

# **A Practical Exploration of Home Care Service System Enabled By Digital Technology**

Sicheng Ben

School of Sociology, Beijing University of Technology, Beijing, China

## **Abstract**

**This paper mainly focuses on the study of the digital transformation of home care service system, including three aspects: service structure, operation pattern, and technical practice. Firstly, the paper analyzes all the contents of the multi-cooperation mechanism and the whole process service chain, in order to clarify the operation obstacles of the current service system; Secondly, it discusses the application of intelligent devices, information platforms and management systems in home care, and draws a conclusion that digital technology is conducive to improving service capabilities, better allocating resources, accelerating response speed and other advantages, and has become the most important force to promote the transformation of home care service system.**

## **Keywords**

**Home care; Digital technology; Intelligent service; Pension system.**

## **1. Introduction**

With the increasing proportion of the elderly population, home care has become a key component of China's elderly care service system. Compared with general social nursing homes, home care is more in line with the living habits and expectations of the elderly. However, the current service system construction still faces many deficiencies in the aspects of structure integration, resource scheduling and service response. The development of digital technology provides a new opportunity to optimize the home-based care model. This paper focuses on the integration of digital technology in service structure and operation process, and analyzes its practical value in improving service efficiency and system collaboration ability.

## **2. Structure and Digital Upgrading Direction of Home-Based Elderly Care Service System**

### **(1) Multiple cooperative structure of service supply network**

With the increase of the elderly population, the family-centered home care model is no longer enough to meet the rising demand, and how to build a diversified and coordinated service supply network has become the focus of the elderly care reform. At present, the participants include not only elderly care institutions, but also family members, primary medical institutions, community organizations, professional nursing teams, third-party service providers and government management departments, gradually forming a comprehensive service network. Diversified cooperation is not only the increase of the number of suppliers, but also the reinvention of the supply concept[1]. There should be a clear division of responsibilities among the roles, avoid duplication of work, establish information exchange channels, and ensure continuity and integrity of service. In order to provide a clearer picture of the diverse collaborative structure of the home care service system, the following table lists the main service participants and their functions and responsibilities:

**Table 1.** Home care service providers and functional responsibilities corresponding table

participant	Primary responsibility	Cooperative interface
Family member	Daily care, basic life care	Synchronize with platform data
Community service center	Health intervention, environmental support	Interfacing with health systems
Social organization	Emotional support, cultural activities	Linkage with community platforms
Professional service agency	Nursing, rehabilitation, feeding assistance, etc	Connect with the information platform task scheduling system
Government and regulatory agencies	Platform construction, policy guidance, supervision	Data sharing with operational systems

The table shown above clarifies the main responsibilities and collaborative interfaces of various entities for home care services, facilitating unified coordination, efficient management and effective control.

## (2) Digital enabling direction for the whole process

The traditional home-based care model often has problems such as slow response, process fragmentation, information disconnection, etc., and can not achieve efficient and accurate service needs. With the development of science and technology, using digital technology to enhance the quality of service has become an important means, using technical means to series each link of service, to build a closed-loop, all-time, traceable service process. Home care services include the assessment of the elderly, appointment, dispatch, implementation, feedback, emergency response and other service processes, if each link is cut off and solved by manual link, it will seriously reduce the quality of service. The digital platform can integrate these processes in series, and combine sensing equipment and data systems to achieve fast and timely feedback and service closed-loop. In order to better understand the role of the scheduling system in the service response, the following functions can be used to characterize the calculation logic of the response time:

$$T_r = \frac{D+Q}{R \times P} \quad (1)$$

Where,  $T_r$  is the service response time,  $D$  is the service response time (km),  $Q$  is the queue waiting time (min),  $R$  is the service personnel response rate, and  $P$  is the platform scheduling efficiency coefficient (0~1).

Digitization puts more emphasis on systematic learning ability. The system uses data accumulation to continuously improve its own service strategy, better resource allocation, and promote information interaction and monitoring among various departments. Some regions have realized the integrated management of service records, health archives and assessment information, forming an integrated operating mechanism of "service + health + management", and realizing a multi-way sharing and real-time update model.

## 3. Operation Pattern and Reality of Home-based Elderly Care Service System

### (1) Family-led system is not formed

At present, China's elderly care model is family-centered "family-oriented", and professional care forces are extremely scarce in small towns and urban-rural integration areas, and the main care force is the family. Although it conforms to the traditional concept of "raising children for old age", in terms of specific operation, it faces serious challenges in stability, quality level and service continuity. Family elderly care is mostly manifested as emergency and supplementary elderly care without scientific evaluation and systematic training[2]. For example, adult children live away from home, relying only on neighbors or regular visits; For example, elderly couples depend on each other for survival, if one party's health declines, it will form a nursing crisis. Such family pension can only be a temporary emergency, and cannot meet the needs of long-term chronic disease treatment, unexpected injury treatment needs of emergencies, and companionship needs of psychological and emotional comfort. In addition, family elderly care is not a standardized system, and it cannot build a stable connection point with medical institutions, community services, and social organizations. Therefore, when there is an unexpected situation in the family pension, the elderly often lack support, and the continuity and integrity of the service are problematic. In addition, in the special groups who live alone, empty nests, old age, and can not move, family pension is often no longer the basic security, and the lack of systematic nursing directly exposes the shortcomings of the existing service model.

### (2) Single service, difficult to meet the needs

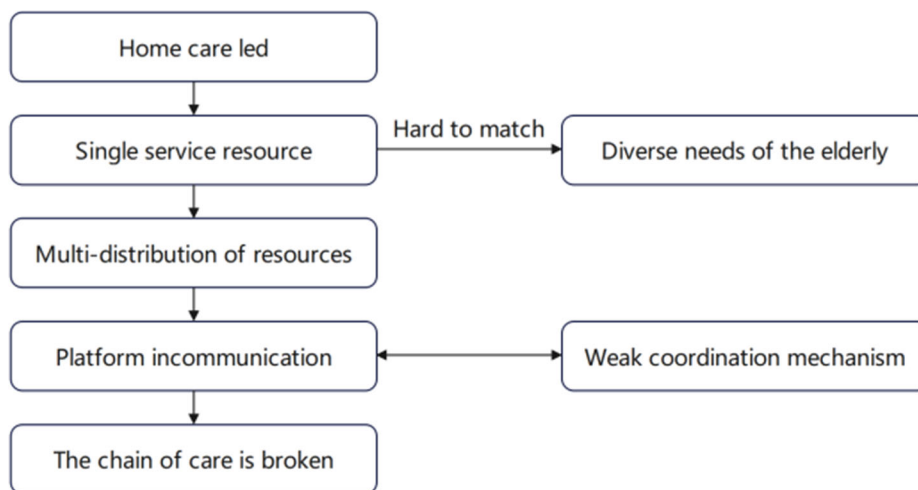
Although the main goal of the current home-based care model is to care for the elderly, there is not too rich level division and targeted management for the relevant service forms that they can obtain at present, and to a large extent, the complex and diversified needs of these elderly can not be accurately matched. In the vast majority of areas, the home care service is mainly to perform some simple tasks such as food delivery, cleaning, bathing and so on. Although these services have met the basic living needs of some elderly people with self-care ability, they have not involved in-depth services such as cognitive disorders, mental health, chronic disease management and health education. Among them, for some individuals who are elderly, have lost their own physical functions and suffer from Alzheimer's disease, due to their own emotional fluctuations, high requirements for care, and their high frequency of demand for care, but the current service is completely inadequate.

Most of the existing services lack evaluation system and personalized service intervention. Elderly users' service needs are mainly self-reported and submitted by themselves, and service platform or community leaders will provide service suggestions based on subjective judgment, so it is difficult to match the real health threats and psychological states of the elderly. In fact, some elderly people have fewer services, but some elderly people will rely too much on services, resulting in unsatisfactory service matching. From the perspective of user experience, the elderly complain about the complexity of service reservation, service waiting time and lack of specific service content; However, the imperfect task allocation and information feedback mechanism of the service side lead to the improvement of service quality and the weakening of the incentive system of remuneration. This leads to the rigid state of "difficult requirement identification - weak service design - slow execution feedback" of the overall service system.

### (3) Scattered resources and weak coordination

Family pension includes the joint input and participation of many systems, but under the setting of resource composition structure, it shows a state of "wide distribution, weak linkage and scattered operation". From the perspective of the formulation of resource input pattern, or from the perspective of the management mode of the organization, the "synergy effect" has not been fully developed. First, there is a lack of communication and connection between the service providers. The government, communities, third-party enterprises and volunteer organizations carry out their own business, forming a relatively independent system. The "separation" of information and data leads to the lack of effective collaboration between services and the waste of resources caused by "large and unreasonable" services. Secondly,

there is a lack of cross-platform sharing mechanism between service links. Most platforms are only visible within the platform and cannot flow at high speeds between multiple terminals. The community elderly care system cannot obtain the electronic medical record data of medical institutions, and the emergency response system cannot link to the long-term care service plan, resulting in the failure of integrated service presentation, intelligent push, and closed-loop management. This kind of "information island" phenomenon makes it difficult for each organization to effectively cooperate with each other. At the same time, in terms of system construction and supervision mechanism, most regions still use the ledger assessment and manual inspection mode, and can not carry out fine control of service effectiveness and quality. The model of evaluation is "whether it is done", and the content in the service, user satisfaction and actual improvement are not managed as evaluation criteria, making the synergy mechanism useless. The following figure summarizes the main structural breakpoints and collaborative obstacles faced by the current home-based care service system in operation:



**Figure 1.** Schematic diagram of operation problem chain and structural bottleneck of home-based elderly care service system

As shown in Figure 1, the problems in family care, service docking, cross-departmental cooperation, etc., are the main structural and communication problems faced by the current home-based care service system.

#### 4. Practice Path and Exploration Method of Home Care Enabled by Digital Technology

##### (1) Integration of smart devices into daily care

The implementation of intelligent home care service has brought a significant impact on the original care model. The original care mode, which relies on artificial periodic inspection or regular telephone greetings, is gradually unable to meet the needs of 24-hour full care and care for the elderly. The application of digital tools has transformed the way of care from "manual intervention" to "automatic perception" and from "sudden response" to "advance warning"[3]. Common household smart devices include: vital signs detector, smart mattress, wearable bracelet, infrared sensor, door sensor, smoke alarm and so on. Mobile devices worn on the hands of the elderly can monitor the elderly's walking, heartbeat and sleeping conditions, and transmit remote data information through low-power wireless network technology; The pressure sensitive pad installed in the mattress of the elderly can monitor the adverse phenomenon of long-term immobility of the elderly and avoid the occurrence of bedsores; Infrared sensors installed in the bathroom, kitchen and other fall-prone areas by monitoring

the elderly's activity frequency changes, providing data for the assessment of the elderly's self-care ability. You can also start a video conversation or call to ask if there is a response

Typical use cases are as follows: when the elderly living alone do not get up at the specified time, the mattress and infrared sensor no information record, the system will immediately alarm the platform, the platform automatically sent to the elderly family members or community grid, and automatically start a video conversation or call to ask whether there is a response. If not, the relevant personnel will be on the scene within 15 minutes. This workflow has been gradually closed in some pilot areas, greatly improving the efficiency of crisis response. It should be noted that these devices do not operate separately, but often collect information through the edge gateway and summarize it to the elderly care service center or local data center to achieve collaboration between devices. This way of "multi-device linkage + instant response" has become one of the main ways of old-age care for elderly people with mobility difficulties, replacing a way of relying on intuition and experience in the past.

## (2) Information platform connectivity service link

Data center is an essential basic project in the digital development of elderly care services[4]. Its significance lies not only in the integration of data, including server, client, customer management, regulatory information, etc., but also in the bridge role from "front-end perception" to "back-end execution".

The service platform includes three main functions: "service portal + operation background + supervision channel". Customers (the elderly themselves or their children) can access the service portal with handheld electronic devices (apps, applets, voice terminals), view the list of booking services, and enter their requirements online. Based on the elderly's identity authentication status, demand intensity, location information and other factors, the best supply of service providers will be matched and automatically generated, and confirmation feedback will be issued and provided to the background. The control center receives order information, service resources, staff allocation information, completes order dispatch, route optimization, risk assessment, and records and tracks. Relevant government departments can directly monitor the total number of services, average response speed, employee arrival rate and other core indicators through the system to increase service quality control and management efforts. In some places, intelligent risk assessment algorithms are combined to simulate the behavioral characteristics, physiological conditions, and historical data of the elderly, so as to predict the risks of falls and chronic disease recurrence in advance, and improve the prevention of services.

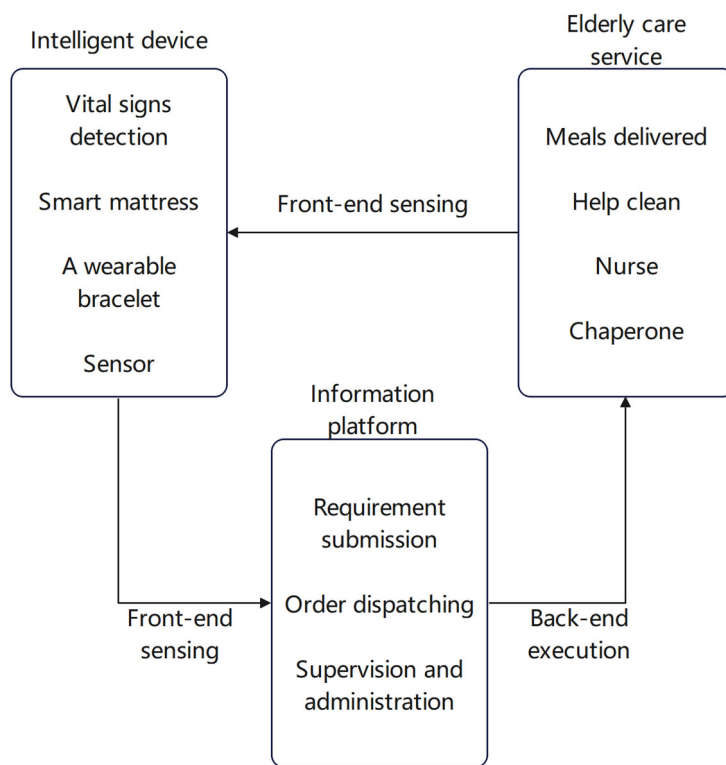
The one-body structure of "user-platform-service provider - supervision" replaces the original "one-to-one" and "relying on interpersonal relationships" scheduling form, and introduces a new generation of service channels with "unified standards, clear processes, and automatic response", which is especially suitable for urban communities with sparse population and a relatively high proportion of elderly people.

## (3) Digital system support operation management

In addition to care execution and platform scheduling, digital technologies are also being used to support the operation of the entire set of elderly care services and improve management effectiveness. Technology is no longer a simple tool, but has become a "digital skeleton" that can assist service process management and even stimulate the improvement of service system management and operation[5]. First of all, service operators in various regions set up elderly care service operation and management systems to integrate human resource deployment, performance assessment, financial settlement, risk control and other processes. Manage staff online check-in and attendance, electronic record of service information, fill in the roadmap and photo proof after service completion, so as to ensure that the service process is monitored and the quality of service can be quantified. With the support of digital technology, it can also monitor work pressure and assignment in real time, adjust the arrangement of human

resources, and improve the efficiency of service operation. Second, the construction and integration of digital systems extends to government service platforms and city databases for information aggregation and policy coordination. Some cities have even launched a "pension points" system to register the frequency of elderly people's participation in health lectures and other activities, which is converted into points for exchange for convenient services in daily life, so as to encourage the elderly to actively interact with society.

In addition, the exploration of the "multi-platform docking + cross-system linkage" model has also been carried out successively, that is, the elderly care platform docking with medical, emergency, disabled services and other institutions, so that it forms an intelligent control model with real-time monitoring, unified data recording, and rapid response. This is also the change from "passive service" to "predictive governance", and is also an important trend in the future development of elderly care information. The following figure shows the embedded structure and collaborative path of digital technology in the home-based care service process:



**Figure 2.** Schematic diagram of home care service path enabled by digital technology

As can be seen from Figure 2, the digital system technology means are applied to the perception, scheduling, management and other work links, and then form a mutual and efficient home care service ecological chain.

## 5. Conclusion

With the progress of society, home care is becoming the main way of care in the future, and is undergoing a great change from "family support" to "system coordination". The digital intervention not only optimizes the service system and process, but also provides a practical support platform for the elderly to spend their old age peacefully for a long time. Practice shows that the integrated application of intelligent devices, information platforms and digital systems can improve service level and response timeliness. Therefore, in order to build a more intelligent, efficient and warm home care service model, we should further increase the reform

and innovation of relevant systems, promote the application of technology integration and the construction of standard systems.

## **Acknowledgments**

The successful completion of this study is due to the guidance and inspiration of many experts in terms of academic insights and paper writing skills. At the same time, I also want to thank many people in the service industry who provide help in data collection and empirical analysis, whose valuable experience provides a good reference for this paper. At the same time, I would like to deeply thank all my good friends and colleagues for their support and encouragement during this study.

## **References**

- [1] Li J .Research on the Social Security and Elderly Care System under the Background of Big Data[J].Mobile Information Systems, 2023, 2023(000):12.
- [2] Yu J , Huang J , Yang Q .Long-Term Adoption or Abandonment of Smart Technology in the Chinese Elderly Home Care Environment: A Qualitative Research Study[J].Healthcare (Basel, Switzerland), 2023, 11(17):14.
- [3] Vincek V , Rogina E K , Bogataj D .Impact of Digital Technology on the Quality of Life of Older Adults - Literature Review[J].IFAC PapersOnLine, 2024, 58(3):304-309.
- [4] Li J , Weng J , Tian W .Research on the Construction of Group Elderly Care Service Platform Based on IoT Technology[J].Journal of Electronic Research and Application, 2024, 8(2):68-73.
- [5] Ma T G S P I .Theologizing on Artificial Intelligence in Elderly Care[J].The Linacre Quarterly, 2025, 92(1):19-26.