

Research on the Collaborative Governance System for Health Data under the “Healthy China 2030” Strategy: Postprint

Authors: It is well known, Hu Changping

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Abstract

[Purpose/Significance] Improving citizens' health levels is an inevitable requirement following socioeconomic development to a certain stage; the construction of a collaborative health data governance system helps achieve this requirement from an information science perspective; the governance system needs to take national strategy as macro-level guidance and comprehensively serve the overall goal of improving citizens' health levels. [Method/Process] By comprehending the spirit of the “Healthy China 2030” Planning Outline text, and based on analyzing the health information governance needs of various governance stakeholders, this paper proposes a collaborative health data governance system oriented toward the “Healthy China 2030” strategy, and puts forward safeguard measures for key links. [Results/Conclusion] Coordinating the construction and safeguarding of health data governance systems across all levels, departments, and stakeholders helps realize the social value of health data while advancing national health strategic objectives, thereby expanding the research scope of health informatics.

Full Text

Abstract

[**Purpose/significance**] Improving citizens' health levels is an inevitable requirement as economic and social development reaches a certain stage. The construction of a health data collaborative governance system helps achieve this goal from the perspective of information science. [**Method/process**] Based on an understanding of the spirit of the “Healthy China 2030” Planning Outline and an analysis of the health information governance needs of various governance entities, this paper proposes a health data collaborative governance system oriented toward the “Healthy China 2030” strategy, and puts forward safeguard

measures for key links. **[Result/conclusion]** Coordinating the construction and guarantee of health data governance systems across all levels, departments, and stakeholders not only helps promote national health strategic objectives but also realizes the social value of health data, thereby expanding the research scope of health informatics.

Keywords: Healthy China 2030; collaborative governance; health data

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1 Data Governance Issues Under the “Healthy China 2030” Strategy

The “Healthy China 2030” Planning Outline, issued by the Central Committee of the Communist Party of China and the State Council on October 25, 2016, aims to achieve the great goals of national longevity and rejuvenation by improving the physical and mental health of all citizens [1]. The strategic significance of “Healthy China 2030” lies in meeting citizens’ demands for comprehensive physical and mental health development, thereby laying a solid foundation for economic and social progress—an essential component of building a strong economic and cultural nation. In the first half of 2020, the COVID-19 pandemic emerged as a global threat, severely endangering lives and property worldwide. In the early stages of the outbreak, although governments took response measures, the virus’s rapid transmission and strong infectivity still caused numerous infections. Among these cases, many self-healing individuals shared characteristics such as strong immunity and fewer underlying diseases. This demonstrates that the orderly advancement of the “Healthy China 2030” strategy not only fulfills its fundamental significance and value but also creates a buffer zone for public health emergencies, buying a window of opportunity to control the spread of incidents. Therefore, as epidemic control work proceeds steadily and social life recovers in an orderly fashion, the continuous deepening of the “Healthy China 2030” strategy—and even the extension of its successful experiences worldwide to realize the great vision of a community with a shared future for mankind—represents an imperative task and historical mission for our government in the future.

To accomplish this practical goal, the design of its governance system and the improvement of safeguard measures are essential. Among these, important theoretical research and practical work involves health data governance. From a value realization perspective, the purpose of data governance is to coordinate data relationships and leverage data’s role throughout its lifecycle to enhance organizational efficiency and unlock data value. By extension, health data governance involves managing various types of health data within the system, coordinating data governance elements, and 挖掘健康数据的潜在价值. However, current data governance research focuses on universal framework design and methodological analysis, lacking domain-specific governance solutions and method construction. Particularly in the field of health informatics, there is no governance

framework that analyzes, integrates, and coordinates health data governance elements against a national background and strategic needs.

This paper takes the goals and tasks of the “Healthy China 2030” Planning Outline as its starting point. Based on a comprehensive review of health informatics and data governance research, it analyzes the needs and motivations in health big data governance work. Combining the content and formal characteristics of health big data, it demonstrates the applicability and necessity of collaborative governance theory, and proposes a collaborative governance system oriented toward the “Healthy China 2030” strategy along with closely integrated safeguard measures, aiming to provide a theoretical framework and practical reference for solving related problems.

2 Related Concepts and Connotations of Health Data Governance

A systematic review and analysis of health big data governance research is a necessary step in constructing a collaborative governance system oriented toward the “Healthy China 2030” strategy. The conceptual analysis and connotation discussion of health data governance as a practical problem are carried out from two perspectives: health informatics and data governance.

2.1 Health Informatics

Health informatics is an emerging interdisciplinary field that studies how to use information technology to meet users’ health needs, solve related health problems, and support medical decision-making [2]. With the development of social informatization, the research scope of health informatics continues to expand. Research objects are no longer limited to specific studies starting from electronic medical records and behavioral data but have incorporated more background and contextual information to examine themes such as health information policy analysis, health literacy improvement, and health information education expansion [3].

From a research perspective, macro-level health informatics studies include health policy text content analysis and evolution research on health informatics, aiming to reveal topic characteristics and analyze policy orientation to provide decision-making support for future disciplinary development and policy formulation. For instance, Zhang et al. conducted content analysis on the “Healthy China 2030” policy text through open coding and keyword co-occurrence, identifying the core discourse system and distribution characteristics of keywords [4]. Zhou et al. analyzed the relationship between health literacy and health information communication from a national strategic perspective and proposed targeted suggestions for improving health literacy in China after comparing it with the U.S. health literacy action plan [5]. Xiao et al. analyzed the overall objectives of the national health strategy and, combined with the development requirements of health and medical undertakings, proposed the basis for set-

ting health evaluation indicators, their connotations, and calculation methods to provide evidence for health policy formulation [6]. These macro-level studies are mostly positioned at the national strategic level, examining issues from the perspectives of top-level layout, design, and long-term development.

Meso-level health informatics research includes health information evaluation studies and the positioning and development of health undertakings. Strictly speaking, the boundary between meso-level and micro-level research in health informatics is relatively blurred. Tan explored the contribution of public libraries to influencing social determinants of health from the perspective of health social determinants theory, providing references for public health policy formulation [7]. Yue et al. studied the knowledge network structure in the medical and health information field, visualizing the expansion and convergence models of scientific communities in stages and identifying research themes at different disciplinary development phases [8]. Wang et al. analyzed the stickiness of knowledge transfer in online health communities from a privacy computing perspective and proposed corresponding solutions [9]. Compared with macro-level holistic research, meso-level and micro-level studies focus more on specific scenarios and practical guidance, examining issues from the perspectives of disciplinary development, institutional responsibilities, and positioning.

Micro-level health informatics research includes user behavior studies in health communities and user health information services. Micro-level research in health informatics is based on users' health data, oriented toward user needs, and aims to improve user experience. It has always been an important research content and direction in health informatics. Song et al. proposed the concept of digital natives, analyzing how users growing up in digital environments change their health information credibility judgments with different information sources, providing references for personal knowledge management [10]. Zhai et al. analyzed users' cognitive patterns and behavioral characteristics based on their posted content in health communities, and then constructed a faceted retrieval system oriented toward user health needs [11]. Jin et al. analyzed influencing factors of users' health information seeking behavior based on the triadic reciprocal model in social cognitive theory, providing guidance for practical work [12]. As users' health needs become more refined, behavioral research increasingly focuses on specific scenarios.

The management, utilization, and mining of health data are important foundations and starting points for health informatics research. However, current health informatics research—across all three levels—does not consider the governance and cross-departmental coordination of health data itself, nor does it coordinate research from different levels and entry points. There remains room for improvement in enhancing health data utilization efficiency and 挖掘数据的经济价值与社会价值方法.

2.2 Data Governance

The concept of “data governance” originated in the corporate sector, stemming from IBM’s IT governance activities [13], which embedded management authority into hierarchical organizational structures to achieve corporate goals such as performance improvement and financial enhancement. Subsequently, data governance evolved into a separate management domain as an important subset of IT governance, centrally managing enterprise data to achieve economic value while reducing compliance risks.

Due to the significant impact of data governance activities and the continuous development of e-government, the popularization and deepening of informatized office work, and the increasing demand for data openness, governments began experimenting with data governance. The main governance content includes both macro-level aspects such as management organizational structures and the establishment of data management regulations and systems [14], and micro-level aspects such as data warehouse construction and document content management [15]. These activities have important practical significance and theoretical research value for improving citizens’ lives, enhancing government capabilities, and deepening social informatization. Therefore, academic research on data governance has continuously deepened alongside practical work.

In terms of concept and problem definition, some researchers have analyzed the background, content, and structural characteristics of government data governance, pointing out the difficulties and challenges of government data governance in combination with environmental and era contexts [16]. This clarifies specific problems and constraints and forms an important foundation for optimizing existing structures and promoting institutional changes. Zhang et al., based on an analysis of the shortcomings and defects in the top-level design of China’s government information resources, pointed out that government information resource governance should aim to improve governance capabilities, focusing on promoting optimized collaborative models and constructing management systems [17]. Framework and model research 致力于针对具有共性的问题, 提出普适、泛化的指导框架构建方案.

On the other hand, data governance activities in specific environments are important research themes in this field. Activities address data sharing problems. Zhang proposed a governance model for scientific data sharing, conducted scenario analysis, and presented sharing models such as resource pools, data publishing, and data trading [18]. In response to problems such as imperfect structures, weak technical support, and ambiguous definition of rights and responsibilities in government data governance [19], Zuo et al. proposed a cross-departmental government data governance framework based on the seven elements of the DAMA framework environment [20][21], achieving cross-departmental data sharing and utilization by clarifying entities and establishing norms and standards. An et al. approached from a methodological perspective, proposing a big data governance system structure

combining the Deming Cycle and clarifying the elements of the methodology for constructing big data governance systems [22]. These studies have made important contributions to enriching data governance theory and providing references for practice.

Combining conclusions from both conceptual and framework research, and considering data governance entities and objectives, this paper organizes data governance tasks across different dimensions as shown in Table 1 :

Table 1 Data Governance Objectives Under Different Entities

Entity	Primary Governance Objectives and Tasks
Government	Led by government agencies and collaborating with other multiple entities, focusing on goals such as enhancing government credibility and improving administrative efficiency, using policies and laws as primary means and technology and management as supplementary means, to govern government data resources
Enterprise	Primarily aiming to achieve economic value from data, using a combination of technical and management means to manage and control data availability, relevance, usability, integrity, and security throughout its entire lifecycle
Research Institution	Through preservation, sequential organization, knowledge mining, and content correlation of primary or secondary research data, as well as developing sharing norms, to achieve goals such as discovering and predicting new disciplinary growth points, author collaboration patterns, research topic evolution patterns, and reducing knowledge circulation costs

From the perspective of responsible parties, data governance can be divided into enterprise data governance, university data governance, and government data governance. From the depth of governance activities, it can be divided into macro-level, meso-level, and micro-level data governance. Diverse research from different angles has enriched the field and made significant progress, providing references for the formulation of specific governance activity systems. However, current research findings cannot be applied to the construction of health data governance frameworks, particularly system research under the “Healthy China 2030” strategic background, making it difficult to effectively release the economic and social value embedded in health data. Therefore, based on a review of relevant research, this paper analyzes the needs of health data governance and proposes a health data governance system based on collaborative thinking.

3 Data Governance Needs in the “Healthy China 2030” Strategy

Health data governance has three main needs:

(1) Macro-level objective: Improving citizens' health levels and developing the health industry. Top-level designers represented by the Central Committee of the Communist Party of China, the State Council, and special leading groups are the theoretical subjects of health data governance. Their specific governance needs must be understood in conjunction with the strategic planning objectives of “Healthy China 2030”—that is, what substantive contributions data governance activities can make to advancing these goals. Macro-level objectives include two closely coupled aspects: improving citizens' health levels to meet the challenges of an aging society, and actively developing the health industry to achieve social and economic value from health information. These two aspects are causally linked and closely interconnected. The 挖掘、利用与治理 of health data is an important foundation and guarantee for completing macro-level objectives in an informatized social environment, 贯穿治理活动的流程与层次, thus requiring full consideration of the decision-making value of health data to complete the foundational work and design of the architecture.

(2) Meso-level orientation: Improving health data management levels in line with local realities. The middle level, composed primarily of local governments at all levels, medical institutions, and third-party data service providers, constitutes the practical subject of health governance. Through management, administrative, or technical means, these entities conduct governance and safeguard activities that can be regarded as subsets and specific descriptions of macro-level design requirements. As the backbone of governance activities, the meso-level needs to transform top-level guidelines and strategic spirit, combine them with local governance realities, fully consider existing governance achievements and problems, and enhance citizen satisfaction from a practical and operational perspective. Simultaneously, it should actively formulate health policies and standards using decision-making information provided by health data to deliver quality information services to upstream and downstream management chains.

(3) Grassroots service: Optimizing user experience while integrating information resources and services. The objects of data governance focus on the micro-level—data generated by individual users or groups exhibiting health behaviors, including but not limited to electronic medical records, physical and mental health profiles, behavioral trajectories during epidemic periods, genetic and underlying disease histories, and interaction data in medical and health communities. As citizens whose data is being governed, their needs are more specific than other governance levels, manifested in both information needs and service needs. In the context of the times, information needs include, for example, designated nucleic acid testing units during the pandemic and COVID-19 medical insurance reimbursement policies. Governance needs at this level focus on providing high-quality information with high timeliness and reliable content, forming a closed-loop information flow structure, as well as long-term preservation based on cloud computing and distributed management, and data mining based on big data technology to provide integrated health information services.

4 Construction of a Health Data Collaborative Governance System Under the “Healthy China 2030” Strategy

Through collaborative governance of health data, this system aims to achieve the organic unification of national, institutional, and citizen objectives under the “Healthy China 2030” agenda, promoting the conflict-free realization of collective and individual interests. Due to the diversification of governance entities and the complexity of objects, overlapping relationships exist among the needs of different entities, while object needs are dynamic and time-sensitive, changing with targets and environments. Therefore, collaborative thinking is needed to integrate various elements into a flexible, compatible, and ubiquitous governance framework. Previous data governance system construction research has shown significant independence and hierarchy due to large differences in objectives and perspectives across macro, meso, and micro levels, lacking a system that integrates processing, governance elements, and perspective levels. Thus, a governance system that coordinates different levels needs to be constructed.

Governance framework construction can generally proceed from two angles: a top-down, macro-level objective-oriented systematic approach, or a bottom-up, task-oriented agile approach. Considering the top-level guiding significance of the “Healthy China 2030” Planning Outline and the needs of multi-dimensional governance entities, this paper adopts a top-down construction approach—that is, from national goals guiding local practice, and from local work guiding service institutions’ design of data content and service interfaces. This process requires reflecting control flow through information flow to maintain collaborative and integrated work within and between levels. Considering the close horizontal and vertical cooperation in health data governance and their strong coupling relationships, this paper proposes a collaborative governance system oriented toward “Healthy China 2030,” with its structure shown in Figure 1 [Figure 1: see original paper].

From a functional structure perspective, the collaborative governance system consists of top-level macro-frameworks, middle-level meso-controls, and grassroots micro-data sources. Top-level designers issue guidelines such as planning outlines and coordinate national-level relevant departments to conduct macro-management covering health big data, medical information, and citizens’ quality of life through major policies. The middle control layer comprises local governments at all levels, public hospitals, and third-party health service-related institutions engaged in control management practices. This layer has a complex structure and high coupling degree, requiring both technical and management means to complete governance work. The grassroots micro-data layer contains massive user behavior data, reflecting important information such as users’ segmented needs, behavior patterns, and cognitive schemas. In terms of control flow and data flow direction, policy and regulatory management measures generate governance guidance that flows from the top level to lower levels, serving as guidance, reference, or basis for activities at lower levels. Health baseline data and governance object demand feedback, in structured or semi-structured forms,

flow from lower power-potential levels to higher levels, providing the basis for high-level construction of governance platforms and formulation of governance policies, forming governance guidance programs oriented toward or even predictive of group needs and cognition. The governance system is now explained in detail for each level.

4.1 Top-level Planning of Health Data Governance

The top-level governance system operates around the strategic spirit of the “Healthy China 2030” Planning Outline, thoroughly implementing the requirements of the Central Committee of the Communist Party of China and the State Council on promoting citizens’ all-round development. Specific departments involved at the top level include but are not limited to the National Health Commission, the National Medical Products Administration, and the National Healthcare Security Administration. These numerous departments oversee certain aspects or several aspects of citizens’ health information, with certain correlations in their management domains, requiring unified coordination groups to coordinate information sharing, communication, and rights and responsibilities allocation under the guidance of planning outline principles. Technically, a collaborative governance information platform should be built to plan and define governance elements, subjects, objects, and environments. This part’s guiding opinions and objectives primarily form top-down information flow in the form of policy documents, evaluation objectives, meeting spirits, and other primary and secondary information. Specifically, three practical tasks need to be undertaken:

First, defining health data governance objectives and needs. Top-level planners need to define health data governance objectives and needs, including governance scope, expected outcomes, and normative measures, correctly distinguishing between usable data and data requiring privacy protection. Combining the national health level objectives in the “Healthy China 2030” Planning Outline, governance needs should be quantitatively expressed to maximize the decision-support value of health data.

Second, establishing health data governance effectiveness evaluation indicators. Evaluating health data governance effectiveness is the foundation for dynamic adjustment of the governance system. Governance effectiveness needs to comprehensively consider multiple factors; traditional input-output ratios no longer simply apply to complex informatized environments. Effectiveness indicators should include the scale of health databases, completeness of health information content, integration degree of unstructured health data, knowledge mining effectiveness in health information, and the promotion level of health information governance to citizens’ health improvement. Simultaneously, relationships between indicators should be clarified and weights for each indicator should be established based on feedback information.

Third, proposing health data governance results acceptance methods. Health

data governance effectiveness acceptance must closely integrate with the citizen health level requirement standards in the strategic plan. Acceptance work forms a feedback structure with the previous step of governance effectiveness evaluation. Through combined quantitative and qualitative acceptance, and comparison with past citizen health levels and health data governance situations, the governance effectiveness evaluation system can be corrected to better align with governance needs and the strategic spirit of Healthy China.

For the application and implementation of top-level planning, it is necessary to comprehensively consider the strategic objectives and functional positioning of multiple departments. The coordination group should formulate targeted evaluation indicators based on the core spirit of the “Healthy China 2030” strategy, such as urban green coverage area, changes in smoker numbers, and universal medical treatment duration. These evaluation constraints unify governance subjects, objects, and elements in the real environment.

4.2 Middle-level Collaboration in Health Data Governance

The meso-level of the governance system is responsible for transforming top-level strategic input into practical output. Through multi-departmental, cross-institutional, and cross-regional collaboration, and in combination with local data governance needs, targeted governance programs are formulated. Data flow at this level is relatively complex, as it connects the top and grassroots levels while considering the complex information needs of internal multiple entities. It provides support for management decision-making while reducing blockages in internal data circulation. From the perspective of governance subject collaboration, middle-level data governance subjects include government agencies, public hospitals, and third-party service institutions, each with specific work contents:

(1) Local government agencies’ health data collaborative governance programs and practices. Health data collaborative governance requires coordination and jurisdiction from authoritative institutions. Improving citizens’ health levels and health literacy as strategic spirit is also the main work of local government agencies at all levels. Three governance tasks need to be accomplished: first, formulate health data collaborative governance programs that comply with local actual conditions, using these as standards to determine local user privacy protection standards; second, formulate reasonable health policies by combining the two aspects and release them as practical references for other institutions; third, local governments should use top-level governance structure demands as practical guidance for this level, transforming macro concepts and guidance into specific needs for policy release. Public hospitals, based on their long-term preservation of electronic medical record data, can discover, monitor, and track high-risk populations, providing decision-making basis for government health data governance program formulation, thus forming a feedback loop between government agencies and public hospitals. Through cooperation between government agencies and third-party services, data utilization capabilities are

strengthened, remedying the problem of slow emergency response caused by institutional lag behind practice, forming an inter-institutional feedback loop that reflects the lifecycle of health data.

(2) Long-term preservation and graded sharing of data in public hospitals. Medical data, as an important component of health data, plays a crucial role in health policy formulation and citizen health status analysis, making it the most important object in health data governance work. As the distribution scenario for citizens' medical information, local public hospitals should adhere to the principle of moderate openness according to government policies, implementing graded sharing of users' health data. On the other hand, through technical means, they should achieve long-term preservation of medical and health data, reflecting citizens' health conditions and periodic characteristics in stages, while identifying and monitoring high-risk populations with potential health problems in combination with the social environment.

(3) Health information organization and knowledge mining by third-party institutions. Social collaboration in health data governance requires close cooperation from third-party service institutions. Online health community platforms such as Thumb Doctor and Ali Health have strong technical backgrounds and means, providing professional services including health Q&A, health information organization, and recommendation, 致力于挖掘健康数据的经济价值。In the health data governance framework, third-party service institutions need to selectively acquire and organize health data in accordance with government health governance requirements while ensuring user privacy. Using machine learning and data mining, they should conduct knowledge mining on user behavior data and health information to improve personalized service levels, feeding the knowledge mining results back to government decision-makers as references for governance policy formulation.

For the practical implementation of middle-level collaboration, it is necessary to ensure control of data flow. Data flow serves as both the control flow of governance subjects centered on government agencies and the source for third-party data service institutions to conduct knowledge mining and user demand discovery, as well as the basis for public hospitals' medical record profiling. Work at this level should focus on achieving unified data storage and exchange protocols.

4.3 Grassroots Services in Health Data Governance

The grassroots component of the collaborative governance system consists of users who, through self-governance and information integration service interfaces, provide health information services to users while collecting their health records and behavior records. This provides a data foundation for complex collaborative governance at the middle level and achieves grassroots-middle-level governance collaboration. This level mainly includes two aspects of work:

(1) Citizen health data fusion. When seeking medical treatment and im-

proving their health, users leave behind large amounts of behavioral records and health information. This information includes both online-generated information in internet environments, such as interaction content and behavior records in health communities, electronic registration, and electronic medical records, and offline-generated data stored digitally, such as physical outpatient consultations and travel trajectories. User-generated health data is diverse in type and complex in correlation. Data fusion governance functions need to be provided at service and collection interfaces to establish complete storage formats, metadata standards, and noise and redundant data processing, providing a data foundation for upper-level governance structures.

(2) Citizen health information service fusion. The grassroots level of health data collaborative governance is also where the service fusion layer is deployed. While collecting information, it provides one-stop or partial one-stop information services to users, mainly including online consultations, health community interactions, faceted retrieval of health information, and personalized health information recommendations based on needs. Information collection and service are the starting point and endpoint of information governance. Grassroots governance work needs to start from data fusion, provide diversified services for different users and demand levels based on middle-level governance achievements, and present them through an integrated platform to enhance service levels and governance standards.

The implementation of grassroots design also centers on the management and control of data flow. On one hand, in terms of citizen health information fusion, it standardizes and unifies multi-source, multi-content, and complex correlated user information for content-based data fusion, providing usable data foundations for middle-level knowledge mining. On the other hand, in horizontal data flow, besides general health services in the planning outline, it strengthens health information and data services to meet basic information needs while improving citizens' health information literacy.

5 Safeguard Measures for the Health Data Collaborative Governance System Under the “Healthy China 2030” Strategy

The essence of data governance system guarantee is an activity that achieves top-level framework objectives through policy norms, value orientation, and technical implementation, considering how to maximize the benefits of guarantee activities while minimizing costs [23][24]. First, in health data governance activities, top-level evaluation formulation and adjustment have far-reaching impacts on the activity direction and value orientation at the grassroots level beyond their original intentions. Therefore, the rationality and flexibility of evaluation objectives must be considered in governance system guarantees to achieve the connection between theoretical guidance and practical operation. Second, considering the important role of information flow in the control chain

and its ability to represent subject behavior, as well as the problem of theoretical guidance becoming disconnected from practical operation in large frameworks, guarantees must be considered from the perspective of information transmission [25]. Finally, in the information society, health information literacy is an important subset of user information literacy. The self-awareness and self-governance capabilities of grassroots users play crucial roles in improving governance guarantee effectiveness and controlling costs. Only by approaching from the three perspectives of “objective-information flow-user” can the health data collaborative governance system under the “Healthy China 2030” strategy be efficiently guaranteed.

5.1 Reducing Information Flow Viscosity Between Levels and Entities

Entities in the health data collaborative governance system have complex and diverse relationships. Except for the root node and bottom-level data, middle-level governance subjects and objects have large amounts of information flow and control flow input and output. Information may become distorted or ineffective after multiple transmissions due to channel noise, such as inconsistencies in metadata field content and expression between government data warehouses and public hospitals or third-party institutions regarding data preservation, or whether data collected by grassroots data acquisition interfaces meets effectiveness and timeliness requirements. Therefore, through information technology and management mechanisms, it is necessary to accelerate the transmission, invocation, and sharing speed of health information at the same level and between different entities at different levels, distinguish management standards and priorities for different types of health information, and reduce information viscosity at certain links or within certain entities to ensure health information timeliness. For vertically flowing data streams, timeliness and readability must be ensured to avoid viscosity and excessively long upload and download queues caused by governance system problems. Horizontally flowing data streams need to ensure consistency, standardization, and compatibility to realize their value for knowledge mining and decision-making basis across different departments and task scenarios, avoiding delays caused by unifying data sources and eliminating ambiguities.

5.2 Ensuring Diversified Governance Goals and Flexible Evaluation Systems

The governance goals in the “Healthy China 2030” strategy are complex and diverse, including citizen-oriented goals such as healthy aging and improved maternal and child health levels, as well as industry-level goals such as deepening health industry development and strengthening food and drug supervision. Therefore, in collaborative governance system design, the principles of diversification and flexibility must be upheld to reasonably quantify qualitative goals in the strategy, select appropriate evaluation indicators, and combine them with actual conditions at each governance level. The evaluation system should

have generalized adaptability to new problems and different manifestations of inherent problems, allowing governance goals to be completed in prioritized and phased manners without conflict. The starting point of governance must fully combine long-term governance and emergency response requirements, proceed from citizens' actual conditions, and be implemented to improve citizens' health levels.

5.3 Enhancing Citizens' Health Information Self-Governance Capability

As the grassroots level of the governance system, citizen health data is crucial to the stability of the entire governance structure and the effectiveness of governance results. From the perspective of governance activities, individual citizens can be regarded as both atomic units of the system and governance subjects whose governance objects are themselves. As a populous country with an aging trend, to prevent involution in governance activities, we must identify the next breakthrough for improving governance effectiveness beyond leading institutions: enhancing citizens' self-governance capabilities. This involves making good use of information service platform interfaces and publicity functions to accelerate the integration and simultaneous improvement of users' health literacy and information literacy, guiding self-governance habits and information awareness in network environments, strengthening citizens' management, preservation, and reporting of personal information, and promoting their cooperation with government, medical institutions, and third-party institutions to relieve pressure on middle-level governance entities.

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Note: Figure translations are in progress. See original paper for figures.

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