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Construction of a Closed-Loop Management System for Hospital Operations Driven by the Diagnosis-Related Groups (DRG) System for Medical Insurance: Promoting High-Quality Development of Hospitals

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Abstract: *Objective:* Taking the reform of the Diagnosis-Related Groups (DRG) payment system for medical insurance as an opportunity, we aim to construct a closed-loop management system for lean hospital operations under the trusteeship of urban medical groups, thereby promoting high-quality hospital development. *Methods:* Led by the Medical Insurance DRG Management Committee, we established a closed-loop MDT-DRG management system, data analysis system, pharmaceutical and consumable management system, discipline construction management system, and standardized medical record front page filling management system. These measures enabled refined operational management, fostering high-quality hospital development. *Results:* After the trusteeship of Qingdao Municipal Hospital from 2024 to 2025, leveraging the reform of the medical insurance DRG payment system, combined with the integration of medical disciplines and improved performance management, lean operational management effectively achieved six improvements (15.25% year-on-year increase in outpatient and emergency visits, 7.62% increase in discharges, 50.08% increase in surgeries, 71.89% increase in Level IV surgeries, 10.76% increase in Case Mix Index, and 45.99% increase in cases with weights > 2), two reductions (41.18% decrease in average inpatient drug costs and 28.69% decrease in average outpatient drug costs), and one innovation (78.92% year-on-year increase in Level IV surgeries for national examinations). *Conclusion:* This effectively promoted the overall operational efficiency and competitiveness of the hospital, laying a solid foundation for the establishment of a tertiary hospital and achieving the goal of satisfaction for the government, hospital, medical insurance, and patients.

Keywords: High-quality development of public hospitals; Medical insurance DRG payment reform; Operational efficiency; Lean operational management; Discipline integration; Performance management

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1. Research background and purpose

In 2021, the General Office of the State Council issued the *Opinions on Promoting High-Quality Development of Public Hospitals*, requiring public hospitals to shift from scale expansion to quality and efficiency enhancement and from extensive management to refined management. Diagnosis-Related Groups (DRG) serve as a crucial tool for public hospital reform, aiming to standardize medical practices and improve the efficiency of medical insurance fund utilization. The National Healthcare Security Administration explicitly proposed in the *New Three-Year Action Plan for DRG/DIP Payment System Reform* that by the end of 2025, the DRG/DIP payment system reform would cover all qualified medical institutions providing inpatient services. This study, led by the Medical Insurance DRG Management Committee, aims to construct a closed-loop management system for lean hospital operations to promote high-quality hospital development.

2. Methods

2.1. Multi-department collaboration to construct a closed-loop MDT-DRG management system

We established an MDT-DRG management system involving pharmaceuticals, medical insurance, pharmacy, consumables, medical records, and information departments, defining roles and responsibilities. The Medical Affairs Department oversees diagnostic behavior regulation, discipline integration medical group management, clinical pathway management, and the formulation of non-essential consumable lists. The Medical Insurance Office interprets medical insurance policies, strengthens fee management, medical insurance audits, settlement difference calculations, and penalties for medical insurance violations. The Medical Records Department monitors medical record quality and provides training on medical record front pages, including coding quality and the selection of primary diagnoses and surgeries. The Pharmacy Department oversees rational drug use regulation, evaluates prescriptions for key disease groups, and formulates non-essential drug lists. The Operations Management Department analyzes DRG operational situations (refined to departments–disease groups–medical groups), conducts DRG performance evaluations, and provides departmental operational guidance. The Equipment Department evaluates the cost-effectiveness of consumables and negotiates prices. The Finance Department handles DRG cost accounting. The Information Center provides information technology support, data acquisition, and integrated information reports [1]. Through monthly DRG Management Committee meetings, a multi-department joint evaluation mechanism for standardized diagnosis, rational drug use, rational consumable use, and medical record writing norms is established, forming a problem ledger, identifying responsible departments, tracking rectification progress, and establishing a normalized closed-loop MDT-DRG management model.

2.2. Establishing a comprehensive data analysis system with horizontal and vertical coverage

Based on big data analysis, we established a comprehensive data analysis system covering all dimensions, conducting descriptive analyses of average costs, drug cost ratios, consumable cost ratios, and medical service income ratios across various disease types, department heads, diagnostic team leaders, and attending physicians. This enables an accurate understanding of cost structures for each disease type, timely analysis of warning data, rectification of unreasonable factors, and continuous tracking to eliminate unreasonable diagnoses through the PDCA cycle.

2.3. Accurately grasping disease costs, integrating clinical pathways with cost management, and achieving a closed-loop management system for pharmaceuticals and consumables

Pharmaceutical and consumable costs are significant operational expenses for hospitals. Leveraging data analysis, we strengthened pharmaceutical and consumable governance. The Clinical Pharmacy Department evaluated rational drug use and provided alternative drug lists to guide departments in selecting cost-effective and centrally procured drugs. The Equipment Department enhanced consumable management, focusing on high-volume and high-cost consumables, regularly organizing supplier negotiations, guiding departments to prioritize cost-effective alternatives, and classifying medical consumables into "essential consumables" and "non-essential consumables" based on function, usage, and evidence-based factors. Combined with in-house expert evaluations, standardized patient approaches were used to develop clinical pathways, clinical drug pathways, and clinical consumable pathways [2], which were included in the comprehensive target assessment system for continuous supervision and closed-loop management.

2.4. Establishing a closed-loop management system for discipline construction based on data analysis

Using seven key indicators from the DRG evaluation system—total weight, CMI, number of DRG groups, time consumption index, cost consumption index, mortality rate for low and medium-risk cases, and standardized mortality rate—we conducted descriptive analyses of medical data. Based on our existing disease groups, we identified our hospital's strengths, weaknesses, and areas for improvement in disciplines. We continuously tracked existing disease types, especially key ones, promptly analyzed reasons for data anomalies, rectified unreasonable factors, and established a closed-loop management system for discipline construction to ensure orderly development.

2.5. Using performance as a lever to incentivize physicians to improve their ability to treat complex and challenging cases

In the new stage of public hospital development, the development model needs to balance quality and efficiency. DRG is a method of grouping inpatients based on statistical control theory, with the outstanding advantage of clearly defining and measuring outputs in the medical service field. This study refined the performance evaluation system by improving total weight performance, CMI value assessment performance, DRG group number performance, performance for cases with weights ≥ 2, and incentives for Level III and IV surgeries. This guided departments to actively adjust their disease structures, undertake new technologies and projects, challenge complex and severe cases and high-difficulty surgeries, and continuously improve medical quality and technical levels.

2.6. Establishing a closed-loop management system for standardized medical record front page filling

High-quality medical record front pages are essential for objective, true, and reliable DRG grouping results [3,4]. We organized special lectures on CHS-DRG payment medical record front page filling, provided in-depth clinical department guidance for physicians in selecting primary diagnoses and surgeries, implemented primary quality control at clinical departments, secondary quality control at the Medical Records Department, and tertiary quality control by hospital-level quality control personnel. The Medical Records Department summarized and provided feedback on quality control issues, conducted retraining on existing problems, and

listed them as key content for the next quality control cycle, forming a P-D-C-A closed-loop management system for medical record front pages.

2.7. Establishing a closed-loop feedback mechanism featuring "immediate communication," "scheduled evaluations," and "regular feedback"

We established a DRG Management Office for immediate communication on issues encountered during DRG implementation. Through the MDT-DRG management mechanism, we conducted scheduled evaluations of indicators such as the number of patients, CMI values, and cost structures in departments. We also established a DRG briefing to regularly provide feedback on departmental budget execution, disease structures, and disease benefits.

3. Results and conclusion

High-quality development is a requirement set by the state for public hospitals and is also essential for their own growth. Against the backdrop of high-quality development in hospitals and changes in medical insurance payment models, public hospitals face the challenge of upgrading and transforming their management models and approaches. The reform of the DRG payment system has altered the hospital's revenue generation model, shifting from relying primarily on pharmaceuticals, consumables, and examinations to increasing income by reducing costs and optimizing processes [5,6]. This study, taking DRG as the foundation and leveraging the reform of the medical insurance DRG payment system as an opportunity, constructed a closed-loop management system for lean hospital operations under the trusteeship of urban medical groups, led by the DRG Management Committee. In 2024, the group's operations effectively achieved six improvements (a 15.25% year-on-year increase in outpatient and emergency visits, a 7.62% increase in discharges, a 50.08% increase in surgeries, a 71.89% increase in Level IV surgeries, a 10.76% increase in CMI, and a 45.99% increase in the number of cases with weights > 2), two reductions (a 41.18% decrease in average inpatient drug costs and a 28.69% decrease in average outpatient drug costs), and one innovation (a 78.92% year-on-year increase in Level IV surgeries for national examinations). This effectively promoted the overall operational efficiency and competitiveness of the hospital, achieving the goal of satisfaction for the hospital, patients, and other stakeholders.

Disclosure statement

The authors declare no conflict of interest.

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