Research on Countermeasures for the Precision Construction of Integrated Smart Medical and Elderly Care Services in Dalian City

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Abstract: Accelerating population aging poses significant challenges to traditional elderly care models, which struggle to meet increasingly diverse and high-quality demands. Integrated smart medical and elderly care, a novel model utilizing modern information technology to amalgamate medical and elderly care resources, represents a critical pathway towards achieving precision in elderly care services. This study focuses on Dalian City, aiming to investigate the precision construction of its integrated smart medical and elderly care services. Through literature review, policy analysis, and case study, this paper systematically examines the policy evolution and developmental status of integrated smart elderly care in Dalian. It further delves into existing deficiencies in precision across three dimensions: demand identification, service coordination, and support systems. The research identifies root causes including data silos, lack of standardization, and talent shortages. Consequently, the paper proposes countermeasures from three perspectives: constructing an intelligent demand assessment system leveraging big data, creating an integrated service coordination platform, and refining precision-oriented policy and talent support mechanisms. These recommendations are designed to facilitate the transition and upgrading of Dalian's elderly care services from mere availability to quality, and from generalized to precise, thereby offering a reference for innovating elderly care service systems in comparable Chinese cities.

1. Introduction

Population aging constitutes a severe challenge for China's current social development. Dalian City, characterized by a higher degree of aging within the Northeast region, faces a large elderly population base, rapid growth rate, and concurrent trends of advanced aging and empty-nesting, creating an urgent demand for high-quality and efficient elderly care service systems. "Smart elderly care," leveraging information technologies such as the Internet of Things (IoT), big data, and artificial intelligence (AI), enables precise perception of elderly needs, accurate delivery of services, and optimal allocation of resources, representing an inevitable choice for addressing the

limitations of traditional care models. The Dalian municipal government attaches great importance to smart elderly care construction, prioritizing it as a key people's wellbeing project [1-2]. Therefore, systematically researching the current status, problems, and countermeasures regarding the precision construction of integrated smart medical and elderly care services in Dalian holds not only theoretical significance for enriching smart elderly care theory but also substantial practical significance for enhancing the sense of fulfillment, happiness, and security among Dalian's elderly population, and for providing replicable and scalable "Dalian experience" nationwide.

2. Current Status of Precision Construction of Integrated Smart Medical and Elderly Care Services in Dalian

2.1 Policy Evolution

In recent years, the issue of integrated medical and elderly care has received increasing attention at the national level, with numerous policies related to healthcare, rehabilitation, and nursing being introduced. Examples include the "Healthy China 2030" Plan Outline issued in 2016, the Healthy China Initiative (2019–2030) released in 2019, and the Guiding Opinions on Further Promoting the Development of Integrated Medical and Elderly Care Services published in 2022 [3-5]. The issuance of these policy documents carries significant implications for guiding the development of integrated medical and elderly care in Dalian.

The policy development of integrated smart medical and elderly care in Dalian has undergone a deepening process from conceptual introduction to practical exploration. Initial policies were predominantly macro-guidance oriented, such as the "Implementation Opinions on Promoting the Integration of Medical and Health Services with Elderly Care," which preliminarily defined the development direction for integration [5]. As technology advanced and demands became more apparent, policies from the "13th Five-Year Plan" to the "14th Five-Year Plan" period began to show greater specificity, emphasizing the incorporation of "smart" elements. For instance, the "Dalian City Action Plan for the Development of the Smart Health and Elderly Care Industry"explicitly proposed the construction of smart health and elderly care demonstration communities and the promotion of related products and services [6]. The "Dalian City '14th Five-Year Plan' for the Construction of the Elderly Care Service System" further identified "developing smart elderly care" as a key task, aiming to create an "Internet + elderly care" service model, promote the construction of smart elderly care platforms, and support the application of smart devices in homes, communities, and institutions [7]. This evolution of policies outlines Dalian's strategic upgrade from encouraging medical-elderly care integration to vigorously promoting "smart integration" with precision, providing a solid institutional guarantee for precision construction.

2.2 Development Status

Guided by current policies, the precision construction of integrated smart medical and elderly care services in Dalian has achieved preliminary results. Firstly, regarding platform construction, some districts and counties have initially established regional smart elderly care service platforms, integrating some offline service provider resources to offer basic services such as online appointments, health consultations, and emergency calls for the elderly. Secondly, in terms of service carriers, leading elderly care institutions and community day care centers have introduced equipment like smart mattresses, one-button call systems, and smart wristbands, enabling remote monitoring of vital signs and safety monitoring for residents. Thirdly, regarding model exploration, various attempts such as "government-led, enterprise-operated" and "community platform, multi-

party participation" have emerged, attempting to link medical institutions, elderly care facilities, communities, and families through technological means. However, overall, the current construction remains primarily at the initial stage of "intelligent" replacement of "mechanization." Most applications focus on safety monitoring and convenience services, leaving significant room for improvement in the core aspects of precision—deep mining of demand, personalized service customization, and cross-departmental resource coordination.

3. Problems in the Precision Construction of Integrated Smart Medical and Elderly Care Services in Dalian

3.1 Insufficient Precision in Demand Identification

A significant discrepancy exists between current service provision and the actual, dynamic needs of the elderly, revealing weak capacity for precise identification. Firstly, methods for demand collection are singular, often relying on traditional questionnaires or simple registrations, lacking the capability for continuous, dynamic, and unobtrusive analysis of elderly behavior patterns, health changes, and service preferences using big data technologies. Secondly, data is characterized by "fragmentation" and "isolation." Data on the elderly held by departments such as Civil Affairs, Health, Medical Insurance, and Public Security have different standards and heterogeneous systems, failing to integrate effectively, thus preventing the formation of a comprehensive "precision profile" of the elderly. Consequently, services pushed by platforms tend to be "generalized" packages, struggling to meet the differentiated and personalized needs of various elderly groups (e.g., disabled, semi-disabled, chronic disease management, cognitive impairment). The "first mile" of precise service delivery is thus hindered.

3.2 Weak Precision in Service Coordination

The core of integrated smart medical and elderly care lies in "integration," meaning the seamless connection and efficient coordination between medical and elderly care resources. However, the precision in this aspect is currently severely inadequate. On one hand, online platforms are often decoupled from offline services. A platform might receive an order for medical nursing care but cannot quickly and accurately match it with qualified medical personnel or institutions having available capacity, leading to delayed responses and service gaps. On the other hand, coordination barriers between different systems are stringent. Health monitoring data from elderly care institutions struggles to sync directly with Hospital Information Systems (HIS); community family doctors cannot promptly access health records of seniors from care facilities; the medical insurance payment system and the smart elderly care service platform are not interconnected [8]. This results in inefficient transitions between "medical" and "care," creating breakpoints in the service chain. This coordination failure reduces smart platforms to mere "information display boards" rather than functioning as genuine "resource dispatch hubs."

3.3 Lack of Precision in the Support System

The sustainable operation of precise services requires a precision-oriented) support system, an area where Dalian still has shortcomings. In policy support, existing policies are mostly macro-level guidance, lacking detailed, operable implementation rules and regulations for key links such as data sharing, standardization, privacy protection, service pricing, and online medical insurance payments. This creates significant concerns for participating entities, especially enterprises, deterring investment. Regarding funding support, government subsidies for smart elderly care projects often

focus on initial hardware procurement and platform construction, with insufficient sustained support for post-implementation operation, maintenance, data analysis, and content services. This leads to many projects "emphasizing construction over operation," hindering their ability to provide precise services continuously. In terms of talent support, there is an acute shortage of interdisciplinary talent proficient in both elderly care operations and information technology. Concurrently, the frontline nursing staff generally possess low digital literacy, unable to effectively operate smart devices or utilize data to improve services, becoming a talent bottleneck restricting the implementation of precision.

4. Suggestions and Countermeasures

4.1 Construct an Intelligent, Big Data-Based System for Precise Demand Assessment and Identification

Addressing the challenge of inaccurate demand identification hinges on breaking down data barriers and systematically creating a "precision profile" of older adults. First, a unified city-wide big data center for smart elderly care should be established [9]. Under strict compliance with the Personal Information Protection Law and the Data Security Law, unified data collection standards and cross-departmental technical interface specifications must be formulated. An administrative coordination mechanism should be mandated to promote system-level interconnection and semantic-level interoperability of data from civil affairs, health, medical insurance, human resources, and social security departments, forming a comprehensively covered and dynamically updated foundational database of the elderly population. Second, there should be a strong push for the adoption of low-cost, high-reliability smart terminal devices. IoT devices such as smart bracelets, remote monitors, and home sensors should be deployed on a large scale among specific groups such as advanced-age and live-alone seniors to enable real-time, unobtrusive collection of physiological data, daily behavior patterns, and abnormal events. This shifts the mode from traditional manual inquiry to automated, continuous data collection. Finally, artificial intelligence algorithms such as machine learning and deep learning should be introduced to build multimodal predictive models for elderly needs. These models will conduct integrated analysis and in-depth mining of converged multi-source heterogeneous data to accurately identify individual health risks, service preferences, and potential demands. This facilitates a transition from "people seeking services" to "services finding people," promoting personalization, proactivity, and precision in the supply of elderly care services.

4.2 Building an Integrated Online-to-Offline Service Coordination and Delivery Platform

Enhancing the precision of service coordination requires constructing a "smart brain" that integrates resource allocation, service matching, and quality control. It is recommended to comprehensively upgrade the existing municipal-level smart elderly care service platform, transforming it from an information portal into an integrated operational platform that combines service integration, resource dispatch, process management, and performance evaluation. This platform should possess closed-loop management capabilities including intelligent identification of service demands, precise matching of resources, whole-process online supervision, multi-dimensional service quality evaluation, and online payment (including exploring medical insurance card-free payment and long-term care insurance settlement) [10]. At the online level, relying on smart recommendation algorithms, optimal service resources should be assigned to elderly demand orders based on multi-dimensional indicators such as geographical location, service capacity, and user ratings. At the offline level, a standardized, multi-professional, and grid-based service team

should be established to ensure efficient response and high-quality execution of service orders. Furthermore, emphasis should be placed on deeply integrating the platform with regional Healthcare Information Systems (HIS), community public health record systems, and medical insurance settlement systems. This will break down technical and administrative barriers between heterogeneous systems, achieve two-way interaction of health information, and enable seamless connectivity in medical-care service processes, laying the foundation for continuity in "integrated medical and elderly care" services.

4.3 Improving the Precision-Targeted Policy Support, Funding Guidance, and Talent Development System

To ensure the sustainable operation of the precision service model, it is essential to systematically optimize the institutional and resource support systems. At the policy level, implementation rules such as the Dalian Municipal Measures for the Management of Data in Integrated Smart Medical and Elderly Care and the Smart Medical-Care Service Quality Management Specifications should be introduced. These should clarify ownership relationships, usage boundaries, and privacy protection requirements for public and social data, while also refining medical insurance payment policies, government procurement service catalogs, and performance evaluation mechanisms for smart elderly care services. At the funding level, innovative financial support methods should be adopted to shift the focus from "emphasizing equipment investment" to "emphasizing operational services." A smart elderly care industry guidance fund should be established to incentivize private capital participation in the development of precision solutions and service provision through mechanisms such as "unveiling top-ranked projects" and public-private partnership (PPP) models for service outsourcing. Moderate subsidies should also be provided to eligible elderly users of smart elderly care services. At the talent level, cooperation with local universities and vocational institutions should be promoted to establish interdisciplinary programs in "smart health and elderly care," aimed at cultivating interdisciplinary talent with knowledge in medicine, elderly care, information technology, and management. Simultaneously, large-scale, tiered digital skills training should be conducted for existing service personnel, and information technology application capabilities should be incorporated into the vocational skill certification system, thereby holistically enhancing the team's digital literacy and service capability.

5. Conclusion

Findings: This study focused on the practical issue of precision construction of integrated smart medical and elderly care services in Dalian City, employing methods such as literature review, policy analysis, and systematic sorting for investigation. The research concludes that although Dalian has made preliminary progress in policy support and practical exploration, significant deficiencies in precision persist across three key areas: demand identification, service coordination, and the support system. The root causes are identified as data silos, lack of coordination mechanisms, and insufficient systemic support. Addressing these issues, the paper proposes a systematic approach focusing on three levels: constructing a big data-driven demand identification system, creating an integrated service coordination platform, and refining precision-oriented policy and talent support mechanisms. These measures aim to propel the development of Dalian's integrated smart medical and elderly care services towards higher levels of precision and personalization.

Prospects: This research primarily relied on qualitative analysis of macro policy texts and publicly available materials, lacking large-scale empirical survey data on the needs of Dalian's

elderly population and quantitative evaluations of the operational effectiveness of various smart elderly care platforms. This limitation may affect the targetedness and granularity of the proposed countermeasures. Future research could utilize methods such as large-sample questionnaires, in-depth interviews, and comparative case analysis to gather primary data, conduct more scientific classification and grading of elderly needs, and perform quantitative analysis on the cost-effectiveness of different precision service models. This would enable the proposal of more operational and quantifiable implementation pathways, providing a more solid theoretical foundation for the high-quality development of the smart elderly care sector in Dalian and nationwide.

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