Research on the Localization of the Patient-Centered Medical Home Model in China: Analysis of Adaptability, Challenges, and Pathways (Postprint)

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Abstract

In the context of the global transformation of primary health care (PHC) systems, the "Patient-Centered Medical Home" (PCMH), with its core philosophy of "person-centered integrated continuous team-based services," has become an important paradigm for improving the quality of PHC services. China' s community health services are currently in a critical stage of deep transformation from disease treatment to health management. The in-depth advancement of systems such as family doctor contract services and hierarchical diagnosis and treatment has provided practical soil for absorbing and integrating PCMH concepts. This paper systematically reviews the core elements and international practical experience of PCMH. By comparing the current status of China' s community health service system, it identifies structural differences and transformation challenges across six key dimensions: payment incentives, information technology, human resources, service culture, organizational management, and system synergy, and subsequently proposes corresponding collaborative reform strategies. On this basis, the study constructs a step-by-step implementation path consisting of four stages— "organizational preparation, process reshaping, comprehensive promotion, and continuous improvement" —aiming to provide a reference that is both theoretically systematic and practically operable for promoting the high-quality development of China' s family doctor contract services, shifting from "emphasizing signing" to "emphasizing service" and from "fragmentation" to "integration."

Full Text

Preamble

Chinese General Practice

Abstract

General practice (GP) serves as the cornerstone of the primary healthcare system, playing a vital role in maintaining public health and managing chronic diseases. This paper examines the current state of general practice in China, focusing on its historical development, the evolution of the medical education system, and the challenges faced in clinical practice. We analyze the integration of machine learning and deep learning technologies in enhancing diagnostic accuracy and patient management within the GP framework. By synthesizing current research and policy trends, we provide insights into the future trajectory of Chinese general practice, emphasizing the transition from a hospital-centric model to a community-based, integrated care system.

Introduction

The development of general practice in China has undergone significant transformation over the past few decades. As the population ages and the burden of chronic non-communicable diseases increases, the demand for high-quality primary care has become more pressing than ever. Unlike specialized medicine, general practice emphasizes comprehensive, continuous, and coordinated care for individuals, families, and communities.

[Figure 1: see original paper]

The Chinese government has implemented various policies to strengthen the "gatekeeper" role of general practitioners (GPs). These initiatives aim to redirect patient flow from tertiary hospitals to community health centers, thereby optimizing resource allocation and reducing healthcare costs. However, several barriers remain, including a shortage of qualified personnel, disparities in regional development, and the need for more robust clinical decision support systems.

The Role of Technology in General Practice

In recent years, the application of advanced computational methods has revolutionized the field of primary care. Machine learning and deep learning algorithms are increasingly utilized to analyze large-scale electronic health records (EHRs) and medical imaging data. These technologies assist GPs in early disease detection and personalized treatment planning.

For instance, predictive models can be used to identify patients at high risk of developing complications from diabetes or hypertension. Mathematically,

such models often involve the optimization of a loss function $\mathcal{L}(\theta)$ to minimize prediction error:

$$\min_{\theta} \sum_{i=1}^{n} \mathcal{L}(f(x_i;\theta), y_i) + \lambda R(\theta)$$

where x_i represents patient features, y_i denotes the clinical outcome, and $R(\theta)$ is a regularization term to prevent overfitting. By integrating these tools into the clinical workflow, GPs can provide more precise and efficient care.

Challenges and Future Directions

Despite the

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Localization of the Patient-Centered Medical Home Model in China: Analysis of Adaptability, Challenges, and Implementation Paths

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Abstract

The Patient-Centered Medical Home (PCMH) is an innovative primary healthcare delivery model designed to provide comprehensive, coordinated, and continuous care. While the PCMH has demonstrated significant success in international contexts, its localization in China requires a rigorous evaluation of its adaptability to the domestic healthcare landscape. This study analyzes the core components of the PCMH model—including comprehensive care, patient-centeredness, coordinated care, accessible services, and quality and safety—and evaluates their alignment with China' s current healthcare reforms and the "Healthy China" strategy. We identify key challenges such as the shortage of high-quality primary care talent, fragmented information systems, and rigid payment mechanisms. Finally, this paper proposes a strategic path for the localization of PCMH in China, emphasizing the integration of multidisciplinary teams, the utilization of digital health technologies, and the reform of value-based insurance reimbursement systems to enhance the quality and efficiency of primary healthcare services.

Introduction

As the global burden of chronic diseases intensifies and populations age, traditional episodic healthcare models are increasingly struggling to meet the com-

plex needs of patients. The Patient-Centered Medical Home (PCMH) has emerged as a transformative framework for primary care, emphasizing a holistic approach to patient health rather than the treatment of isolated symptoms. In China, the ongoing transformation of the healthcare system—characterized by the development of hierarchical medical systems and the strengthening of community health centers—provides a fertile ground for exploring the PCMH model. However, the transition from a hospital-centric system to a primary-care-led "medical home" requires more than just the adoption of international standards; it necessitates a deep integration with China's unique socio-economic and institutional context.

1. The Core Connotation and Adaptability of the PCMH Model

1.1 Core Components of PCMH

The PCMH model is built upon five foundational pillars:

1. **Comprehensive Care:** Providing for the vast majority of a patient's physical and mental healthcare needs, including prevention and wellness, acute care, and chronic care.
2. **Patient-Centeredness:** Delivering primary care that

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Against the backdrop of the global transformation of Primary Health Care (PHC) systems, the "Patient-Centered Medical Home" (PCMH) has emerged as a vital paradigm for enhancing the quality of PHC services. Its core philosophy emphasizes "people-centered, integrated, continuous team-based services."

China's community health services are currently in a critical transition phase, shifting from a focus on disease treatment to comprehensive health management. The deep implementation of policies such as the Family Doctor Contract Service (FDCS) and the hierarchical medical system provides fertile ground for absorbing and integrating the PCMH concept. This paper systematically reviews the core elements and international practical experiences of the PCMH. By comparing these with the current state of China's community health service system, we identify structural differences and transformation challenges across six key dimensions: payment incentives, information technology, human resources, service culture, organizational management, and systemic synergy. Consequently, we propose corresponding collaborative reform strategies. Building on this analysis, the study constructs a progressive implementation path

consisting of four stages: "organizational preparation, process remodeling, comprehensive promotion, and continuous improvement." This framework aims to provide a theoretically systematic and practically actionable reference for promoting the high-quality development of China' s family doctor services, facilitating the transition from "emphasizing signing" to "emphasizing service" and from "fragmentation" to "integration."

Keywords: Community Health Services; Patient-Centered Care; General Practitioners; Integrated Health Care Systems; Primary Health Care

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Research on the Localization of the Patient-Centered Medical Home Model in China: Adaptation Mechanisms, Challenges, and Pathway Analysis ZHAO Xinxin1, 2, SUN Xiaoting1, 2, 3*, LUO Xinhao1, SUN Jin1, PENG Derong3, ZHENG Jialin2 1.School of Public Health and General Practice, Tongji University School of Medicine, Shanghai 200331, China 2.Institute of Health Policy and Medical Education, Tongji University School of Medicine, Shanghai 200331, China 3.Pengpu Xincun Street Community Health Service Center, Jing' An District, Shanghai; Pengpu Xincun Street Community Health Service Center Affiliated to Tongji University School of Medicine, Shanghai 200435, China

【Abstract】

Under the background of the global transformation of Primary Health Care (PHC) systems, the Patient-

Centered Medical Home (PCMH) model, with its core philosophy of "people-centered, integrated, continuous, and teambased care" , has emerged as a significant paradigm for enhancing PHC service quality. In China, community health services are undergoing a critical transition from a disease-treatment focus towards health management. The deepening implementation of systems such as contracted family doctor services and hierarchical diagnosis and treatment provides fertile ground for adopting and integrating PCMH concepts. This paper systematically reviews the core elements of PCMH and international practical experiences.

By comparing these elements with the current state of China' s community health service system, this study identifies structural discrepancies and transformational challenges across six key dimensions: payment incentives, information technology, human resources, service culture, organizational management, and systemic collaboration. Corresponding synergistic reform strategies are proposed.

Research on the Localization of the Patient-Centered Medical Home Model in China: Adaptation Mechanisms, Challenges, and Pathway Analysis

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Abstract

The Patient-Centered Medical Home (PCMH) model represents a transformative approach to primary care, emphasizing comprehensive, coordinated, and accessible services. As China seeks to strengthen its community health service system, understanding the adaptability of the PCMH model within the domestic context is critical. This research evaluates the alignment between PCMH principles and China' s current healthcare infrastructure. By analyzing six core dimensions—payment incentives, information technology, human resources, service culture, organizational management, and systemic collaboration—the study highlights significant structural gaps. Specifically, it addresses the transition from volume-based to value-based payment systems, the integration of digital health records, and the cultivation of a multidisciplinary workforce. The findings suggest that successful localization requires a synergistic reform strategy that harmonizes policy support with clinical practice to overcome existing institutional barriers.

1. Introduction

The evolution of primary healthcare in China has reached a critical juncture where the focus is shifting from basic coverage to high-quality, integrated service delivery. The Patient-Centered Medical Home (PCMH) model, which originated as a framework to improve pediatric care and subsequently expanded to general adult medicine, offers a potential blueprint for this transition. However, the direct application of Western models into the Chinese healthcare landscape necessitates a rigorous analysis of "fit" and "feasibility."

2. Structural Discrepancies and Challenges

The localization of the PCMH model faces multifaceted challenges rooted in the historical and systemic characteristics of China' s health system.

2.1 Payment Incentives and Financial Sustainability Current reimbursement mechanisms in China often prioritize volume over value. To adopt

the PCMH model, the payment system must transition toward bundled payments or capitation models that reward health outcomes and care coordination rather than individual clinical encounters.

2.2 Information Technology and Data Integration While digitalization

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on this analysis, the study constructs a progressive, four-stage implementation pathway comprising "organizational preparation, process re-engineering, comprehensive scaling, and continuous improvement". The aim is to provide a reference that combines theoretical systematicity and practical operability, thereby to promote the high-quality development of China's contracted family doctor services with the emphasis shifting from "quantity of contracts" to "quality of service", and from "fragmented" to "integrated" care. 【Key words】

Community health services; Patient-centered care; General practitioners; Delivery of health care,

integrated; Primary health care

At present, China's healthcare system is undergoing a historic transition from a "disease-centered" approach to a "health-centered" one. Both the "Healthy China 2030" Planning Outline and the "14th Five-Year" National Health Plan explicitly emphasize the need to strengthen the primary healthcare service system, promote the high-quality development of family doctor contract services, and construct an integrated healthcare delivery system [**?**]. However, current practice indicates that China's family doctor services face multiple challenges, including "signing without servicing," a low sense of gain among residents, and a mismatch between service supply and complex demands [**?**]. Medical services in community health centers still require further optimization regarding integration, teamwork, and continuity, leaving a gap between current performance and the goal of providing "all-round, full-cycle" health services. Consequently, achieving a high-quality leap from "prioritizing contract quantity" to "prioritizing service substance" has become a critical issue for primary healthcare reform. The "Patient-Centered Medical Home" (PCMH) model, originating in the United States and promoted through certification by organizations such as the American College of Physicians (ACP), has been proven effective in enhancing primary care quality, improving patient experience, and controlling medical costs [**?**]. This model emphasizes accessible, continuous, and comprehensive primary care through coordinated team-based nursing, patient-centered partnerships, comprehensive and sustained care coordination, and data-driven quality improvement. Its core principles align closely with China's reform direction of promoting integrated, continuous, and humanized primary health services. Ongoing initiatives in China, such as the "Quality Service at the Grassroots" campaign [**?**] and the construction of "tight-knit" county-level medical commu-

nities [**?**], provide unprecedented policy opportunities and organizational frameworks for adopting the PCMH model. Systematically analyzing the advanced concepts and elements of PCMH—and adapting them to fit China' s medical institutional background, resource conditions, and resident health needs—holds significant theoretical value and practical urgency for improving the quality and efficiency of the primary healthcare system.

This study aims to analyze the core elements and international practical experience of the PCMH model. It explores the alignment and structural differences between PCMH and China' s current family doctor contract services in terms of service philosophy, teamwork, payment incentives, information technology, and patient roles. By doing so, this research constructs a localized implementation path for the PCMH concept with distinct stages and clear tasks, providing a theoretical basis and operational blueprint for enhancing the continuity, coordination, and residents' sense of gain in China' s family doctor contract services.

This study adopts a systematic literature review and comparative analysis method.

The entire process is divided into three stages: data acquisition, data screening, and data analysis.

1.1 资料获取

To comprehensively obtain relevant materials regarding the "Patient-Centered Medical Home" (PCMH) and primary health care reforms across various countries, the research team conducted a systematic search of both Chinese and English literature. The Chinese literature search primarily covered the China National Knowledge Infrastructure (CNKI), Wanfang Data Knowledge Service Platform, and the VIP Chinese Science and Technology Periodical Database. The English literature search primarily covered PubMed, the Web of Science Core Collection, Embase, and CINAHL. The search period was set from the inception of each database to December 2025.

The search strategy employed a combination of subject headings and free-text terms. English search terms included "Patient-Centered Medical Home," "Primary Health Care," "Primary Care," "General Practice," and "Family Medicine," as well as "delivery of health care, integrated," "continuity of patient care," and "quality of health care." Chinese search terms included "以患者为中心的医疗之家" (Patient-Centered Medical Home), "初级卫生保健" (Primary Health Care), "家庭医生签约服务" (Contracted Family Doctor Services), "全科医学" (General Practice), "整合服务" (Integrated Services), "连续性照护" (Continuity of Care), and "服务质量" (Quality of Service).

Furthermore, manual supplementary searches were conducted on the official websites of authoritative domestic and international organizations, including the American College of Physicians (ACP), the National Committee for Quality Assurance (NCQA), the World Health Organization (WHO), and the National

Health Commission of the People' s Republic of China. These searches aimed to obtain relevant policy documents, standards, guidelines, reports, and statistical data to ensure the authority and timeliness of the information.

1.2 资料筛选

After an initial deduplication of the retrieved literature, two researchers independently screened the records based on the inclusion and exclusion criteria. Any disagreements were resolved through discussion or by consulting a third party.

Inclusion criteria: Literature that explicitly explores the definition, core elements, implementation effects, or challenges of the Patient-Centered Medical Home (PCMH) model; literature introducing primary healthcare system reform practices in various countries (such as the United States, United Kingdom, Canada, Australia, Germany, Singapore, etc.) that involves elements related to PCMH concepts, such as team collaboration, continuity of care, and payment reform; literature and policy documents analyzing the current status, challenges, and reforms of China' s family doctor contract services and community health service systems; literature types including research papers, systematic reviews, official reports, policy documents, and authoritative guidelines; and literature published in both Chinese and English.

Exclusion criteria: Literature for which the full text is unavailable; non-research or incomplete information sources such as news reports, editorials, and conference abstracts; and literature with significant content duplication or low quality.

1.3 资料分析

This study employs a methodology that combines thematic analysis with a comparative framework analysis.

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The thematic analysis involves a systematic induction of the included literature related to the Patient-Centered Medical Home (PCMH). By refining the conceptual evolution and identifying universally recognized core elements, we establish a baseline framework for subsequent analysis.

The comparative framework analysis utilizes the core elements of the PCMH as analytical dimensions. Taking the primary health care reform practices selected from various countries (including China) as the subjects of analysis, we constructed a comparative analytical framework [9-10]. We systematically extracted specific manifestations, policy instruments, and contextual characteristics of these international practices across each dimension. By comparing similarities and differences, we structurally identified areas of adaptation and underlying challenges.

Core Elements of the PCMH and Insights from International Practice

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Evolution, Core Elements, and Certification Assessment of the Patient-Centered Medical Home (PCMH)

The concept of the Patient-Centered Medical Home (PCMH) originated in the 1960s, initially designed to provide a continuous, comprehensive, and welcoming care environment—akin to a "home" —for children with complex chronic conditions requiring multidisciplinary collaborative management. These children often faced significant fragmentation of care as they moved between their homes and various specialized medical institutions. Consequently, the original core philosophy of the "Medical Home" was to imbue medical facilities with the attributes of a home, emphasizing accessible, continuous, comprehensive, and family-centered collaborative care. This person-centered philosophy quickly expanded beyond pediatrics and was widely adopted and developed by organizations such as the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), and the American College of Physicians (ACP). Particularly in the early 21st century, in response to systemic challenges such as skyrocketing healthcare costs, the increasing burden of chronic diseases, and service fragmentation, the PCMH was redefined and promoted. It evolved from a care model for specific populations into an organizational and service framework aimed at reshaping the entire primary care system [**?**]. Its five recognized core elements are: (1) Comprehensive and coordinated team-based care, led by primary care physicians in collaboration with multidisciplinary teams including nurses, pharmacists, and social workers to provide holistic services; (2) Patient-centered partnerships that respect patient preferences and cultures while promoting shared decision-making and self-management support; (3) Comprehensive and continuous care coordination, involving proactive referral management and follow-up tracking to ensure seamless service transitions; (4) Accessible and convenient services, provided through flexible scheduling, teleconsultations, and extended service hours; and (5) Systems for quality and safety.

Data-driven continuous quality improvement and patient safety assurance are also integral. Numerous systematic reviews have confirmed that implementing the PCMH model can significantly enhance the quality of chronic disease management, reduce hospitalization and emergency department visit rates, and improve patient satisfaction [**?**].

International certification and assessment for the PCMH have been established through several authoritative systems, including The Joint Commission, the National Committee for Quality Assurance (NCQA), and the Accreditation Association for Ambulatory Health Care (AAAHC). Among these, the NCQA' s PCMH Recognition program is the most influential.

This certification revolves around the five core elements of the PCMH, detailing numerous measurable and verifiable standards—such as team composition, appointment accessibility, evidence-based diagnosis and treatment, care coordi-

nation, patient-centered communication, and quality improvement. Assessment and grading (e.g., Levels 1–3) are conducted through a combination of documentation submission and onsite inspections [**?**]. Furthermore, tools such as the "Patient-Centered Primary Care Assessment" (PC-PCA), the Consumer Assessment of Healthcare Providers and Systems (CAHPS) for patient experience, and the Leapfrog Group' s patient safety surveys provide external measurement and public reporting of service quality, patient safety, and experience across primary care institutions, including PCMHs.

These systematic certification and assessment frameworks not only promote the standardized implementation and continuous improvement of the PCMH model but also provide a methodological reference for the objective measurement and comparison of primary care service quality.

2.2 国际实践成效，基于共同要素的多样化演绎

An analysis of international practices based on the five core elements of the Patient-Centered Medical Home (PCMH) framework (Table

1) reveals that while policy instruments and implementation pathways vary, reform directions are significantly converging. This convergence represents a collective pursuit of enhanced service integration and continuity. These global practices can be viewed as "localized interpretations" of the core PCMH elements adapted to different national contexts. For instance, Canada has actively promoted a structural transformation from independent general practitioner clinics toward "primary healthcare teams" [**?**]. Singapore, through its Primary Care Networks, enables small private clinics to share resources and achieve service synergy [**?**]. Australia has moved beyond traditional fee-for-service models by piloting population-based or value-based bundled payments within its Diabetes Care Project and Health Care Homes; these initiatives incentivize teams to provide integrated, preventive services while supporting clinics in their transition toward comprehensive care models through Primary Health Networks [**?**, **?**].

The analysis indicates that the effectiveness of these practices across various dimensions depends on several common critical supports. These include clearly defined team roles and collaborative workflows (particularly the pivotal role of care coordinators), interoperable information systems, and payment incentives aligned with integrated service goals—specifically the shift from fee-for-service to capitation, bundled, or value-based payment models. Furthermore, an organizational culture committed to continuous improvement is essential for long-term success [**?**].

However, challenges remain widespread, including change fatigue among medical staff, misalignments between legacy payment systems and new models, and barriers to cross-sectoral data sharing. These international experiences and lessons suggest that the essence of localizing the PCMH model is not the verbatim adoption of a specific country' s model. Instead, it involves absorbing the

core philosophy of responding to fundamental patient needs and using this as a framework to identify, strengthen, restructure, and innovatively integrate relevant elements that already exist or are currently developing within the domestic healthcare system [**?**].

3 我国社区卫生服务体系与 PCMH 核心理念的适配度、差异性与本土化挑战分析

Compatibility Analysis

The "Healthy China 2030" initiative and the "14th Five-Year" National Health Plan advocate for comprehensive, full-cycle health services. These objectives are highly consistent with the Patient-Centered Medical Home (PCMH) goals of providing integrated, continuous, and person-centered primary care. Currently, China' s family doctor contract service system has achieved nationwide coverage. Under this system, family doctor teams provide contracted residents with comprehensive and continuous medical and health management services. By emphasizing the principle of "fulfilling contracts through engagement," this system establishes the organizational framework and institutional guarantee for the sustained relationships advocated by the PCMH model.

Furthermore, the *Guidelines for Evaluating the Service Capacity of Community Health Service Centers* [**?**] and the recently released *Guidelines for Capacity Building of Primary-level Chronic Disease Health Management Services* [**?**] emphasize team-based services, continuity of management, and patient safety—all of which align with the core elements of PCMH. The design of the hierarchical medical system, which focuses on primary-level first contact and two-way referrals, alongside the construction of medical alliances and integrated county-level medical communities, coincides with the coordinated service networks emphasized by PCMH. Additionally, the *Notice on Key Tasks for Primary Health Care Comprehensive Pilot Zones in 2025* proposes that for contracted residents···

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Core Concepts and Their Relationship with the PCMH

The Patient-Centered Medical Home (PCMH) is a care delivery model characterized by comprehensive, coordinated, and accessible primary care. The core concepts of this model are intrinsically linked to improving patient outcomes and streamlining healthcare delivery. By shifting the focus from episodic care to a continuous, relationship-based approach, the PCMH ensures that patients receive holistic support tailored to their specific needs.

Central to the PCMH is the concept of the "medical home," which serves as the primary point of contact for patients within the healthcare system. This model emphasizes the integration of various health services, ensuring that primary

care, specialty care, hospitals, and community support services work in tandem. This seamless coordination is essential for managing chronic conditions and preventing fragmented care, which often leads to medical errors and increased costs.

Furthermore, the PCMH model prioritizes patient engagement and shared decision-making. By fostering a collaborative environment where patients and their families are active participants in their own care plans, the PCMH enhances treatment adherence and patient satisfaction. This alignment between core primary care principles and the PCMH framework creates a robust foundation for high-quality, value-based healthcare.

Background of Primary Care Models and Systems

Primary care serves as the cornerstone of a sustainable healthcare system, acting as the first point of contact for individuals and families within the medical hierarchy. The fundamental objective of primary care is to provide comprehensive, continuous, and coordinated health services that address the majority of personal health needs. By focusing on prevention, health promotion, and the management of chronic conditions, primary care systems aim to improve population health outcomes while reducing the overall burden on secondary and tertiary specialized medical facilities.

The evolution of primary care models has been shaped by varying national health policies, socioeconomic conditions, and the shifting epidemiological landscape. Traditionally, primary care was often characterized by fragmented, episodic encounters focused on acute symptom relief. However, modern systems have transitioned toward the "Patient-Centered Medical Home" (PCMH) and integrated care models. These contemporary frameworks emphasize a holistic approach, where multidisciplinary teams—including general practitioners, nurses, pharmacists, and social workers—collaborate to provide proactive rather than reactive care.

In many developed nations, the "gatekeeping" system is a defining feature of the primary care architecture. In these systems, patients must consult a primary care physician before accessing specialist services, ensuring that medical resources are allocated efficiently and that care remains longitudinal. Conversely, other systems allow for more direct access to specialists but often struggle with higher costs and fragmented patient records. The effectiveness of these systems is frequently measured by their ability to achieve the "Triple Aim" : improving the individual experience of care, improving the health of populations, and reducing the per capita cost of healthcare.

The integration of digital health technologies and machine learning has further transformed the background of primary care. Electronic Health Records (EHRs) and clinical decision support systems now enable primary care providers to track patient health trends more accurately and identify high-risk individuals through predictive modeling. As global healthcare systems face the challenges of aging

populations and the rising prevalence of multi-morbidity, the strengthening of primary care systems remains a critical priority for achieving universal health coverage and long-term systemic resilience.

The Patient-Centered Medical Home (PCMH) model is characterized by a high degree of marketization, with managed care and value-based payment systems serving as its primary drivers.

Interdisciplinary Teams and Permanent Nursing Staff

In the modern healthcare landscape, the integration of interdisciplinary teams has become a cornerstone for delivering high-quality patient care. These teams typically consist of professionals from diverse clinical backgrounds—including physicians, therapists, social workers, and pharmacists—working collaboratively to address complex medical needs. Within this framework, the role of permanent nursing staff is particularly critical. Unlike temporary or rotational staff, permanent nurses provide a sense of continuity and stability that is essential for the long-term success of interdisciplinary collaboration.

The presence of permanent nursing staff within these teams fosters deep institutional knowledge and strengthens interpersonal professional relationships. Because permanent nurses are consistently present, they develop a comprehensive understanding of departmental protocols and patient populations, allowing them to serve as a vital communication bridge between different specialties. This stability reduces the risk of information loss during handovers and ensures that the patient's holistic care plan is consistently followed. Furthermore, permanent staff are more likely to engage in long-term quality improvement initiatives, as they have a direct stake in the clinical outcomes of their specific unit.

Effective interdisciplinary coordination relies heavily on the leadership and advocacy provided by nursing professionals. Permanent nurses often act as the primary coordinators of care, synthesizing input from various specialists to create a cohesive treatment strategy. Their longitudinal observation of patients allows them to identify subtle changes in clinical status that might be missed by consultants who only see the patient during brief rounds. By maintaining a permanent nursing presence, healthcare organizations can ensure that the interdisciplinary team operates with maximum efficiency, ultimately leading to improved patient safety, reduced lengths of stay, and higher levels of professional satisfaction across the healthcare continuum.

Emphasizing Shared Decision-Making and Self-Management Support

Primary Care Teams (PCTs) operate within the federal structure of Canada, where funding is allocated at the provincial level. Under this system, provinces maintain a high degree of autonomy, resulting in healthcare reforms that are primarily centralized and executed at the provincial level.

Establish Palliative Care Teams (PCTs) comprising physicians, nurses, pharmacists, social workers, and other relevant professionals.

Clearly define roles within the team and strengthen cross-disciplinary collaboration, particularly emphasizing the critical role of nurses in the management and coordination of chronic diseases. Furthermore, prioritize patient preferences and promote the implementation of shared decision-making tools across various provinces.

Integrated and Coordinated Team-Based Care

Integrated and coordinated team-based care represents a collaborative healthcare delivery model designed to improve patient outcomes through the seamless interaction of multidisciplinary professionals. This approach moves beyond traditional siloed medical practices, emphasizing a patient-centered framework where physicians, nurses, pharmacists, social workers, and other specialists work in unison. By leveraging the unique expertise of each team member, this model ensures that care plans are comprehensive, consistent, and tailored to the specific needs of the individual, particularly those with complex or chronic conditions.

The core of this model lies in effective communication and shared decision-making. Through regular interdisciplinary meetings and the use of integrated health information systems, team members can synchronize their efforts, reduce redundant testing, and minimize the risk of medical errors. Coordinated care transitions—such as moving a patient from a hospital setting to home care—are prioritized to prevent gaps in treatment. Ultimately, integrated team-based care aims to enhance the quality of service, increase patient satisfaction, and optimize the efficiency of the healthcare system as a whole.

Patient-Centered Partnerships

The concept of patient-centered partnerships represents a fundamental shift in the healthcare landscape, moving away from traditional paternalistic models toward a collaborative framework. In this paradigm, patients are no longer passive recipients of medical interventions but are recognized as active participants and experts in their own lived experiences. This approach emphasizes mutual respect, shared decision-making, and the integration of the patient' s values, preferences, and social context into the clinical process. By fostering a robust partnership between healthcare providers and patients, clinical outcomes can be significantly improved, as treatment plans become more aligned with the patient' s daily reality and long-term goals.

Effective patient-centered partnerships rely heavily on transparent communication and the democratization of medical information. Providers must move beyond the mere transmission of clinical data to engage in meaningful dialogue that empowers patients to take agency over their health. This involves utilizing health literacy strategies to ensure that complex medical concepts are accessible, thereby enabling patients to contribute effectively to the development of their care pathways. When patients feel heard and valued as partners, adherence

to therapeutic regimens increases, and the psychological burden of managing chronic conditions is often mitigated through a sense of shared responsibility.

Furthermore, the integration of technology and data-driven insights plays a crucial role in sustaining these partnerships. Digital health tools, such as patient portals and remote monitoring systems, facilitate continuous engagement outside the traditional clinical setting, allowing for real-time adjustments to care. However, the success of these technological interventions depends on their ability to support, rather than replace, the human connection at the heart of the therapeutic relationship. Ultimately, a patient-centered partnership is characterized by a commitment to holistic care that addresses not only the biological markers of disease but also the emotional and social determinants of health, ensuring that the healthcare system serves the person, not just the patient.

Comprehensive and continuous care coordination proactively manages referrals and follow-ups by leveraging integrated healthcare networks.

Accessible and convenient services

Quality and Safety Systems

The establishment and maintenance of a robust quality and safety system are fundamental to ensuring the reliability, integrity, and excellence of organizational outputs. In contemporary industrial and research environments, these systems serve as the structural framework for risk mitigation, regulatory compliance, and continuous process improvement. By integrating standardized protocols with rigorous monitoring mechanisms, organizations can systematically identify potential hazards and implement corrective actions before they escalate into systemic failures.

Core Components of Quality Assurance

A comprehensive quality system is built upon the principles of traceability, consistency, and verification. Quality assurance (QA) focuses on the procedural aspects of production, ensuring that every stage of a project adheres to predefined standards and best practices. This involves the implementation of rigorous documentation standards, regular internal audits, and the utilization of statistical process control to monitor performance metrics. Through these methods, the system ensures that the final product or research outcome meets both internal specifications and external stakeholder expectations.

Safety Management and Risk Mitigation

Safety systems are designed to protect human capital, physical assets, and the environment from harm. An effective safety framework transitions from a reactive posture to a proactive, risk-based approach. This includes conducting thorough hazard assessments, establishing emergency response protocols, and fostering a culture of safety awareness among all personnel. By integrating

safety considerations into the earliest stages of design and operational planning, organizations can significantly reduce the frequency and severity of workplace incidents and environmental impacts.

Integration and Continuous Improvement

The synergy between quality and safety systems creates a holistic management environment where efficiency and security are mutually reinforcing. Modern systems increasingly leverage digital tools and data analytics to track real-time performance indicators and predict potential vulnerabilities. Central to this integration is the concept of continuous improvement (e.g., the Plan-Do-Check-Act cycle), which encourages iterative refinements based on empirical data and feedback. Ultimately, a well-integrated quality and safety system not only ensures compliance with international standards but also enhances the overall sustainability and competitiveness of the organization.

Flexible Appointment Scheduling, Electronic Visits, and Extended Service Hours

Data-Driven Continuous Quality Improvement Linked to Payment

In the contemporary healthcare landscape, the integration of data-driven methodologies has become a cornerstone for achieving continuous quality improvement (CQI). By leveraging large-scale datasets and advanced analytics, healthcare providers can identify systemic inefficiencies, monitor clinical outcomes in real-time, and implement evidence-based interventions. This systematic approach ensures that quality enhancement is not a static goal but a dynamic process that evolves alongside technological advancements and clinical discoveries.

A critical evolution in this framework is the transition toward value-based care models, where reimbursement is directly linked to performance metrics. Under these "pay-for-performance" or "value-based payment" structures, financial incentives are aligned with the quality and efficiency of care provided, rather than the volume of services rendered. By utilizing machine learning and deep learning algorithms, organizations can more accurately predict patient risks and measure the impact of specific treatments, providing a robust foundation for these payment models.

The synergy between data analytics and financial incentives creates a powerful feedback loop. When payment is contingent upon meeting specific quality benchmarks—such as reduced readmission rates or improved patient safety indicators—healthcare organizations are further motivated to invest in sophisticated data infrastructures. This alignment not only promotes transparency and accountability but also ensures that resources are allocated toward practices that yield the highest clinical value for patients. Ultimately, linking data-driven qual-

ity improvement with payment mechanisms serves as a catalyst for sustainable excellence in the healthcare delivery system.

Exploring Electronic Health Records (EHR) for After-Hours Service Provision

Introduction

The integration of Electronic Health Records (EHR) into clinical workflows has fundamentally transformed the delivery of healthcare services. While much of the existing research focuses on the utilization of these systems during standard clinical hours, there is a growing need to explore how EHR data can be leveraged to optimize after-hours services. After-hours care presents unique challenges, including reduced staffing levels, the need for rapid clinical decision-making, and the management of acute patient needs outside of traditional primary care settings.

The Role of EHR in After-Hours Care

Electronic Health Records serve as a critical repository of longitudinal patient data, providing clinicians with immediate access to medical histories, medication lists, allergy information, and previous diagnostic results. In the context of after-hours service, this accessibility is vital for ensuring patient safety and continuity of care. When a patient presents with an urgent issue outside of regular hours, the ability to retrieve comprehensive data through the EHR allows the attending clinician to make informed decisions without the delays associated with manual record retrieval or incomplete patient self-reporting.

Data-Driven Insights and Machine Learning Applications

The vast amount of data stored within EHR systems offers significant opportunities for applying machine learning and deep learning techniques to improve after-hours service delivery. By analyzing historical patterns of after-hours visits, healthcare administrators can better predict patient surges and allocate resources more effectively. For instance, predictive models can identify high-risk patients who are more likely to require urgent care, allowing for proactive interventions during regular hours to mitigate the need for after-hours services.

Furthermore, machine learning algorithms can be trained to recognize early warning signs of clinical deterioration by monitoring real-time data inputs within the EHR. In an after-hours setting, where specialized staff may be limited, these automated alerts can serve as a crucial safety net, prompting timely clinical reviews and potentially preventing adverse outcomes.

Challenges and Considerations

Despite the potential benefits, several challenges remain in the effective utilization of EHR for after-hours services. Interoperability remains a significant

hurdle; if after-hours providers cannot seamlessly access records from a patient's primary care physician or other specialists, the utility of the EHR is diminished. Additionally, the quality and completeness of data entry during high-pressure after-hours shifts can vary, potentially impacting the accuracy of downstream data analysis.

Privacy and security are also paramount. Accessing sensitive patient information outside of standard operational frameworks requires robust authentication

Provincial health departments establish quality indicators and link them to the allocation of a portion of funding.

Primary Care Networks (PCNs) represent a cornerstone of the National Health Service (NHS), which is a tax-funded healthcare system driven by performance management and budget control [**?**]. These networks integrate general practices, community care, and mental health services into multi-agency teams. By extending consultation hours and supporting patient self-management, PCNs aim to deepen the scope and quality of primary care delivery.

PCNs feature a "Clinical Director" and a dedicated team responsible for coordinating complex cases.

Promote online appointment systems and expand access to digital services as core performance management tools within a national-level Quality and Outcomes Framework.

Patient-centered care and shared decision-making (Patient-Centered Care/Shared Decision-Making) are central to modern healthcare. The German government and public institutions have established "Family Doctor Centers" and "Integrated Care" contracts through legislative frameworks. These initiatives aim to standardize and strengthen the ownership, rights, and responsibilities of patients within the medical treatment framework [**?**]. Furthermore, the German government continues to fund significant research projects focused on enhancing patient-centered care and the implementation of shared decision-making, reinforcing the core coordinating role of family physicians in the delivery of healthcare services.

Integrating specialist physicians and nursing services, and providing comprehensive support through disease management programs, is essential for optimizing patient outcomes. These programs facilitate a multidisciplinary approach to care, ensuring that clinical expertise and continuous nursing support are seamlessly coordinated. By leveraging structured management protocols, healthcare providers can improve the consistency of treatment, enhance patient adherence, and ultimately reduce the burden of chronic conditions on the healthcare system.

Family medicine clinics and teleclinics provide after-hours services.

PHNs aim to bridge service gaps, while the Health Home pilot emphasizes care coordination.

Improving rural accessibility through telehealth: General practice clinics providing after-hours services under the National Safety and Quality Health Service (NSQHS) Standards and voluntary accreditation.

The Patient-Centered Medical Home (PCMH) pilot and Health Care Homes (HCHs) represent significant shifts in primary care delivery. Within the framework of Primary Health Networks (PHNs), these initiatives aim to coordinate regional services across all PHNs to improve health outcomes. While traditional chronic disease management programs under Medicare have primarily relied on a fee-for-service model, the HCHs model explores a more integrated approach to chronic disease management. This transition emphasizes a shift toward patient-centered goal setting, with PHNs acting as regional planners to guide and facilitate service integration.

Regulating Decision-Making Authority Based on Clinician-Patient Partnerships Through Legislation and Economic Incentives

The traditional paternalistic model of medicine is increasingly being replaced by a framework centered on clinician-patient partnerships. This shift necessitates a re-evaluation of how decision-making authority is allocated and regulated within the healthcare system. To ensure that these partnerships are both effective and equitable, it is essential to employ a combination of legislative frameworks and economic incentives that formalize the rights and responsibilities of both parties.

Legislative Frameworks for Shared Decision-Making

Legislation serves as the foundational pillar for protecting patient autonomy while defining the professional boundaries of clinicians. Effective legal structures should move beyond simple "informed consent" toward a more robust requirement for shared decision-making (SDM). By codifying the patient' s right to participate in the selection of diagnostic tests and treatment plans, the law can transform the clinician-patient relationship from a hierarchical one into a collaborative partnership.

Furthermore, legislative measures must address the legal liability of clinicians who engage in shared decision-making. When a patient, fully informed of the risks and benefits, chooses a treatment path that results in a suboptimal outcome, the legal system should provide clear guidelines that protect clinicians from unwarranted malpractice claims. This legal clarity encourages clinicians to respect patient preferences without the fear of defensive medicine, thereby strengthening the partnership.

Economic Incentives and Value-Based Care

While legislation provides the rules, economic incentives drive the behavior of healthcare providers and institutions. Traditional fee-for-service models often

prioritize the volume of procedures over the quality of the decision-making process. To foster a partnership-based model, reimbursement structures should be transitioned toward value-based care, where outcomes and patient satisfaction are prioritized.

Specific economic incentives can include:

- **Reimbursement for Consultation Time:** Adjusting billing codes to compensate clinicians for the time spent in detailed discussions and shared decision-making processes with patients.
- **Pay-for-Performance Metrics:** Incorporating patient-reported experience measures (PREMs) and patient-reported outcome measures (PROMs) into the compensation models for healthcare providers.
- **Grants for Decision Aids:** Providing financial support for the development and implementation of evidence-based decision aids that help patients understand complex medical information.

Balancing Authority and Responsibility

The regulation of decision-making authority is not about diminishing the clinician' s expertise, but rather about integrating that expertise with the patient' s values and life context. Legislative and economic tools should aim to create

Primary Care Networks

Primary Care Networks (PCNs) represent a fundamental shift in the organization of local healthcare services, designed to foster collaboration between general practices and other health and social care providers. By working together at scale, these networks aim to provide more proactive, personalized, and coordinated care for local populations. PCNs typically serve communities of approximately 30,000 to 50,000 patients, a size small enough to maintain the continuity of local general practice while being large enough to benefit from shared resources and specialized integrated clinical teams.

The core objective of Primary Care Networks is to address the increasing complexities of patient needs, particularly for those with long-term conditions or multiple comorbidities. By integrating services such as pharmacy, physiotherapy, and social prescribing within the primary care setting, PCNs reduce the burden on individual practices and improve patient access to diverse healthcare professionals. This collaborative model facilitates a more holistic approach to population health management, allowing for targeted interventions that address specific local health inequalities and improve overall community well-being.

Furthermore, PCNs serve as a critical bridge between primary care and the broader healthcare system, including hospitals, mental health services, and voluntary organizations. This integration ensures smoother transitions for patients moving between different levels of care and promotes a more efficient use of

healthcare resources. Through shared data, joint workforce planning, and collective decision-making, Primary Care Networks are positioned to drive innovation and sustainability within the healthcare landscape, ensuring that primary care remains the bedrock of a modern, responsive health system.

Interdisciplinary Integrated Teams and the "Healthier SG" National Strategy

The "Healthier SG" national strategy is a government-led initiative designed to transform the healthcare landscape by integrating private general practitioner (GP) clinics into a unified shared network. This strategic framework encourages residents to establish long-term relationships with a dedicated family physician, ensuring continuity of care. By organizing private clinics into these networks, the strategy facilitates the sharing of critical resources, including care coordinators and specialized chronic disease management programs.

To support this integration, the strategy leverages robust digital infrastructure. The National Electronic Health Record (NEHR) system and various disease registries provide essential data, enabling the Ministry of Health to monitor key performance indicators (KPIs) within primary care. Furthermore, a centralized digital service platform streamlines the patient experience by facilitating appointment scheduling and providing access to telemedicine services.

At the core of this model are interdisciplinary integrated teams. These teams comprise a diverse range of healthcare professionals, including nurses, care coordinators, health coaches, and pharmacists. By working collaboratively, these professionals provide comprehensive support tailored to the individual needs of the patient, ensuring that the "Healthier SG" vision of proactive and preventive community-based care is realized.

Primary health care and family doctor contracting services are characterized by strong government leadership, placing equal emphasis on both public health and clinical medical services.

Institutional requirements mandate the formation of family doctor teams, with policy advocacy emphasizing the principle of "signing and fulfilling contracts." While these initiatives rely on medical alliances and community health communities to establish referral channels, practical operations suffer from insufficient cross-professional collaboration and a lack of role clarity. Furthermore, the depth of resident participation in decision-making remains limited by a lack of effective tools, and the management of information feedback loops requires significant strengthening.

The exploration of capitation-based payment for basic medical insurance funds has provided a demonstration model for payment reform [**?**]. This indicates that many elements of the Patient-Centered Medical Home (PCMH) are not entirely new concepts in China; rather, they have already emerged in various forms within existing policies and practices.

3.2 差异性与本土化挑战分析

Despite the alignment in strategic direction, China' s primary healthcare service system exhibits significant "systemic heterogeneity" compared to the ideal Patient-Centered Medical Home (PCMH) model in terms of deep structure, incentive mechanisms, and cultural habits. This heterogeneity constitutes the core challenge for localized practice, manifesting primarily across six interrelated dimensions: payment incentives, information technology, human resources, service culture, organizational management, and systemic synergy .

First, structural differences exist at the foundational support levels of payment incentives and information technology. Regarding payment incentives, the PCMH model is rooted in a "value-based payment" financial system designed to incentivize teams to maintain population health using the most rational resource allocation. In contrast, China' s primary healthcare institutions remain strongly oriented toward public health and disease management tasks [**?**]. Revenue primarily depends on fee-for-service payments and public health funds calculated based on workload [**?**]. Although contracted service fees serve as compensation [**?**], payment standards for "soft services" such as health management remain vague and incentives are insufficient. This results in a lack of motivation for institutions to conduct in-depth preventive health management, creating a mismatch with value-based payment methods. In terms of information technology, PCMH utilizes highly integrated and interoperable Electronic Health Records (EHR) as the core hub for team collaboration and quality management. Conversely, China' s primary healthcare sector contends with multiple business systems with inconsistent standards, leading to fragmented data storage and "data silos" [**?**]. Information cannot flow effectively between institutions, making it difficult to support real-time team collaboration, patient engagement, and continuous quality improvement.

Providing basic services, the data-driven mechanism for appointment processes and outcome quality, and the culture of improvement for personalized service time are still being cultivated, while flexibility is currently developing.

Secondly, operational differences exist at the practical level of human resources and service culture. In terms of human resources, PCMH relies on cross-professional teams (including doctors, nurses, pharmacists, and social workers) with clear structures, defined rights and responsibilities, and explicit collaborative processes [**?**]. Although Chinese family doctor teams have been established, members are often loosely organized. Public health, clinical, and nursing personnel frequently operate in isolation within their respective functional lines, lacking stable collaboration mechanisms, effective communication, and shared performance goals, which prevents the full realization of team effectiveness [**?**].

Regarding service culture, PCMH actively advocates for patients to participate in decision-making and self-management as equal partners, emphasizing personalized health goals. However, some patients in China exhibit a strong dependence on physician authority, and their awareness and capacity for active partici-

pation require further cultivation [**?**]. Simultaneously, limited consultation time and a lack of effective tools and processes to support shared decision-making hinder this transition.

Finally, systemic constraints exist within the external environmental dimensions of organizational management and systemic synergy. In organizational management, the success of PCMH depends on the formation of an endogenous learning culture centered on continuous quality improvement within medical institutions. The service drivers for China' s primary healthcare institutions are largely derived from top-down administrative evaluations, with indicators often focusing on service volume and task completion. Transforming these external requirements into internal motivation for continuous improvement remains a critical challenge for deepening reform. Regarding systemic synergy, the prerequisite for PCMH to function as an effective "gatekeeper" is its embedding within a mature, information-interoperable integrated healthcare network. Although China is vigorously constructing medical consortia and healthcare communities, referral coordination remains largely in a unidirectional and loose stage, with information feedback and shared responsibility mechanisms yet to be fully realized.

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Prerequisites for PCMH in the United States

The Context of China (Shanghai)

1．支付与激按价值付费、管理式医疗、

Integrated Financial Incentives

The payment system is primarily based on fee-for-service or capitation, with public health funding managed separately from medical service fees.

Misalignment of incentives: The value compensation mechanisms for team collaboration, health management, and health outcomes remain underdeveloped.

2．信息技术高度整合的 EHR 系统，支持跨机（IT）基础构数据交换与质量报告自动生成

Multiple vertical systems (Public Health, HIS, and Contracted Services) coexist with inconsistent standards, resulting in the formation of "data silos."

Data Barriers: Information connectivity requires further improvement, which to some extent restricts the continuity of care tracking, team collaboration, and data-driven quality improvement.

3. Team Roles: There is a need for a clearly defined "Nursing Coordinator" role. Currently, the involvement of doctors and family doctor teams is of-

ten "more formal than substantive." General practitioners face a paradox of role overload and functional absence; their core coordination functions remain ill-defined, and their burden is excessive. Meanwhile, the coordination potential of other members, such as nurses and pharmacists, has not been fully utilized, leaving significant room to improve the operational efficiency of the team through clear division of labor and accountability.

4．患者期望习惯于预约制、长时间交流、

Active participation in decision-making.

Patients tend to seek immediate medical attention, place high value on drug accessibility, exhibit high dependence on physician authority, and demonstrate varying levels of engagement in self-management.

Service Model Conflict: The planned and preventive nature emphasized by the Patient-Centered Medical Home (PCMH) may conflict with patients' demands for immediacy and traditional doctor-patient relationship dynamics.

5. Organizational Management: Under market competition and financial incentives, there is an endogenous drive for continuous improvement.

Driven primarily by administrative assessment, evaluation indicators often focus on quantity and task completion rates, leaving institutions with limited autonomy for innovation.

Risk of Formalism: Caution is needed regarding the potential decoupling between procedural execution and core service models or quality culture transformation.

6. Referral and Coordination: Integrated medical networks, such as Accountable Care Organizations (ACOs), possess mature internal mechanisms for referrals and information sharing.

Medical Alliances and Medical Communities are currently in the construction phase; upward and downward referrals are often unidirectional and lack an effective closed-loop for information feedback.

Coordination Vacuity: The core "gatekeeping"and coordination functions require further systematic support and guaranteed feedback mechanisms.

Mechanisms need to be strengthened to better support the "gatekeeper"function of primary care in coordinating referrals and ensuring continuity of care. A deep analysis of these differences reveals that the root cause lies in the evolution of the PCMH model within a Western context, which is closely coupled with specific market-based insurance payment systems, clinic- or physician-centered service delivery models, and individualized doctor-patient contractual cultures [**?**]. In contrast, China's system is built upon strong government planning, equal emphasis on public health and clinical services, and a tradition of collectivism rooted in work units and communities. The discrepancy between the Chinese

system and the PCMH represents a profound "systemic heterogeneity"; the core challenge lies in the fact that existing elements are "present but not strong" and "linked but not integrated."

Therefore, the key challenge of localization is not the "transplantation" of a foreign model from scratch, but rather the creative integration of core PCMH concepts (such as continuity, coordination, and patient engagement) with China's existing institutional carriers (Family Doctor Contracting), organizational platforms (Community Health Service Centers, Medical Communities), and policy tools (payment reform, informatization, and performance evaluation). This approach aims to resolve deep-seated issues such as weak connections and poor synergy among existing elements.

Collaborative Reform Strategies and Localization Implementation Path Design

To address the six major challenges mentioned above, this research group proposes that integrating the PCMH concept in China requires a systematic and integrated collaborative reform scheme, comprising the following six key strategies:

(1) Reforming payment models to reshape incentive mechanisms: Implement a composite payment model based on "capitation-based global budget + performance bundling." The health insurance funds and basic public health service funds for contracted residents within a jurisdiction should be bundled and prepaid to the Medical Community or Family Doctor teams. Specific performance bonuses should be extracted from these funds and strictly linked to core PCMH quality indicators, such as chronic disease control rates, follow-up completion rates, patient satisfaction, and referral closed-loop rates.

(2) Leveraging information technology to break information silos: Implement a "Primary Care Health Information Middleware" strategy. Establish a unified data integration platform at the Medical Community or regional level to formulate primary care data standards. This involves the minimal and standardized aggregation of data from HIS, public health, and contracting systems to prioritize the multi-level utilization of contracted residents' health information and the tracking of referral status.

(3) Reengineering team capabilities and empowering roles: Launch a primary health team capacity enhancement program based on new payment standards. Strengthen the "gatekeeper" role of general practitioners.

Assign clear responsibilities and assessment weights for nurses as health managers or coordinators, and introduce shared participants such as clinical pharmacists and rehabilitation therapists into the team. Implement targeted micro-skill training and incorporate core PCMH competencies into the mandatory modules of continuing education for primary health personnel, with particular emphasis on communication, coordination, team leadership, and health management.

(4) Cultivating cultural values to guide doctor-patient synergy: Design service

value presentation and participation mechanisms targeted at the patient side. Reshape patients' perception of the quality of contracted services by providing value-added services such as "green channels" for referrals, personalized health plans, and online consultation feedback. Simultaneously, gradually improve residents' health literacy and participation capacity through health education to incrementally build a new type of partnership. Utilize tools such as open health records, health education apps, and health diaries to design patient self-management tasks and incentives, constructing a progressive engagement model.

(5) Transforming management mechanisms to stimulate endogenous motivation: Promote a cultural shift in primary medical institutions from administrative assessment to endogenous quality improvement. Integrate superior administrative assessment indicators with internal continuous quality improvement cycles based on PCMH principles. Encourage teams to use health data to hold regular quality analysis meetings, independently identify problems, set improvement goals, and link improvement results to team performance.

(6) Strengthening systemic synergy to solidify the community of interests: Establish cooperation mechanisms and a "community of responsibility" based on benefit-sharing and data interoperability. Within the Medical Community, establish an economic community through bundled health insurance payments characterized by "sharing savings and co-bearing overruns." Enforce and digitalize the implementation of information pushing for upward-referred patients and the reception and follow-up tasks for downward-referred patients, incorporating referral coordination quality into the performance evaluation of both institutions.

Drawing on experience from implementation science, this research group believes that the successful implementation of the above collaborative reform strategies and the localized integration of the PCMH concept to improve the quality of primary medical services may require four progressive stages: from organizational foundation-building to process reengineering, followed by comprehensive promotion and continuous improvement. This will ultimately achieve systemic synergy and data-driven continuous optimization of service quality [Figure 1: see original paper].

Conclusion and Outlook: The localized practice of the PCMH concept is currently in a critical development phase.

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1．组织领导：成立 PCMH 服

Quality Improvement Leadership Group

2．团队组建：根据服务人口

Based on the project requirements, it is essential to clearly define the roles and responsibilities of each team member. This process involves establishing a precise division of labor and the redistribution of key performance indicators (KPIs) to ensure alignment with the overall objectives.

3．信息准备：升级或联通信

information systems to ensure the interactive circulation and convenient accessibility of health information.

4. Patient Mobilization: Carry out community outreach and recruitment for the initial cohort of "Health Partner" volunteers.

1．重塑流程：优化慢性病管理、

Integrated Service Pathways for Postoperative Rehabilitation and Comprehensive Geriatric Assessment

To optimize clinical outcomes and enhance the quality of life for elderly patients, the following three to five integrated service pathways have been developed. these pathways combine postoperative rehabilitation protocols with Comprehensive Geriatric Assessment (CGA) to ensure a holistic approach to recovery.

1. Perioperative Orthopedic Rehabilitation Pathway for Fragility Fractures

This pathway focuses on elderly patients undergoing surgery for hip or vertebral fractures. It begins with a pre-operative CGA to identify baseline cognitive function, nutritional status, and fall risk. Postoperatively, the service integrates early mobilization protocols with targeted physical therapy. By utilizing the CGA data, clinicians can tailor pain management strategies to minimize the risk of postoperative delirium, while nutritional interventions are implemented to counteract sarcopenia. This integrated approach aims to restore independent mobility and reduce the incidence of secondary fractures.

2. Postoperative Cardiac Rehabilitation and Frailty Management

Designed for elderly patients recovering from cardiac procedures (such as CABG or valve replacement), this pathway merges traditional cardiac rehabilitation with frailty interventions. The process involves continuous monitoring of cardiovascular stability alongside periodic reassessments of the patient' s functional reserve. Based on CGA findings regarding exercise tolerance and psychological well-being, a personalized "exercise prescription" is developed. This pathway emphasizes the transition from hospital to home-based care, ensuring that the

patient' s physical activity levels are safely increased while managing polypharmacy and potential depression.

3. Neurological Recovery and Cognitive Support Pathway

This service pathway is tailored for elderly patients who have undergone neurosurgical interventions or are recovering from stroke-related surgeries. The integration of CGA allows for the early detection of cognitive impairment and sensory deficits (vision/hearing) that may hinder rehabilitation. The pathway includes intensive speech and occupational therapy, supplemented by cognitive stimulation exercises. Social workers and caregivers are integrated into the service loop to address the "caregiver burden" identified during the assessment, ensuring a supportive environment for the patient' s long-term neuroplastic recovery.

4. Comprehensive Oncological Postoperative Support Pathway

Elderly cancer patients often face complex recovery trajectories due to the systemic effects of both surgery and malignancy. This pathway utilizes CGA to evaluate the patient' s "biological age" rather than chronological age, guiding the intensity of postoperative rehabilitation. It integrates nutritional support, psychological counseling, and symptom management (such as fatigue and chronic pain). By monitoring functional status through the CGA framework, the clinical team can make data-driven decisions regarding the timing

2．试点运行：在示范团队中运

Implement the new workflow, focusing on testing key components such as referral coordination, team communication, and patient engagement.

3．工具开发：开发本土化的患

The following practical tools are provided to support clinical implementation: patient health plan templates, team collaboration checklists, and referral handoff forms.

1 制度固化：将试点成功流程、

Formalize tools and communication mechanisms into official institutional regulations to ensure all teams master new concepts. Shape an organizational culture of "Team Collaboration, Patient First" by sharing success stories and establishing patient feedback walls.

1．数据驱动：定期分析服务

By leveraging comprehensive data and patient health records, we implement a Plan-Do-Check-Act (PDCA) cycle for quality improvement to ensure continuous

enhancement of clinical outcomes.

2．外部协同：与合作机构建

Establish closer mechanisms for talent cultivation, technical support, and collaborative quality improvement.

3．政策倡导：总结实践经验、

evidence, providing a decision-making reference for payment reform and policy optimization.

For Chinese general practice, the Patient-Centered Medical Home (PCMH) represents not only an innovation in service models but also a reshaping of the discipline' s core essence and value. Promoting the localized practice of the PCMH concept in China is a strategic choice to enhance the quality of community health services and achieve the transition from mere "contracting" to "meaningful engagement." The key to successful localization lies in its systematic nature; team building or information technology cannot be emphasized in isolation. Instead, there must be a synchronized transformation of service models, payment methods, performance management, organizational culture, and professional roles [**?**]. This is a long-term, systematic project requiring the collective participation of policymakers, researchers, and practitioners, with the ultimate goal of continuously optimizing the integration and continuity of primary care in China.

The limitations of this study lie in its primary reliance on literature and policy analysis to construct a theoretical model for a localized implementation path. Empirical intervention studies in specific institutions are still needed to test its feasibility, effectiveness, and actual impact on patient health outcomes, medical costs, and the experiences of healthcare personnel. Furthermore, due to constraints in article length and core focus, this paper did not conduct an in-depth analysis of international PCMH systematic evaluation methods, certification processes, or indicator systems. Future research should focus on conducting rigorously designed community intervention trials using mixed-methods approaches to quantitatively evaluate health management effectiveness and health economic benefits, while qualitatively analyzing the acceptance and experiences of both teams and patients. Additionally, specialized discussions could be conducted regarding mature PCMH assessment tools, certification standards, and their localized application. The specific design and implementation effects of the path model proposed in this study are highly dependent on the local policy environment, and its generalizability remains to be verified in regions with varying levels of economic development.

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and Sun Jin were responsible for literature research; Peng Derong and Zheng Jialin were responsible for quality control and supervision; Zhao Xinxin and Sun Xiaoting were responsible for policy analysis and final formatting. All authors have read and agreed to the publication.

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Abstract

General practice (GP) serves as the cornerstone of the primary healthcare system, playing a vital role in maintaining public health and managing chronic diseases. This paper explores the current state, challenges, and future directions of general practice in China. By analyzing the integration of machine learning and deep learning technologies into clinical decision support systems, we examine how digital health interventions can enhance the quality of care provided by general practitioners. Furthermore, we discuss the importance of standardized residency training and the implementation of the "gatekeeper" system to ensure equitable access to healthcare services across diverse populations.

Introduction

In recent years, China has undergone significant healthcare reforms aimed at strengthening the primary care sector. General practice, as a discipline, focuses on providing comprehensive, continuous, and coordinated care to individuals and families. Unlike specialized medicine, general practice emphasizes the biopsychosocial model of health, addressing not only physical ailments but also psychological and social determinants of health. The increasing burden of aging populations and the prevalence of non-communicable diseases (NCDs) have necessitated a shift from hospital-centric care to community-based management.

The Role of Technology in General Practice

The rapid advancement of artificial intelligence (AI) has provided new tools for general practitioners to improve diagnostic accuracy and patient management. Machine learning algorithms can analyze vast amounts of electronic health record (EHR) data to identify patterns and predict disease progression. For instance, deep learning models have been successfully applied to medical imaging and genomic data to assist in early screening for conditions such as diabetic retinopathy and cardiovascular diseases.

[Figure 1: see original paper]

As shown in [Figure 1: see original paper], the integration of AI into the GP workflow involves several stages, from data acquisition to clinical validation. The mathematical framework for these predictive models often relies on optimizing objective functions. Consider a generalized model where the predicted outcome $\hat{y}$ is a function of input features x and model parameters θ:

$$\hat{y} = f(x; \theta)$$

To minimize the prediction error, we utilize a loss function $\mathcal{L}$, such as the cross-entropy loss for classification tasks:

$$\mathcal{L}(\theta) = -\frac{1}{n}\sum_{i=1}^{n}[y_i \log(\hat{y}_i) + (1 - y_i)\log(1 - \hat{y}_i)]$$

By applying gradient descent, parameters are updated to improve the model'

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Ethical Challenges and Governance of Generative Artificial Intelligence in Clinical Research

Abstract

The rapid development of Generative Artificial Intelligence (GAI) has introduced transformative opportunities for clinical research, yet it simultaneously presents significant ethical challenges. This paper analyzes the core ethical issues arising from the application of GAI in clinical settings, including data privacy risks, algorithmic bias, the "black box" nature of decision-making, and the shifting landscape of research integrity. We propose a multi-dimensional governance framework that integrates technical safeguards, ethical oversight, and regulatory policy to ensure the responsible integration of GAI in clinical research.

1. Introduction

In recent years, the field of medicine has witnessed a paradigm shift driven by deep learning and large-scale language models. Generative Artificial Intelligence (GAI) differs from traditional discriminative AI by its ability to create new content, ranging from synthetic patient data to automated clinical trial protocols. While these capabilities promise to accelerate drug discovery and optimize clinical workflows, they also challenge existing ethical frameworks governing human subject research. As GAI models become increasingly integrated into the clinical research lifecycle, it is imperative to address the tension between technological innovation and the fundamental principles of bioethics.

2. Ethical Challenges of GAI in Clinical Research

2.1 Data Privacy and Informed Consent The training of GAI models requires vast datasets, often comprising sensitive electronic health records (EHRs). Traditional anonymization techniques may prove insufficient against the sophisticated pattern-recognition capabilities of GAI, leading to potential re-identification of research participants. Furthermore, the dynamic nature of GAI makes it difficult to provide participants with a clear understanding of how their data will be utilized in the future, complicating the process of obtaining truly informed consent.

2.2 Algorithmic Bias and Fairness GAI models are susceptible to inheriting and amplifying biases present in their training data. If the underlying data lacks diversity—representing only specific demographics or clinical settings—the

generated outputs may be biased against marginalized populations. In clinical research, such biases can lead to inequitable health outcomes and the exclusion of certain groups from the benefits of medical innovation, violating the principle of justice.

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Service Capacity Evaluation Guidelines for Community Health Service Centers (2023 Edition)

1. Overview

The "Service Capacity Evaluation Guidelines for Community Health Service Centers (2023 Edition)" (hereinafter referred to as the "Guidelines") have been developed to further improve the primary healthcare service system and enhance the comprehensive service capabilities of community health service centers. These guidelines serve as a standardized framework for assessing the quality, efficiency, and scope of medical and public health services provided at the community level.

2. Evaluation Framework and Objectives

The primary objective of the 2023 Guidelines is to promote the high-quality development of primary healthcare. By establishing a scientific and systematic evaluation index system, the guidelines aim to: - Standardize the management and operational procedures of community health service centers. - Improve the clinical diagnosis and treatment capabilities for common and frequently occurring diseases. - Strengthen the integration of clinical medicine and public health services. - Enhance the overall patient experience and satisfaction within the community.

3. Key Evaluation Dimensions

The evaluation system is structured around several core dimensions, ensuring a holistic assessment of a center' s performance:

3.1 Basic Infrastructure and Equipment This dimension evaluates the physical environment, including the rational layout of functional areas, the availability of essential medical equipment, and the implementation of information technology systems to support digital health records and telemedicine.

3.2 Medical Service Capabilities Focusing on clinical excellence, this section assesses the center' s ability to provide outpatient services, emergency care, and inpatient services (where applicable). Key indicators include the variety of medications available, the proficiency of surgical or technical procedures performed, and the effectiveness of traditional Chinese medicine (TCM) services.

3.3 Public Health Services The Guidelines emphasize the role of community centers in population health management. Evaluation criteria include the management of chronic diseases (such as hypertension and diabetes), maternal and child health services, immunization programs, and infectious disease prevention and control.

3.4 Management and Quality Control Effective governance is critical for sustainable service delivery. This dimension examines human resource management, financial oversight, medical safety protocols, and the continuous improvement of healthcare quality through internal audits and feedback mechanisms.

4. Implementation and Continuous Improvement

The 2023 Guidelines encourage a dynamic evaluation process. Community health service centers are expected to conduct regular self-assessments to identify gaps in service delivery. External evaluations conducted by health administrative departments will

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Insights from the Construction of Management Consortia

The construction of medical consortia is a critical strategic deployment for deepening the reform of the medical and health system in China. By integrating medical resources and optimizing the hierarchical diagnosis and treatment system, these consortia aim to improve the overall efficiency of the healthcare service system. This paper explores the developmental trajectory and practical experiences of management consortia, offering insights into their structural optimization and operational sustainability.

1. The Necessity of Management Consortia

In the context of the "Healthy China" strategy, the traditional fragmented medical service model can no longer meet the growing health needs of the population. Management consortia serve as a bridge to connect tertiary hospitals with primary healthcare institutions. Through the unified management of personnel, finances, and property, these consortia facilitate the downward flow of high-quality medical resources, thereby enhancing the service capacity of community-level health centers.

2. Key Strategies in Consortium Construction

The success of a management consortium depends on several core pillars. First, the establishment of a clear governance structure is essential. This involves defining the rights and responsibilities of the leading hospital and the member units to ensure coordinated decision-making. Second, the integration of information systems is a prerequisite for seamless patient referrals and resource sharing. By utilizing digital platforms, consortia can achieve "data mobility" instead of requiring patients to travel unnecessarily.

Furthermore, the "talent sharing" mechanism plays a vital role. Senior clinicians from tertiary hospitals are encouraged to provide on-site guidance and training at primary clinics. This not only improves the technical skills of local staff but also builds trust among patients regarding the quality of primary care.

3. Challenges and Policy Implications

Despite significant progress, the construction of management consortia faces several challenges. These include inconsistent compensation mechanisms, difficulties in aligning the interests of different stakeholders, and the lack of long-term evaluation standards. To address these issues, policy support must be strengthened.

Government departments should refine the medical insurance payment methods to incentivize the "first visit at the primary level" and promote the rational distribution of patients. Additionally, the performance appraisal system for consortia should shift from a focus on scale expansion to a focus on health outcomes and patient satisfaction.

4. Conclusion

The construction of management consortia is a complex systemic project that requires continuous exploration and innovation. By focusing on resource integration, institutional reform, and technological empowerment, these consortia can effectively support the realization of a hierarchical medical system. The experiences gained

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