Development, Dilemmas and Countermeasures of Smart Elderly Care

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Abstract. In recent years, China's population aging and social digitalization have been deepened. The active response to population aging has been a vital issue of widespread concern in society. Broad prospects can be seen in the integrated development of the Internet and various fields. As a new elderly care model that integrates technology and elderly care, smart elderly care has become an irreversible trend of the times. Till now, the connotation and development of smart elderly care has been defined by academia in multiple dimensions, and numerous local characteristics have been found in smart elderly care in China. However, smart elderly care is at the primary stage in China with difficulties such as an imperfect standard system, underdeveloped industrial order, imbalance between supply and demand, insufficient information sharing, unresolved digital dilemma and limited social recognition. In the future, we should optimize top-level design, realize multi-governance, adhere to cross-border integration, promote age-friendly technology, change the concept of elderly care, and bridge the digital divide, so as to boost the sustainable and desirable development of smart elderly care in Chin.

Keywords: Smart Elderly Care; Development; Dilemmas; Countermeasures.

1. Introduction

Since the 21st century, China has undergone accelerated aging process, and the number and proportion of the elderly population has skyrocketed. According to Figure 1, the number of people aged 65 and above in China is increasing year by year, and the proportion of China's total population continues to rise. In 2022, the number of people aged 65 and above in China will reach 209.78 million, accounting for 14.9% of the total population. With in-depth population aging, how to handle population aging is a concerned issue in current society. Accompanied by aging, digitalization is also an inevitable trend in Chinese social development. Thanks to the emerging sci-tech revolutions and industrial transformation worldwide, there are broad prospects and unlimited potential in the integrated development of the Internet and various fields, which has been an irresistible trend. With the rapidly evolving information technologies such as the Internet, big data and artificial intelligence, intelligent services have been widely used in China, transforming production and lifestyle, and boosting social governance and service efficiency. Hence, a new model featuring "the Internet + elderly care", smart elderly care, has become a new trend for developing elderly care services in China. Since 2019, the state has successively issued policy documents, including the *Implementation Plan on Solving the Difficulties of the Elderly in Using Intelligent Technology*, the *Action Plan for the Development of the Smart Healthy Elderly Care Industry (2021-2025)* and *Opinions on Developing Silver Economy to Improve the Well-being of the Elderly*, etc., aiming to further apply updated information technology and intelligent hardware products in elderly care services, solve the dilemmas confronted by the elderly in using intelligent technology, allow the old-age people to share the informatization development, and support the smart elderly care. At present, China's smart elderly care is still at its primary stage. To fully perceive the current development and problems of smart elderly care, this paper sorts out the connotation, development and typical demonstration of smart elderly care in China, which defines the development of smart elderly care, and then accurately locates the outstanding problems in its current development. On this basis, relevant countermeasures and suggestions to promote smart elderly care in China are proposed.
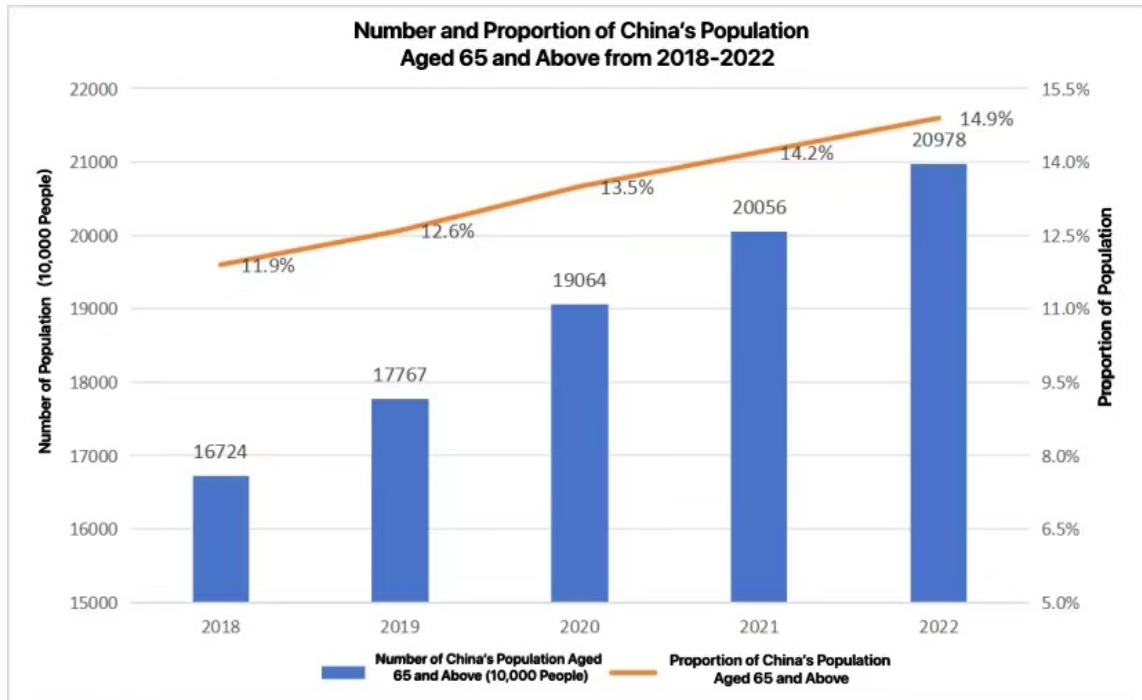
Figure 1 Number and Proportion of China's Population Aged 65 and Above from 2018 to 2022

2. Development of Smart Elderly Care

2.1 Connotation of Smart Elderly Care

The connotation of smart elderly care is diverse with different definitions in academia. Internationally, smart elderly care has an earlier origin, and research is biased towards system construction and product research and development from the medium and micro perspectives.[1] Its concept was first brought forth by the British Life Trust Fund with a purpose of unshackling the shortcomings of the traditional elderly care model with spatiotemporal restraints. By virtue of the cutting-edged management and information technology, it integrates all service participants, forms an organic whole and improves elderly care services through IoT platforms represented by the government, community and medical institutions[2] Domestically, smart elderly care started late and formed during the development of smart cities.[3] According to Zuo Meiyun, smart elderly care makes use of modern science and technology such as information technology to support the life service and management of the elderly around their daily life, security, medical care, health care and rehabilitation, entertainment and leisure, learning and sharing, etc., so as to realize the autonomy and personalized intelligent interaction between technology and the elderly from aspects of smart elderly assistance, smart elderly utilization and smart elderly care.[4] In terms of functions, Chen Youhua et al. believe that smart elderly care can achieve data-driven management from the technical perspective, accurate matching of supply and demand from the service perspective, and smart visual decision-making from the organizational perspective.[5] In terms of characteristics, Wang Xiaohui et al. proposed that smart elderly care is characterized by big data collection, accurate identification of needs and accurate delivery of services.[6] In addition, Zuo Meiyun held that compared with traditional mode, smart elderly care embodies the advantages of integrating information technology, adhering to "people-oriented", providing "high-quality and efficient" services and caring for the spiritual life of the elderly.[7] To sum up, smart elderly care is an inevitable trend in the upcoming development of elderly care.

2.2 Development of Smart Elderly Care

The development of smart elderly care in China reflects the development of smart elderly care policy research to some degree. In terms of its development, Zuo Meiyun pointed out that smart

elderly care in China has stepped into the growth period from the enlightenment exploration period. Since 2017, the state has issued policy documents such as the *13th Five-Year Plan for the Development of National Aging and the Construction of Pension System*, the *Notice of the National Office on Aging and Implementing the Action of "Smart Elderly Assistance"*, the *Promotion Catalogue of Smart Healthy Elderly Products and Services*, and the *Work Plan for Promoting High-quality Development of Digital Technology for Aging*, which indicate that the smart elderly care industry has ongoing enriched and stabilized types of products and services, with its increasingly mature application.[8] In terms of the development of pertinent policy research, Shen Qi et al. divided its evolution in China into three stages: early planning and exploration of industrial layout (2014-2016), service upgrading and cultivation of new elderly care formats (2017-2020), improving quality and efficiency and the service system optimization (2021-present). In the early exploration stage, policy growth was relatively stagnant, focusing on topics such as elderly informatization and elderly development planning. In December 2016, after the state issued *Several Opinions of the General Office of the State Council on Comprehensively Liberalizing the Elderly Care Service Market and Improving the Quality of Elderly Care Services*, smart elderly care came into rapid development. During this period, policies mostly focused on basic livelihood security, innovation of elderly care models and service system construction. The "14th Five-Year Plan" in 2021 and the outline of long-term goals in 2035 mark that the formulation of China's smart elderly care policies has been in a new stage of lifting quality and efficiency. The policies at this stage are more aimed at practical problems.[9]

2.3 Typical Demonstration of Smart Elderly Care

Till now, China's smart elderly care has formed serial local characteristic cases, providing rich enlightenment for the development of smart elderly care. Technology-empowering elderly care services is a vital measure to improve elderly care services in Beijing. According to the integrated design concept of "one network, one terminal, one platform", Beijing not only promotes the real-time linkage of elderly service data and information and improves the supervision ability and service through intelligent means, but also builds the application scenario of smart elderly service and promotes the accurate docking of supply and demand of old-age service. In addition to enhancing the integrated development of information technology and elderly services, Beijing builds a smart elderly platform that blends technology and temperature.[10] Shanghai lays emphasis on technological empowerment to promote the specialization and scale of the smart, healthy and elderly care industry.[11] To drive the innovation and practicality of elderly care services in platform construction, health care, service nursing, supervision, etc., Youkang smart elderly care service platform based on SaaS cloud, the smart elderly care platform featuring "system + service + elderly + terminal" and "1 +32 + X" smart elderly care network in Zhoujiadu Street have been built, so as to improve its practicability considering the needs of the elderly.[12] As one of the earliest Chinese regions to be aging, Jiangsu Province has made many attempts to prosper smart elderly care and solve the aging problem. Jiangsu has issued 85 policy documents closely related to the development of smart elderly care, initially forming a policy framework. The policy focuses on public service, industrial models and smart technology, which initially formed a smart elderly care models, providing enlightenment for a better smart elderly care system in China.[13]

3. Dilemmas Faced by Smart Elderly Care

Smart elderly care provides insights for solving population aging, which meets the inevitable requirements of the development of the times. At present, China's smart elderly care has made achievements in many aspects, such as the system improvement in terms of policies, the continuous enrichment of the types of products and services, and the increasingly mature platform construction in terms of applications. However, it is still in its infancy and has not yet formed a perfect and

comprehensive development model, with many obstacles in standard system, industrial order, supply and demand balance, information sharing, digital dilemma, and social recognition.

3.1 Imperfect Standard System and Underdeveloped Industrial Order

In terms of standard system construction, Ji Chunyan believes that due to the late start and limited government functions, China's smart pension policy support system is imperfect with an incomplete standard norm system and departmental coordination mechanism, and the institutional environment needs to be optimized.[14] In terms of the standard design, Zhong Renyao et al. propose that the standard design of smart elderly care services in China is unscientific with an insufficient grasp of the overall direction and ideas, and the evaluation indicators are not detailed enough. Hence, its application is limited.[15] In terms of standard system coordination, Ren Jie et al. mention that a systematic standard in the central government has not been formed by the policy in this field with a lack of practical guidelines in the local government, all of which have defects and are difficult to play a specific guiding role.[16] In terms of industrial order construction, Chen Youhua et al. propose that China's smart elderly care is mostly dominated by the government with a low participation rate of market organizations. In addition, there is vicious competition within the industry, which makes it difficult to form an industrial chain.[17] In terms of supervision, Wu Ping et al. believe that the capabilities, resources and regulatory means of regulatory agencies are misaligned with the rapidly developing technologies and the behaviors of diversified subjects. Meanwhile, a lack of coordination exists across departments and fields. Thus, it is difficult for a single government supervision to tackle all problems about advancing such an industry.[18] In terms of main body coordination, Yang Xiaodong et al. hold that inactive coordination can be seen in China's smart elderly care. In other words, the government's leading role is not significant, lacking effective incentives, restraint mechanisms and social support. Besides, market supplementary roles are not in place with insufficient multi-level elderly care services.[19]

3.2 Imbalance Between Supply and Demand, and Insufficient Information Sharing

In terms of the main responsibility of supply, Wang Cheng et al. mention that it is not yet mature in China, and the network nodes are scarce and occupied by various stakeholders, making it challenging to meet the huge needs of the elderly in the grid.[20] From a technical perspective, Wen Jun et al. believe that digital technology is constantly innovating. Thus, there are uncontrollable risks, and the marketization of applying smart elderly care technology can easily trigger barriers to the sharing of pertinent resources.[21] In terms of business model, Wu Xue points out that smart elderly care has not yet formed an effective industrial chain and business operation model in China. The number of talents engaged in the R&D and service of smart elderly care products is insufficient, and the professional technology is not advanced, which cannot meet the multi-level, multi-type and personalized elderly care needs of the elderly, leading to the mismatch and disconnect between their supply and demans.[22] In terms of information sharing, Zhang Li et al. hold that smart elderly care lacks a national top-down big data platform, resulting in numerous data stagnation only in one specific industry, enterprise, community and region at present, which blocks the integration of information resources of departments and industries.[23] From the perspective of resource integration, Yang Xiaodong et al. believe that domestic smart elderly care lacks multi-channel funding support, a perfect elderly care service information system and a standardized talent training mechanism. The resource embedding is also insufficient, which makes it difficult to promote elderly care services.[24]

3.3 Unresolved Digital Dilemma and Limited Social Recognition

In terms of digital dilemma, Zhu Qin holds that China's smart elderly care has digital dilemmas such as digital exclusion, resource mismatch, digital anxiety and digital addiction, opaque algorithms, data leakage and abuse, etc., which undermine its services, popularity and sustainable development.[25] In terms of law and ethics, Zhu Minli believes that while smart elderly care brings benefits to human beings, there are risks in legal ethics, which are embodied in the conflict between

the privacy protection and algorithm monitoring required by the elderly, the conflict between their social needs and the intelligent rationality of robots, the conflict between the one-dimensional emotional dependence of the elderly and the deceptive risk of robots, and the conflict between the independent choice and materialized manipulation of the elderly.[26] In terms of responsibility ethics, Chen Xiao proposes that it is difficult for robots to independently provide "warm" services in fulfilling their care responsibilities, which limits the privacy dignity of the elderly, thus exposing the elderly to more severe risks of privacy leakage and making them lack trust in robot services.[27] In terms of social order, Zhang Aijun et al. point out that during the social intelligent transformation, the elderly have become a vulnerable group during the technological empowerment due to the digital divide. However, capital and technology naturally discriminate and exploit vulnerable groups. When they are combined with the social power operating implicitly behind technological alienation, discrimination will be an implicit social mentality or even an explicit social order, threatening the rights of the old-aged people, public order and good customs, and social public safety.[28] In terms of social recognition, Fu Chang believes that due to their older age, outdated ideas and consumption habits, and weak publicity efforts, some elderly lack the correct cognitive attitude and related knowledge towards the Internet, so they are not used to or even reject the use of the Internet. As a new intelligent elderly care model, the social recognition of smart elderly care is limited.[29]

4. Development Path of Smart Elderly Care in the Future

As the intensifying aging population, the rapidly growing demand for elderly care has brought new opportunities to smart elderly care, and smart elderly care services have shown a good development trend. To promote the sustainable and desirable development of smart elderly care in China, scholars put forward countermeasures and suggestions from different aspects such as top-level design, multi-governance, cross-border integration, technology suitability for the elderly, digital divide, etc., so as to optimize smart elderly care, promote the sustainable and desirable development of smart elderly care in China, solve relevant problems, and respond to the population aging.

4.1 Optimize Top-level Design and Realize Diversified Co-governance

In terms of legal system construction, Song Yeqin et al. point out that institutional norms are the behavioral standards and operational foundation for the development of smart elderly care. Given that improving legal guarantees and policy construction can improve the efficiency of smart elderly care governance, it is necessary to promote its industry standards and legal rules and regulations, and provide supporting safeguard measures.[30] In terms of the application of policy tools, Liang Changyong et al. propose that at different stages of smart elderly care, the government should focus on the supporting application of different policy tools, break technical barriers, form an efficient and effective ecological environment, and improve the efficiency of platform operation.[31] In terms of development mechanism, Wu Xue believes that as a systematic project, smart elderly care requires the cooperation and joint efforts of social forces from all walks of life. Thus, a multi-level cooperation mechanism should be constructed among the government, enterprises, social organizations and scientific research institutions for China's smart elderly care to achieve sustainable and desirable development.[32] In terms of government overall planning, Zhou Lingyi et al. mentioned that the government should fully apply the advantages of all-level agencies and departments, balance the relationship between pilot, promotion and unification, and ultimately achieve the unified command and consistent gestures.[33] In terms of platform construction, Guo Qing et al. propose that the government should fully use the existing elderly service information based on China's national conditions, promote the sharing and rational utilization of data information, and establish three kinds of smart elderly platforms, such as big data platform, management platform and service platform, with unified standards.[34] In terms of supervision, Yuan Wenquan et al. believe that the government should establish a rule system that combines legal norms with autonomous statutes and a supervision

system that combines penetrating supervision with whole-process supervision, so as to promote the rule system and supervision system of smart elderly care construction.[35]

4.2 Adhere to Cross-border Integration and Promote Elderly-friendly Technology

In terms of cross-border integration, Ren Yang et al. hold that the government should intensify related market-oriented operation, clarify the decisive role of market mechanisms in resource allocation and the role positioning of various market players, promote industrial clusters, enrich the elderly service market, and build a smart elderly service industry chain and integrated service network system.[36] In terms of resource integration, Jin Yuxi et al. propose that we should give full play to the advantages of the elderly cooperation model, establish an intelligent elderly service interconnection mechanism with resource integration, clarify the responsibilities among various subjects, and further promote the establishment of an intelligent elderly service system.[37] In terms of data sharing, Zhang Jingtang et al. believe that the ability of Unicom sharing and dynamic management of relevant data should be improved, and the balance between technical rigidity, personal privacy and subjective value should be adjusted, so as to get rid of data neighborhood avoidance in the traditional elderly care model.[38] In terms of the balance of interests, Wu Ping et al. point out that smart elderly care service products cannot achieve true technological neutrality compared with traditional ones. To protect the best interests of the elderly, designers should try their best to achieve true technological neutrality and value, and build a technical order of smart elderly care services that upholds algorithmic justice, thus forming a hidden order for its future development.[39] In terms of aging-friendly technology, Zuo Meiyun proposes that smart elderly care technology should realize elderly-friendly functions and operations, create easy-to-use and enjoyable intelligent applications for the elderly, and enrich their emotional and spiritual lives.[40] In terms of mechanism construction, Wei Meng believes that we should establish a multi-party cooperation mechanism, consolidate the joint innovation network of Industry-University-Research, and intensify the integration of technology and elderly care. Moreover, the construction of smart elderly service teams should be strengthened, professional service talents should be cultivated, and elderly-friendly technology should be promoted to better serve the elderly.[41] In terms of privacy protection, Nie Aichan holds that we should strengthen privacy protection and introduce a data litigation system for the elderly to protect their data subject rights and privacy protection rights. Moreover, attention should be paid to strengthening humanistic care and constructing smart services to protect the aging.[42]

4.3 Transform the Concept of Elderly Care and Bridge the Digital Divide

In terms of moral ethics, Wu Xue points out that we should strengthen the awareness of ethical and moral hazard prevention and control, strictly abide by the bottom line of scientific and technological ethics during technology research and development, and enhance the awareness of moral hazard prevention and control, which not only pursues the accuracy of technology, but also increases the temperature of humanities, so that new technologies can better serve the fairness of smart elderly care.[43] In terms of the concept of elderly care, Zhang Zhao et al. propose that enterprises should lay more emphasis on the needs of the elderly and improve the practicality and easiness in using products. Families, relatives and friends should take initiative in promoting smart elderly care services, expanding their influence, and improving the elderly's willingnes to use pertinent services.[44] In terms of precise elderly care, Yao Xing'an et al. propose that different schemes should be formulated for the elderly with various characteristics to boost the utilization rate of pertinent services and increase its popularity of facilities, thereby promoting smart elderly care.[45] In terms of digital assistance to the elderly, Ye Xiaolan proposes that society should help the elderly to take full part in digital social interactions, and China should strengthen the material supply in the enjoyment of digital rights and interests of the elderly, promote the cultivation of the concept of digital rights and interests of the elderly, and then enable the elderly to enjoy a dignified aging life in the digital age.[46] In terms of inter-generational equity, Tang Kuiyu et al. believe that the family is

always the most important place for socialization, so the technical feedback of offspring can promote the formation of good inter-generational relations, and then build a complete home-based environment for the aged.[47] In terms of digital literacy, Zhu Lihua et al. point out that the elderly should improve their digital literacy, enhance their awareness of privacy protection and risk prevention, actively give feedback on product quality and service content, make services more in line with needs, and optimize the quality and structure of the smart elderly care chain.[48] In terms of service optimization, Zhu Qinghua et al. believe that quite a few elderly people find it difficult to adapt to the smart elderly care information platform due to insufficient technical and information awareness. Thus, enterprises should design elderly-friendly smart elderly care products with more accuracy based on the characteristics of the elderly, realize the precise matching of supply and demand, and build a more comprehensive and systematic life cycle service system for smart elderly care.[49]

5. Conclusion

How to tackle the aging population is related to personal development, social stability and the rise and fall of the national movement. Meanwhile, during the social digital transformation, smart elderly care is an inevitable trend. Strong scientific and technological support as well as the combination with other elderly care models endow unique advantages to smart elderly care, and promote smart elderly care to become the mainstream elderly care model in the future. In addition to conforming to the development trend of the times and promoting the reform of the elderly care model, smart elderly care also provides strong support for meeting the growing needs of the elderly for health, offers insights and means for adapting to the governance needs of the aging society and improving the governance ability of the aging society, and becomes an effective choice to deal with the risks of elderly care. China's smart elderly care construction started late. Although there are some pilot demonstration areas, there are still some practical obstacles such as an imperfect standard system, underdeveloped industrial order, imbalance between supply and demand, insufficient information sharing, unresolved digital dilemmas and limited social recognition. In the future, we should not only start from the aspects of policy, technology, concept, etc., but also improve the top-level design from the institutional aspect, combined with specific reality. From the aspect of governance, social subjects participate to realize pluralistic co-governance. From the operational aspect, the government and market work together to insist on cross-border integration. From the technical aspect, we should promote technological change and elderly-friendly technology. From the conceptual aspect, we should transform the concept of elderly care and adhere to people-oriented. From the application aspect, we should improve digital literacy, bridge the digital divide, and further promote the higher quality and more sustainable development of China's smart elderly care.

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