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ARTICLE

Localization Challenges and Strategic Approaches in Implementing DRG Payment in China

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ABSTRACT

The Diagnosis-Related Group (DRG) is a system of classification that categorizes patients into distinct diagnostic groups based on various clinical and resource consumption factors, facilitating a predetermined payment for each group and promoting efficiency in healthcare expenditure. This study comprehensively examines the localization strategies for the DRG payment system in China, highlighting the necessity for continuous optimization of DRG grouping and payment standards, strengthening healthcare quality and cost control, preventing over-treatment and ethical risks, and constructing a comprehensive payment system. It also emphasizes the importance of enhancing the standardization and informatization of healthcare data to support the accurate collection, analysis, and utilization of data, ensuring more precise decision-making and policy implementation. The analysis is based on a review of international DRG payment systems and their diverse applications, providing valuable insights and comparative perspectives for China's DRG payment reform. The study concludes that the localization of DRG payments in China is not only a technical challenge but also a vital step towards modernizing the healthcare system, which will significantly impact the medical and healthcare sector in China by ensuring the sustainable allocation of healthcare funds, improving service quality, and fostering the fair and efficient development of healthcare services across diverse regions, and ultimately enhancing health outcomes for the population.

Keywords: China; Diagnosis-Related Groups (DRG); Healthcare Payment Reform

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1. Introduction

As healthcare systems worldwide grapple with rising financial pressures and the demand for optimized resource allocation, payment reforms have become a cornerstone of health system modernization. Diagnosis-Related Group (DRG) is a case-mix classification method that categorizes patients into different diagnostic groups based on factors such as age, gender, length of hospital stay, clinical diagnosis, medical conditions, surgical procedures, severity of illness, comorbidities, complications, and treatment outcomes [1]. DRG-based payment systems, initially developed in the United States in the 1970s, have since been adopted and localized by numerous countries, including Germany, Japan, and South Korea [2–4]. These systems mark a paradigm shift from traditional fee-for-service models to performance-based reimbursement frameworks. By grouping patients with similar clinical and resource needs, DRG systems standardize payment rates, incentivize efficient care delivery, and align provider behavior with healthcare policy objectives.

In China, rapid economic development, urbanization, and demographic changes have significantly increased the demand for equitable, high-quality, and affordable healthcare services. However, the country faces several challenges, including regional disparities, uneven resource distribution, and rising healthcare costs. To address these issues, the Chinese government has prioritized payment reform as a key strategy for healthcare transformation. Since Beijing's pilot DRG grouping in 2014, China has progressively expanded its DRG reform efforts, culminating in the launch of a national pilot program in 2019. This initiative formally introduced the China Healthcare Security DRG (CHS-DRG) system, an ambitious step toward modernizing healthcare financing and ensuring sustainable use of public funds.

The localization of DRG systems in China offers a critical opportunity to reshape the nation's healthcare delivery framework. However, the adaptation process is fraught with challenges. China's healthcare landscape is marked by vast differences in regional economic development, healthcare infrastructure, and patient demographics. Moreover, implementing a DRG-based system requires not only the development of scientific grouping standards but also accurate data collection, stakeholder collaboration, and mitigation of risks such as upcoding and service undersupply.

International experiences provide valuable lessons for China. The United States emphasizes the importance of continuously updating DRG groupings to reflect advancements in medical technology and treatment standards. Japan's hybrid Diagnosis Procedure Combination (DPC) system highlights the benefits of diversified payment models, integrating per-day and fee-for-service reimbursements. South Korea underscores the critical role of quality monitoring and regulatory oversight in reducing ethical risks and ensuring service equity. These global insights offer essential guidance as China charts its path toward a localized, efficient, and equitable DRG system.

This article examines the intricacies of DRG implementation and localization in China, drawing extensively from global best practices and lessons learned. It explores international DRG payment systems and their implications for China's reforms, evaluates the outcomes of pilot projects across major cities, and provides strategic recommendations to address technical, operational, and policy challenges. The analysis underscores the importance of adopting a comprehensive and adaptive approach, leveraging advanced information technology and robust regulatory frameworks to ensure long-term success.

By addressing both theoretical and practical aspects, this study contributes to the ongoing discourse on payment reform in China's healthcare system. It highlights the transformative potential of DRG systems to improve cost efficiency, healthcare quality, and resource utilization. Ultimately, the successful localization of DRG models in China represents not just a technical innovation but also a pivotal step in achieving the broader goals of healthcare equity, quality, and sustainability.

2. Methodology

This study adopts a systematic literature review to analyze the localization of DRG payment systems in China. Relevant articles and reports were sourced from academic databases such as PubMed, Web of Science, Scopus, and CNKI, as well as official publications from the National Healthcare Security Administration (NHSA). The search covered materials published between 2000 and 2025, ensuring a focus on contemporary practices.

Key search terms included "Diagnosis-Related

Groups", "DRG payment system", "healthcare cost control", "quality-based payment", and country-specific terms like "DPC Japan", "South Korea DRG",and "DRG China". Boolean operators and filters were used to refine the search results, and both English and Chinese sources were reviewed.

Inclusion criteria prioritized articles that focused on DRG implementation, grouping methods, payment mechanisms, and healthcare outcomes, while excluding studies unrelated to DRG systems or lacking empirical evidence. Policy documents, technical reports, and case studies from reliable sources were also included.

Data from selected articles were analyzed to identify trends in DRG grouping methods, payment standards, and challenges in implementation. Insights from international DRG systems were compared to China's pilot projects, providing a foundation for discussing localization strategies. This approach ensures a broad yet focused understanding of the topic.

3. Development and Global Adoption of DRG

DRG was first developed in the United States as a payment model that linked specific hospital conditions to their associated healthcare costs[1]. The system was initially designed to group hospitalized patients based on their resource consumption and similarities in medical conditions. In addition, DRG has been widely used to evaluate the quality of medical services, focusing on factors such as technical skill, resource efficiency, costs, mortality rates, and readmission rates[5, 6]. It also plays a critical role in allocating healthcare resources, evaluating performance, and improving hospital management practices. These applications provide a novel approach for comprehensively optimizing and enhancing the healthcare service environment and quality. Since then, many countries have adopted DRG systems. By 2018, over 50 countries were using DRGs in various applications. As DRGs were implemented globally, multiple versions of the systems emerged—currently, there are over 25 variations—including the Australian Refined-DRG (AR-DRG), the Nord DRG in Nordic countries like Finland, the HRG in the United Kingdom, the GHM in France, and the G-DRG in Germany[7].

In the United States, the DRG-based payment system was introduced to identify clinical differences in groups of patients as well as to document variation in hospitals and physicians' practices by comparing similar groups with each other[8]. It has undergone continuous updates and improvements since its first introduction in 1976. These updates which are revised every two years have included factors such as primary diagnoses, secondary diagnoses, disease severity, and risk of death. The fifth generation of DRG, also known as the International Classification System, includes 330 base groups, which are further divided into three subgroups based on disease severity levels. This version is not only used for U.S. federal healthcare insurance but has also become a standard system for expenditure evaluation. It was officially integrated into the U.S. prepayment system for healthcare costs in 2000 and has been continuously refined since its implementation[9]. Over decades of payment practice, the system has gained extensive experience and has been adapted to different patient demographics and resource consumption, including a pediatric-adjusted version of the DRG scheme. This modified scheme was later consolidated into comprehensive diagnosis-related groupings applicable to all patient types[10].

In Japan, the Diagnosis Procedure Combination (DPC) payment system was officially launched in 2003[11]. This is a per-day payment system composed of 18 Major Diagnostic Categories (MDC) and two surgical categories. The DPC is adapted to the length of hospital stay, and it includes 2,241 DRGs covering 516 diseases. Japan's DPC payment system is based on a complex daily allowance structure, divided into four payment periods. In the first period, the daily allowance is 15% higher than the average daily allowance; in the second period, it is equal to the amount of the average level of service; if the service level exceeds the average to the extent of the average plus two standard deviations, the third period's payment rate is set at 85% of the second period's rate. The dividing lines for these service levels are unique for each DPC and are reset every two years based on data submitted by DPC hospitals[12]. Compared to DRG models in other countries, Japan's DPC system is relatively loose toward hospitals, allowing them to participate voluntarily. Additionally, the pricing calculation method favors hospitals, with fee-for-service components consisting mainly of physician fees, high-cost drugs, and medical consumables.

4. The Application and Development of DRG in China

China began focusing on Diagnosis-Related Group (DRG) in the late 1980s, conducting extensive research on the application. In 1988, the Beijing Hospital Management Research Institute was established to explore scientific methods for evaluating hospital input-output, controlling medical costs, and improving the quality of medical services. Since then, China has made significant progress in DRG research and practice. In 2003, Beijing initiated preliminary preparations for implementing DRG-based payment systems and began collecting foundational DRG data. By 2011, Beijing became the first city in China to pilot the DRG payment system. Beijing's DRG-based payment is the first implemented DRG-based prospective payment system in China [13].

With the establishment of the National Healthcare Security Administration (NHSA), China started to comprehensively promote the reform of healthcare payment systems based primarily on CHS-DRG and DIP (Diagnosis-Intervention Package). This reform aims at improving the efficiency of the use of medical funds, guiding the rational allocation of medical resources, controlling the unreasonable rise in medical costs, safeguarding the rights and interests of residents under medical protection, and supporting the healthy development of medical and health care.

Additionally, in its 14th Five-Year Plan, the Chinese government set goals for a more mature and well-established healthcare security system. These goals include completing reforms of essential mechanisms like insurance payment and fund supervision, as well as enhancing the standardization, precision, convenience, and collaboration of healthcare management. These objectives underscore that China's adoption of the DRG payment system aims to address the imbalance in healthcare resource distribution, enhance the efficiency and quality of healthcare services, and ensure the sustainability of the healthcare security system. Following the establishment of the NHSA in 2018, China quickly launched national pilot programs for DRG-based payment reforms. After nationwide trials from 2019 to 2021, the NHSA issued a three-year action plan for reform at the end of 2021. This plan outlines a phased and gradual approach from 2022 to 2024, with the goals of fully completing the DRG/DIP payment reform and promoting high-quality development in healthcare insurance. The specific targets include: by the end of 2024, all regions within the medical insurance system will implement DRG/DIP payment reforms; by the end of 2025, DRG/DIP payment systems will cover all eligible inpatient healthcare institutions, with comprehensive coverage of disease categories and healthcare funds [14].

In 2024, the NHSA issued a notice on the implementation of the DRG and DIP payments version 2.0 grouping scheme. This directive not only requires regions that newly implemented DRG/DIP payment systems in 2024 to adopt version 2.0 directly, but also requires regions that have already used the system to complete the transition to version 2.0 by December 31, 2024, to improve the standardization and consistency of the payment system.

Currently, 30 pilot cities have fully transitioned to the payment phase of the DRG system, and most regions have achieved high coverage of disease subgroups. For example, in Beijing, the capital of China, there are 696 disease groups in total, with 647 groups covered under actual payments, achieving a coverage rate of 93%. In Tianjin, the third largest municipality in China, 674 out of 696 disease groups are covered, with a coverage rate of 96.98%. The DRG/DIP payment system reform has been implemented in 282 districts nationwide, accounting for 71% of the total number of districts in China.

The DRG pilot model has not only made the pilot hospitals profitable as a whole and shortened the length of hospital stay [13], but it has also effectively controlled the rapid growth of medical costs, reduced the financial burden on insured persons, and improved the efficiency of the use of medical funds. Through the DRG payment, effective treatment can be provided, improving the consistency of care delivery and bringing the cost of care closer to its true clinical value [15].

5. The DRG Concept

The DRG-based payment system divides inpatients into a certain number of disease groups according to disease severity, treatment complexity, and resource consumption homogeneity to achieve diverse management goals [16]. The basic principle of the DRG payment system is to categorize hospitalized patients into different diagnostic groups based

on factors such as disease diagnosis, treatment methods, age, gender, comorbidities, and complications. Patients within the same DRG group are considered to consume similar medical resources during treatment. The healthcare insurance institution then sets a uniform payment standard for each DRG group based on historical cost data, covering all medical services provided during a patient's hospital stay. Upon discharge, hospitals receive the corresponding payment from the insurance fund based on the DRG group to which the patient belongs.

The objectives of this payment method are to promote the rational use of medical resources, control unreasonable increases in medical expenses, and incentivize hospitals to improve service efficiency and quality. The DRG payment system uses a prospective payment model, allowing hospitals to predict their revenue before providing services. This encourages hospitals to manage costs effectively and avoid unnecessary medical services and resource waste. Additionally, the DRG payment system is usually accompanied by strict monitoring and evaluation mechanisms to ensure that the quality of medical services remains unaffected while costs are controlled.

Through this approach, the DRG payment system contributes to the sustainability of healthcare funds and the fairness of medical services, balancing the interests of the government, hospitals, and patients.

6. Challenges Facing the DRG Payment System in China

To meet the goals of full DRG/DIP coverage by 2025, China has progressed from initial exploration to widespread implementation, moving from pilot cities to nationwide application, and from top-level design to detailed guidelines. As of the end of 2023, over 90% of coordinated regions in China have implemented DRG/DIP payment reforms, positively influencing healthcare institutions to actively control costs and standardize clinical practices[17]. However, as the DRG payment reforms deepened, several issues emerged during pilot implementation and policy practices, including insufficient levels of informatization, incomplete performance evaluation mechanisms, medical behavior distortion, and inadequate regulatory oversight.

6.1. Insufficient Level of Informatization

Unlike fee-for-service payment methods, DRG payments are based on the health status, treatment methods, and outcomes of patients during their hospital stay. This requires data and records to be accurately coded, classified, grouped, and processed using DRG model algorithms. DRG payments place technical requirements on the generation, collection, quality control, storage, transmission, and reporting of relevant data and records. The payments also require multiple departments to coordinate workflows, including clinical, medical, insurance, operations, finance, case management, and information. A prerequisite for meeting these requirements is effective IT support. This requires targeted enhancement of hospital information technology to improve data management and expand information system functionality[18].

The level of hospital informatization directly impacts the quality of case records. Currently, hospitals face challenges such as large data volumes, inefficient case coding verification methods, and incomplete patient records. Information systems, as auxiliary tools, can significantly reduce errors in case documentation, but hospitals must establish a high-standard medical data quality management system. Presently, some hospitals in China have low levels of informatization and lack reasonable and accurate quality control of medical records. This leads to inaccurate data, which in turn affects the accuracy of DRG grouping. Implementing data validation in the process of submitting inpatient medical records can help reduce logical errors and improve data accuracy[19]. For instance, a tertiary oncology hospital receives approximately 300 inpatients daily. During the admission registration process, staff members are required to inquire about and input each patient's basic information. Given the high volume and repetitive nature of this task, errors are inevitable, such as omission of patient contact information or incomplete entry of address and ID number. These issues can lead to significant challenges in subsequent processes, including data reporting, statistical analysis, case tracking, medical dispute handling, and health insurance claims. During hospitalization, while some information is directly imported through the information system, other details such as doctors' signatures, discharge method, plans for readmission within 31 days, and ventilator usage time are completed by clinicians in electronic medical records(EMRs). However,

due to the clinicians' heavy workload and insufficient awareness of the importance of accurate medical record front-page reporting, discrepancies and ambiguities often arise. These issues not only reduce work efficiency but also affect the accuracy of data reporting [20].

6.2. Incomplete Performance Evaluation Mechanisms

Performance evaluation mechanisms are crucial tools in hospital management. They play a vital role in improving healthcare service quality, enhancing operational efficiency, and controlling costs. However, many hospitals' current performance evaluation systems are not fully aligned with the reform requirements of the DRG payment model. In China, DRG-based performance evaluation has yet to effectively fulfill its intended guiding role. The performance evaluation is essential for improving hospital operational efficiency and healthcare quality. Despite this, most hospitals prioritize controlling medical costs in their assessments. This narrow focus may lead to a decline in healthcare quality and hinder the adoption of advanced medical technologies. Consequently, negative healthcare outcomes may arise, increasing healthcare costs and placing a greater financial burden on health systems [21, 22].

Some pharmacists are concerned that the existing performance management systems could negatively impact their income, thereby reducing their enthusiasm for providing pharmaceutical services. For clinical pharmacists, performance evaluations often emphasize research achievements rather than the outcomes of pharmaceutical services. This approach undermines their motivation to deliver effective pharmaceutical care to patients [23].

In addition, the quality and accuracy of medical coding significantly influence medical staff's income. For instance, the decline in physician income in German children's hospitals after the introduction of DRG payments was primarily due to coders' lack of competence. This resulted in inaccurate and incomplete coding, leading to poor reimbursement of costs [24].

6.3. Medical Behavior Distortion

Under the DRG-based prepayment system, healthcare institutions incur additional costs as the volume of services they provide increases. Once the threshold is exceeded, institutional surpluses may turn into deficits. In this cost-focused environment, certain distortions in medical behavior may arise: (1) Selective Patient Admission: Institutions may prioritize low-risk individuals for insurance while avoiding patients with severe conditions. This practice reflects hidden ethical dilemmas in medicine. (2) Imbalance in Care Structures: To compensate for the loss of benefits caused by shorter inpatient stays, outpatient visits may increase, leading to structural imbalances in medical care. (3)Reduction in Expensive Clinical Procedures: Institutions might reduce costly and less effective clinical procedures. This could result in a lack of certain medical services and related problems [25].

For example, percutaneous coronary intervention (PCI), a common cardiovascular procedure, involves stent or balloon implantation to expand narrowed blood vessels and restore blood flow. The severity of the patient's condition often determines the procedure. If a patient with multi-vessel stenosis requires three stents, the total cost may exceed the budget. Under performance pressures, physicians may avoid providing the recommended treatment due to cost constraints. Diseases primarily treated with medication or internal medicine face similar issues. While fee-for-service models in the past led to overtreatment, DRG-based practices may result in under-treatment, which contradicts the principle of doing no harm [26].

Additionally, physicians may manipulate coding to artificially assign low-risk patients to higher-paying DRG groups to generate higher Medicare revenues. This practice has led some providers to rely on manipulating coding rather than improving revenue by enhancing care efficiency and controlling costs [27].

6.4. Inadequate Regulatory Oversight

Currently, due to the relatively short duration of DRG payment reform implementation in most regions, regulatory processes and mechanisms for distorted behaviors remain underdeveloped. Regulatory experience is limited [28]. Oversight by medical insurance departments over healthcare services is insufficient, leaving widespread issues in routine medical services inadequately addressed. Problems such as over-treatment, excessive testing, and unbundled billing persist, increasing risks to medical insurance funds

and threatening system fairness [29].

In the future, as reforms in medical insurance payment methods deepen and medical institutions continue their trend of external expansion, their growing familiarity with DRG/DIP payment rules is likely to lead to profit-driven behavioral adjustments. This shift could introduce new risks to the security of medical insurance funds.

When medical insurance oversight is inadequate, the lack of sufficient resources and regulatory tools may encourage non-compliant practices by healthcare institutions and professionals. These behaviors not only result in unnecessary expenditures from insurance funds but also pose potential risks to patient safety and health. To mitigate systemic vulnerabilities caused by insufficient oversight, medical insurance departments must ensure more comprehensive regulatory coverage as DRG payment reform progresses.

7. International Case Studies of DRG Payment Systems

To gain a comprehensive understanding of the implementation and impact of DRG payment systems worldwide, it is essential to examine their application in different countries. By analyzing international case studies, we can identify both the commonalities and unique adaptations of the DRG model to various healthcare environments. This analysis not only highlights the strengths and limitations of these systems but also provides valuable insights for policymakers in tailoring DRG payment reforms. Below, the DRG systems in the United States, Japan, and South Korea are explored as representative examples. These cases illustrate the evolution and challenges of DRG-based payment models in distinct healthcare systems. As China undergoes profound reforms in its healthcare payment system, it can draw on the experiences of other countries to guide its approach.

7.1. The DRG Payment System in the United States

The United States is the birthplace of the Diagnosis-Related Group (DRG) payment system, which was integrated into the federal Medicare payment system in 1983 as a tool for managing inpatient healthcare costs. The core principle of the DRG system is to categorize patients into groups based on their medical conditions, with standardized payment rates set for each group. This approach aims to control the excessive growth of medical expenses. In recent years, the U.S. payment system has evolved from a single DRG model to more complex multi-payment systems, including the Resource-Based Relative Value Scale (RBRVS) and Value-Based Payment (VBP). These evolving payment models focus not only on controlling healthcare costs but also on improving healthcare quality.

The implementation of DRG has led to shorter hospital stays and reduced overall expenses [30]. However, it has also introduced challenges, such as "upcoding" practices and a decline in necessary medical services. To address these issues, the United States has established a strict regulatory framework that includes peer reviews and government oversight to ensure fairness and compliance within the payment system.

7.2. The DRG Payment System in Japan

Japan's DRG payment system, known as the Diagnosis Procedure Combination (DPC) payment system, was officially implemented in 2003 [31]. This system adopts a hybrid payment structure, combining per-diem fixed payments and fee-for-service payments. The per-diem fixed payment applies to hospital fees, while the fee-for-service payment applies to physician fees. The formula for calculating fixed payment points is:

$$\begin{aligned} &Fixed\ payment\ points\ = \\ &(Standard\ fixed\ payment\ per \\ &DPC\ inpatient\ day \times Length\ of\ stay) \\ &\times Hospital-specific\ coefficient \end{aligned} \tag{1}$$

The standard fixed payment per DPC inpatient day and the length of stay are divided into three periods, with different fixed payment points for each period. The design of these fixed payment points follows two principles: (1) Basing the fixed payment points on the average medical resources consumed; (2) Calculating the points using data derived from the value-based healthcare reimbursement system [32].

The DPC system features a segmented payment design, dividing the length of hospital stays into three phases, each with a distinct payment standard. This approach reflects the variations in resource consumption over the duration of a patient's hospital stay. Since the implementation of the DPC system, hospitalization costs in Japan have decreased,

and the average length of hospital stays has significantly shortened[33]. Despite its benefits, the DPC system faces challenges, particularly regarding the complexity of DPC grouping and fixed payment standards. These challenges arise mainly from the need to optimize and update coding systems. Japan addresses these issues through quality improvement programs and hospital evaluation mechanisms, regularly adjusting payment standards to align with advances in medical technology and clinical practices.

7.3. The DRG Payment System in South Korea

South Korea implemented its national health insurance system in 1977, adopting a fee-for-service (FFS) model for healthcare payments[34]. Under this system, providers are reimbursed for each medical service they deliver. However, studies have shown that FFS models often lead to a rapid escalation in medical costs due to incentives for overtreatment[35]. To address these issues, the Korean government introduced a Diagnosis-Related Groups (DRGs) payment system as an alternative[36]. This reform aimed to mitigate the challenges associated with the FFS model while promoting cost-effective care. By modifying the U.S. AP-DRG system, South Korea developed the K-DRG system in 1991[37]. In February 1997, a pilot program was launched to apply K-DRG payments to eight groups of surgical diseases and procedures. By 2001, the payment model was adjusted to cover seven categories, encompassing 78 groups. A resource-based relative value (RBRV) scale was also introduced for physician compensation to address the negative effects of the fee-for-service (FFS) model[38, 39].

However, the pilot program primarily focused on relatively simple diseases and failed to ensure adequate medical services for patients with severe and complex conditions. To expand coverage and apply DRG payments to all hospitalized patients, South Korea introduced the "New DRG" payment system in 2008. This system integrates length-of-stay (LOS) as a core factor and combines DRG payments with FFS. Beginning in April 2009, the New DRG system was piloted in public hospitals. The scope of the program and the number of disease groups were gradually expanded, covering 567 types of diseases by 2020.

Overall, South Korea's DRG-based payment reform has progressed slowly. Due to strong opposition from private hospitals, DRG payments were implemented for 15 years only in hospitals that voluntarily participated. It was not until 2017 that the scope of implementation was expanded to include all public and private hospitals[11].

8. Insights for China from International DRG Payment Systems

8.1. Continuous Optimization of DRG Grouping and Payment Standards

Countries like the United States, Japan, and South Korea emphasize the continuous optimization of DRG grouping and payment standards. In the United States, the DRG grouping is updated every two years to incorporate the latest developments in diagnostics and treatment[10]. Japan periodically revises DPC payment periods and rate standards based on data analysis to align with changes in healthcare resource utilization[40]. Similarly, South Korea regularly updates grouping standards to account for disease severity and hospitalization duration[41].

In China, the implementation of DRG systems must prioritize the scientific and adaptive nature of grouping. While promoting the nationwide standardization of CHS-DRG grouping, it is crucial to strengthen data analysis and technical support to ensure grouping standards keep pace with advancements in medical technology and evolving disease profiles. Furthermore, a payment rate adjustment mechanism should be established to address regional disparities in healthcare resources, ensuring fairness and rationality in payment standards.

8.2. Strengthening Healthcare Quality and Cost Control

The U.S. payment system has transitioned from fee-for-service to diagnosis-based payment and, ultimately, to value-based payment (VBP), emphasizing the critical balance between healthcare quality and cost control. The VBP system in the U.S. incentivizes high-quality healthcare services through rewards and penalties[42]. Similarly, Japan and South Korea have integrated healthcare quality monitoring metrics into their DRG payment systems to enhance the quality of medical services[41].

China should incorporate more quality control and assessment indicators into its DRG payment system. By lever-

aging insurance payment policies, hospitals can be encouraged to improve service quality. Developing a payment incentive mechanism based on healthcare quality would help control costs without compromising service standards. Additionally, promoting data sharing among healthcare institutions and strengthening the supervision of service quality are crucial strategies for raising overall healthcare standards.

8.3. Preventing Over-Treatment and Ethical Risks

While the core advantage of the DRG payment system is controlling healthcare costs, it also carries ethical risks, such as over-treatment and "upcoding". For example, in Germany, doctors and midwives adjust their coding practices in response to financial incentives. Specifically, they avoid upcoding newborns with low chances of survival while upcoding infants who are expected to require more costly treatments [43].

Therefore, it is important to prevent overtreatment and ethical risks.In the United States, peer reviews and government oversight are crucial in curbing inappropriate coding practices. Japan adopts a mixed payment system to reduce incentive distortions inherent in single payment models [40], while South Korea conducts regular checks and payment adjustments to prevent coding violations and cost-related abuses [41].

Although the implementation of DRG helps improve quality of life and enhance hospital efficiency, it is essential to ensure that such efficiency gains do not compromise healthcare quality and equity. Preventative measures must be in place to mitigate any negative effects. Moreover, physicians' behavior is strongly influenced by hospital policies [44]. Thus, while cautiously limiting hospitalization costs and lengths of stay, more emphasis should be placed on implementing clinical pathways.

Drawing on international experiences, efforts should focus on strengthening the supervision of coding accuracy and rationality to prevent multiple coding and overtreatment. Establishing an independent clinical audit and coding evaluation system, with regular audits of hospital records and coding practices, is recommended. Violations should be strictly penalized to maintain the integrity and fairness of the payment system.

8.4. Building a Comprehensive Payment System

Beyond DRG payment systems, countries like the United States and Japan have adopted diversified payment models. For instance, the U.S. combines DRG payments with the Resource-Based Relative Value Scale (RBRVS) and Value-Based Payment (VBP) systems [45]. Similarly, Japan's DPC system integrates per-day payments with fee-for-service payments [40].

A single payment model may not sufficiently address the diverse medical needs in China. Therefore, China should develop a comprehensive payment system that combines DRG payments with other models, such as fee-for-service, capitation, and value-based payment. Pilot projects can be conducted to identify the most suitable combination of payment models for China's unique healthcare environment. This approach aims to enhance the efficiency of healthcare fund utilization and improve the overall quality of medical services.

8.5. Enhancing Standardization and Informatization of Healthcare Data

During the implementation of the DRG payment system, the United States and Japan have emphasized data standardization and informatization. A unified disease classification and coding system enables a more scientific and standardized application of payment systems. In Japan, intelligent healthcare information systems have enhanced the efficiency of data collection and analysis, supporting the dynamic adjustment of payment standards [40].

As China progresses with DRG payment reform, it should accelerate healthcare data standardization to ensure accurate data collection and usage. Strengthening information infrastructure is also crucial to enable data sharing and interoperability among hospitals, insurance providers, and regulatory bodies. This will provide essential data support for informed decision-making within the payment system [41]. Moreover, improved informatization will enhance oversight of hospital service quality and payment compliance.

9. Analysis of China's DRG Pilot Projects

In December 2018, the National Healthcare Security Administration (NHSA) issued a notice to initiate a national pilot program for DRG-based payment systems. Subsequently, 30 cities across China were selected as pilot cities for DRG payment system reform. This initiative drew on international DRG payment experiences, making localized adjustments to suit China's specific context.

In Shenyang, the total number of hospitalizations across the city was determined, alongside a target control group and total weight metrics. These metrics focused on monitoring specific diseases and setting the payment weights and rates for the following year. Shenyang's DRG implementation had positive impacts on medical behavior and resource allocation, improving the stability and predictability of healthcare payments [45].

In Guangzhou, the total expenditure of the city's annual inpatient pooled fund was determined, and the total expenditure for the Diagnosis-Intervention Package (DIP) system was calculated. Contrary to the usual practice of case-based payment, the DIP payment scheme includes a price adjustment mechanism through which the actual reimbursement for each case is determined ex post [46]. The city also established a weight coefficient for designated healthcare institutions under the DIP model. However, due to human and administrative factors, the implementation in Guangzhou led to instability in payments.

Within China's DRG pilot projects, significant variations exist in the number of disease groups across regions. This has sparked discussions about the relationship between the number of disease groups and the scientific validity of management practices. A finer classification of disease groups can improve case inclusion rates, but the key question remains whether it can standardize medical behavior, improve healthcare quality, and enhance resource efficiency. Both DRG and DIP systems operate under a total budget for healthcare funds, with each disease group assigned a weight value. DRG, through expert-adjusted weight values, more accurately reflects the true value of healthcare services, providing positive incentives for medical behavior. In contrast, DIP determines disease group values and point values at the end of the year based on the total budget and the total number of service points. This makes it difficult for medical institutions to predict the value of each point at the beginning of the year, increasing uncertainty.

Guangzhou's DIP policy may encourage healthcare institutions to increase service volume to secure a larger budget, potentially leading to the overuse of healthcare funds. It controls the growth rate of medical service costs, reduces PM, PLF, and PEF to varying degrees, and changes the structure of medical expenses. It also guides the rational allocation of healthcare resources and reflects the value of medical personnel services [47]. Conversely, Shenyang's DRG system, with rational weight adjustments, incentivizes hospitals to treat more severe cases, improving the efficiency of medical resource utilization [45]. DIP is considered a transitional method toward the full implementation of a DRG payment system. As local practices mature, a more scientific, systematic, and long-term healthcare payment system is expected to emerge.

10. Localization Strategies for DRG Payment System in China

10.1. Technical Preparation and Informatization Construction

China needs to establish a unified disease grouping platform, standardize disease diagnosis and procedure codes, develop scientifically sound disease-specific payment groups, and calculate reasonable medical expenses for each group. This requires the national healthcare insurance system to mandate that pilot hospitals strictly adhere to the CHS-DRG detailed grouping plan. Pilot hospitals must ensure the accurate collection of historical medical record data, settlement information, and proper mapping of codes [48]. Hospitals must build the foundational technical infrastructure necessary for DRG payments. This includes establishing a mature grouping system, implementing electronic medical records throughout the treatment process, managing clinical pathways, and strictly regulating case documentation. These measures necessitate improvements in hospitals' informatization capabilities, including enhanced data reporting quality and ensuring real-time interaction between the healthcare settlement system and the DRG grouping system [49]. Additionally, clinicians play a pivotal role in advancing healthcare

payment system reforms. Since all payment methods must align with clinical guidelines, the classification and terminology of diagnoses and procedures should be standardized at the national level. Clinicians bear the responsibility of adopting standardized and rational diagnostic and treatment practices, as these practices form the foundation for future pricing and payment standards[16].

10.2. Establishing a Random Factor Adjustment Mechanism

To address potential risks associated with DRG payments, such as patient selection, insufficient services, and declining medical standards, it is necessary to include a random factor adjustment mechanism in the DRG payment system. This mechanism ensures flexibility and sustainability. One example is the floating rate payment model used in Wuxi, Jiangsu Province. In this model, initial rates are set at the start of the year. By year-end settlement, if the actual cost increase surpasses a specific threshold, the payment rate for that level is recalculated based on the total increase limit. Additionally, for high-cost services and new technology projects, a "maximum amount" funding application mechanism can be introduced. This mechanism allows innovative diagnostic and treatment methods, which are not covered under existing codes, to receive compensation through an application process.

10.3. Establishing an Effective Incentive Mechanism

It is crucial to develop a comprehensive incentive chain that links the healthcare insurance system, hospitals, clinical departments, and physicians. This should be accompanied by corresponding internal hospital management and performance evaluation systems. To achieve this, experienced clinical experts from hospitals should be invited to contribute to the development of localized and refined grouping versions. Additionally, a collaborative price negotiation mechanism should be organized. This mechanism would involve finance departments, health commissions, designated hospitals, and insurance companies. Together, they would determine settlement standards, projects, and probability coefficients while maintaining dynamic reverse adjustments for optimization[48]. Extensive training and discussions are essential to shift the mindset of healthcare personnel. These efforts will help them understand that DRG payments represent a public contract between the healthcare insurance bureau and hospitals. Under this system, the better the service quality provided to patients, the higher the reimbursement hospitals receive from insurance funds.

10.4. Establishing a Comprehensive Supervision Mechanism

The National Healthcare Security Administration should establish a unified DRG payment management information platform to enable closed-loop management of the entire DRG payment process. Logical validation rules must be implemented, requiring real-time data uploads for verification to improve the quality of data reporting. A comprehensive and objective DRG payment quality evaluation system should also be developed. This system should incorporate intelligent auditing, real-time monitoring, and early warning mechanisms. Big data analytics can be utilized to evaluate and analyze the operation of healthcare insurance, enabling continuous assessment and precise financial analysis. Although DRG payment reform has shown significant effects in controlling cost escalation and improving quality, potential issues such as patient selection bias and upcoding must be carefully addressed to prevent unintended consequences[13].

11. Conclusions

As global healthcare costs continue to rise and the pressure on resource allocation intensifies, the DRG payment system has become a widely used tool for controlling costs and managing healthcare quality. Countries such as the United States, Germany, Japan, and South Korea have gained valuable experience and insights from implementing DRG payment systems, offering important references for China's localization of this system.

Since Beijing adopted the DRG grouping method in 2014, China has progressively advanced healthcare payment reforms. The release of the DRG payment pilot technical specifications and grouping scheme by the National Healthcare Security Administration (NHSA) in 2019 marked a significant milestone in China's DRG reform. However, China's complex healthcare environment and significant regional dis-

parities present numerous challenges to localizing the DRG payment system.

To address these challenges, China must draw lessons from international experiences while developing grouping and payment standards tailored to its healthcare system and regional variations. This requires enhancing data analysis, improving regulatory mechanisms, strengthening information technology systems, and continually refining the payment model. Policymakers should carefully design each component of the DRG payment system to align with policy objectives. It is also essential to conduct rigorous randomized trials or comparative studies to generate evidence on the impact of DRG payments on healthcare systems and health outcomes. This is particularly important in low-income settings to guide policy development[50]. These efforts are vital for ensuring the sustainable use of healthcare funds and fostering the fair and efficient development of healthcare services. Localizing the DRG payment model is not merely a technical challenge but a crucial step in modernizing China's healthcare system. Successfully implementing this model will profoundly and positively impact the country's healthcare development.

Author Contributions

Conceptualization, Z.C. and S.B.S.; methodology, Z.C.; validation, Z.C.; formal analysis, Z.C.; investigation, Z.C.; resources, Z.C.; writing—original draft preparation, Z.C.; writing—review and editing, S.B.S.; visualization, Z.C.; supervision, S.B.S.; project administration, S.B.S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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