Practice and Reflection on Community-Based Diabetes Management Models from a Value Co-Creation Perspective (Postprint)

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Abstract

China is one of the countries experiencing the most rapid growth in diabetes prevalence globally and has the largest diabetic population. The "Healthy China 2030" Planning Outline explicitly calls for further prevention and control of major diseases, implementation of diabetes prevention and treatment initiatives, guidance for diabetic patients to enhance health management, and delaying or preventing the onset and progression of diabetes. Over the past two decades, value co-creation theory has been increasingly applied and developed in the health services sector, with various countries and regions exploring low-cost, high-effectiveness solutions for diabetes prevention and control; however, its application remains relatively limited in the domestic chronic disease management field. This paper, from a value co-creation perspective and with grassroots communities as the focal point of analysis, further synthesizes domestic and international chronic disease management experiences, proposes future directions across four dimensions: proactive health, organizational guidance, digital technology, and incentive mechanisms, and provides a reference framework for optimizing and refining the grassroots diabetes management service system, establishing a multi-stakeholder collaborative community chronic disease management model based on value co-creation, and achieving co-creation, co-governance, and shared benefits in chronic disease management.

Full Text

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Abstract

China is one of the countries with the fastest-growing diabetes prevalence worldwide and has the largest number of people with diabetes. The "Healthy China 2030" Planning Outline explicitly proposes to further prevent and control major diseases, implement diabetes prevention and control actions, and guide patients with diabetes to strengthen health management to delay or prevent the onset and progression of diabetes. Over the past two decades, value co-creation theory has been well-developed in the health services field, with various countries and regions exploring low-cost, high-effectiveness programs to prevent and control diabetes. However, this approach remains relatively lacking in China' s chronic disease management domain. Based on a value co-creation perspective and using primary-level communities as the research focus, this paper summarizes domestic and international chronic disease management experiences and proposes future directions from four aspects: active health, organizational guidance, digital technology, and incentive mechanisms. This provides references for optimizing and improving the primary-level diabetes management service system, establishing a multi-stakeholder collaborative community chronic disease management model based on value co-creation, and achieving co-creation, co-governance, and shared benefits in chronic disease management.

Keywords: Diabetes mellitus; Chronic disease management; Value co-creation; Community health services; Review

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1. Literature Search Strategy

We conducted computer-based searches of PubMed, Web of Science, CNKI (China National Knowledge Infrastructure), and Wanfang Data for relevant literature from database inception to May 2023. Chinese search terms included "价值共创" (value co-creation), "糖尿病管理" (diabetes management), "慢性病管理" (chronic disease management), and "社区卫生服务" (community health services). English search terms included "Diabetes," "Chronic Disease Management," "Value-Co-creation," and "Community health services." Inclusion criteria comprised studies, reviews, and meta-analyses related to primary-level diabetes management and value co-creation published between January 2013 and May 2023, with classic literature relevant to the topic considered regardless of publication date. Exclusion criteria included non-Chinese/English literature, commentaries, letters,

conference proceedings, duplicate publications, and studies of poor quality.

2. Theoretical Foundation

2.1 Concept of Value Co-creation In 1999, American scholar Ramirez first proposed the concept of "value co-production," identifying customers and enterprises as the core of value creation, with both parties creating value through mutual communication and collaboration. This marked the early germination of value co-creation thought, though co-production is not entirely identical to value co-creation. With technological advancement and evolving conceptual frameworks, customers have played increasingly important roles in "value co-production," transitioning from passive production factor resources to active collaborative participants. Current value co-creation theory primarily derives from two schools: service-dominant logic and customer-dominant logic. American scholars Vargo and Lusch proposed the service-dominant logic of value co-creation, emphasizing the role of consumers and viewing service as the fundamental basis of all economic exchange. Prahalad et al. proposed the customer-dominant logic of value co-creation, considering interactive customer experiences as the core of value co-creation.

2.2 Application of Value Co-creation in Healthcare Value co-creation theory has evolved through five stages: customer experience, service-dominant logic, service logic, service science, and service ecosystems. In recent years, the service ecosystem perspective of value co-creation has gained widespread attention. In 2016, American scholars Vargo et al. proposed the health service ecosystem perspective of value co-creation theory, suggesting that all participants achieve mutual benefit through resource integration and service exchange, constrained by institutions and institutional arrangements, and co-create value through experiences in nested and overlapping service ecosystems. The same year, Australian scholars Frow et al. proposed that value co-creation practices play important roles in reshaping health ecosystems, with health value subjects including micro-, meso-, and macro-level interactive structures, and the co-creation process involving value propositions, technology resource integration, health information sharing and exchange, institutional norms, and incentive constraints.

Over the past two decades, value co-creation theory has been well-applied in health services. In 2006, Michael Porter first proposed "value-based healthcare," advocating for a patient-centered approach that emphasizes patient needs during diagnosis and treatment while controlling healthcare resource consumption and costs to provide higher-value services. Enhanced team interaction and collaboration between physicians and patients through value co-creation helps improve disease treatment outcomes, promotes patient recovery and prognosis, and positively impacts hospital service quality and patient satisfaction. This represents a necessary means to improve service value and a direction for healthcare service reform and development.

3. International Practice of Diabetes Community Management Models from a Value Co-creation Perspective

International value co-creation applications in health services have developed well. Empirical studies from high-income countries such as the United States and Canada demonstrate that healthcare professionals activate patient participation and health responsibility to achieve value co-creation, using low-cost, high-effectiveness programs to prevent and control diabetes. Representative models include the Chronic Care Model, Caring Others Increasing Engagement in Patient Aligned Care Teams, Shared Medical Appointments, and Telehealth-support, Integrated care with CHWs and MEdication-access (TIME) .

3.1 Chronic Care Model The Chronic Care Model emphasizes patient-centered, multi-level collaboration and integration among patients, health service organizations, and communities in chronic disease management. It has been widely applied in high-income countries such as the United States and Europe. The Innovative Care for Chronic Conditions Framework (ICCCF) builds upon the Chronic Care Model to provide a comprehensive conceptual framework for preventing and managing long-term diseases in resource-limited environments, with broad application in low- and middle-income countries. Characterized by "connecting healthcare with other social resources," this model improves chronic disease clinical care and outcomes through multi-level collaborative networks spanning "policy-health system-community-individual," implementing high-quality care management. Under the guidance of CCM and ICCCF, primary-level communities have effectively established patient-centered, multidisciplinary diagnostic and treatment teams, with clinical decision support systems and electronic health management data widely applied in patient treatment goal setting. Community family doctors receive training in evidence-based diabetes treatment protocols and health education, further improving glycemic, blood pressure, and lipid control levels, enhancing patient medication adherence, diet, and physical exercise self-management behaviors, and reducing medical costs.

3.2 Caring Others Increasing Engagement in Patient Aligned Care Teams The 2021 Diabetes Self-Management Education and Support Guidelines call on healthcare professionals to actively incorporate "family supporters" into diabetes education and support programs. The team-based diabetes management model for empowering supporters is built upon the guideline concept of "family supporters,"emphasizing the role of family and friends in monitoring and supporting patient health outcomes including blood glucose, blood pressure, and lipids. This model trains family supporters in behavior change techniques such as goal setting and action planning, and utilizes digital technologies including biweekly automated interactive voice calls and primary care visit preparation calls to strengthen supporter engagement. The model increases active supporter participation in self-management, promotes healthy patient behaviors, does not cause greater diabetes distress or caregiver burden among family supporters,

and demonstrates that brief training for family supporters can enhance self-management assistance for patients with type 2 diabetes.

3.3 Shared Medical Appointments First proposed by Noffsinger, the Shared Medical Appointments model aims to develop an innovative care delivery model that provides comprehensive medical care and self-management support while reducing healthcare costs. The model has been successfully applied across multiple medical fields, including geriatric chronic disease management, cancer care, and pain management. By combining group peer support with clinical one-on-one care, it effectively brings patient groups together with interdisciplinary healthcare teams including physicians, pharmacists, nurse practitioners, rehabilitation therapists, dietitians, and social workers for a series of meetings. During these sessions, team leaders encourage participants to set "behavior goals" and "action plans," discuss key areas of diabetes care, and share experiences and self-management strategies. The model has been modified and adjusted multiple times during primary care practice promotion to enhance feasibility. Comprehensive evidence demonstrates that Shared Medical Appointments effectively improve patient health outcomes, particularly glycemic control, and reduce "detours" in healthcare services, helping patients obtain more targeted guidance.

3.4 Telehealth-support, Integrated Care with CHWs and MEdication-access (TIME) International Diabetes Federation data indicate that 81% of people with diabetes live in low- or middle-income countries, and in developed countries, most diabetes patients are from low- or middle-income populations. The TIME program aims to combine current evidence-based chronic disease management solutions with medical-industrial collaboration to provide effective interventions for healthcare-limited low- and middle-income regions. The program consists of three components: T (Telehealth-support) involves weekly physician training meetings with community doctors and monthly half-hour thematic group visits addressing glycemic control, medication adherence, and concerns; I (Integrated care with CHWs) involves structured visits through research teams meeting weekly for six months to discuss barriers in medical, social, and self-management domains; ME (MEdication-access) addresses low-income medication adherence issues through low-cost prescriptions such as metformin and glimepiride. This program helps patients achieve better glycemic and blood pressure control and improved medication adherence, while increasing community physician adherence to American Diabetes Association guidelines. Telehealth support helps better identify patient care barriers, reduce costs, enhance communication, and improve HbA1c outcomes.

4. Domestic Practice of Diabetes Community Management Models from a Value Co-creation Perspective

In recent years, the Chinese government has introduced numerous policies promoting primary-level chronic disease prevention and treatment. In 2009, type

2 diabetes was incorporated into the National Basic Public Health Service Program for standardized management. In 2016, seven ministries including the State Council's Healthcare Reform Office issued joint documents advancing pilot programs for the family doctor contract system, providing comprehensive, continuous, and coordinated basic medical and health services for residents. Driven by these national policies, China has gradually established a community-based chronic disease management system for older adults, actively exploring high-quality services oriented toward the needs of elderly chronic disease patients and striving to enhance the applicability, scientific rigor, and comprehensiveness of community chronic disease management systems in the context of population aging.

Domestic applications of value co-creation in healthcare systems primarily consist of case studies and theoretical research, with relatively few studies in chronic disease management and limited empirical research on health outcomes and mechanisms. Domestic diabetes community management model explorations have focused on three categories: primary healthcare service models, internet-based medical service models, and online-to-offline (OTO) resource integration models.

4.1 Primary Healthcare Service Model As a global strategic initiative, primary healthcare is key to health systems'response to health challenges, including health promotion, education, chronic disease management, and rehabilitation. Chronic disease patient health management services are core components of the National Basic Public Health Service Standards (2021 Edition), which specify that health management for hypertensive and type 2 diabetic patients aged 35 and above among permanent residents shall be provided free of charge by the medical service system, funded by government finance. Patients can access corresponding free health services at community health service institutions or township health centers in their jurisdiction, with timely referral for patients unsuitable for primary-level treatment. This model has gradually matured in China, forming a platform based on community health service institutions where family doctor teams provide comprehensive, multi-level, and personalized chronic disease management services for contracted older adults. Multiple empirical studies demonstrate strong positive correlations between community primary healthcare service models and various favorable outcomes, effectively improving patient medication adherence and quality of life, reducing specialist medical service utilization and total medical expenditures, optimizing medical resource allocation, promoting resource allocation to primary levels, and transforming healthcare service delivery models.

Although the current community primary healthcare service model has been implemented, it has not fully integrated the value co-creation concept. Implementation challenges include passive resident contract fulfillment, phenomena of "contracting without engagement" and "contracting for the sake of contracting," and residents' unclear understanding of family doctor service project contents

and functions, leading them to bypass community facilities for specialist hospital visits, thereby constraining primary care service model development. Additionally, heavy workloads, low compensation, and low social status at community health institutions make it difficult to attract high-quality medical talent, reducing family doctors' enthusiasm for value co-creation.

4.2 Internet-based Medical Service Model As China' s new healthcare reform progresses, relevant government departments have responded by vigorously promoting medical technology informatization and intelligence from the perspectives of new technology application and policy incentives. This has enabled internet-based medical service models to evolve with more possibilities, providing opportunities to address traditional healthcare dilemmas. Common current internet-based medical models include virtual health communities, electronic health records, and smart healthcare platforms. These models, built upon internet platforms, provide medical resource queries, health records, electronic prescriptions and visit records, patient psychological counseling, and remote medical consultation services, collaboratively building production and consumption systems among patients, healthcare providers, internet platforms, and social stakeholders to further achieve a chain reaction of "value consensus-value sharing-value symbiosis and value co-winning," ultimately realizing value co-creation within the system. Multiple empirical studies indicate this model helps reduce outpatient pressure at general hospitals and community hospitals while providing faster, more targeted assistance for diabetes patients to improve health outcomes.

China's healthcare industry remains in the digital transformation stage. Despite the potential value brought by internet-based medical service models through technological development, challenges persist. Community diabetes patients are generally older with limited understanding of information and electronic technology and lack subjective initiative. Conventional online consultations require high patient self-management capabilities and make long-term tracking difficult. Community doctors' utilization levels of electronic information systems vary considerably, increasing workload and reducing effective communication time between doctors and patients.

4.3 Online-to-Offline (OTO) Resource Integration Model As "Internet Plus" enters the health management field, the OTO (online-to-offline) model has emerged to maximize health management resource utilization. First proposed by Alex Rampell and widely applied in the tertiary sector, this model' s core lies in combining online support with offline experiences, enhancing service value through strengthened online-offline interaction to achieve value co-creation outcomes. Currently, this model is extensively applied in health education and rehabilitation intervention fields. In primary-level community diabetes management, the model integrates offline medical resources based on online management channels, organizing health management teams including endocrinologists, registered nurses, health managers, clinical dietitians, community doctors, fam-

ily doctors, and health promotion volunteers to provide online services such as appointment scheduling, health consultation, remote medical care, and rehabilitation follow-up, as well as offline services including diabetes diet management, exercise guidance, and oral medication instruction. Empirical studies demonstrate this model facilitates long-term, continuous dynamic tracking of diabetes patients, helps improve self-management behaviors, assists patients in maintaining more persistent and stable glycemic control, and satisfies individualized health management needs through online remote medical and health consultation services, laying a foundation for promoting rational medical resource allocation and enhancing continuous community care.

However, current community health service development in China remains unbalanced, with insufficient doctor-patient communication and inadequate continuity of community care representing major obstacles to diabetes health promotion. While the OTO model enhances diabetes patients' health literacy and self-management capabilities, it faces shortcomings including imperfect information sharing technology across regions, lack of human resources for health management teams, and inability to conduct long-term tracking management under population mobility. The OTO model remains in the exploration stage, has not yet formed a mature service system, and is only used in some communities, requiring further development as an emerging model.

5. Prospects for China' s Primary-Level Diabetes Community Management Models

China has achieved certain successes in primary-level diabetes health management through comprehensive application of lifestyle interventions, multidisciplinary specialist teams, and mobile internet technology, with primary healthcare service models, internet-based medical service models, and OTO models continuing to develop. However, the synergistic co-creation role between doctors and patients has not been fully realized, patients' roles in health management goal setting and shared decision-making for self-management have not been activated and empowered, and multi-stakeholder partnerships among communities, universities, medical staff, and patients in chronic disease management have not been established. Therefore, optimizing and improving the primary-level diabetes management service system and establishing a multi-stakeholder collaborative community chronic disease management model based on value co-creation to achieve co-creation, co-governance, and shared benefits in chronic disease management is urgently needed.

5.1 Promoting Active Health and Innovating Community Diabetes Management Models In 2016, the Central Committee of the Communist Party of China and the State Council issued the "Healthy China 2030" Planning Outline, identifying universal health as the fundamental purpose of building a healthy China. The Basic Medical and Health Promotion Law of the People' s Republic of China, implemented in June 2020, advocates that citizens are

the first responsible persons for their own health and must firmly establish and practice health management concepts that emphasize personal health responsibility. The "first responsible person" concept has brought forth a new "active health" model, representing the sum of all social activities conducted by humans around health, including controlling risk factors from their source and creating health value throughout, with the goal of ensuring everyone can access equitable, accessible, efficient, and high-quality lifelong healthcare services.

Since the state incorporated diabetes treatment into basic public health service categories, China has made considerable progress in primary-level diabetes management, though the management core remains physician-centered with patients lacking awareness of their rights and value in participating in their own disease management. Based on value co-creation perspectives and active health concepts, we must further innovate community diabetes management models from macro perspectives of national strategy and modern governance concepts, meso perspectives of institutional norms and incentive mechanisms, and micro perspectives of empowerment and shared decision-making, to motivate diabetes patients to participate in self-management goal setting and intervention strategy formulation, transforming them from passive health service users to active health co-creators and health promoters who create value through social resource integration and multi-stakeholder communication.

5.2 Strengthening Organizational Guidance and Coordinating Multi-stakeholder Co-governance and Shared Benefits In 2021, the Central Committee of the Communist Party of China and the State Council issued the "Opinions on Strengthening the Modernization of Primary-level Governance Systems and Governance Capacity," explicitly stating that primary-level governance is the cornerstone of national governance. Communities are the "last mile" connecting Party committees and governments with the masses, and community governance represents the basic unit and critical link in national governance. As an effective means of diabetes health management, primary-level community intervention serves as an important channel for integrating multi-party forces and a vital platform for achieving people' s health, making it imperative to strengthen organizational guidance and coordinate multi-stakeholder co-governance and shared benefits.

The key to strengthening organizational guidance lies with Party and government organizations, which must further strengthen the leadership responsibilities of primary-level Party committees and organizations, enhance the construction of village (neighborhood) committee public health committees, integrate community and social resources, leverage multi-stakeholder roles, adopt a family doctor-centered "1+N" model incorporating community workers, volunteers, nearby universities, and various economic organizations, and utilize social interpersonal network capital to jointly formulate and implement diabetes community intervention protocols, improving chronic disease management effectiveness. On the foundation of implementing the family doctor contract service model,

social workers should be selected as assistants to support management activities. Experienced outstanding diabetes patients, retired physicians, retired teachers, and veteran Party members should be recruited as volunteers to serve as leaders of community self-management groups, responsible for collecting data on blood glucose, diet, and exercise and conducting health education, thereby leveraging peer support and group management social support functions. Nearby university organizations should be invited to conduct health science popularization lectures, develop health education lecture topic lists, and build integrated medical-prevention health education platforms to effectively enhance residents' health literacy and empower and motivate diabetes patients.

5.3 Leveraging Digital Technology to Empower High-Quality Development of Multi-stakeholders In 2018, the State Council issued the "Opinions on Promoting the Development of 'Internet Plus Healthcare,' "emphasizing the promotion of internet technology applications in health from three dimensions: service systems, support systems, and strengthened industry regulation and security. Effectively leveraging digital technology to build an interconnected diabetes management platform for multiple stakeholders and empower their development represents the key to innovating diabetes management models. Leveraging information technology support means fully utilizing innovations in digital intelligence technology, including the Internet of Things, big data, cloud computing, artificial intelligence, and sensor technology, to break through bottlenecks in "Internet Plus Healthcare"development. This involves strengthening the construction of health medical big data sharing and exchange systems through multi-terminal cooperation, data sharing, and portable electronic records to effectively promote cooperative communication among diabetes patients, family doctors, community workers, and community volunteers. For diabetes patients, management platforms can track data on exercise, diet, blood glucose, and lipids to motivate them to maintain healthy lifestyles and improve self-efficacy, self-control, and self-decision-making abilities. For family doctors, community workers, and volunteers, management platforms can provide effective information push and regular assessments, establish and improve health knowledge popularization pathways and training mechanisms, and enhance their medical service capabilities to empower high-quality development. Additionally, when leveraging digital technology, attention must be paid to strengthening health medical data security systems, providing autonomy in health privacy data collection, actively exploring privacy protection technologies, and improving data security protection capabilities in medical and health institutions.

5.4 Incentive and Assessment Support to Promote Sustainable Value Co-creation Models In 2023, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the "Opinions on Further Improving the Medical and Health Service System," clarifying that primary-level medical and health institutions should serve as the main platform for establishing a family doctor contract service model cen-

tered on general practitioners with effective linkage between general and specialized practice and organic integration of medical treatment and disease prevention. Family doctors serve as the critical link in innovative diabetes management models and important connectors in value co-creation models. Strengthening incentive and assessment mechanisms helps improve family doctors' service enthusiasm and promotes model sustainability, enhancing primary-level community diabetes management capacity and service levels.

Strengthening incentive and assessment support involves two key aspects. First, emphasizing both process and outcome assessments by establishing health management outcome-oriented incentive and constraint mechanisms, incorporating diabetes patients' health outcome improvements and personalized goal achievement rates as family doctor assessment indicators, and providing financial incentives, recognition, and continuing education opportunities for family doctors meeting assessment standards to enhance their sense of responsibility and motivation. Second, further improving family doctor service financing and payment mechanisms by integrating them with medical insurance funds, encouraging exploration of combining primary-level outpatient capitation payment with family doctor contract services, and linking capitation standards, total budgets, year-end settlements, and assessment elements with family doctor contract indicators to promote the transformation of people' s concepts from "passive treatment" to "active health."

Author Contributions

NIU Luyao, YING Xinyu, and ZHANG Shuqin were responsible for conceptualization and design, domestic and international literature collection and synthesis, and manuscript writing. AN Zhixin and JI Jingya were responsible for domestic and international literature collection and supplementation, and table preparation and organization. LIU Yuehua and GAO Yuexia were responsible for conceptualization and design, manuscript revision, quality control, and final review.

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