Research on the Digital Divide in Smart Healthcare for the Elderly under Portugal's "National Digital Strategy - Digital Simplification" Policy

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Abstract: The launch of Portugal's "National Digital Strategy - Digital Simplification" policy signifies the country's determination for digital development and application, comprehensively covering sectors such as education, healthcare, elderly care, and public administration. The elderly, as the largest group demanding healthcare services, face a significant digital divide problem in the context of smart healthcare development. This paper, based on the definition of core concepts and guided by the theory of digital governance, investigates the digital divide in smart healthcare for the elderly under the Portuguese policy from three dimensions: the access divide, the usage divide, and the outcome divide. The research findings indicate that the elderly in Portugal face issues such as inadequate access to network environments and smart healthcare devices, insufficient willingness to use smart healthcare, and diminished accessibility to smart healthcare services. Based on these findings, and grounded in Portugal's "National Digital Strategy - Digital Simplification" policy, the study proposes corresponding governance countermeasures from three aspects: improving the top-level design and supporting measures for elderly smart healthcare services; promoting multi-party collaboration to eliminate the elderly's resistance to smart healthcare; and enhancing the equity and effectiveness of smart healthcare usage among the elderly. This research aims to provide a reference for Portugal to better advance the multi-party collaborative governance of the "digital divide" in elderly healthcare under the "National Digital Strategy - Digital Simplification" context, and to effectively improve the accessibility, equity, and convenience of healthcare for the elderly in the digital age.

Keywords: Portugal; Elderly Population; Smart Healthcare; Digital Divide

1.Introduction

On December 12, 2024, the Portuguese Minister of Education, Science and Innovation, together with the Minister of Youth and Modernization, unveiled Portugal's "National Digital Strategy - Digital Simplification". The strategy emphasizes that digital transformation is intended to simplify people's lives, enhance their quality of life, and promote the development of Portugal's productivity and competitiveness. This strategy will be applicable until 2030 and will impact areas such as healthcare, housing, government sectors, and corporate digitalization in Portugal.

With the advancement of public policies for digital healthcare in Portugal, the elderly, as the group with the greatest demand for medical services, have not had their medical rights and interests protected during the rapid transition from traditional to

digital healthcare services. Instead, due to issues like the access divide, usage divide, and outcome divide of the digital gap, their original accessibility and equity in medical services have been compromised. Studying the digital divide in elderly healthcare under the national digital strategy policy is a critical topic for improving the governance capacity of an aging society and enhancing the equity and accessibility of smart healthcare for the elderly.

2. Core Concepts and Theoretical Foundation

2.1 Concept Definition

2.1.1 Smart Healthcare

Smart healthcare, as the name suggests, is the digital transformation of traditional medical service processes through the application of information technologies such as Artificial Intelligence, Blockchain, and the Internet of Things. Faris S Alghareb et al. (2025) define smart healthcare as the use of advanced internet information technology to manage residents' health records through a medical information system, thereby achieving interaction between medical institutions, personnel and equipment, and patients and medical staff, ultimately realizing an informatized and digitized smart healthcare system, regional health system, and home health system [1]. Ibrahim Ahmad et al. (2025) view the smart healthcare system as a comprehensive transformation of the entire process of traditional medical services, using residents' health records and electronic patient records as a database, medical cloud data as the technological core, and constructing an efficient medical system that integrates government supervision, information security, information standards, business applications, and health management through various information technologies [2].

Synthesizing the views of the above scholars, this paper defines smart healthcare as a process of medical digitalization and intelligent transformation based on AI technology, deeply applying online medical and intelligent medical technologies to overcome the spatial and temporal limitations of traditional offline medical care. Smart healthcare is a revolutionary wave of medical services based on AI technology. Portugal's "National Digital Strategy - Digital Simplification" also includes the digital transformation of healthcare. Under the guidance of this strategy, Portugal has planned and guided the development of telemedicine, electronic health records, and smart medical software and applications. The implementation of smart healthcare not only signifies an innovation in medical technology but also a profound social change. It requires the joint participation of medical institutions, technical personnel, policymakers, and the general public to build a more equitable, efficient, and humanized healthcare service system [3]. In this process, how to effectively narrow the digital divide for the elderly in the field of smart healthcare and ensure they can equally enjoy the convenience brought by digital medical care will be a crucial issue in the implementation of Portugal's "National Digital Strategy - Digital Simplification" policy.

2.1.2 Core Connotation of the Digital Divide

The concept of the digital divide first emerged in the late 1980s. In 1999, the U.S. National Telecommunications and Information Administration (NTIA) found that with the development of internet information technology, there was a gap in information access and the ability to use new technologies between those who could obtain them and those who could not, defining this disparity as the digital divide [4]. With the development of digital technology, the connotation of the digital divide has continuously expanded and enriched.

Figure 1: Core Content of the Digital Divide

Core Content of the Digital Divide	Description
Access Divide	Due to differences in environment and infrastructure, leading to unequal access to internet information ports and equipment.
Usage Divide	Due to differences in willingness to use, leading to disparities in the application of information technology.
Outcome Divide	Due to differences in knowledge levels, cognitive abilities, values, and acceptance capabilities, leading to disparities in the outcomes achieved from using the technology.

As shown in Figure 1, Anasuya K. Lingappa et al. (2025) categorize the digital divide into three levels: the first level is the access divide, mainly concerning the equipment and facilities for accessing the internet information port; the second

level is the usage divide, referring to the individual's willingness to apply information technology; and the third level is the knowledge divide, referring to the differences in individuals' opportunities and abilities to apply information technology [5]. Apeksha Mewani et al. (2025) argue that the three levels of the digital divide symbolize new types of inequality caused by differences in technology access, technology use, and knowledge acquisition among different groups and individuals, and the digital divide will trigger other problems as society develops [6].

Compared to the younger generation, the elderly generally have lower educational levels and differ from the younger generation in their acceptance of information technology, frequency of information resource use, and mastery of information knowledge. Furthermore, physical decline, such as presbyopia and reduced finger dexterity, is common, making the elderly gradually become a vulnerable and marginalized group in the digital economy era.

At the access divide level, the elderly, due to economic and material constraints, use computers and smartphones at a significantly lower rate than the youth. This situation is more pronounced in rural areas, and the increase in the aging population will further exacerbate the digital divide problem for the elderly.

At the usage divide level, the elderly's demand for digital information services is significantly reduced. Coupled with the complexity of the interface design of various digital software, this further suppresses the elderly's motivation and willingness to use digital technology.

At the outcome divide level, due to significant differences from the younger generation in cognition, attitude, values, and behavioral patterns, the elderly also show significant disparities in the effectiveness of internet use. This situation is the main manifestation of the digital divide for the elderly in the digital economy era. The uneven distribution of the digital dividends created by the rapid promotion of digital service technology is making the elderly a digitally vulnerable group.

2.2 Theoretical Basis for Portugal's "National Digital Strategy - Digital Simplification"

In the 1990s, global digital technology and information developed explosively, and the digital economy environment compelled public administration to optimize and reform its processes. In this context, the British scholar Patrick Dunleavy proposed the theory of Digital Era Governance (DEG), arguing that the advent of the digital era would drive the re-engineering and simplification of government administrative processes. By applying digital technology to public service delivery, government administrative efficiency can be significantly improved, and public satisfaction with government work can be enhanced [7]. Therefore, the DEG theory advocates for a governance model that applies information technology to government public service processes, actively uses digital technology to enhance interaction between the government and businesses/the public, and promotes democratization by simplifying government procedures.

The DEG theory includes three main components: First, the re-integration and optimization of government processes and responsibilities through digital technology, reducing the waste and duplication of administrative resources. The concept of re-integration does not advocate for centralized management but aims to promote the enhancement of democratization in new public management. Second, needs-based holistic governance. The application of digital information technology will help change the situation where the government is the sole dominant governing body. By expanding the subjects of collaborative governance on digital information platforms, it can enhance the interaction between the government and the public, promote government information disclosure, and simultaneously boost the public's active participation in governance, improving the quality of supervision and management over government affairs [8]. Third, digital transformation. Digital transformation forces government departments to undergo digital change, leading to the digitalization of administrative work. Digital transformation meets the public's demand for high-efficiency government services and also breaks the single mode of communication between the traditional government and the public, thereby realizing a "data running instead of people" digital government and e-governance.

The DEG theory aligns with the trend of digital development. Currently, digital technology is one of the comprehensive indicators for measuring a country's development quality. Portugal is comprehensively advancing digital construction, with the technological revolution represented by information technology developing rapidly, and the healthcare industry has also undergone a technological revolution. The "National Digital Strategy - Digital Simplification" issued by Portugal includes the construction and application of smart healthcare systems. Specifically, it covers services such as online registration and

card creation, online appointment scheduling, online diagnosis and treatment, online testing and examination booking, and mobile payment. It utilizes AI analysis technology, voice assistance technology, facial recognition technology, smart device association technology, and artificial customer service/family intervention technology in mobile application interfaces, online consultation processes, and intelligent assistance for online and offline consultations. The construction of smart healthcare is the specific practice of the DEG theory in the medical field. Under the guidance of Portugal's "National Digital Strategy - Digital Simplification," the practice of DEG theory in the medical field will continue to deepen, providing strong support for building a more equitable, efficient, and humanized healthcare service system.

3.Analysis of the Digital Divide in Smart Healthcare for the Elderly under Portugal's "National Digital Strategy - Digital Simplification" Policy

The application of smart healthcare brings great convenience to younger patients, but since residents' digital literacy varies, the rapid promotion of smart healthcare also poses significant challenges to the elderly, who have relative difficulty using smart information terminals. There is a significant digital divide between the elderly and modern smart healthcare.

3.1 Access Divide: Inadequate Access to Network Environment and Smart Healthcare Devices

A good network access environment is the fundamental element for realizing smart healthcare. Portugal is actively promoting the construction of network infrastructure, but problems such as unstable network access and insufficient network coverage still exist in remote and rural areas. In parts of Madeira and the Cape Verde Islands, due to relatively backward development, complex geographical environments, and scattered populations, the cost for network operators to lay high-speed networks is excessively high, resulting in very weak or even absent network signals in these areas. Smart healthcare services such as remote consultation and real-time health data upload require high network stability and speed [9]. If elderly patients cannot connect to the network stably, they will have difficulty communicating smoothly with doctors via video, and they will not be able to timely transmit data collected by home smart medical devices to the doctor's end, hindering the development of remote smart healthcare services.

Secondly, smart healthcare moves beyond the traditional interaction between medical institutions and patients, allowing the elderly to establish a remote care model with doctors through smart healthcare systems and devices. Smart healthcare is highly dependent on smart devices. Patients can wear health monitoring devices, and medical institutions can collect real-time health data such as blood pressure, heart rate, and blood oxygen from the elderly. However, the income sources of some elderly people in Portugal are very limited, mainly relying on pensions for living. According to data from the Portuguese National Statistics Institute, over 50% of the elderly have a monthly pension in the range of 600-800 Euros. After deducting basic living expenses such as rent, utilities, and food, the remaining funds are insufficient to cover smart medical devices that often cost hundreds of Euros. The constraint of economics and the high price of smart healthcare devices form a sharp contradiction, which leads to the significant problem of insufficient access to smart terminals for the elderly in the construction and promotion of smart healthcare in Portugal.

3.2 Usage Divide: Complex Operation of Smart Healthcare Devices Inhibits Willingness to Use

Due to age-related decline in learning and cognitive abilities, the elderly face greater difficulty in learning to operate complex smart healthcare device software [10]. Furthermore, common health management APPs often have complex interface designs and small fonts. Functions such as doctor selection, appointment booking, and settlement processes are numerous. Elderly patients, due to physical decline and poor finger dexterity, are prone to accidental touches, leading to operational errors or even incorrect payments. Despite the Portuguese government's call to promote digital transformation in healthcare, the government and communities have not provided corresponding training for the elderly on the use of smart healthcare devices. This leaves many elderly Portuguese people at a loss when trying to use these APPs and software.

According to surveys, over 70% of the elderly in Portugal cannot complete the registration and login process independently when using smart healthcare APPs for the first time. It is even more difficult for them to record, upload, view, or download medical examination reports during subsequent use. Such smart healthcare APPs, lacking age-friendly design, are clearly difficult to use smoothly on their own. Moreover, in the Portuguese healthcare system, public hospital resources are very strained, and patients need to book specialists in advance on online medical platforms, choosing the most suitable option from

numerous departments and doctor schedules. These difficulties suppress the confidence and motivation of the elderly to use smart healthcare devices. Over time, the elderly develop a sense of caution and resistance towards smart healthcare, which is detrimental to their acceptance of it.

3.3 Outcome Divide: Diminished Equity in Accessing Smart Healthcare Services for the Elderly

The issuance of Portugal's "National Digital Strategy - Digital Simplification" aims to promote the digital application of social public services, simplify administrative procedures, and enhance the public's convenience in obtaining services. However, the elderly, as a vulnerable group in terms of digital literacy, not only fail to equally enjoy the benefits brought by digital technology during Portugal's digital promotion process but also have their equity and accessibility to smart healthcare services diminished due to the digital divide.

Currently, Portugal is actively developing smart healthcare, installing a large number of smart terminal devices in various medical institutions to improve the convenience and efficiency of patient visits. However, the corresponding offline registration and appointment channels and windows have been significantly reduced. Relevant departments and medical institutions are also allocating more resources to the construction of online healthcare, which is clearly unfavorable for the elderly, who have relatively low digital literacy. On the one hand, the elderly are the largest group demanding medical services, yet their digital literacy is relatively low, creating a contradiction in the structure of medical supply and demand. That is, the elderly have a high demand for medical services, but the accessibility of smart healthcare services is low. Although some elderly people actively try to use smart healthcare systems under the context of the national push for smart healthcare, the lack of unified training and their relatively low digital literacy means the effectiveness of their attempts is not significant. Over time, the problem of the outcome divide will dampen the enthusiasm of the elderly to use smart healthcare, thereby exacerbating the expansion of the digital divide.

4. Governance Countermeasures for the Digital Divide in Smart Healthcare for the Elderly under Portugal's "National Digital Strategy - Digital Simplification" Policy

From the above analysis, it is clear that the core content of the digital divide is mainly divided into the access divide for smart devices, the usage divide, and the outcome divide. Under Portugal's "National Digital Strategy - Digital Simplification" policy, the government is focused on promoting the digital transformation of processes in healthcare, education, elderly care, and public administration. The elderly, as the largest group demanding medical services, have become a digitally vulnerable group in the context of smart healthcare due to differences in digital literacy [11]. Based on this, to enhance the accessibility and equity of smart healthcare for all citizens and optimize the effectiveness of government digital governance, the governance countermeasures for the digital divide among the elderly under the "National Digital Strategy - Digital Simplification" framework can be approached from the following three aspects.

4.1 Improve the Top-Level Design and Supporting Measures for Elderly Smart Healthcare Services

In the process of advancing smart healthcare development, Portugal should improve the top-level design of smart healthcare services for the elderly to provide policy and legal guarantees for their smart medical visits. Firstly, in response to the situation where many elderly people do not know how to use smart healthcare, the government should issue corresponding regulations allowing relatives or community staff to assist with appointment booking services. In addition, the government should promote cooperation between urban medical institutions and rural/marginal institutions through methods such as tax reductions and increased subsidies, to facilitate the downward flow of high-quality medical resources. This will alleviate the situation where the elderly in remote rural areas cannot enjoy the benefits of smart healthcare, such as remote consultation and remote surgery [12]. At the same time, medical institutions should be mandated to provide dual-track services to ensure age-friendly medical provision. By creating elderly-friendly hospitals and inviting volunteers to guide the elderly in using smart healthcare, the resistance and fear of the elderly towards smart healthcare can be overcome. It is worth noting that a good and stable network environment is one of the fundamental conditions for effectively carrying out smart healthcare. The Portuguese government, in promoting digital transformation, should focus on the construction of high-quality network environments and simultaneously encourage the elderly to actively access smart terminal devices.

Furthermore, the Portuguese government should actively optimize the policy framework for smart healthcare services for the

elderly, mandating that the government and communities regularly provide digital literacy training to the elderly to enhance their ability to use digital technology services. The relevant government should issue policy documents to regulate the orderly promotion of smart healthcare device usage in medical institutions at all levels, preventing the situation where medical institutions, in pursuit of short-term benefits, completely cut off offline medical services. Medical institutions should be required to retain a certain proportion of on-site registration slots, in-clinic appointment quotas [13], and promote the parallel development of online and offline services in the Portuguese healthcare system.

4.2 Social Collaboration to Eliminate the Elderly's Resistance to Smart Healthcare

Surveys show that a considerable proportion of the elderly in Portugal have a certain degree of fear and resistance towards using smart healthcare. They are uncertain about the consequences of using it and are also worried about being disliked due to their lack of proficiency, leading to low motivation and willingness to use smart healthcare over time, which further widens the usage divide for the elderly. In response to this situation, under the framework of the Portuguese policy, in addition to the government regulating and guiding medical institutions for digital transformation, a friendly atmosphere for the elderly to use digital technology services should also be created across society.

The government and communities can dispatch volunteers and relevant staff to explain smart healthcare technology to the elderly. For those in need, digital technology application skills training and assistance should be provided to eliminate their fear of using smart devices. For example, volunteers can explain and demonstrate how the elderly can download health APPs, how to book appointments, check reports, etc., and promote the convenience of smart healthcare to guide the elderly to recognize the benefits that digitalization brings to their lives and medical visits [14]. Furthermore, the government should encourage digital reverse-feeding from families and children to the elderly. The encouragement and guidance from children and family members regarding the use of smart healthcare can effectively eliminate the elderly's resistance and fear towards medical digitalization.

4.3 Enhance the Equity and Effectiveness of Smart Healthcare Usage for the Elderly

While smart healthcare is being vigorously promoted in Portugal, the government should focus on enhancing the equity of smart healthcare usage for the elderly. In addition to improving the digital literacy of the elderly and encouraging them to actively use smart healthcare, the government should also establish green medical channels outside of smart healthcare for specific digitally marginalized elderly groups. These channels should include various appointment methods such as telephone booking, online booking, in-clinic doctor booking, discharge follow-up booking, on-site booking, and dedicated "Help the Elderly and Disabled" manual windows. The elderly can choose according to their own situation. This approach, which fully considers the special circumstances of the elderly and provides diverse choices, effectively alleviates the digital dilemma in their medical visits [15].

In addition, to strengthen the age-friendly design of smart healthcare devices, the government should require medical institutions to categorize smart healthcare devices into age-friendly and standard versions. In the age-friendly smart healthcare devices, the interface and consultation process should be simplified, and the font size should be enlarged with added explanations, to comprehensively enhance the effectiveness of smart healthcare usage for the elderly [16].

5.Conclusion

In the process of promoting the popularization of smart healthcare under Portugal's "National Digital Strategy - Digital Simplification," the digital divide among the elderly is essentially a product of the collision between the policy's modernization goals and the reality of an aging society. The governance of the digital divide among the elderly in the context of smart healthcare exhibits distinct contemporary characteristics. Strengthening the governance of the digital divide among the elderly, creating an age-friendly smart healthcare service system, and enabling the elderly to truly enjoy the digital dividends released by smart healthcare services is a crucial component of achieving social equity and inclusive development. In the future, with the continuous development of digital technology and the acceleration of the aging trend, the governance of the digital divide among the elderly will become a long-term task jointly faced by governments and all sectors of society worldwide. Portugal will also promote the popularization and development of smart healthcare through continuous policy optimization, technological innovation, and social participation, ensuring that the elderly can equally and conveniently enjoy the medical service benefits of the digital age.

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