

Multiple Coupling Mechanisms for Advancing Sports-Medicine Integration: Practical Pathways for Health Promotion and Collaborative Governance in China

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ABSTRACT

Sports-medicine integration represents a critical pathway for the synergistic evolution of sports and healthcare systems under China's "Healthy China" strategy. Drawing upon coupling theory and pilot practices of sports-medicine integration across multiple regions in China, this paper analyzes the dynamic relationships between sports and healthcare systems from loose coupling to tight coupling and subsequently to hybrid coupling. Based on modularity thinking, it constructs multiple coupling mechanisms encompassing product modularity, process modularity, organizational modularity, and supporting systematization. Through case studies of typical practices in Tianjin, Shenzhen, Shanghai, Xiamen, Changzhou, and Suzhou, this paper reveals the critical pathways for translating the concept of sports-medicine integration into practical implementation, providing actionable methodological guidance for deepening sports-medicine integration while enriching the application of coupling theory in public health governance.

Keywords: Sports-medicine integration, Coupling theory, Collaborative governance, Exercise prescription, Modularity, Health promotion

1 Introduction

1.1 Background

Currently, the prevalence of chronic diseases among Chinese residents continues to rise, with health issues such as overweight/obesity, hypertension, and diabetes becoming increasingly prominent. The traditional medical model emphasizing treatment over prevention can no longer satisfy the multi-level, full-cycle health needs of the population. Against this backdrop, the *"Healthy China 2030" Planning Outline* issued by the Chinese government in 2016 explicitly called for strengthening sports-medicine integration and non-medical health interventions, and for promoting the development of disease management and health service models combining sports and medicine. Consequently, sports-medicine integration, as a pivotal lever for the transition from "passive medical care" to "proactive health," has become a focal point of attention in both academic and practitioner communities.

1.2 Research Questions

Sports-medicine integration is not a simple superposition of sports and healthcare systems; rather, it involves profound transformations in resource allocation, organizational structure, service processes, and institutional environments. However, for a considerable period, China's sports system and healthcare system have belonged to different administrative sequences, facing practical dilemmas including departmental barriers, fragmented resources, absent standards, and talent shortages. As a result, sports-medicine integration has often remained at the level of conceptual advocacy in practice, lacking replicable and sustainable operational pathways. How to construct a set of sports-medicine integration promotion mechanisms suited to China's national conditions, and how to achieve the evolution of the two systems from

"formal separation" to "substantive integration," constitute a major theoretical and practical problem urgently requiring resolution.

1.3 Research Approach

Coupling theory provides a powerful analytical tool for understanding the internal mechanisms of sports-medicine integration. This theory posits that two or more systems with similar properties, under human regulation, can interact to produce coupling effects, forming a new, higher-level structural-functional entity. This paper introduces coupling theory into sports-medicine integration research, combining innovative practices from multiple regions across China in recent years, and proposes multiple coupling mechanisms coordinating loose coupling and tight coupling, endeavoring to provide an operational framework for sports-medicine integration that possesses both theoretical depth and practical validity from the perspective of modularity.

2 Literature Review

2.1 Development and Application of Coupling Theory

The concept of coupling originated in physics, referring to the phenomenon whereby two or more systems or forms of motion influence each other through various interactions (Liu et al., 2005). Coupling is classified into four types according to degree of tightness: non-coupling, loose coupling, tight coupling, and complete coupling. Weick (1976) innovatively introduced the concept of "loose coupling" into organizational management, proposing loose coupling theory, which focuses on the state wherein elements within and between organizations maintain both connection and relative independence, providing an important perspective for understanding collaborative relationships among complex organizations. Ren et al. (1994) introduced the coupling concept into systems science, proposing systems coupling theory, which holds that two or more systems with similar properties, under artificial regulation, can combine into a new, higher-level structure-function entity, achieving system evolution. Subsequently, coupling theory has been widely applied in ecology, economics, management, and other fields.

In public administration, coupling theory has been employed to analyze collaborative governance mechanisms among different departments and different levels of government. Loose coupling is characterized by flexibility and adaptability, with modules interacting through clear interface rules; tight coupling, by contrast, features norms, commands, and control, with high degrees of integration among members capable of effectively circumventing deficiencies in market mechanisms. These two coupling modes are not oppositional but can be dynamically combined according to specific contexts to form hybrid coupling patterns.

2.2 Evolution of Sports-Medicine Integration Research

In China, the interactive relationship between sports and medicine has generally undergone three developmental stages: sports-medicine coordination (formal separation), sports-medicine combination (formal and substantive coexistence), and sports-medicine integration (substantive unity) (Zhang et al., 2017). Early research focused primarily on the medical value of sports and the clinical application of exercise prescriptions, while in recent years the focus has gradually shifted toward governance models, service systems, and implementation pathways for sports-medicine integration. Scholars have proposed various practical forms, including hospital-based models, community-based models, and physical fitness monitoring center models. Nevertheless, regarding how to break through departmental barriers and establish sustainable collaborative mechanisms, systematic theoretical responses remain lacking.

Notably, existing research has mostly explored sports-medicine integration from single dimensions (e.g., policy, service, or human resources), with relatively few analyses from the

perspective of system coupling regarding how two heterogeneous systems—sports and healthcare—can achieve functional complementarity and resource interdependence through modular reorganization. This paper attempts to address this gap by combining coupling theory with modular thinking to construct a multi-dimensional coupling mechanism for sports-medicine integration, and by proposing practical pathways for implementing this mechanism based on typical practices across China.

3 Coupling Relationships in Sports-Medicine Integration

The sports industry and healthcare industry are two independent systems of equal rank. Sports-medicine integration is the process by which coupling effects emerge through interactions between them, forming a new composite system (the sports-medicine coupling system). In this process, both systems maintain their respective independence and core functions while achieving resource exchange and functional complementarity through interface rules, thereby promoting the enhancement of the new system's overall capabilities.

3.1 Loose Coupling and the Sports-Medicine Relationship

Loose coupling theory emphasizes that components within a system are interrelated yet remain relatively independent, such that adjustments to one component do not fundamentally affect other modules in the system (Weick, 1982). In the initial stages of sports-medicine integration, sports and healthcare systems often exhibit loose coupling: community health service centers collaborate with social sports organizations to provide fitness guidance; hospitals cooperate with sports institutions on scientific research; and fitness clubs partner with medical institutions to offer sports rehabilitation services. Under this model, both parties maintain their organizational boundaries and operational logics, achieving resource complementarity through project-based or agreement-based cooperation.

The advantages of loose coupling lie in its high flexibility, low barriers to entry, and strong adaptability, making it suitable for rapid experimentation and experience accumulation during the exploratory phase of sports-medicine integration. For example, the Shenzhen Municipal Culture, Radio, Television, Tourism and Sports Bureau (2023) summarized the work dynamics of exercise prescription workstations, selecting three units from among 46 fitness venues, traditional Chinese medicine clinics, and gyms across the city as pilot sites for the first batch of exercise prescription workstations. Social sports instructors with exercise prescription specialist qualifications provide citizens with sports injury rehabilitation and scientific fitness guidance services. This model of "government guidance + social institution participation" represents a typical manifestation of loose coupling in practice.

However, loose coupling also has evident limitations: cooperation lacks institutional guarantees and is easily interrupted by personnel changes or policy adjustments; service quality varies without unified standards; and divergent interests among parties make stable collaborative relationships difficult to form. Therefore, sports-medicine integration cannot remain solely at the level of loose coupling; tight coupling mechanisms must also be established in critical domains.

3.2 Tight Coupling and the Sports-Medicine Relationship

Tight coupling is characterized by norms, commands, and control, with high degrees of integration among its members capable of substantially circumventing deficiencies in market mechanisms (Bird et al., 2019). In sports-medicine integration, tight coupling is primarily manifested in the incorporation of exercise interventions into clinical diagnosis and treatment processes within medical institutions, the establishment of standardized exercise prescription service systems, and the implementation of rigorous certification management and quality control.

Hospitals leverage certification management systems to strengthen administrative governance, with internal systems exhibiting characteristics of tight coupling. Through the implementation of certification management, entry thresholds for institutions and organizations can be raised, and management structures strengthened to yield better management outcomes. Tight coupling can effectively promote the establishment of intimate relationships among institutions, form stable inter-organizational cooperative relationships, motivate members to devote their best practical efforts to collaboration, and facilitate and achieve significant, systemic organizational transformations.

Tianjin's exploration of sports-medicine integration provides a paradigm for tight coupling. In November 2022, Tianjin established the Medical Exercise Prescription Quality Management Group, with Tianjin Hospital taking the lead in drafting China's first local technical service standard for exercise prescriptions—the Technical Service Specification for Exercise Prescriptions—which was formally promulgated in August 2024 (Zhang, 2026). This standard translates abstract health concepts into a comprehensive operational manual encompassing process control, risk management, and evaluation, transforming "exercise is medicine" from a concept into an executable, regulable, and promotable municipal standard. On this basis, the Tianjin Municipal Health Commission and the Municipal Sports Bureau jointly issued the Implementation Plan for the Construction of Pilot Medical Institutions for Sports-Medicine Integration in Chronic Disease Prevention and Treatment in Tianjin, selecting 43 medical institutions covering tertiary hospitals, secondary hospitals, and community-level facilities from 61 applicant units to enter the pilot program. Four systematic training sessions on scenario-based exercise prescriptions were conducted, cumulatively cultivating over 300 interdisciplinary talents possessing both medical and exercise guidance competencies. This tight coupling model of "standard leadership + pilot advancement + talent cultivation" effectively ensures the standardization and safety of exercise prescription services.

3.3 From Binary Opposition to Hybrid Coupling

Loose coupling and tight coupling do not represent a binary opposition; rather, they can be dynamically combined according to different stages, levels, and functional requirements of sports-medicine integration. At the macro-governance level of sports-medicine integration, tight coupling policy coordination mechanisms must be established between sports administrative departments and health departments; at the meso service level, loose coupling project-based cooperation can be adopted between hospitals and community fitness centers; and at the micro-operational level, tight coupling collaborative processes must be established between exercise prescription specialists and general practitioners.

When modules at different levels and of different relationship types within sports and healthcare form couplings, this facilitates the realization of the strategic goal of "sports-medicine integration boosting Healthy China" within management and control (Li & Feng, 2022). The hybrid coupling model preserves the flexibility and innovativeness of loose coupling while absorbing the standardization and stability of tight coupling (Heller, 1999), representing the inevitable choice for sports-medicine integration to evolve from pilot exploration toward institutionalization and large-scale promotion.

4 Multiple Coupling Mechanisms and Practical Pathways

Loose coupling decomposes a system into multiple modules, forming a flexible coupled whole through a modularity-characterized coupling mechanism. Modules and the main body exhibit part-whole and component-system relationships. For the modular reorganization of tasks in sports-medicine integration projects, the first step is decomposition; the resulting sub-tasks exhibit a certain coupling property, after which the relationships among sub-tasks are analyzed to achieve modular reorganization. Based on practical explorations across China, this paper

constructs a multi-dimensional coupling mechanism for sports-medicine integration from four dimensions—product modularity, process modularity, organizational modularity, and systematic supporting measures—and highlights practical pathways for specific practices within each dimension.

4.1 Product Modularity

Product modularity refers to the process of dividing a product system into several mutually independent yet collaboratively interdependent modules according to interface rules. In a modular architecture, product modules establish loose coupling relationships based on relatively clear interface rules, making module reuse more convenient (Tao & Wei, 2015). Product modularity in sports-medicine integration centers on constructing a full life-cycle exercise-for-health service product system, productizing, standardizing, and personalizing services such as exercise prescriptions, physical fitness testing, health assessments, and chronic disease interventions.

4.1.1 Construction and Application of Exercise Prescription Databases

The exercise prescription represents the core product module of sports-medicine integration. Its essence lies in developing personalized exercise intervention plans based on an individual's health status, physical fitness level, and exercise risk. Since 2019, the Wuxing Street Community Health Service Center in Zhonglou District, Changzhou, in collaboration with Changzhou University and Changzhou Sports Hospital, has implemented a chronic disease exercise intervention project. For populations with overweight and obesity, type 2 diabetes, and dyslipidemia, expert teams comprising general practitioners, social sports instructors, and exercise prescription specialists provide "tailor-made" exercise programs through physical fitness testing and functional assessments (Jiangsu Provincial Sports Bureau, 2024). Following 12 weeks of exercise management and health education, the center successfully identified effective exercise prescriptions applicable to patients with various diseases, constructing an exercise prescription database for chronic disease patients and developing a chronic disease exercise management model suited to the local context. The center has also incorporated exercise intervention into chronic disease patient health management family doctor contract service packages, allowing patients to freely select personalized contract service contents through an "à la carte" model. In the past two years, over a thousand residents with personalized family contracts have selected exercise intervention programs, fully demonstrating the practical value of exercise prescription product modules.

4.1.2 Embedding of Smart Health Products

With the development of digital technology, product modules such as smart fitness equipment, wearable devices, and exercise health management applications provide new technical support for sports-medicine integration. Wu (2024) reported that Shenzhen has continued to advance the construction of smart fitness equipment in recent years. Bao'an District took the lead in piloting smart sports demonstration venues integrating cloud computing, big data, the Internet of Things, and artificial intelligence, achieving full coverage of smart fitness facilities across ten sub-districts. These smart devices can not only monitor exercisers' heart rate, blood pressure, and exercise volume in real time but also synchronize data to medical institutions' health management systems, providing objective evidence for physicians to adjust exercise prescriptions, thereby achieving seamless connection between sports product modules and healthcare service modules.

4.1.3 Development of Life-Cycle Health Service Packages

The sports-medicine integration product system should cover the full life cycle from children and adolescents to the elderly. Centered on the theme of "exercise for health promotion," Shanghai has established a full life-cycle exercise health management and science popularization education system, providing corresponding scientific guidance for different age groups. Hunan Xiangjiang New Area has successfully established two "sports-medicine integration demonstration bases" at Leifeng Street Community Health Service Center and Lugu Street Community Health Service Center, providing residents with full-chain services from physical fitness testing and exercise assessment to personalized exercise prescription issuance and exercise process monitoring (Zhang, 2024). Residents understand their health status and exercise programs through the Personal Physical Fitness Testing Report, and exercise scientifically according to personalized "exercise prescriptions," gradually developing scientific fitness habits.

4.2 Process Modularity

Process modularity refers to the process of decomposing a service flow system into multiple mutually independent modules according to functional requirements and matching relationships, and connecting them through interface rules. This expands the adaptive scope of the process system, transforming organizational relationships from tight coupling to loose coupling (Hao et al., 2007). In sports-medicine integration practice, the key to process modularity lies in establishing a closed-loop service chain from health screening, risk assessment, prescription formulation, exercise intervention to effect evaluation, enabling each link to operate independently while maintaining mutual connectivity.

4.2.1 Standardization of the Four-Step Process

Xiamen launched the pilot construction of sports-medicine integration demonstration communities in June 2019, constructing a four-in-one collaborative model of "government departments—hospitals—communities—research institutes" (Wan, 2020). Its standardized process is as follows: First, community health service centers conduct disease screening and physical examination indicator collection for intervention populations; second, medical and exercise experts jointly conduct risk assessments combining national physical fitness monitoring indicators; third, personalized "exercise prescriptions" are customized based on assessment results; finally, the effectiveness of health interventions is verified through regular prescription adjustments and pre-post intervention data comparisons. Participants perform resistance training twice weekly in centralized sessions and aerobic exercise or walking check-ins three times weekly online, with dedicated personnel responsible for recording, supervision, and Q&A throughout the process (Xiamen Municipal Sports Bureau, 2019). Following six months of exercise intervention, over 100 chronic disease participants showed significant improvements in blood glucose, blood pressure, and other indicators, verifying the effectiveness of standardized process modules.

4.2.2 Process Embedding in Family Doctor Contracted Services

Since 2021, Huangqiao Street Community Health Service Center in Xiangcheng District, Suzhou, has explored an innovative "sports-medicine integration" family doctor service model, embedding sports-medicine integration processes into existing chronic disease management workflows (Healthy Xiangcheng, 2025). The center has constructed a chronic disease exercise health intervention smart system; family doctor teams comprise general practitioners, community nurses, public health physicians, traditional Chinese medicine practitioners, rehabilitation therapists, and pharmacists, who conduct testing and assessments for contracted residents and issue "exercise prescriptions." Additionally, general practitioners from superior hospitals participate in guidance, promoting high-quality development of family doctor



contract services. Data show that the exercise intervention center has established exercise files for 73 chronic disease patients in its jurisdiction, providing scientific exercise guidance services, with patients showing varying degrees of improvement in relevant indicators following intervention.

4.2.3 Cross-Institutional Process Coordination

Process modularity requires not only intra-institutional standardization but also process collaboration among different institutions. Hunan Xiangjiang New Area has incorporated "sports-medicine integration" into the grassroots health management and prevention system as well as family doctor service team health services. Community health service centers are equipped with professional exercise facilities, and professional sports-medicine integration experts prescribe exercise "prescriptions" for residents (He, 2024). Physicians can provide real-time online guidance on residents' exercise prescription execution through wearable electronic devices and exercise health management systems, ensuring the safety and effectiveness of exercise prescriptions during implementation. This "offline testing + online guidance" process combination breaks through temporal and spatial limitations, improving service efficiency.

4.3 Organizational Modularity

Organizational modularity refers to the process of decomposing an organizational system into several independently operating modules according to certain rules, and then integrating them into a network organization through interface rules (Karim, 2006). Sports-medicine integration involves multiple stakeholders including government, hospitals, communities, schools, enterprises, and social organizations. The core of organizational modularity lies in clarifying the functional positioning of each stakeholder, establishing clear collaborative interfaces, and forming a collaborative governance network combining "loose-tight" relationships.

4.3.1 Community Model

Shanghai's Shangti community model represents a typical case of organizational modularity. Under the leadership of the Shanghai Municipal People's Government, this model provides public health services for different populations through public-private cooperation. In Version 1.0, sub-districts provide venues, purchase equipment and services, enterprises invest in construction and operational management, and low fees are charged for elderly users. Version 2.0 integrates public service resources: sub-districts provide venues, enterprises are responsible for investment, construction, and operational management, and nominal fees are charged for elderly users (RMB 99/month), forming a sustainable operational model of "government contributing a portion, enterprises investing a portion, and citizens paying a portion" (Huang, 2021). Currently, Shangti has opened multiple outlets in Shanghai and plans to demonstrate and promote the model in multiple cities. This model achieves modular reorganization of the government's public management functions, enterprises' market-oriented operational capabilities, and communities' venue resources, realizing large-scale provision of sports-medicine integration services.

4.3.2 Hospital Model

The hospital model is an organizational form that takes medical institutions as the main body and incorporates exercise intervention into the clinical diagnosis and treatment system. The Sports Hospital of the General Administration of Sport of China's Institute of Sports Medicine was among the earlier hospitals in China to establish exercise prescription clinics, providing personalized exercise prescriptions for sub-healthy or diseased populations. Tianjin Hospital in Tianjin leverages multidisciplinary advantages to integrate resources across disciplines and departments, opening exercise prescription clinics. Taihu Road Street Community Health

Service Center in Hexi District, Tianjin, deeply integrates exercise prescriptions into daily diagnosis and treatment, incorporating exercise prescriptions into family doctor contract services (Zhang, 2026). In April 2025, Sichuan Province conferred the designation of "sports-medicine integration pilot institutions" upon 13 units including West China Hospital of Sichuan University, West China Second University Hospital, Sichuan Provincial People's Hospital, and Sichuan Provincial Institute of Sports Science. Each pilot unit will actively conduct "exercise prescription" pilots and explore exercise-for-health service mechanisms according to the Implementation Plan for Sichuan Province Sports-Medicine Integration Pilot Work (2025–2027) (Hu, 2025). This hierarchical modular organization of "tertiary hospitals leading + secondary hospitals supporting + community hospitals implementing" facilitates the vertical flow of high-quality medical resources.

4.3.3 Social Institution Model

Sports-medicine integration requires not only the participation of public medical institutions but also the collaboration of market-oriented organizations such as fitness clubs, sports rehabilitation centers, and health management enterprises. Shenzhen's first batch of exercise prescription workstation pilot units included social institutions such as traditional Chinese medicine clinics, traditional Chinese medicine practices, and fitness clubs; personnel on duty must possess exercise prescription specialist or exercise instructor qualifications (Shenzhen Municipal Culture, Radio, Television, Tourism and Sports Bureau, 2023). As "terminal modules" of the sports-medicine integration service network, these social institutions can penetrate communities and stay close to residents, providing convenient and flexible exercise health services. Meanwhile, pilot workstations employ WeChat group check-in supervision methods, allowing self-disciplined individuals to motivate less active individuals, encouraging mutual support for exercise adherence and forming positive social support networks.

4.3.4 Industry-University-Research Collaboration

The deepening advancement of sports-medicine integration cannot proceed without scientific research support. The Wuxing Street Community Health Service Center in Changzhou collaborates with Changzhou University and Changzhou Sports Hospital on chronic disease exercise intervention projects; Xiamen's sports-medicine integration demonstration communities assemble expert teams from community health service centers and universities; and Hunan Xiangjiang New Area has sports-medicine integration expert teams from the Third Xiangya Hospital of Central South University and the School of Health and Physical Education of Hunan University of Technology and Business providing guidance. This industry-university-research modular combination of "university research + hospital technology + community practice" accelerates the translation and application of research findings, providing sustained knowledge supply for sports-medicine integration.

4.4 Supporting Systematization

To advance sports-medicine integration, systematic guarantees are also required for policy institutions, standards and norms, talent cultivation, and funding investment. Systematic supporting measures constitute the external conditions for the stable operation of multiple coupling mechanisms, equivalent to the "visible design rules" of a modular system, providing an institutional framework for the independent operation and collaborative interaction of each module.

4.4.1 Standard System Construction

Standards represent the key for sports-medicine integration to transition from "experience-driven" to "standards-driven." The Technical Service Specification for Exercise Prescriptions issued by Tianjin, as one of the earlier local standards for exercise prescription technical

services formulated in China, clarifies the exercise prescription issuance process, risk assessment methods, physical fitness testing norms, and prescription execution and supervision requirements, translating abstract health concepts into executable, regulable, and promotable municipal standards. Furthermore, establishing complete and professional health promotion service practitioner cultivation and evaluation systems, and implementing dynamic evaluation systems for health service effectiveness throughout the entire pre-during-post process, provide technical supervision guarantees for sports-medicine integration practice.

4.4.2 Interdisciplinary Talent Cultivation

Talent constitutes the core resource for sports-medicine integration. Currently, interdisciplinary talent who understand both medicine and fitness guidance is severely scarce, becoming a bottleneck constraining sports-medicine integration development. Tianjin conducted systematic training on exercise prescription theory, risk assessment, physical fitness testing, and prescription formulation for over 110 medical personnel from 43 pilot units, and advanced clinical exercise physiologist training for chronic diseases such as obesity. Hunan Xiangjiang New Area, through a series of exercise prescription theory and practical training sessions, has enabled general practitioners and public health physicians at community health service centers to become "exercise prescription specialists" capable of issuing exercise prescriptions. Going forward, interdisciplinary programs combining sports and medicine must be established in medical schools and sports institutions, and vocational certification systems for exercise prescription specialists, sports rehabilitation therapists, and health managers must be established to fundamentally address talent shortages.

4.4.3 Policy Coordination and Funding Assurance

Sports-medicine integration involves multiple departments including sports, health, medical insurance, and civil affairs, requiring the establishment of cross-departmental policy coordination mechanisms. The Xiamen Municipal Sports Bureau and the Municipal Health Commission jointly issued implementation guidelines related to the pilot construction of sports-medicine integration demonstration communities, providing policy foundations for district-level implementation of sports-medicine integration demonstration community construction. Regarding funding, in addition to government fiscal investment, market-oriented mechanisms must be improved, pathways for medical insurance payment and exercise intervention must be explored, and social capital participation in sports-medicine integration service provision must be encouraged. Shanghai's Shangti model of "government contributing a portion, enterprises investing a portion, and citizens paying a portion" represents a beneficial attempt at diversified financing.

4.4.4 Digital Platform Support

In the information age, sports-medicine integration must rely on digital platforms to achieve data interoperability and service collaboration. Xiangcheng District, Suzhou, has constructed a chronic disease exercise health intervention smart system, gradually building a full-process chronic disease management and big data service platform for sports-medicine integration; Chengdu has issued resource maps for weight management and mental health services (Yu, 2025), integrating information on 46 weight management clinics, 43 mental health clinics, and 27 sleep clinics across 23 districts (county-level cities and counties), enabling citizens to quickly locate the nearest health service points. These digital supporting measures effectively reduce the information costs for residents in accessing sports-medicine integration services and improve service accessibility.

5 Conclusion

Sports-medicine integration is a complex systematic engineering endeavor involving conceptual renewal, organizational transformation, process reengineering, and institutional innovation. Based on coupling theory and drawing upon practical experience of sports-medicine integration from multiple regions across China, this paper proposes that sports-medicine integration should follow a practical pathway of "coordinating loose coupling and tight coupling, combining modular reorganization with systematic supporting measures." At the product level, product modularity of health services is achieved through the standardized construction of exercise prescription databases, smart health products, and service packages covering the full life cycle. At the process level, process modularity of service chains is achieved through the standardization of the "screening-assessment-intervention-feedback" closed loop and cross-institutional collaboration. At the organizational level, a modular collaborative governance network is constructed through the functional positioning and interface rule design of multiple stakeholders including government, hospitals, communities, enterprises, and universities. At the supporting measures level, sustainable institutional guarantees are provided for sports-medicine integration through the systematic construction of standards systems, talent cultivation, policy coordination, and digital platforms.

Admittedly, the deepening advancement of sports-medicine integration still faces numerous challenges: departmental barriers have not been completely dismantled, interdisciplinary talent remains scarce, pathways for medical insurance payment of exercise prescriptions remain unclear, and the vitality of social forces' participation awaits further stimulation. Looking ahead, sports-medicine integration will pay greater attention to the dynamic evolution laws of coupling mechanisms, exploring differentiated pathways for sports-medicine integration models across different regions and populations. As sports-medicine integration continues to improve, the future will see the health threshold shifted forward, from focusing on treating existing diseases to preventing diseases before they occur. Sports-medicine integration will upgrade to sports-public health integration, achieving chronic disease prevention and improving the physical fitness of the entire national population.

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