Research on the Optimal Allocation of Community Elderly Care Service Resources Based on Big Data Technology

Shuying Li

Taiyuan Health School, Taiyuan 030012, Shanxi, China

Abstract: With the accelerating aging process of China's population, the demand for community elderly care services has shown diversified and personalized characteristics. However, problems such as insufficient total care service resources, uneven distribution, and prominent supply-demand contradictions have seriously affected service quality. Big data technology, with core advantages including data collection, analysis and mining, and accurate prediction, provides a new solution for the allocation of community elderly care service resources. This paper systematically studies the application value of big data technology in the allocation of community elderly care service resources from three aspects: resource allocation efficiency, service accuracy, and management intelligence. Combined with practical needs, it proposes optimal allocation strategies such as building a big data analysis platform and accurately grasping the elderly's care needs, striving to provide operable path references for the construction of community elderly care service systems, promoting the early realization of the elderly care service goal of "adequate support and proper care for the elderly", and boosting the high-quality development of China's elderly care service industry.

Keywords: Big data technology; Community; Elderly care; Service resources

1. Introduction

The "14th Five-Year Plan for National Aging Career Development and Elderly Care Service System" clearly points out that "promote the digital transformation of elderly care services and use big data, artificial intelligence and other technologies to optimize the allocation of elderly care service resources", which points out the direction for the reform of community elderly care service resource allocation. Big data technology can integrate the health data, demand data, and resource data of community elderly, analyze the problems of "accurate demand identification, dynamic resource allocation, and personalized service supply" from multiple perspectives, and break the limitations of traditional allocation models. At present, some cities are striving to apply big data technology to community elderly care services, but they are still exploring in terms of data integration, analysis and application,

and talents. In view of this, this paper carefully analyzes the application value of big data technology and comprehensively constructs resource optimal allocation countermeasures, so as to provide theoretical basis and practical examples for promoting the efficient utilization and accurate supply of community elderly care service resources.

2. Application value of big data technology in the allocation of community elderly care service resources

2.1. Improve resource allocation efficiency and alleviate supply-demand contradictions

On the one hand, big data technology can realize dynamic monitoring and efficient scheduling of resources. By installing intelligent terminals in the community to real-time obtain data on the usage status, idle status, and number of unused equipment of care resources, and using the big data platform for visual display [1]. Community managers can flexibly adjust resources based on this information: when the number of disabled elderly in a community surge leading to a shortage of nurses, the big data platform can automatically dispatch idle care personnel from surrounding communities to support. On the other hand, big data technology can achieve accurate prediction of resource demand [2]. By analyzing historical data such as the age, health status, and living habits of community elderly, combined with regional population change trends, the big data platform can predict the demand for care resources in the next period of time. Communities can reserve relevant resources in advance according to the prediction results, recruit temporary care personnel or increase investment in rehabilitation equipment before the arrival of demand peaks, avoiding the problem of "temporary shortage".

2.2. Improve service accuracy and meet personalized needs

Firstly, big data technology can form a "holographic demand portrait" of the elderly. By integrating multi-source information such as community health records, intelligent device data, questionnaire survey data, and family feedback data, the big data platform can construct a demand portrait including dimensions such as "health status, care needs, service preferences, and payment capacity" [3]. Secondly, big data technology can realize personalized recommendation of service items. Based on the demand portrait, the big data platform uses algorithms to match the most suitable care service items and resources: for the above-mentioned slightly disabled elderly living alone, it can provide a service combination of "3 home-based rehabilitation care sessions per week (including blood pressure monitoring) + 1 intelligent safety monitoring session per day (such as fall alarm) + 1 psychological companionship session per week", and match caregivers with hypertension care experience and portable intelligent monitoring equipment, etc.; this personalized service recommendation improves service satisfaction and avoids unnecessary waste [4].

2.3. Improve management intelligence and optimize service quality

Traditional community elderly care service management mostly relies on manual records and paper files, resulting in slow data updates, difficult information exchange, and lack of quality supervision, making it difficult to control the entire service process. Through data integration and intelligent analysis, big data technology can promote the management model from "manual extensive" to "intelligent refined", thereby improving service quality [5].

On the one hand, big data technology can realize full-process traceability and supervision of services. Caregivers upload service information in real-time through a mobile APP during service provision, and intelligent

devices automatically record service data, which are synchronized to the big data platform. Managers can check the service status of each link on the platform, and promptly intervene and correct if a caregiver has insufficient service time, irregular operations, etc.; family members can also query the elderly's service status through the platform to improve service transparency [6]. On the other hand, big data technology can achieve dynamic evaluation and improvement of service quality. By analyzing service data, the big data platform can automatically generate evaluation reports on service quality, and identify existing problems and corresponding improvement suggestions. Communities continuously improve service processes and resource allocation according to these evaluation reports, forming a cycle of "evaluation–improvement–re-evaluation".

3. Countermeasures for the optimal allocation of community elderly care service resources based on big data technology

3.1. Integrate multi-source data and build a unified data resource library

Communities need to cooperate with departments such as health and wellness, civil affairs, and medical insurance, as well as medical institutions, elderly care enterprises, and intelligent device manufacturers to integrate various data and establish a unified data resource library for community elderly care services [7]. This database should cover three types of data: the first is basic information of the elderly, such as age, gender, family composition, housing conditions, and economic status, to analyze service accessibility and payment capacity. The second is health and demand data, including health records, physical function status, and care needs, to accurately identify those in need of help [8]. The third is data on the supply of various resources, including information on caregivers, equipment materials, and service items, so that they can be dispatched and used at any time. For example, communities can connect to the electronic medical record systems of local hospitals to obtain the elderly's medical history data, collect daily health data through smart bracelets, and obtain resource supply data through nursing institution management systems, achieving "one-network sharing" of data. It is necessary to establish a data update mechanism, clarify the data update responsibilities of various departments and institutions, and ensure data freshness.

3.2. Build core functional modules to realize data value transformation

The big data analysis platform needs to develop four core functional modules: "data collection–analysis and mining–decision support–service connection", transforming data into resource allocation decisions and service supply actions [9]. Firstly, the data collection module can access data from multiple terminals and has a cleaning function to ensure data quality. Secondly, the analysis and mining module uses big data algorithms to conduct multi-dimensional analysis including demand analysis, resource analysis, and matching analysis [10]. Thirdly, the decision support module presents the above results in the form of visual reports to provide managers with resource allocation suggestions. Fourthly, the service connection module realizes automatic matching from demand to resources to services. For example, after the elderly submit care needs through the platform, the system will automatically recommend suitable caregivers and required service items, generate a service order, and notify relevant personnel, realizing the automatic completion of the entire process from demand submission to final execution.

3.3. Strengthen data security assurance and protect the elderly's privacy

The elderly's health data and personal information are sensitive data, so a strict data security assurance system must be established to prevent data leakage and abuse. Firstly, improve data security management systems, clarify the permissions and processes for data collection, storage, use, and sharing. Caregivers can only access the data of their own service objects, and must obtain the consent of the elderly or their guardians if they want to share the data with others [11]. Secondly, use technical means for protection, such as encrypting data, implementing access control, adopting strong authentication methods such as facial recognition and dynamic passwords, and conducting security monitoring. Thirdly, strengthen the publicity of laws and regulations and carry out personnel training. Organize platform managers and caregivers to study the Data Security Law and the Personal Information Protection Law, clarify their respective data security responsibilities, and prevent illegal operations. For example, communities can cooperate with professional network security companies to conduct regular data security assessments and vulnerability testing to ensure the safe and stable operation of the platform and safeguard the privacy rights of the elderly [12].

3.4. Collect care needs through multiple channels to ensure no omissions

Communities should form an "online + offline" multi-channel demand collection system covering different types of elderly to ensure comprehensive and non-missing demand collection. For online channels, develop user-friendly online demand submission platforms for the elderly, including WeChat mini-programs, telephone hotlines, and intelligent terminals, allowing the elderly to easily submit their needs; for elderly friends who are not familiar with intelligent devices, their families or community grid workers can help submit on their behalf; the platform should have clear demand classification and a demand description field where the elderly can add more detailed information [13]. For offline channels, arrange community grid workers and caregivers to conduct regular home visits, focusing on disabled, elderly living alone, and advanced-age groups, to understand their daily care problems and service experiences through face-to-face communication [14]. In addition, set up special demand collection points in community activity centers or elderly canteens, and assign staff to help the elderly fill out relevant questionnaires. It is also possible to cooperate with hospitals and community health centers to collect care needs when the elderly seek medical treatment or undergo physical examinations. For example, doctors can propose necessary rehabilitation care items based on the elderly's health status and help submit them.

3.5. Respond to care needs personally and provide customized services

According to the results of demand stratification and classification, provide customized care service plans for the elderly and match appropriate resources to achieve precise "one-person-one-policy" services. Firstly, formulate personalized service plans. Combine the elderly's needs, health status, and service preferences to formulate detailed personalized service plans, specifying service items, service frequency, service duration, and service supervisors. For example, arrange a service plan of "twice-daily home care + three rehabilitation training sessions per week + 24-hour intelligent monitoring" for disabled elderly [15]. Secondly, match professional resources. Based on the requirements of the service plan, find and assign qualified caregivers and suitable service equipment. Thirdly, dynamically adjust service plans. Use the big data platform to monitor service effects in real-time and promptly adjust service plans and resource allocation according to changes in needs. For example, after 2 months of rehabilitation care, the functional status of a community elderly has improved significantly. Through analyzing the elderly's rehabilitation data, the big data platform will automatically change the service plan from "three rehabilitation training sessions per week" to "one rehabilitation guidance session per week", and allocate these idle

rehabilitation resources to other elderly in need.

4. Conclusion

In summary, big data technology has significant application value in the optimal allocation of community elderly care service resources. It not only improves the efficiency of resource allocation and effectively alleviates supply-demand contradictions but also greatly enhances service accuracy and meets the personalized needs of the elderly. At the same time, the introduction of big data technology has also promoted the development of management intelligence and further optimized service quality.

Disclosure statement

The author declares no conflict of interest.

References

[1] Wu B, Zheng J, 2024, Innovation and Practice of "Intelligence + Care" for Community Elderly Under the Guidance of Healthy China Based on the Triple Helix Theory. Proceedings of the 6th Shanghai International Nursing Conference, 2024(2): 182–184.

[2] Sha S, Li Y, Liu S, et al., 2024, Application Progress of Social Ecosystem Theory in Nursing Safety Management of Elderly in Nursing Institutions. Evidence-Based Nursing, 10(19): 3514–3517.

[3] Guo X, Zhu K, Huang X, et al., 2024, Latent Profile Analysis of Active Aging and Nursing Needs of Community Elderly. Chinese Journal of Nursing, 59(16): 2014–2020.

[4] Liu J, Cao Y, Chen M, et al., 2024, SWOT Analysis of Demand for Medical and Nursing Services for the Elderly in Communities of Underdeveloped Cities. Health Vocational Education, 42(15): 135–139.

[5] Liu X, Zheng H, Zhang J, et al., 2024, Preference for Home-Based Medical and Nursing Services Among Disabled Elderly in Beijing Based on Discrete Choice Experiment. Chinese Nursing Research, 38(11): 1887–1894.

[6] Zhao Z, 2024, Moral Boundaries of Robot Intervention in Elderly Care. Medicine and Philosophy, 45(9): 30–34.

[7] Zhang M, Sun X, Hu M, et al., 2023, Nursing Service Needs and Influencing Factors of Elderly in County-Level Integrated Medical and Nursing Institutions. China Rural Health, 15(10): 12–15 + 19.

[8] Liu L, Zhang S, Hu X, 2023, Investigation on Nursing Needs and Services of the Elderly in Sichuan Province. Chinese Journal of Nursing, 58(19): 2339–2344.

[9] Li Y, 2023, Development of an Evaluation Tool for Matching Supply and Demand of Community Nursing Services for the Elderly Under the Background of Integration of Medical and Nursing Care, thesis, Shihezi University.

[10] Yang S, 2023, Causes of Differences in Supply Level of Community Long-Term Care Services in Wuhan, thesis, Central China Normal University.

[11] Hu H, 2022, Construction and Application of a Grading Standard for Long-Term Care Needs Assessment of Community-Dwelling Elderly, thesis, Central South University.

[12] Dai L, Duan Y, Zhang M, et al., 2021, Structural Analysis of Demand for Home-Based Nursing Services Among Community Elderly. Chinese General Practice, 24(25): 3238–3243.

[13] Xi R, Tao Y, Zhang H, et al., 2021, Application of Intelligent Medicine Boxes in Community Elderly Care. Technology Wind, 2021(3): 15–16.

[14] Shao P, Zheng D, 2020, Illness Status and Nursing Needs of Elderly in Urban Communities. Journal of Traditional Chinese Medicine Management, 28(21): 194–197.

[15] Zhao M, Wang Y, Jiang Y, 2020, Demand for Home-Based Nursing Services Among Community Elderly Under the Background of Integration of Medical and Nursing Care. Journal of Nursing Administration, 20(8): 540–543 + 549.