when the decision made independently by the artificial intelligence system leads to adverse consequences, it is difficult to determine the responsibility subject according to the rules of clarifying the responsibility subject in traditional laws. When an intelligent nursing robot collides with an elderly person due to wrong independent decision-making, it is difficult

to clearly define whether it is the responsibility of the developer for algorithm setting, the manufacturer for hardware performance, or the user for improper operation when determining the responsibility.

Complexity. Artificial intelligence systems usually involve knowledge and technologies in multiple disciplines, and their algorithms and models are often very complex. Taking image recognition technology for detecting falls of the elderly as an example, it involves a large amount of data training, complex algorithm optimization and the cooperation of hardware devices. This complexity makes the technical research and development, product production and application process involve many participants, including algorithm developers, data annotators, hardware manufacturers, software integrators, etc. Once a problem occurs, it is difficult to sort out the responsibility relationship between various subjects. According to the principle of defining traditional legal liability, it is extremely difficult to determine the fault and responsibility scope of each subject when multiple subjects are involved, and the relationship is complex.

Data Dependence. The powerful functions of artificial intelligence largely depend on a large amount of data support. In elderly care, it is necessary to collect various sensitive information such as health data, living habits data and behavior data of the elderly.

On the one hand, the collection and use of data need to follow strict legal and ethical norms to protect the privacy of the elderly; on the other hand, the quality and security of data also directly affect the performance and reliability of artificial intelligence systems.

If data is leaked, tampered with or incorrect, it may cause artificial intelligence systems to make wrong decisions, which may damage the rights and interests of the elderly.

From the perspective of ethical principal theory, violating the basic ethical principle of protecting the privacy of the elderly in the process of data

collection and use will infringe on the rights and interests of the elderly, which also highlights the importance of following ethical norms in this process.

Analysis of legal liability of artificial intelligence in elderly care

Identification of responsible subjects from the perspective of product Liability

In the scenario where artificial intelligence is applied to elderly care, from the perspective of product liability, the identification of responsible subjects is more complex. When smart care products have defects that cause damage to the elderly, according to traditional product liability law, the producers and sellers of the products usually bear the liability. "Product Quality Law of the People's Republic of China" stipulates that producers are responsible for product quality, and producers shall bear compensation liability if products have defects that cause damage to personal or other people's property. However, in artificial intelligence products, the definition of producers becomes vague. Taking intelligent elderly care robots as an example, their hardware may be produced by one manufacturer, while the software algorithms are developed by another technology company, and may also involve data service providers, etc. This multi-subject participation in the production model makes it difficult to determine the real "producer". If the robot makes wrong behaviors due to algorithm defects, such as wrong judgment of the elderly's needs leading to accidental injury, the hardware manufacturer may shirk responsibility because the algorithm is not developed by it, and the algorithm developer may emphasize the hardware operation problems, leading to the phenomenon of responsibility shifting. From the in-depth analysis of product liability theory in legal liability theory, under the traditional product liability system, producers are responsible for product design, manufacturing and other links, and sellers have certain obligations to review and inform product quality.

However, in artificial intelligence products, due to the diversification of their components and the complexity of technology, traditional theories are difficult to apply directly. As the creator of the key part of the product, the algorithm developer's degree of producer liability for algorithm defects is not clearly stipulated in the current law. This leads to great disputes in the identification of liability in actual cases when damage is caused by algorithm problems, and it is difficult to accurately define the responsible subject according to existing legal rules. Sellers also face the problem of liability definition. When selling smart care products, whether sellers have the obligation to give a detailed explanation of the complex technical principles and potential risks of the products is not clearly stipulated in the current law. If the seller fails to fully fulfill the obligation of notification, causing the elderly and their families to use the product without fully understanding it and suffer damage, the extent of the seller's liability is also unclear.

For example, a merchant sells a smart health monitoring device but fails to explain to the purchasing elderly and their families that the device may have data deviation in a specific environment. The elderly adjust their medication based on inaccurate data, resulting in physical discomfort.

Currently, the identification of the seller's liability is controversial. According to the principle of the seller's obligation to inform in legal liability theory, the seller shall disclose important information that may affect consumers' use and rights and interests of the product.

However, for products with high technical complexity, such as artificial intelligence products, the specific scope and standards of the obligation to inform are not clear in law, which makes it difficult to accurately determine the seller's liability in specific cases.

Fault identification and burden of proof in tort liability

In the field of tort liability, the fault identification of tort acts caused by artificial intelligence has particularity.

In traditional tort liability, fault is usually judged according to the actor's subjective psychological state, but the behavior of artificial intelligence systems is not based on human subjective consciousness. For example, if an intelligent health monitoring device gives wrong health tips due to wrong data processing, leading to delayed treatment of the elderly, its fault identification cannot simply apply traditional standards. Currently, it is necessary to consider objective factors such as whether the developer has defects in algorithm design and testing, and whether the operator is responsible for equipment maintenance and data management.

From the perspective of the theory of fault identification in tort liability in legal liability theory, traditional fault identification focuses on the actor's subjective intent or negligence, but the behavior of artificial intelligence systems has autonomy and non-subjective consciousness. In this case, it is necessary to draw on the objective fault theory, that is, to judge fault from whether the actor's behavior meets the reasonable standard of duty of care. For developers and operators of artificial intelligence products, their reasonable duty of care includes ensuring the scientific of algorithm design, comprehensiveness of testing, timeliness of equipment maintenance and security of data management. If there are deficiencies in these aspects, leading to tort acts of artificial intelligence systems, it should be determined that they have faults. However, the current legal provisions in this regard are not perfect, making it lack clear legal basis in the actual identification of faults.

In terms of burden of proof, it is extremely difficult for the elderly and their families to provide evidence in artificial intelligence infringement cases. They need to prove that the artificial intelligence product or service has defects, that they have suffered damage, and that there is a causal relationship between the two. However, the professionalism and complexity of artificial intelligence technology make it difficult for ordinary users to obtain relevant technical evidence, such as algorithm codes and

data processing processes, which are often in the hands of developers and operators. In this case, if the traditional rule of "who claims, who proves" is still followed, the elderly will be in an extremely disadvantageous position in the process of safeguarding their rights. For example, in a case where an intelligent nursing device causes injury to an elderly person, if the elderly's family is unable to obtain relevant evidence of the device's internal algorithm and data processing, and cannot effectively prove that the device has defects and the causal relationship with the elderly's injury, it will be difficult to safeguard their legitimate rights and interests. According to the theory of evidence law, the allocation of burden of proof should consider factors such as the difficulty for both parties to obtain evidence. In artificial intelligence infringement cases, because the elderly and their families are at an obvious disadvantage in obtaining key technical evidence, continuing to use the traditional burden of proof rules is not in line with the principle of fairness. Therefore, it is necessary to adjust the rules of burden of proof to balance the positions of both parties in the lawsuit, but the current relevant laws have not made adaptive changes in this regard.

Application dilemmas of existing legal provisions

The existing legal system has many application dilemmas in dealing with the liability issues of artificial intelligence in elderly care. Product Quality Law mainly aims at the quality problems of traditional products and lacks clear regulations on key elements such as algorithms and data in artificial intelligence products. For example, there are no clear legal provisions on whether algorithm defects belong to product defects and how to define algorithm defects. In the face of artificial intelligence infringement, the Tort Liability Law is difficult to effectively protect the legitimate rights and interests of the elderly due to the difficulties in fault identification and burden of proof.

In the legal relationship of contracts, the contracts signed between the elderly or their families, and the

providers of smart care products often have irregular standard terms and unequal rights and obligations. Product providers may take advantage of their dominant position to exempt or reduce their own responsibilities and restrict the rights of the elderly in the contracts.

However, the current Contract Law is not perfect in regulating such standard terms and cannot fully protect the interests of the elderly in contractual relations. In addition, due to the rapid iteration of artificial intelligence technology, the lag of law makes it impossible for newly emerging problems to be regulated by law in time, further exacerbating the dilemma of legal application. For example, some smart care products have new function restrictions or changes in privacy policies after software updates, but contracts do not make reasonable agreements on this, and the rights and interests of the elderly are difficult to protect. From the perspective of legal development theory, law has stability and lag, while technological development has rapid iteration. When emerging artificial intelligence technology is applied to the field of elderly care, the existing legal system is difficult to quickly adapt to the new changes brought by technology. In relevant laws such as Product Quality Law, Tort Liability Law and Contract Law, there is a lack of targeted provisions on the special nature and problems of artificial intelligence products and services, resulting in the inability to accurately apply existing legal provisions when handling relevant disputes, and it is difficult to realize the effective protection of the elderly's rights and interests by law and the standardized guidance of the application of artificial intelligence technology.

Discussion on ethical responsibilities of artificial

Intelligence in elderly care

Ethical principles for protecting the rights and interests of the elderly

In the process of applying artificial intelligence to elderly care, the primary ethical principle is to protect the rights and interests of the elderly. This

includes respecting the autonomy of the elderly and ensuring that the use of artificial intelligence will not violate the elderly's right to make independent decisions. For example, when using an intelligent decision-making assistance system to formulate a care plan for the elderly, full consultation should be conducted with the elderly to enable them to participate in the decision-making process, rather than being unilaterally decided by the system. When introducing an intelligent care plan formulation system, an elderly care institution fully communicated with the elderly and adjusted the plan according to the elderly's wishes and needs, ensuring the elderly's autonomy.

From the perspective of the principle of autonomy in ethical principal theory, everyone has the right to independently decide their own affairs, and the elderly are no exception. In the scenario of artificial intelligence-assisted elderly care, respecting the autonomy of the elderly means that in decision-making involving important matters such as the elderly's life and health, we cannot rely solely on the judgment of artificial intelligence systems, but should regard the elderly as one of the decision-making subjects. This not only reflects respect for the individual dignity of the elderly but also helps to improve the elderly's acceptance and satisfaction with care services. When providing suggestions on care plans, intelligent decision-making assistance systems should provide clear and understandable information to help the elderly understand the content and impact of the plans, so that they can make decisions based on their own values and needs. Protecting the privacy of the elderly is also an important ethical principle. In the operation process, artificial intelligence systems will collect a large amount of personal information about the elderly, from health data to daily living habits.

This information should be strictly protected to avoid leakage and abuse. Relevant institutions and developers have the responsibility to take encryption technology, access control and other measures to ensure the privacy and security of the elderly.

At the same time, when collecting data, it is necessary to inform the elderly of the purpose, storage method and sharing scope of the data, and obtain their explicit consent. Some smart health monitoring device manufacturers, before collecting the elderly's health data, explain the use and protection methods of the data to the elderly through clear and understandable interfaces and instructions, and collect the data only after obtaining the elderly's consent.

Principles of privacy is an important part of ethical principal theory, which emphasizes confidentiality and control of personal information. In the case of artificial intelligence collecting and processing a large amount of elderly data, following the principle of privacy requires relevant subjects to take reasonable technical and management measures to prevent data leakage and improper use. Informing the elderly of data-related information and obtaining their consent is a key step to ensure the elderly's control over their own data, reflecting respect and protection for the rights and interests of the elderly. Ensuring the dignity of the elderly is also indispensable. The design and use of artificial intelligence products and services should avoid discrimination or insult towards the elderly and maintain their personal dignity.

For example, when communicating with the elderly, companion robots should conform to standards of respecting the elderly in their language and behavior and must not use inappropriate or offensive expressions. In terms of language design, a brand of companion robot uses a gentle and respectful tone to communicate with the elderly, avoiding words that may make the elderly feel uncomfortable. The principle of dignity is one of the core values of ethical principles, which requires respect for the personal dignity of individuals in any case. In the scenario of interaction between artificial intelligence and the elderly, both the language expression and behavior of robots should reflect respect for the elderly. Avoid using content that may be discriminatory or disrespectful and ensure that the elderly feel that their dignity is maintained in the

process of interacting with artificial intelligence products and services, which is of great significance for improving the quality of life and psychological state of the elderly.

Considerations of algorithm ethics in elderly care

As the core of artificial intelligence, algorithm ethics is particularly critical in elderly care. Algorithmic bias is a prominent problem. If algorithms used to evaluate the health status or care needs of the elderly have biases, it may lead to unfair treatment of certain groups of elderly people. For example, due to the limitations of training data, algorithms may make inaccurate evaluations of elderly people with specific diseases or from specific regions, affecting their access to appropriate care services. Studies have found that some health assessment algorithms have deviations in evaluating the health status of elderly people in rural areas, resulting in these elderly people being unable to obtain timely and accurate allocation of care resources.

From the perspective of algorithm ethics theory, algorithmic bias violates the principle of fairness. The principle of fairness requires that all individuals be treated equally in terms of resource allocation and access to opportunities, without discriminatory differences due to the characteristics of their groups. In the field of elderly care, the design and training of algorithms should ensure their fairness and avoid adverse effects on specific elderly groups due to data bias or algorithm design defects.

This requires ensuring the comprehensiveness and representativeness of data in the data collection stage, covering data of various elderly groups with different regions, health status and economic levels; in the process of algorithm design and optimization, detecting and correcting possible biases to ensure that all elderly people can obtain fair care services based on accurate algorithm evaluation. The interpretability of algorithms is also crucial. In the elderly care scenario, when artificial intelligence systems make decisions based on algorithms, such as smart devices judging that the elderly have fallen

and issuing an alarm, or health monitoring systems suggesting adjusting care plans, the decision-making process should be able to be explained to the elderly, their families and caregivers.

Algorithmic decisions lacking interpretability will cause distrust and are not conducive to responsibility tracing and improvement when problems occur. In addition, it is necessary to ensure the transparency of algorithms, disclose the basic principles, data sources and possible risks of algorithms, so that relevant personnel can understand the operation mechanism of algorithms and better supervise and apply artificial intelligence technology. Some advanced intelligent care systems have begun to provide algorithm explanation functions, explaining the basis and process of decisions to users, and enhancing users' trust in the system.

The principles of algorithm interpretability and transparency are important contents of algorithm ethics. Interpretability helps relevant personnel understand the logic of algorithmic decision-making and enhance trust in artificial intelligence systems. In elderly care, when it comes to important decisions such as health status assessment and emergency judgment, being able to explain the basis of algorithmic decisions to the elderly and their families enables them to better accept and cooperate with relevant measures.

Transparency requires disclosing key information of algorithms, including the scope of data sources, the basic principles of algorithm models, and possible limitations and risks. This not only helps relevant personnel supervise and evaluate algorithms but also provides conditions for discovering and correcting possible problems of algorithms, thus better protecting the rights and interests of the elderly.

Interest conflicts and ethical review mechanisms

As the core of artificial intelligence, algorithm ethics is particularly critical in elderly care. Algorithmic bias is a prominent problem. If algorithms used to evaluate the health status or care

needs of the elderly have biases, it may lead to unfair treatment of certain groups of elderly people. For example, due to the limitations of training data, algorithms may make inaccurate evaluations of elderly people with specific diseases or from specific regions, affecting their access to appropriate care services. Studies have found that some health assessment algorithms have deviations in evaluating the health status of elderly people in rural areas, resulting in these elderly people being unable to obtain timely and accurate allocation of care resources.

From the perspective of algorithm ethics theory, algorithmic bias violates the principle of fairness. The principle of fairness requires that all individuals be treated equally in terms of resource allocation and access to opportunities, without discriminatory differences due to the characteristics of their groups. In the field of elderly care, the design and training of algorithms should ensure their fairness and avoid adverse effects on specific elderly groups due to data bias or algorithm design defects. This requires ensuring the comprehensiveness and representativeness of data in the data collection stage, covering data of various elderly groups with different regions, health status and economic levels; in the process of algorithm design and optimization, detecting and correcting possible biases to ensure that all elderly people can obtain fair care services based on accurate algorithm evaluation.

The interpretability of algorithms is also crucial. In the elderly care scenario, when artificial intelligence systems make decisions based on algorithms, such as smart devices judging that the elderly have fallen and issuing an alarm, or health monitoring systems suggesting adjusting care plans, the decision-making process should be able to be explained to the elderly, their families and caregivers. Algorithmic decisions lacking interpretability will cause distrust and are not conducive to responsibility tracing and improvement when problems occur. In addition, it is necessary to ensure the transparency of algorithms, disclose the basic principles, data sources and possible risks of algorithms, so that

relevant personnel can understand the operation mechanism of algorithms and better supervise and apply artificial intelligence technology.

Some advanced intelligent care systems have begun to provide algorithm explanation functions, explaining the basis and process of decisions to users, and enhancing users' trust in the system. The principles of algorithm interpretability and transparency are important contents of algorithm ethics. Interpretability helps relevant personnel understand the logic of algorithmic decision-making and enhance trust in artificial intelligence systems. In elderly care, when it comes to important

decisions such as health status assessment and emergency judgment, being able to explain the basis of algorithmic decisions to the elderly and their families enables them to better accept and cooperate with relevant measures. Transparency requires disclosing key information of algorithms, including the scope of data sources, the basic principles of algorithm models, and possible limitations and risks. This not only helps relevant personnel supervise and evaluate algorithms but also provides conditions for discovering and correcting possible problems of algorithms, thus better protecting the rights and interests of the elderly. As shown in Figure 1.

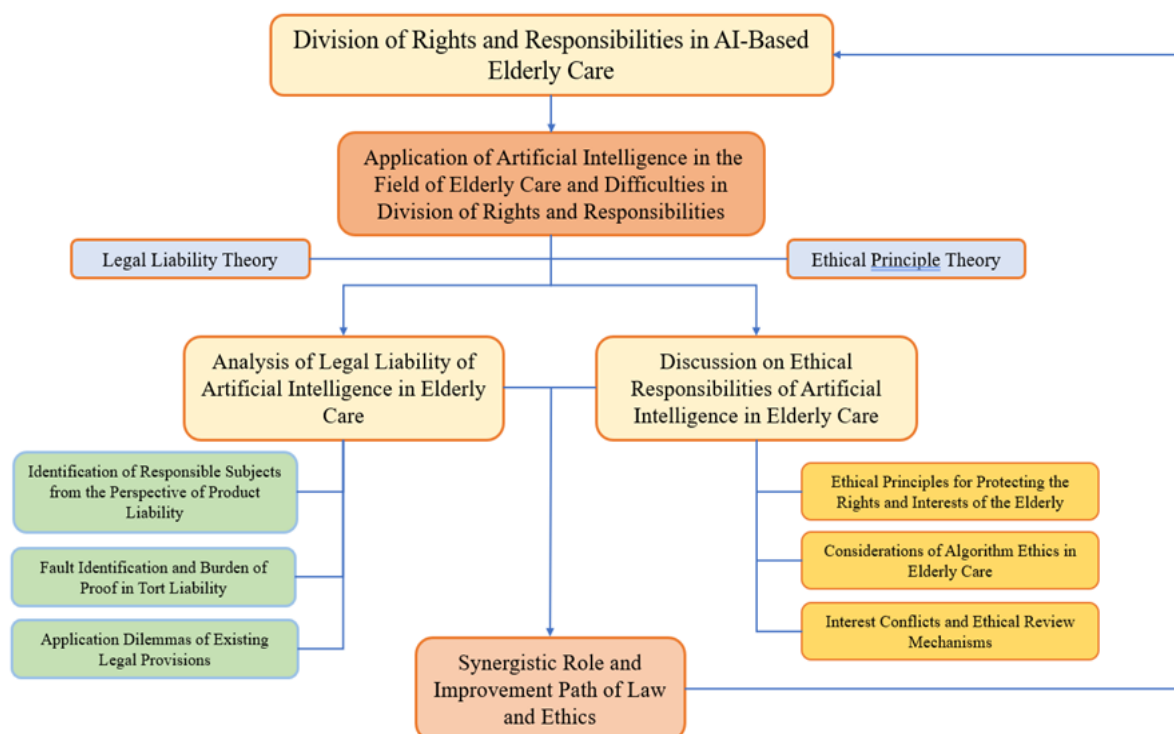


Figure 1. Division of rights and responsibilities in AI-Based elderly care.

Synergistic role and improvement path of law and ethics

Complementary relationship between Law and ethics

Law and ethics have a complementary relationship in regulating the rights and responsibilities of artificial intelligence in elderly care. As a mandatory code of conduct, law provides basic behavioral norms for the application of artificial intelligence.

By clearly stipulating the subject of responsibility, the form of responsibility, and the scope of rights protection through legal provisions, illegal and tortious acts can be sanctioned, and the legitimate rights and interests of the elderly can be guaranteed to have a clear remedy when infringed.

For example, the relevant provisions of the Product Liability Law and the Tort Liability Law can provide a legal basis for determining the attribution of responsibility when artificial intelligence products or services cause damage to the elderly.

Ethics guides the development and application of artificial intelligence technology from a higher level. Ethical principles provide a value orientation for the research and development, design, and use of artificial intelligence, urging relevant subjects to fully consider the rights and interests of the elderly and public interests while pursuing technological progress and commercial interests.

For example, algorithm ethics requires ensuring the fairness, interpretability, and transparency of algorithms. Although these ethical requirements cannot be directly enforced by law, they can urge developers to consciously abide by moral norms and reduce problems caused by improper application of technology from the source.

The implementation of law requires ethical support, and the public's recognition and compliance with the law depends to a certain extent on the guidance of ethical concepts; the effective implementation of ethical norms also requires legal guarantees. For behaviors that seriously violate ethical morality and cause serious consequences, legal sanctions can strengthen the authority of ethical norms.

Suggestions for improving relevant laws and regulations

To better cope with the division of rights and responsibilities of artificial intelligence in elderly care, relevant laws and regulations need to be improved. In terms of product liability, the producer liability of various participants, such as hardware, software, algorithms, and data services in artificial intelligence products should be clarified.

For example, special clauses can be formulated to stipulate that algorithm developers shall bear corresponding liability for damage caused by algorithm defects, and at the same time clarify the obligations of hardware manufacturers and software integrators in ensuring the overall quality of products.

In terms of the liability of sellers, the obligation of sellers to inform about the technical risks and usage precautions of artificial intelligence products should be clarified. If the seller fails to fulfill this obligation and causes damage to consumers, they should bear

corresponding compensation liability. In the field of tort liability law, in view of the particularity of artificial intelligence infringement, the standards for determining faults and the rules for burden of proof should be adjusted.

The principle of presumption of fault should be adopted, that is, when artificial intelligence products or services cause damage to the elderly, it is presumed that developers, operators, etc., are at fault, unless they can prove that they are not at fault. At the same time, the burden of proof on the elderly and their families should be appropriately reduced, and it should be stipulated that developers, operators, and other parties who hold key technical evidence shall bear part of the burden of proof, such as providing algorithm design documents and data processing records, to balance the positions of both parties in the lawsuit. In addition, special laws and regulations on the application of artificial intelligence in the field of elderly care should be formulated to comprehensively regulate data protection, privacy rights, product standards, liability insurance, etc., filling the gaps in the existing legal system and providing comprehensive and specific legal basis for the application of artificial intelligence in elderly care.

For example, we can learn from the relevant provisions of the EU's General Data Protection Regulation (GDPR) to strengthen the protection of the elderly's personal data and clarify the responsibilities and obligations of data controllers and processors.

The "Personal Information Protection Law of the People's Republic of China" also stipulates the obligations of personal information processors, which can be further refined and implemented in the scenario of artificial intelligence care.

Measures to strengthen ethical supervision and norms

Strengthening ethical supervision and norms is crucial for guiding the healthy development of artificial intelligence in elderly care. First, an independent ethical supervision body should be established, whose members should include

ethicists, legal experts, gerontologists, and public representatives.

This body is responsible for conducting full-process supervision over the application of artificial intelligence in elderly care, starting from the project approval stage of product research and development, reviewing whether it complies with ethical principles, and continuously monitoring ethical issues during product use.

Formulate detailed ethical guidelines and operational norms to clarify the ethical requirements and codes of conduct for artificial intelligence in elderly care. Governments should increase financial support for this field and strengthen regulatory systems. It is crucial for expert R&D teams to maintain high ethical standards and avoid seeking personal gains. To address the issue of algorithmic bias, mechanisms for algorithm auditing and supervision should be established. This requires bias detection and correction during the development of artificial intelligence systems, using diverse and representative data for model training to ensure algorithmic fairness.

Additionally, research on the interpretability of artificial intelligence decisions should be promoted, and visual and easy-to-understand algorithm explanation tools should be developed. For example, it is stipulated that the principle of minimum necessity should be followed in the process of data collection, and only data directly related to and necessary for elderly care should be collected; in algorithm design, training data that may lead to discriminatory results should be avoided.

For behaviors that violate ethical guidelines, corresponding disciplinary mechanisms, such as public condemnation and industry bans, should be established to enhance the binding force of ethical norms.

Strengthen ethical education for artificial intelligence practitioners and incorporate ethical training into relevant professional education and vocational training systems. Through training, improve practitioners' ethical awareness, enable

them to consciously abide by ethical norms in the process of technology research and development and application, and ensure the ethical application of artificial intelligence in elderly care from the perspective of personnel.

At the same time, encourage the public to participate in ethical supervision, establish public reporting channels, and promptly investigate and handle ethical issues reported by the public, forming a good atmosphere where the whole society pays attention to and supervises the ethical application of artificial intelligence.

Conclusion

The application of artificial intelligence in the field of elderly care is a double-edged sword. It not only provides innovative solutions to cope with the care pressure brought by population aging but also triggers complex issues of rights and responsibilities division due to the characteristics of technology and the inadaptability of traditional regulatory systems.

From a legal perspective, the ambiguous identification of product liability subjects, the dilemma of tort liability determination, and the lag of existing laws make it difficult for the elderly to obtain adequate remedies when their rights and interests are damaged; from an ethical perspective, issues such as algorithmic bias, privacy leakage, and interest conflicts test the moral bottom line of technological application.

The synergy between law and ethics is the core path to solve this dilemma. Law constructs behavioral boundaries with its coercive power. It is necessary to clarify the rights and responsibilities of various participants in artificial intelligence through improving the product liability system, optimizing tort liability rules, and formulating special regulations, to provide rigid constraints for technological application. Ethics, with its value-guiding role, regulates technology research and development and application from the source through establishing independent supervisory institutions, formulating ethical guidelines, and

strengthening practitioners' education, ensuring that technology serves the fundamental interests of the elderly. The two support each other: law provides guarantees for the implementation of ethics, and ethics provides a value coordinate for the improvement of law.

In the future, with the iteration of technology and the upgrading of social needs, it is necessary to continuously adjust the legal and ethical frameworks dynamically. On the one hand, track the frontier of artificial intelligence technology development and promptly transform mature ethical consensus into legal norms. Only in this way can we build an elderly care system that balances technological innovation and humanistic care, allowing artificial intelligence to truly become a "smart assistant" to safeguard the dignity and rights of the elderly, and realize the harmonious unity of technological progress and social equity in an aging society.

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Conflicts of Interest

The authors declare no conflict of interest.

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