

Hindrance Identification of 5G Application in Healthcare: A Case Study of Jinan Residents

Jinwei Zhang*, Kaiyuan Cong, Kaijie Jia, Wennuo Liu

School of management, Shandong University of Traditional Chinese Medicine, Jinan, China

* Corresponding Author Email: 934156558@qq.com

Abstract. 5G technology is an advanced technology based on cloud computing, mobile communication and Internet of Things, which has important advantages in the process of large-scale data transmission. 5G technology is of great significance to the development of the intelligent medical system with wise information technology (WIT120) as the core. At present, there are still various problems in technology, economic, institution, interest and ethics in the development of 5G healthcare. This study uses questionnaire interview and inductive analysis as the main research method, and takes Jinan residents as the interviewees, aiming to analyze and summarize the current situation of 5G technology application in healthcare, in order to identify the hindrance of 5G technology application and provide theoretical value for the popularization and development of 5G healthcare.

Keywords: 5G technology; WIT120; Application hindrance identification; Questionnaire interview.

1. Introduction

The fifth generation of mobile communication technology is a new generation of broadband mobile communication technology with high speed, low latency and large connectivity as a network infrastructure to realize the interconnection of people, machines and things. 5G medical is based on mobile communication, Internet of Things, and other advanced technologies to realize the interconnection and information sharing between patients and medical personnel, institutions and equipment, as well as the efficient allocation of medical resources.

The absolute ability to combine 5G technology with the healthcare system and the ability to transmit data can be of tremendous value in understanding disease progression and improving predictive capabilities. 5G healthcare, as a new collection of healthcare applications, can fully utilize limited healthcare resources to provide digital, portable and mobile health services for physical monitoring, disease diagnosis and treatment of healthy, sub-healthy and sick individuals. It also enhances personal health status and medical efficiency, which is helpful to alleviate a variety of healthcare system problems. However, residents at present have low awareness of the application of 5G technology in healthcare, which is not conducive to the rapid and effective integration of 5G technology into healthcare and the advancement of wise information technology.

This paper investigates the awareness of Jinan residents about the application of 5G technology, and then identifies the hinderance to the application of 5G technology in healthcare, in order to promote the integration of 5G technology with healthcare, enhance the level and efficiency of medical applications, and improve the patient's access experience and the quality of medical services.

2. Development Status

WIT120 (WIT120) is a professional concept in healthcare that has emerged in recent years. WIT120 is composed of three parts: wisdom hospital system, regional health system, and family health system. The construction and development of "WIT120" is conducive to relieving the pressure of medical resources shortage by realizing telemedicine and self-help medical treatment through information technology; it is beneficial for the sharing and exchange of medical information and resources, thus significantly improving the rationalization of medical resources distribution; it is good for the modernization of China's medical services, consequently improving the medical services. With

the support of national policies, the construction of WIT120 platform has developed rapidly, and the existing achievements have been made in the development of WIT120 in China. Hospital information system is gradually improved, public health is gradually informatized, and chronic disease management is intelligent. However, there are still problems such as low user acceptance and use concept, low degree of information integration leading to inefficient use, time-consuming data entry and imperfect service evaluation system.

In October 2020, Ministry of Industry and Information Technology and National Health Commission issued the "Notice on Further Strengthening Telemedicine Network Capacity Building", in which they proposed to explore innovative applications of 5G technology in WIT120 and promote the construction of medical cloud computing and big data application service systems. The 5G all-wireless solution proposed in the same year subdivides the network system unit of the cabin hospital, and the virtual private network (VPN) tunnel combines each network unit with the data center of the host hospital. The effective use of 5G technology for the rational transformation of WIT120 in the application process fully demonstrates the speed and convenience by technology.

In July 2021, Ministry of Industry and Information Technology and other departments jointly issued the "5G Application "Sailing" Action Plan (2021-2023)", which points out the direction for the development of "5G+ WIT120 ". It is expressly required to develop 5G smart robots and other products, make full use of the 5G technology to enrich application scenarios, and accelerate the development of new services of WIT120 characterized by advanced technology, superior performance and remarkable effects. The preliminary combination of 5G technology and the robot-assisted diagnostic system has been completed by the relevant personnel. The information operation of adjusting parameters and transmitting video images can be completed by remotely manipulating the robotic arm for relevant examinations, ensuring the accuracy and stability of communication between the two sides. The method is effective and simple to operate, and the results of remote diagnosis and hospital consultation have high consistency, which even guarantees the security of the diagnosis process.

In March 2022, the fifth session of the 13th National People's Congress pointed out that the digitization is sweeping through all industries, and big data, AI and other technology services are also accelerating penetration. The medical industry is certainly no exception. Medical AI, medical big data and many other emerging technologies will play an increasingly far-reaching role in healthcare, health insurance, medicine and other aspects.

5G is a key new infrastructure to promote application of digital and intelligence technology in social and economic development, and has great potential in fostering new dynamics of economic development, etc. WIT120 is an important application for people's livelihood in the strategic planning of smart cities, as well as an industrial upgrade and economic growth point driven by the livelihood economy, and its construction application is an irresistible trend. With the current severe epidemic and tight deployment of personnel and materials, the rapid development of 5G technology comes at the right time. 5G+WIT120 is undoubtedly an important tool to combat the Covid-19 pandemic in the social context of minimizing the movement and mass gathering. 5G fluorescent sensors can be used for rapid detection and remote monitoring of COVID-19 patients, which will be beneficial for the future treatment and prevention of SARS-CoV-2 and other infectious diseases. The combination of wearable medical devices and 5G technology also enables real-time monitoring of the physical status of patients with the Covid-19. Through experiments, we have found that such devices have high model prediction correctness and can effectively predict the actual condition of the patient's cardiovascular system, which has long-term development prospects.

At present, as of March 2022, the penetration rate of 5G users is only 23.3%, and the resident penetration rate of 5G healthcare is very unsatisfactory. Residents have a large blind spot for the application of 5G technology in healthcare, so it is of strong practical significance to analyze the hinderance and applications in it.

3. Study Design

3.1 Research Methodology and Subjects Selection

Jinan is a prefecture-level city, provincial capital, sub-provincial city and megacity under the jurisdiction of Shandong Province. In 2021, Jinan's gross regional product was 114.3222 billion yuan, up 7.2% year-on-year. According to the 7th national census, Jinan has a resident population of 9,202,432, with 50.13% male and 49.87% female, and an age structure of 16.44% aged 0-14, 63.6% aged 15-59, 19.96% aged 60 above and 14.07% aged 65 above. For medical services, Jinan ranks 24th among 160 cities in China in terms of overall satisfaction score, and 4th among 19 cities above sub-provincial level in terms of evaluation score, demonstrating a leading position in healthcare in China. At present, Jinan is continuously optimizing the allocation of medical and health resources and focusing on the development of Internet+ medical and health applications for the convenience and benefit of the people, so this paper analyzes the application of 5G technology in healthcare of Jinan as an example.

To analyze the application of 5G technology in healthcare, this study was conducted by questionnaire "Residents' Awareness of the Application of 5G Technology in healthcare" and in-depth interviews with the respondents. Based on the purpose of the study, the urbanization development and the accessibility of data, the residents of each district and county in Jinan were selected as the research subjects according to the proportion of population in each district and county.

Table 1. Population and GDP of Jinan by District and County

Number	District/ County	Permanent Population of the Seventh Census/10,000 people	GDP/billion yuan in 2021
1	Licheng District	111.20	1165.98
2	Zhangqiu District	107.58	1120.40
3	Shizhong District	90.38	1161.73
4	Lixia District	81.91	2124.15
5	Laiwu District	81.60	908.82
6	Tianqiao District	71.80	642.56
7	Huaiyin District	67.50	701.11
8	Changqing District	59.55	371.95
9	Shanghe County	52.73	208.48
10	Jinan Hi-Tech Industrial Development District	42.40	150.31
11	Jiyang District	40.18	223.86
12	Pingyin County	32.31	269.06
13	Gangcheng District	28.70	338.30
14	Southern Mountain Regions	20.43	65.62

3.2 Questionnaire Retrieval

A total of 2107 questionnaires were distributed in this study, and 2058 were retrieved, with a recovery rate of 97.67%, of which 2058 were valid data, with an efficiency rate of 100%. The age and education level of respondents are evenly distributed, with 48.48% and 34.59% of respondents aged 30-45 and 45-60, and 47.17% and 31.43% of respondents with college and below and bachelor's degree respectively, in accordance with the existing population structure.

Table 2. Statistics of Questionnaire Retrieval

Questionnaire	Retrieval		Validity	
Number of distribution	Number of retrieval	Recovery rate	Number of validity	Efficiency rate
2107	2058	97.67%	2058	100%

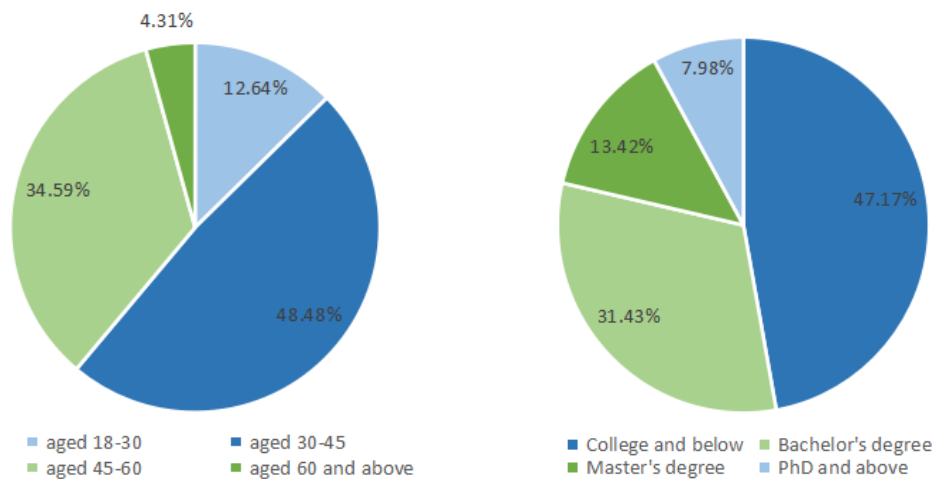


Figure 1. Respondents' Age and Education

4. Analysis of the Current Situation of 5G Technology Applications in Healthcare

4.1 Current 5G Awareness

In this paper, we conducted interviews with residents in districts and counties of Jinan on "5G Medical Awareness" and "The impact of 5G technology on healthcare", and the results are as follows.

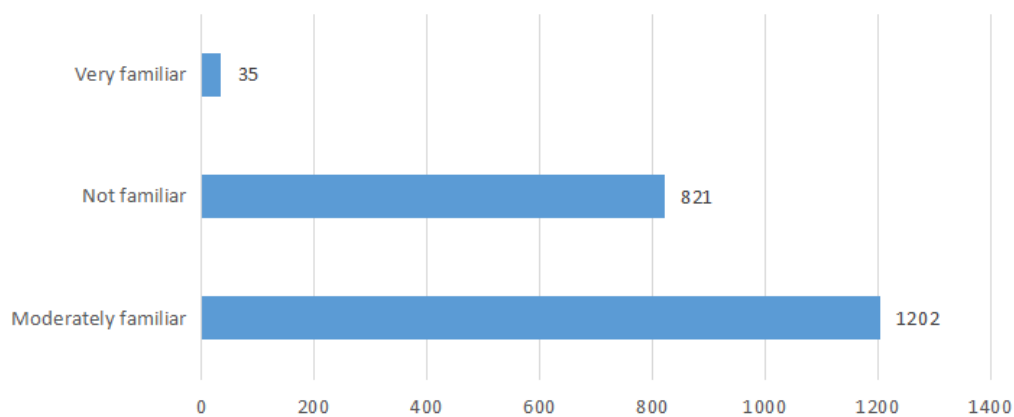


Figure 2. 5G Medical Awareness

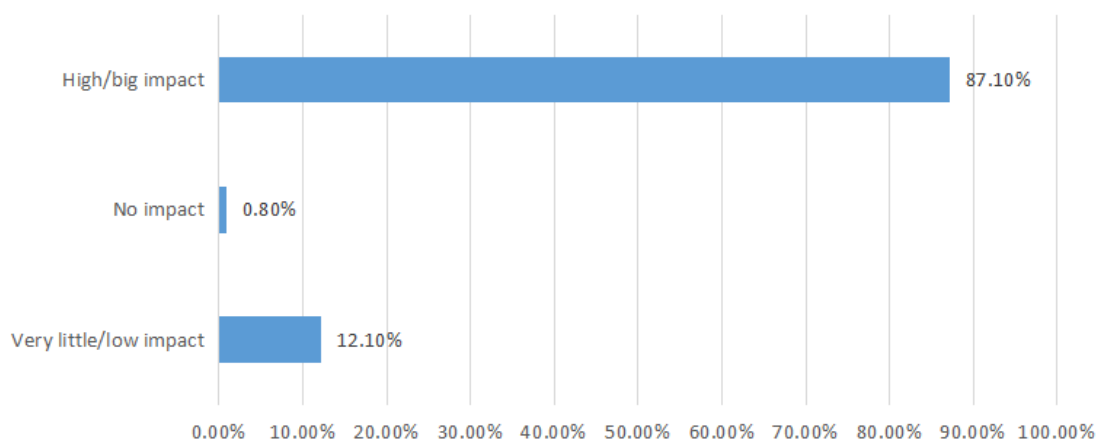


Figure 3. Perceived Impact of 5G on Healthcare

According to the survey data, 58.4% of respondents are aware of 5G healthcare, and 87.1% of respondents consider that 5G will have a great impact on the process of medical treatment. It can be seen that most of Jinan residents believe that 5G technology will be disruptive to the medical process, but the awareness of 5G healthcare among the public is low, which may cause a crisis of trust among the group during the popularization of 5G healthcare. Therefore, in the process of 5G healthcare development, attention should be paid to the popularization of the concept among the masses to help them accept the new technology more quickly and adapt to the changes brought about by the new technology.

4.2 Pathways to Learn About 5G Healthcare

In this paper, we conducted interviews with residents in districts and counties of Jinan on "Pathways to learn about 5G healthcare", and the results are summarized below.

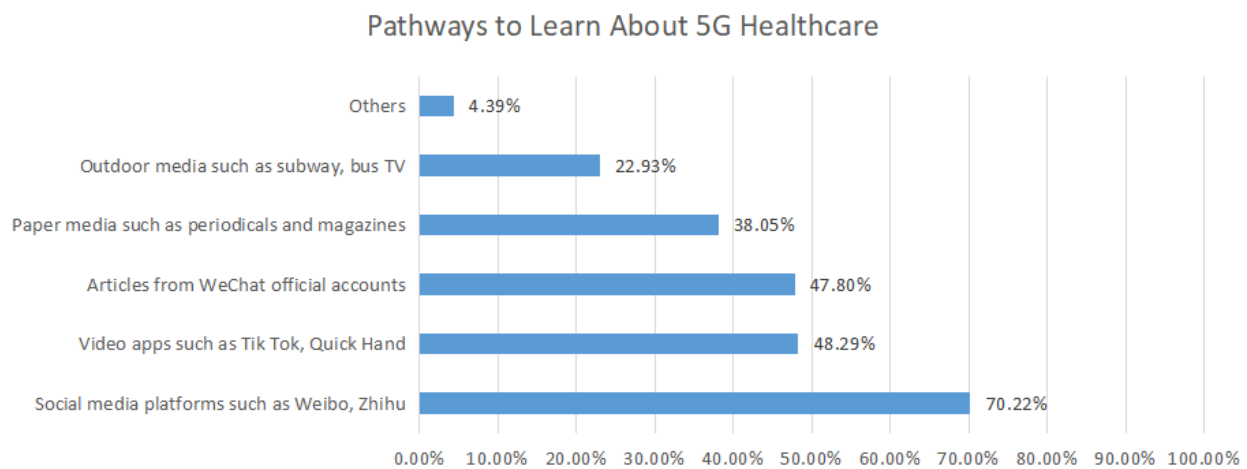


Figure 4. Pathways to Learn About 5G Healthcare

According to the research data, the current population mainly relies on the Internet to learn about 5G medical news, which can be used as an entry point to promote by means of short videos, cartoons and quizzes on online platforms.

4.3 Problems in the Development of 5G Healthcare

In this paper, we conducted research interviews on "Problems in the development of 5G healthcare" with residents of various districts and counties in Jinan as research subjects.

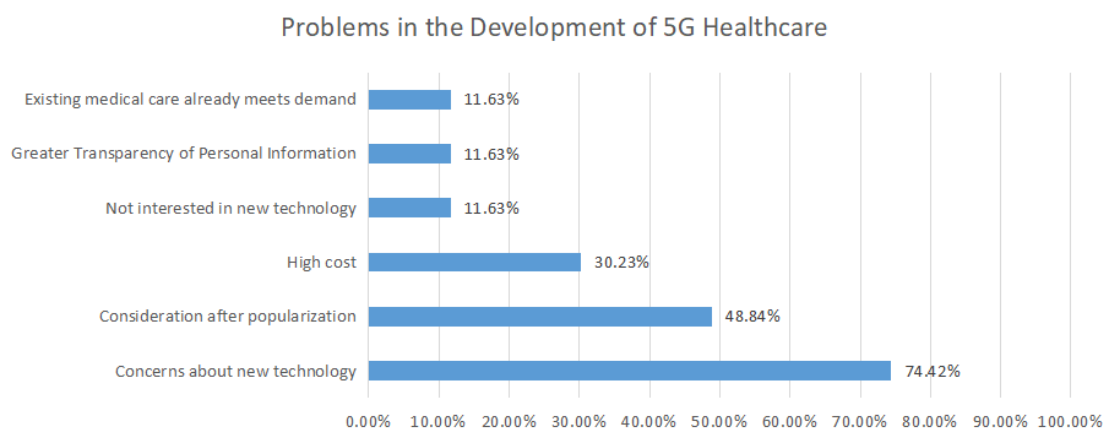


Figure 5. Problems in the Development of 5G Healthcare

According to the results of the study, residents' concerns about the development of 5G healthcare are focused on security and cost. 5G healthcare is empowering the traditional healthcare industry, and the pain points of the existing healthcare system are expected to be fully solved by the continuous

improvement of the new technology, but the expectation itself becomes the shackle of the problem, and the development and application of the technology cannot be separated from the reality of the society. Although there have been many revolutionary breakthroughs, 5G healthcare has not been fully developed, and the problems followed cannot be easily ignored.

5. Analysis of Hindrance Identification of 5G Application in Healthcare

This paper focuses on the hindrance identification of 5G application in healthcare, and makes the following summary based on the analysis of the survey of 5G medical awareness among residents in districts and counties of Jinan.

5.1 Residents' Awareness

Combined with the survey of residents' awareness and understanding, we can see that 5G WIT120 will occupy the main position in the future healthcare, while residents' awareness is not high at present. Therefore, on the basis of the original multi-point promotion, it is supposed to propaganda the 5G WIT120 service to the people with different education. For example, people with higher education (bachelor and above) in universities, enterprises and institutions are regarded as promotion targets, while for people with lower education level, there can be advertisement in the community, streets and other stalls.

5.2 5G Healthcare Security is Risky

According to the survey results, 5G medical security is the most important concern for residents. 5G medical security involves both 5G itself and patient. It is not only related to the safe and stable operation of the communication network, but also the expertise of the operators, the trouble-free of medical equipment and the cooperation of patients. Currently, the overall planning for 5G healthcare is indeed not perfect, and there are still many problems with coordination and cooperation between various departments. The national backbone network is not yet very mature, the stability of inter-regional transmission is not yet guaranteed, and there is still a gap between actual rates and latency and expectations. In addition, the 5G standard has been established for short and the industry chain is still relatively lagging behind. The medical industry has high professional requirements and a low fault tolerance rate for surgical-type operations.

5.3 5G Healthcare Cost is too High

In addition to security, residents are concerned about the cost. 5G healthcare costs are greatly expensive, making it unacceptable to most residents, which is an important hinderance to the application of 5G technology in the healthcare sector. Its direct costs mainly include the cost of 5G communication network construction for operators, 5G medical information system and related medical equipment procurement, maintenance and personnel training costs for medical institutions, and the cost of purchasing healthcare equipment and services on the part of users. Overall, the development of 5G WIT120 involves changes in the medical system and framework, promoting the development of "primary care" and "family doctor" systems, which can effectively improve the health status of residents and reduce medical costs with outstanding overall benefits. In the future, with the development of the entire medical ecology, the cost of 5G healthcare is expected to gradually decrease, and the social benefits will become more and more significant.

6. Conclusion

In the 14th Five-Year Plan, China has included medicine and health in the key "two international" leading pillar industries, which indicates that WIT120 will usher in a period of rapid development. However, the current application of 5G in healthcare is hampered by many problems, mainly the low awareness of residents, the high risk of 5G healthcare security, and the high cost of 5G healthcare. In

healthcare, we should expand the publicity of 5G healthcare in the introduction of 5G technology in the future, increase the technical research of 5G healthcare and personnel training. In addition, it is supposed to focus on solving the problems of unstable development of 5G healthcare and high security risks, and promote the development and change of the WIT120 industry.

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