Advances in Social Science and Culture
ISSN 2640-9682 (Print) ISSN 2640-9674 (Online)
Vol. 6, No. 5, 2024
www.scholink.org/ojs/index.php/assc

Original Paper

The Path of Integrated Development of Digital Technology and Health Care Industry under the Background of Aging Population

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Fund Project

"Research on the Integrated Development of Digital Economy and Health Care Industry System under the Background of Aging" (SJWC2023ZC006) funded by the Digital Economy and Cultural Creativity Integration Development Center of Chengdu Philosophy and Social Science Research Base ;Sichuan University Student Ideological and Political Education Research Center Project: Theoretical Development and Practical Exploration of "Course-based Ideology and Politics" in Engineering Management Major of Colleges and Universities (CSZ230103).

Received: July 29, 2024 Accepted: September 27, 2024 Online Published: October 04, 2024

doi:10.22158/assc.v6n5p58 URL: http://dx.doi.org/10.22158/assc.v6n5p58

Abstract

This article focuses on the integrated development of digital technology and the health care industry in the context of an aging population. The intensification of aging both globally and in China highlights the importance of the health care industry. Digital technologies such as Building Information Modeling (BIM) and Artificial Intelligence (AI) are widely applied in the health care industry but face challenges. The digital transformation of the health care industry is imperative. Although China has achieved success in infrastructure and technological research and development, it also faces issues such as technology acceptance and data security. Integrated development is supported by theoretical and technical foundations, forming personalized, intelligent, and networked service models, and innovation including the development of new service products. In the future, digital transformation needs to address challenges, deepen research, build a high-quality health care ecosystem, improve the quality of life for the elderly, and promote industrial development and social harmony.

Keywords

Aging, Digital Technology, Health Care Industry,Integrated Development

1. Introduction

Globally, the aging of the population has become an increasingly serious social phenomenon. According to the "2023 World Population Aging Report" released by the United Nations Department of Economic and Social Affairs, it is projected that by 2050, the number of elderly people aged 60 and above worldwide will surge to 2.1 billion, accounting for 22% of the total population. This change not only indicates that there will be significant adjustments in economic and social structures but also poses unprecedented challenges to the healthcare system (United Nations Department of Economic and Social Affairs website, 2023). The international community generally defines the proportion of elderly people aged 65 and above as exceeding 7%, 14%, and 20% of the total population as the three stages of an aging society: early, deep, and super-aged. Since China entered the aging society in 1999, the number of elderly people and their proportion in the total population have been continuously increasing. The latest data from the National Bureau of Statistics shows that, as of the end of 2022, the population aged 60 and above in China has reached 280 million, accounting for 19.8% of the total population; the population aged 65 and above is 210 million, accounting for 14.9%. The National Health Commission predicts that around 2035, the population aged 60 and above will exceed 400 million, accounting for more than 30% of the total population, at which time China will fully enter the stage of severe aging. The integration of health care and health aging is closely related, and it can be said that the integration of health care is the objective requirement and practical path to achieve healthy aging (Lin, 2021). The "Health Care Blue Book" points out that between 2022 and 2023, the domestic health care industry market size has exceeded ten billion yuan, but compared with developed countries in Europe and America, China's health care industry accounts for only 7% of GDP, which is significantly low (He et al., 2023).

Under this background, the rapid development of digital technology has opened up a new path to address the issue of aging. The extensive application of cutting-edge technologies such as artificial intelligence, the Internet of Things, big data, and cloud computing is gradually reshaping the traditional health care service model. Technologies such as smart wearable devices, remote medical services, and data analysis provide the elderly with more accurate and convenient health management services. The health care industry, as a key field to respond to the challenge of aging, is becoming increasingly important. It not only covers traditional elderly care services but also includes a variety of services such as health management, rehabilitation care, and daily life care. As the elderly's demand for the quality of life continues to rise, the health care industry is moving towards personalization and intelligence to better meet the diverse needs of the elderly.

However, the application of digital technology in the health care industry is not smooth sailing. Issues such as technology acceptance, data security, and privacy protection all need to be fully considered in the process of integrated development. How to ensure that the application of technology fits the actual needs of the elderly and truly serves the welfare of the elderly is an urgent problem to be solved. In-depth discussion on the path and strategy of the integrated development of digital technology and

the health care industry under the background of aging, by analyzing the current situation of the aging society, the development of digital technology, and the importance of the health care industry, policy recommendations and practical guidance for promoting the integrated development of the two are proposed. A deep understanding of the relationship between aging and digital technology provides theoretical support and practical basis for formulating effective coping strategies, promoting the sustainable development of the health care industry, and improving the quality of life of the elderly, which is the key content of this research.

2. Application of Digital Technology in the Context of Aging

As the elderly population undergoes generational shifts and their income levels increase, their demand structure is generally shifting from subsistence to development and enjoyment, transitioning from material security to service and spiritual-cultural types. The elderly are increasingly eager for a rich and dignified later life, which poses higher demands on the development of multi-level, personalized, quality, and precise elderly care systems and service supply (Li, 2020). In the process of addressing the challenges of aging, the application of digital technology has become an important support for the health care industry. Especially the application of Building Information Modeling (BIM) technology and Artificial Intelligence (AI) technology has shown unique value and potential in the health care industry.

2.1 Application of BIM Technology in the Health Care Industry

BIM technology, by constructing detailed building information models, not only optimizes the planning and design process of health care facilities but also enhances the functionality and safety of the buildings. During the design phase of health care facilities, BIM technology can simulate lighting, ventilation, and pedestrian flow, providing a comfortable and safe indoor and outdoor environment for the elderly. Moreover, the three-dimensional visualization function of BIM allows non-professionals to intuitively understand the design intent and architectural details, facilitating communication and collaboration between interdisciplinary teams.

The application of BIM technology is also crucial during the construction and operation and maintenance phases of health care projects. It can provide real-time data of facilities, helping managers monitor the operational status of buildings for timely maintenance and upgrades. For example, with BIM technology, the usage and maintenance cycles of various equipment in health care project facilities can be accurately tracked to ensure continuous and stable operation of the facilities.

2.2 Extensive Application of AI Technology in the Health Care Industry

The application of AI technology in the health care industry is even more extensive and in-depth, as detailed in Table 1. AI-assisted diagnostic systems analyze medical images to assist doctors in detecting disease signs, greatly improving the accuracy and efficiency of diagnosis. In the daily health management of the elderly, AI technology can collect health data through smart wearable devices, use machine learning algorithms to analyze the data, and provide personalized health advice and early

warnings for the elderly. The application of intelligent voice assistants brings great convenience to the elderly. They can not only remind the elderly to take their medication on time and arrange daily activities but also provide companionship and psychological comfort through voice interaction. AI technology can also predict potential health risks by analyzing the behavior patterns of the elderly and issue timely warnings to safeguard their health.

Table 1. Application of AI Technology in the Health Care Industry

Application Area	Specific Application	Advantages
Health Management	Health monitoring (data collection by wearable devices to generate reports), disease prediction and diagnosis (analysis of medical data to assist diagnosis), nutritional diet management (planning and recipe recommendations)	Providing precise health services, early warning of disease risks, meeting personalized dietary needs
Rehabilitation Training	Development of personalized rehabilitation plans with real-time guidance and feedback, use of humanoid robots to assist in physical rehabilitation	Enhancing rehabilitation efficiency, achieving precise training
Elderly Care Assistance	Development of intelligent elderly care assistance devices (smart wheelchairs, canes, etc.) for autonomous navigation and obstacle avoidance	Improving the mobility and safety of the elderly
Home Environment	Smart home and environmental control (intelligent control of appliances, lighting, temperature, etc.), safety monitoring and early warning (identifying abnormal situations and issuing timely alerts)	Providing a comfortable and convenient living environment, ensuring the safety of the elderly
Companion Services	Intelligent voice assistants provide personalized services, companionship, and chat	Alleviating the loneliness of the elderly

The application of AI technology in the health care industry also covers intelligent environmental control and robot nursing services. Intelligent environmental control systems can automatically adjust indoor temperature, humidity, and lighting according to the needs and preferences of the elderly, creating a more comfortable living environment. Nursing robots can assist with daily living care, such as mobility assistance and dietary care, reducing the burden on caregivers and improving the quality and efficiency of nursing services.

However, despite the broad prospects for the application of BIM and AI technology in the health care industry, there are also a series of challenges in the promotion process. The acceptance of new technology by the elderly, data security and privacy protection issues, and the needs for technology maintenance and updates are all issues that we must seriously consider and resolve in the process of digital transformation. To fully leverage the potential of digital technology, we need to make efforts in technology education, data protection, and policy support.

Through continuous innovation and practice, the application of BIM and AI technology in the health care industry will become more in-depth and extensive. They will provide safer, more comfortable, and personalized health care services for the elderly, providing more effective solutions to the challenges of aging. This is not only an innovation at the technical level but also a profound commitment to improving the quality of life for the elderly, indicating that the health care industry is about to enter a more intelligent and personalized new era.

3. Digital Transformation of the Health Care Industry

Amidst the acceleration of the global aging population, the health care industry is at the forefront of digital transformation. According to forecasts by the International Data Corporation (IDC), by 2025, the global health technology market is expected to reach 1.1 trillion dollars, a figure that highlights the potential and importance of digitalization in the health care industry.

The necessity for digital transformation is not only reflected in the anticipated growth of market size but also in its ability to provide the elderly with more precise and personalized health management services. The use of information technology to build a medical and health care integration platform can eliminate information barriers between elderly care institutions, medical institutions, communities, and families, and improve the communication and cooperation mechanism between medical institutions and elderly care institutions to achieve resource sharing and organic integration.For example, according to data from the China Internet Network Information Center (CNNIC), by 2023, the number of internet users in China aged 60 and above has exceeded 100 million. This large user base provides a vast market space for digital services, as shown in Figure 1.Despite this, digital transformation is not something that can be achieved overnight. It requires a clear strategic plan and a feasible implementation path. In terms of infrastructure construction, according to the "2023 White Paper on China's Digital Economy Development," China's digital economic infrastructure construction has achieved significant results, providing a solid foundation for the digital transformation of the health

care industry. In terms of technology research and development, according to the "2023 China Health Technology Industry Report," China's investment in the research and development of smart medical devices and health management applications continues to increase, promoting the innovation and application of related technologies.

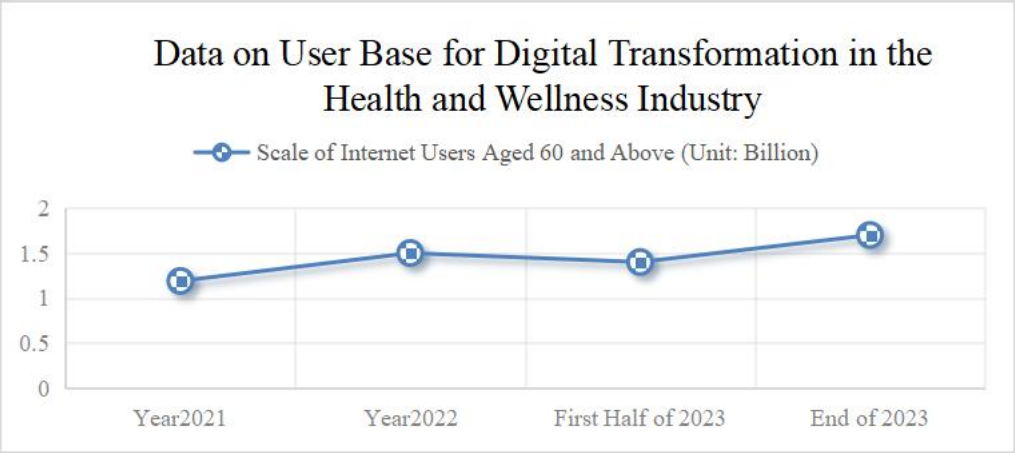

Figure 1. Trend Chart of User Base for Digital Transformation in the Health and Wellness Industry

In terms of service model innovation, digital transformation has made the integration of online and offline services possible. For example, the widespread adoption of remote medical services, according to the "2023 China Remote Medical Development Report," user satisfaction with China's remote medical services has been increasing year by year, showing the potential of digital services to improve user experience. During the transformation process, the challenges we face are also multi-dimensional. In terms of technology acceptance, according to the "2023 China Elderly Digital Life Report," although the digital skills of the elderly have improved, there is still much room for improvement. In terms of data security and privacy protection, with the collection and use of health data, ensuring data security and protecting user privacy have become issues that must be taken seriously during the transformation process.

To address the above issues, efforts should be made to raise funds through multiple channels to reduce the cost of transformation. According to the "2023 China Health Industry Investment Report," the scale of investment in the health industry continues to grow, providing financial support for digital transformation. At the same time, close communication with relevant government departments should be maintained to ensure that the transformation process complies with legal and regulatory requirements.Successful cases of digital transformation, such as Qianxiang Health, Huibo Medical, and Dongjiao Home, have significantly improved the efficiency and quality of health management for the elderly through digital means, as detailed in Table 2. Successful cases can provide us with valuable experience and insights. Through these practices, we can see that digital transformation can not only

enhance the service capabilities of the health care industry but also bring a healthier and more comfortable life experience for the elderly. The digital transformation of the health care industry is a profound change. It requires us to embrace new technologies with an open mind and also requires us to face various challenges in the transformation process with a cautious attitude. Through continuous exploration and practice, we have reason to believe that digitalization will bring a broader development prospect for the health care industry.

Table 2. Successful Cases of Digital Transformation in the Health Care Industry

Case Name	Main Measures	Outcomes and Advantages
Qianxiang Health	Integration of resources, use of smart wearable devices to monitor health status, provision of personalized suggestions through big data analysis, combination of online and offline activities, and provision of diversified services.	Provision of personalized health services, enhancement of elderly health awareness, and comprehensive care for the spiritual world of the elderly.
Huibo Medical	Market demand-oriented, provision of digital solutions, selection as a high-tech enterprise and innovative support project, and inclusion in the Tsinghua University School of Economics and Management case library.	Continuously leading in the health care industry, promoting the development of the medical industry and the construction of a healthy China.
Dongjiao Home	Construction of a digital O2O service platform, provision of door-to-door massage services, optimization of services based on data analysis, and provision of one-stop door-to-door services for the elderly.	Saving users' time and energy, promoting the personalization and precision of health care services, and enhancing the professionalism and targeting of services.
Taikang Home	Creation of an online smart community platform, integration of medical resources, use of big data for resident health	Provision of comprehensive health management and convenient living services, improving the safety and

Case Name	Main Measures	Outcomes and Advantages
	management, and introduction of smart devices.	timeliness of elderly care services.
Qinhe Source	Construction of a digital membership management system, and conduct of online and offline interactive activities.	Improvement of service efficiency and quality, enrichment of the spiritual and cultural life of the elderly, and enhancement of membership belonging.
Ouboting	Use of artificial intelligence to assist nursing decision-making, monitoring of the elderly's activities and health status through smart sensors, and development of personalized nursing plans.	Improvement of the scientific and precise nature of nursing, reduction of nursing risks, and enhancement of the quality of life and satisfaction of the elderly.

4. Integrated Development Model of Digital Technology and Health Care Industry

Promoting supply-side structural reform is crucial for the elderly care service system. The focus is on mobilizing the enthusiasm of all parties in society to achieve a diversified supply of services; fully leveraging the role of the market to achieve a market-oriented supply mechanism; vigorously developing community services to facilitate convenient supply methods; innovating elderly care service technologies to diversify supply means; and adjusting the functions of elderly care institutions to specialize in supply content (Lin, 2017). Driven by the wave of digitalization, the health care industry is undergoing a profound transformation. The integration of digital technology not only brings new opportunities for the development of the health care industry but also provides the elderly with richer and more personalized health management services. This integrated development model, supported by a series of theoretical technologies and innovative modes and mechanisms, is gradually taking shape and being implemented.

4.1 Theoretical Technologies for Integrated Development

The integration of digitalization and the health care industry is based on a range of theoretical technologies. Technology is an important support variable in addressing population aging (Li Lu et al., 2020). The development of artificial intelligence, big data analysis, the Internet of Things, and cloud computing has provided strong technical support for the health care industry. For instance, artificial

intelligence technology can analyze the living habits and health data of the elderly to provide personalized health advice and early warnings, as detailed in Table 3. Big data analysis can help health care institutions understand the needs of the elderly more accurately, optimizing service content and processes.

Table 3. Digital Technology Support for the Health Care Industry

Technology Name	Technology Features	Support Role in the Health Care Industry	Application Examples
Artificial Intelligence	Learning and reasoning capabilities, simulating human intelligence.	Assists in disease diagnosis and prediction, formulates personalized rehabilitation plans, provides functions of smart elderly care assistance devices, and implements companion services through intelligent voice assistants.	Humanoid robots assist in rehabilitation training, intelligent voice assistants accompany the elderly.
Big Data Analysis	Ability to process massive amounts of data and mine data value.	Analyzes health data of the elderly, provides precise health management reports and warnings, provides a basis for nutritional diet management, and assists in medical decision-making.	Personalized health management plans for the elderly through big data analysis.
The Internet of Things	Interconnects devices with each other.	Collects health data of the elderly through wearable devices and sensors and transmits it, achieves smart home device and environmental control, and monitors the living environment of the elderly in real-time for safety.	Smart health monitors transmit real-time health data of the elderly.

Technology Name	Technology Features	Support Role in the Health Care Industry	Application Examples
Cloud Computing	Strong computing and storage capabilities with scalable elasticity.	Provides strong computing power support for various data storage and processing in the health care industry, realizes data transmission and processing for remote medical services, and ensures the stable operation of various health care service platforms.	Remote medical service platforms rely on cloud computing for data processing and service provision.

According to the "2023 China Health Technology Industry Report," China's investment in the research and development of smart medical devices and health management applications continues to increase, showing the extensive application and in-depth research of digital technology in the health care industry. The application of these technologies not only improves the quality and efficiency of services but also brings more convenient and comfortable life experiences for the elderly.

4.2 Integration Development Model and Mechanism

Supported by theoretical technologies, the integrated development model of the health care industry is becoming clear. This model emphasizes personalized, intelligent, and networked services. Personalized services provide customized health management plans by collecting and analyzing the health data of the elderly. Intelligent services use smart devices and applications to achieve remote monitoring and instant response. Networked services build a platform that combines online and offline services to achieve resource sharing and optimal allocation.

For example, according to the "2023 China Remote Medical Device Research Report," the user satisfaction of China's remote medical services is increasing year by year, indicating that the networked service model has a broad application prospect in the health care industry (China Academy of Information and Communications Technology, etc., 2023). At the same time, this model also promotes the balanced distribution of medical resources, allowing more elderly people to enjoy high-quality health care services.

4.3 Design and Implementation of Innovative Models

Based on the integrated development model, the design and implementation of innovative models have become key to promoting the development of the health care industry. This includes the development of new service products, such as smart health monitoring devices and online health consultation

platforms; exploration of new service models, such as community health care centers and home-based elderly care services; and the establishment of new cooperation mechanisms, such as cooperation with medical institutions, research institutions, and enterprises.

The popularization and application of intelligent platforms and products can enhance the possibility of self-care for the elderly, reduce the burden of family and society in elderly care, and lower the risk of special elderly people living alone or being empty-nesters; the use of smart products can stimulate the elderly to continue to participate in economic, social, political, and cultural life within their capabilities, and comprehensively improve the welfare of the elderly (Yang Juhua, 2019). Taking smart health monitoring devices as an example, according to the "2023 China Elderly Digital Life Report," more and more elderly people are beginning to use such devices to manage their health. These devices monitor the vital signs of the elderly in real-time and provide timely health warnings, greatly improving the elderly's sense of health security.

At the same time, community health care centers, as a new type of service model, are gradually becoming popular with the elderly. This model integrates community resources to provide one-stop health care services for the elderly, including health consultation, rehabilitation training, cultural entertainment, etc., effectively meeting the diversified needs of the elderly.

The integrated development model of digital technology and the health care industry is a transformation supported by technology, driven by innovation, and centered on service. This model can not only improve the quality and efficiency of health care services but also bring a healthier, more comfortable, and dignified life for the elderly. With the continuous advancement of technology and the continuous exploration of innovative models, we have reason to believe that this integrated development model will bring a broader development prospect for the health care industry.

5. Conclusion

In this study, we have delved into the theory and practice of the integrated development of digital technology and the health care industry, analyzing the necessity, strategies, challenges, and future development trends of this integration under the backdrop of an aging society. By comprehensively considering the current status of aging, the development of digital technology, and the needs of the health care industry, we have reached a series of insightful conclusions.

Firstly, digital transformation has become an inevitable choice for the development of the health care industry. With the continued growth of the global elderly population, especially the rapid expansion of China's elderly population, traditional health care service models can no longer meet the increasing personalized and diversified needs. The introduction of digital technology, especially artificial intelligence, big data analysis, the Internet of Things, and cloud computing, has provided innovative service models and solutions for the health care industry. These technologies not only improve the efficiency and quality of services but also meet the elderly's higher pursuit of health and quality of life through personalized health management plans.

Secondly, the successful implementation of digital transformation requires a clear strategic plan and a feasible path. This includes infrastructure construction, technology research and development, service model innovation, and adaptation of policies and regulations. For example, China has made significant achievements in the construction of digital economic infrastructure, providing a solid foundation for the digital transformation of the health care industry. At the same time, continued investment in technology research and development has promoted the rapid development of smart medical devices and health management applications, providing the elderly with more accurate and convenient health management services.

However, there are also some challenges in the process of digital transformation. Issues such as technology acceptance, data security and privacy protection, and capital investment all pose obstacles to the digital transformation of the health care industry. Especially for the elderly population, their acceptance of new technology may be lower, and their technical usage ability needs to be improved through training and education. In addition, data security and privacy protection are issues that must be taken seriously during the transformation process. With the collection and use of health data, ensuring data security and protecting user privacy have become problems that we must solve.

In response to these challenges, this study proposes a series of measures. In terms of technology acceptance, user education and training can improve the elderly's acceptance and usage ability of new technologies. In terms of data security and privacy protection, strict data security and privacy protection policies need to be formulated to strengthen the protection of user information. In terms of capital investment, diversified funding channels such as government subsidies and social capital participation can reduce the cost of transformation. At the same time, close communication with relevant government departments is needed to ensure that the transformation process complies with legal and regulatory requirements.

Looking to the future, the digital transformation of the health care industry will continue to deepen. With the continuous advancement of technology and the continuous exploration of innovative models, we look forward to achieving more intelligent and personalized health care services. At the same time, policymakers, industry practitioners, and the academic community need to work together to ensure that technological development matches social needs, protects the rights and interests of the elderly, and promotes the healthy development of the health care industry.

Furthermore, future research also needs to be further deepened. Long-term tracking studies will help us better understand the long-term effects and impacts of digital transformation. Cross-regional comparative studies can reveal the similarities and differences in digital transformation across different regions, as well as successful factors and challenges faced. User participation research will help us better understand the elderly's acceptance and usage habits of digital services to design service models that better meet user needs. Policy formulation and regulatory improvement research will help us better understand how to deal with policy and regulatory issues in digital transformation to promote the healthy development of the health care industry.

Ultimately, this study emphasizes that the integration of digital technology and the health care industry is not only a technological innovation but also a profound commitment to improving the quality of life for the elderly. Through this integration, we hope to build a more inclusive, convenient, and secure health care ecosystem, allowing every elderly person to enjoy the benefits brought by technology and achieve a healthy and dignified old age. This integration will not only promote the development of the health care industry but also make an important contribution to the overall progress and harmony of society.

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