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Obstacles and solutions of digital transformation of elderly care services from the dual perspectives of demand and supply

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Abstract:

With the rapid growth of demographic aging and advancements in information technology, intelligent transformations for different industries are on countries' strategic agenda. Industry dedicated to elderly care with both challenges and potential benefits on this journey is widely explored. Traditional pension frameworks are increasingly incapable of dealing with the heterogeneous and dynamic needs of older adults, showing gaps in the quality of care, resource allocation, and accessibility. This paper addresses the challenges and possible solutions of the digital transformation of elderly care services, focusing on both the demand and supply sides. Based on the quantitative survey among elderly residents of a nursing home in Chengdu and in-depth interviews with industry experts, this study has outlined main barriers of this problem: resistance to wearable technology, emotional attachment to human carers, and privacy concerns. From the supply side, findings show that high implementation costs, low profit margins, and data security concerns present considerable challenges to organizations. The research concludes that for effective transformation, there is a need to integrate non-intrusive, human-centered technologies with financial and regulatory support from governments and collaboration with external platforms to ensure data security. By addressing these challenges, the study provides practical recommendations for the establishment of sustainable, accessible, and emotionally rewarding intelligent ecosystems dedicated to elderly care.

Keywords: population aging, elderly care, intelligent service

1. Introduction

The UN Department of Economic and Social Affairs projects a global population of 2.1 billion people aged 60 years and over by 2050 (United Nations, 2023). The seriousness of this issue indicates that the deepening of the aging population has brought huge pressure to the traditional pension model, and the contradiction between supply and demand of pension services has become increasingly prominent. Under the background of the rapid development of science and technology, intelligent pension, as a new pension model, has gradually become an important way to solve the problem of pension. As the industry came to a revolutionary period, in-depth research on the necessity of intelligent elderly care has important practical significance for meeting the diversified needs of the elderly, promoting the development of the elderly care industry, social harmony, and stability.

Intelligent Senior Care is defined as a new framework using modern information and intelligent control technology to provide efficient, convenient, and personalized care services for seniors (IIGF, 2024). Its core concept is to build a technology-supported elderly care service network that integrates resources and data among the government, communities, medical institutions, service providers, and the elderly, to meet the needs of the elderly in health monitoring, life care, psychological care, social interaction, and other aspects (Liu et al., 2023). Some of the functions that intelligent elderly care include are Artificial Intelligence, remote health monitoring, emergency aid, smart home integration, customized services, social support, etc. While creating a high-end platform and a complete pension system with the goal of meeting the diversified needs of the elderly and in addition, it is important to improve the quality of elderly care through data and smart infrastructure, to promote industrial development, as well as to provide safer, handier, and more professional health and care services to the elderly population.

The process of the transformation is very complicated and challenging. Intelligent elderly care is not only about producing a new product, but also how to effectively apply them into the daily care of elderly people. This is challenging because elderly people are a special kind of group who usually don't have a good understanding of the current technology trend. From a psychological perspective, elderly people do not have enough experiences that could build schema to effectively use intelligent care products. Especially when their existing schema and enculturation don't allow them to accept the transformation, the development of the transformation needs to change the area of targets. Therefore, the research question of obstacles and possible solutions of digital transformation of elderly care services from the perspective of demand and supply are essential when exploring the future of this transformation. To ensure access to first handed data and investigation, this article will mainly explore the obstacles and possible solutions of the intelligent elderly care industry of China.

2. Literature Review

When it comes to the future development of elderly care transformation, there are a lot of intelligent models, and some articles provides a wide coverage of the deployment of intelligent elderly care systems, including wearable technology designed to monitor the health of the elderly, such as biorobot "ElliQ" by a US company focusing on Intuition Robotics. The role of "ElliQ" is to support daily tasks, such as meals, baths, companionship, and other services, while also playing a role in rehabilitation training and nursing that could replace human nursing (PageAdmin CMS, 2020). However, "ElliQ" does not delve into how these implementations fare in real-life settings. Other aspects, including appropriate use by the older adult, willingness to accept and wear the devices continuously, and measures to ensure long-term use, are still poorly addressed. These elements are critical in determining whether the technology could really enhance quality of life and health outcomes for older adults, therefore showing a large gap in the evaluation of their true effects. When considering the needs of the elderly, there are some more important factors that need to be explored, such as the existing enculturation that affects elderly acceptance and understanding of intelligent care. Additionally, it is vital to consider the internet as a trend of receiving information. Older people can't effectively access first-hand information about technology and the benefits it brings, therefore, the process of implementing intelligent models would be a challenge with elderly people. This needs to be explored more deeply to understand how the transformation of intelligent elderly can be correctly developed and applied in the future.

This research paper will aim from a social perspective to understand the needs of elderly people to use technology in investigating if they accept the barrier of technology brought to them or if they do have a hope and expectation of technologies but in another way. The current development of intelligent systems including Integration of IoT, big data, and AI in creating holistic elderly care ecosystems and cross-platform data sharing enhance collaboration among healthcare, social care, and government institutions through the development of shared data platforms. The immersive technologies extend the applications of VR/AR for rehabilitation, virtual travel, and social engagement to improve the mental health and quality of life

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for the elderly (PageAdmin CMS, 2020). These platforms are effective when applying to the pension industry and boost the transformation. The challenge eventually lands on the application of such platform and the successful implementation. The risks of the platform are the obstacles that the society is facing.

In the internet-developed world, data security is the key to successful transformation of the pension industry. To ensure data security, it requires a lot of cost and long term sustainability to keep the data secured. The elderly are a sensitive group as if the data is not secured, the pressure from the public and broken trust between the industry and the elderly will cause problems in the entire industry. Therefore, many common intelligent models that researches outlined in the current society are all third-party companies models. These companies tend to be top companies of the internet industry, such as Aliyun, Tencent, etc. (Wang, 2024). The problem of third-party platforms implementing their safe intelligent model is on the price that institutions need to consider. The price of using a reliable third-party platform is usually expensive when a private pension company is trying to incorporate the intelligent model into their pension house. The cost pressure that brought to the company is what this research will be discussing by diving into the reasoning of obstacles that the company faced in transforming into an intelligent elderly care system.

There are also other articles that outline some of the obstacles in the development of the intelligent elderly care industry, arguing that since the elderly have a generation gap, it is difficult for them to adapt to newer technology (Wang, 2022). However, these articles are not focusing on the fundamental problems of the reasoning behind elderly's employment of technology. The conclusion that these articles outlined was not based on quantitative research but rather on target-group research. Therefore, in order to understand the reasoning behind the challenges of using technology for elders, the study will employ a quantitative research method, sending surveys to elderly people in a pension house to answer the question.

3. Research Methods

3.1 Participants

50 elderly people (M = 68 years old) with no sensing and conscious delays were randomly selected from a nursing home in Chengdu, China, with the survey distributed in paper form by the nursing staff. Because the selected elderly have independent thinking abilities and were monitored under the supervision of a nurse to complete, all data are valid. The questionnaire consists of one rating question, four multiple-choice questions, and one question about objective fact. For each question, one participant is randomly selected to state the reason.

3.2 Research design

In order to understand the current needs of the elderly, the first question explores the future development path of the pension transformation model by asking about the conditions they paid most attention to in the nursing home, including accommodation environment, food, and healthcare, as these three can well cover the necessary needs in life of the elderly.

Next, the question asks them to choose from a scale of 1-5 in terms of their acceptance of technology. Through this problem, we can clearly understand the attitude of the elderly towards the existing technology and evaluate the feasibility of the promotion of smart elderly care technology. According to the above sections, most of the current smart pension equipment requires the elderly to use and have a certain control ability, and if the elderly are fed up with them, the development of smart pension equipment will be hindered.

Two multiple-choice questions are further used to get a clearer understanding of the current level of technology use and equipment acceptance of the elderly in the nursing home. These questions are, "Would you be OK with consistently wearing technology products to check your health every day?", and "What technology are you using?" By asking the elderly whether they can accept to wear a technology product, that is, the current wearable smart device to detect the function of the elderly, we can detect the elderly's acceptance of science and technology through a quantitative index. By asking the elderly about the technology devices they use, three options are given: mobile phone, mobile phone + tablet, mobile phone + smartwatch + tablet. This question ensures that older people are open and able to use existing technologies. The question ensures better understanding of whether there will be a problem of user threshold in the process of elderly care wisdom words transformation.

The next question, "Do you prefer technology to help you invisibly?", reflects the elderly's expectation for the integration of science and technology from a psychological level. Through this question, we can conclude whether the elderly are willing to take the initiative to directly interact with scientific and technological products, or whether the elderly's acceptance of science and technology cannot reach the level of free interaction, as advice for scientific and technological product developers to optimize product design concepts. For the elderly who expect invisible help from technology, product design should focus on conceal-

ment and automation.

Information security is crucial in the era of scientific and technological development, especially in the elderly smart transformation industry, which is a crucial point for the success of such transformation. Understanding older people's trust in technology requires knowing their assessment of the information security risks posed by technology. Therefore, the question is "If you use technology products to help your life, will you worry about information leakage?"

The next question is "If technology can replace care workers, would you prefer it?" Institutional elderly care belongs to the service industry, and the intelligent transformation of the elderly care service industry includes institutional intelligence, with the development of science and technology, not only auxiliary detection equipment appears on the market but also bionic robots, infrared detection equipment, etc., which can replace the role of people. But from a psychological point of view, the elderly have great emotional needs. In institutional nursing homes, the emotional sustenance of the elderly lies in the relationship between them and the nurse. Therefore, the development path of elderly care intelligent transformation should be based on the emotional needs of the elderly to discuss whether it should be replaced or assisted.

In order to understand the cost of supply, the last question asks the elderly how much extra money they were willing to pay to enjoy smart services. Under the known premise, the monthly payment of the secondary nursing home is 3,500 yuan. By playing a video to the elderly and showing different smart pension products such as smart turning beds, walking rehabilitation training equipment, etc. (CCTV Science and Education, 2023), we can understand whether the elderly are willing to calculate the cost and development potential of institutional pension at such an extra price by giving the elderly four payment options: 0-200 yuan per month, 200-500 yuan per month, 500-100 yuan per month and 1000+ per month.

3.3 Data analysis

All data analysis was carried using IBM SPSS (Version 27.0.0.0).

4. Research Analysis

4.1 Research from the demand side

Of the 50 samples that we collected, it is safe to say that elderly do have a preference on technology, as most of the elderly selected 3 (N = 35) on the scale of 1-5 (Figure 1). In the random selection process, the interviewed elderly expressed the reason for selecting 3 as the lack of understanding and knowledge on how technology could be effectively applied to their daily life. They see healthcare monitor products that they use every day, but a further indication of the application of technology is required.

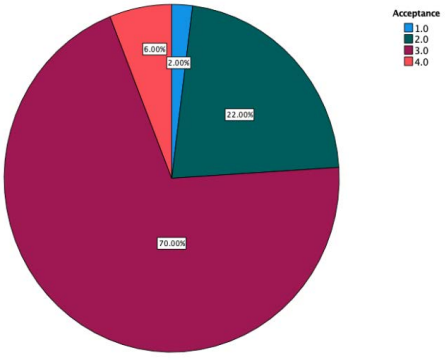

Figure 1. Acceptance of technology

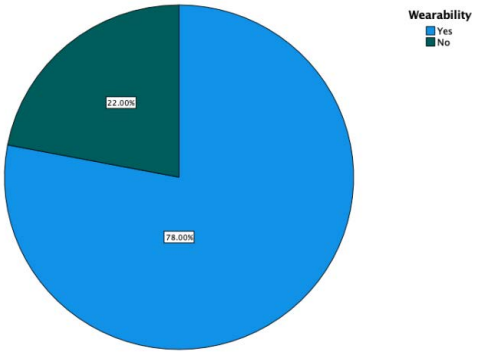

Figure 2. Acceptance of device wearability

To investigate on what kind of technologies are the preferred ones for the elderly, results also showed that there are many obstacles for the elderly to accept science and technology, yet one of the outstanding problems is that the elderly have obvious resistance to wearable smart devices, and it is difficult to adapt to the use of such devices in daily life (Figure 2). During the survey process, the elderly are provided with smart wearable devices such as Apple Watch as examples. The elderly have obvious resistance to this kind of equipment, and most of the elderly do not want to add such a "burden" to their lives. An elderly person randomly selected in this question said that the wearable binding device will bring physical discomfort during use, such as the weight and material of the device may lead to skin allergies or pressure for long-term wear, affecting the comfort of daily activities. Some smart bracelets are relatively tight, and long-term wear will cause scratches on the wrist; the strap material of some devices will cause allergic reactions such as skin itching. This is a major disadvantage of wearable smart monitoring devices

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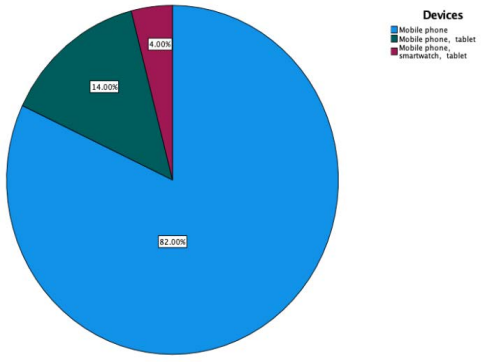
as it requires the elderly to consistently wear the devices in order to measure the most accurate data of their health. However, if wearing them every day is mandatory, it will force elderly people to think about using technology every day.



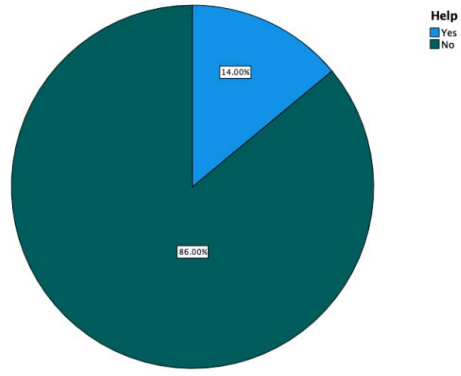


Figure 3. Electronic devices owned Figure 4. Acceptance of help from technology

Additionally, the elderly do not like being manipulated by technology, and they want technology to help them not restrict them. As shown in Figure 3, elderly do have a desire of technology, especially to ensure their safety. From the survey, there are 80% of the sample participants who value healthcare and their safety as the first-place necessity of a pension home. Therefore, we conclude that elderly people have a strong desire for technology, however, due to the lack of ability and barrier of controlling the technology, they tend to want technology to ensure their health without interfering with their normal life. This conclusion presents the critical problem that the current intelligent pension industry is facing, in the development and future of wearable devices, it might not be effectively monitoring elderly health data. Instead, it could possibly be solved by using other monitoring products through infrared ray and AI model, inserting them in daily life objects such as AI mirror, AI mattresses, etc. All these products could help to monitor health while not requiring elderly people to operate them.

The survey results also revealed another aspect of the problem, that is, the majority of the elderly refused to replace the care workers with intelligent robots (Figure 5). In the process of daily care, nursing workers can give in-person care and emotional support to the elderly through face-to-face communication, eye contact, and physical contact. When the elderly feel ill or depressed, the caregiver can detect and give comfort and encouragement in time. This kind of care based on real emotional interaction between people can greatly meet the psychological needs of the elderly and make them feel valued and cared. In contrast, although the robot can complete tasks such as meal and bath assistance according to the preset program, it lacks the emotional temperature and flexibility to truly understand the emotional demands of the elderly and cannot give the elderly deep emotional comfort. From the perspective of a personalized service, nursing workers can provide tailored services according to personality characteristics, living habits, and special needs of each elderly person. In a long-term relationship, they can deeply understand the preferences of the elderly, prepare their favorite meals, and accompany them to engage in interesting activities. The service mode of the robot is relatively fixed, and although it can achieve a certain degree of personalization through programming, there are still certain limitations in dealing with complex and changing situations and meeting the individual needs of the elderly. For example, when communicating with the elderly, the caregiver can flexibly adjust the content and mode of the conversation according to the topic and emotion of the elderly, while the robot may only respond according to the preset procedure, which is difficult to realize in real interactive communication. This phenomenon could also be explained from a psychological perspective, with the Schema theory and enculturation of elderly people on refusing them to replace their human assistants with intelligent robots (Pankin, 2013). As the elderly selected for this research survey conducted have an average age of 68 years old, which means that in their process of enculturation where they are building up schema while growing up. Their growing era did not support technologies being applied into daily life, so the elderlies schema would suggest that having an authentic relationship between human beings are irreplaceable. This conclusion suggests that in the future development of technologies and the transformation to intelligent elderly care, the focus on using technological products to invisibly assist and monitor elderly life needs to be emphasized. It is so far impossible to replace nursing with robots due to the psychological and emotional depth of elderly people's needs.

Technology should make life easier but not to replace and reduce the authentic relationship between humans.

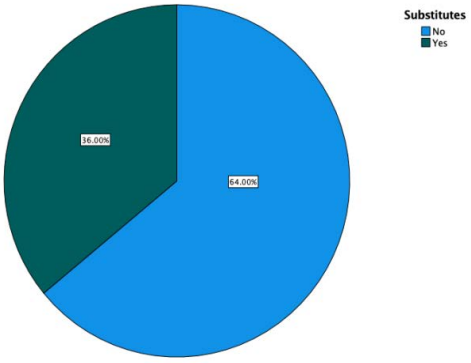


Figure 5. Acceptance of substitutes

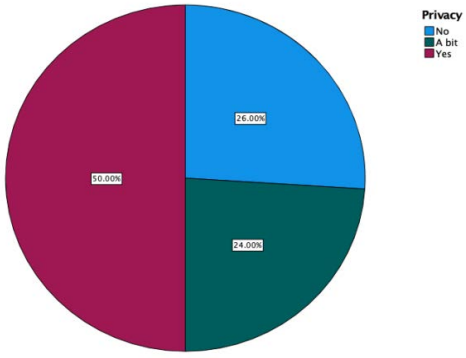


Figure 6. Technology privacy concerns

of care workers

At the same time, through the survey, the elderly do have the basic awareness of privacy prevention (Figure 6), as the unknown technology makes the elderly have doubts about the function of these devices and worry about the disclosure of personal privacy information. According to the function of the existing detection equipment to monitor the body data and movement trajectory, if these data are improperly obtained or used, it may cause damage to their rights and interests. The elderly are relatively weak at learning new technologies, and operating complex wearable devices leaves them confusion and helplessness. The operation interface and function settings of many smart devices are too cumbersome for the elderly, which takes a lot of time and energy to learn and master, undoubtedly increasing their psychological burden and leads them to be discouraged from using technology products. Therefore, the legal framework to ensure the safety of the data needs to be established.

4.2 Research from the supply side

From the supply perspective, through the interview with the Chairman of Chengdu Jinxin Fuxing Kangyang, Zhongyong, a company that holds a brand of pension house institutions in Chengdu. The interview was conducted with semi-structured methods. Some predetermined questions are:

- What is your company's current pension model?
- Have you ever thought about integrating technology into your retirement?
- What is the biggest difficulty?
- Do you think the cost of technological transformation is worth it?

Throughout the interview, Mr. Zhong told us that the profit of institutional pension houses is very low, which is due to the affordability of elderly people. The pricing needs to be controlled within a reasonable price but meanwhile safety, medical healthcare, and food needs to be in high quality. Mr. Zhong also told us that institutional pension houses target elderly people who don't have their child with them that could look after them, so pension institutions are more of a solution for solving people's problems but not a way to make huge profits. Therefore, prices are low and the profit would be low as well, and this is the reason why companies right now are not considering adapting an intelligent eco-system due to the high costs associated with providing personalized care, maintaining facilities, and meeting regulatory requirements.

The reluctance of organizations to transform into intelligent ecosystems is mostly due to the need for protecting the sensitive data of older adults when adopting intelligent systems. This transformation usually requires collaboration with third-party internet-based platforms to manage the acquisition, storage, and analysis of data safely. These collaborations involve significant costs, including those of managing sensitive data, protection from cyber threats, and maintenance of the service infrastructure. In addition, compliance with strict data protection rules increases operational complexity economic costs, thus creating economic challenges for organizations that are planning digital transformation. These challenges make the shift to intelligent ecosystems costly and resource-intensive, slowing down widespread adoption in the industry. The risk of transforming into intelligent health care is huge, because the risk involves data security and the safety of the elderly. Only some of the assistant products that could assist with daily life can be safely implemented, while besides the monitoring from the intelligent model, human monitors are also required because artificial intelligence can't guarantee 100% accurate data. Mr. Zhong told us that "Elderly health needs to be ensured 100%, we cannot blindly trust a certain technology. If accidents happen, we can't ask the intelligent product to handle the legal responsibility, it is better to have everything controlled with

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human nursing."

From our research from the survey, it also seems impossible for the successful transformation of implementing elderly health into a standardized public nursing home for the general public, providing elderly care services that meet the general needs and consumption ability of the public, and the prices and services are relatively moderate. The pension house we interviewed is as such - the price is 4,500 Yuan per month (Chengdu Jinxin Huaxiang Elderly Apartment, 2025), which is considered as a reasonable price. When looking at some of the intelligent products, they are expensive, for example, a video published by CCTV demonstrated the newest technology product applied in the pension industry, one of the products is Smart roll-over bed for the elderly (CCTV). The function is to use a bottom to fold the beds around, and through the track under the mattress, it rotates elderly people around without other people helping. It indeed is a very convenient product, but the pricing is not friendly for institutions, especially when the single price comes to around 70,000 Yuan (West River Hotline, 2022).

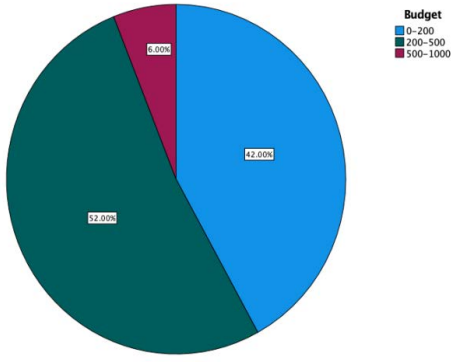

Figure 7. Acceptance of money spent on extra technology services

Considering this cost, when the survey investigates how much seniors are willing to pay extra every month in order to have these services in the institution, the data collects only 3/50 people willing to pay 1000+ a month in exchange for this service. Other 27/50 people chose the additional price range from 200-500, the rest are even lower than willing to pay 200 dollars (Figure 7). This shows that although some elderly are willing to enjoy the accessibility technology brought them, they don't want to afford an additional price in exchange for such. With this imbalance between cost and profit, institutions are not likely to transform into intelligent models while keeping human nursing. This is the obstacle that the supply side faces in the elderly care. In conclusion, relying on companies themselves transforming to a digital pension model is impossible, it requires other forces such as the government to assist in the process. The government could provide sufficient helps from a legal perspective in order to ensure the safety of data and also from a financial perspective.

5. Discussion and Conclusion

Smart pension transformations are required but it is not just about the technological upgrading of elderly care; it calls for a systematic rethinking involving multiple sectors. While older people are demanding technologies that can assist them in increasing their safety and well-being, solutions must be tailored to be easy to use, emotionally supportive, and data secure. On the supply side, institutions need both financial and regulatory support to surmount cost and risk barriers. Lastly, the success of digital transformation in elder care depends on a joint effort by government bodies, technology providers, and caregiving organizations, to create sustainable, human-centered intelligent ecosystems.

References

CCTV Science and Education. (2023, August 10). *Innovation in Progress: Smart Elderly Care (Episode 1)*. Retrieved January 19, 2025, from https://tv.cctv.com/2023/08/10/VIDEnTL3bRPTVhaaDjfYaDrh230810.shtml

Chengdu Jinxin Huaxiang Elderly Apartment. (2025). *Fees, prices, address, phone number, and reviews*. Linkolder.com. Retrieved January 19, 2025, from https://www.linkolder.com/yanglao/16427746

IIGF. (2024). Ren, G. (Author). *Exploration and prospects for the development of the smart elderly care industry in China and abroad*. Central University of Finance and Economics, International Institute of Green Finance. Retrieved January 18, 2025, from https://iigf.cufe.edu.cn/info/1012/9285.htm

Liu, X., Zhang, Y., & Wang, L. (2023). The progress of smart elderly care research: A scientometric analysis based on CNKI and WOS. *International Journal of Environmental Research and Public Health, 20*(2), 1086. https://doi.org/10.3390/ijerph20021086

PageAdmin CMS. (2020). *International trends in smart elderly care empowered by technology*. China Informatization & China Information Association. Retrieved January 18, 2025, from http://www.ciia.org.cn/news/25837.cshtml

Pankin, J. (2013). *Schema theory basic concepts*.

Pereira, R. (2024, October 1). Improving the visibility of older people in global statistics. *Office for National Statistics*. Retrieved January 15, 2025, from https://blog.ons.gov.uk/2024/10/01/improving-the-visibility-of-older-people-in-global-statistics/

United Nations. (2023). World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100. *United Nations*

Department of Economic and Social Affairs. Retrieved January 18, 2025, from https://www.un.org/en/desa/world-population-projected-reach-98-billion-2050-and-112-billion-2100

Wang, B. (2022). Overview of China's smart elderly care industry in 2022. *LeadLeo*. Retrieved January 10, 2025, from http://pdf.dfcfw.com/pdf/H3_AP202303291584655794_1.pdf

Wang, Y. (2024). Challenges and path choices for smart elderly care. *Aging Research, 11*(6), 2185–2190. https://doi.org/10.12677/ar.2024.116317

West River Hotline. (2022). News tracking: A charitable company donates smart beds to help "lamb soup grandma's" son solve turning challenges. Retrieved January 19, 2025, from https://www.xjrb.net/yule/2022/0721/43482.html