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Pathway for labor cost control under DRG-based payment framework in public hospitals

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ABSTRACT

Currently, it is difficult to reflect medical professional values for the labor cost accounting under the framework of diagnosis-related groups (DRGs) payment in public hospitals, and labor cost control is also relatively weak. The present study is conducted to explore new ways of labor cost accounting and control. The point cost method based on resource-based relative value scale (RBRVS) was used to calculate the labor cost related to diagnosis code of GD29 (appendectomy) by literature research and case analysis. It is estimated that the labor cost for the diagnosis code of GD29 is 6374.558 CNY. The point cost method based on RBRVS is feasible in calculating labor cost classified by disease groups, and the implementation pathway for labor cost control is explained on the basis of this method.

Key words: labor cost control; diagnosis-related groups; public hospitals; point cost method

BACKGROUND

To curb the excessive and unreasonable growth of healthcare expenditure, China has recently introduced a series of policies in succession, which aims to safeguard the continuous advancement of reforms in the healthcare system. Among them, health insurance reforms related to payment systems based on diagnosis-related groups (DRGs) have garnered growing public attention. DRGs were first proposed by researchers at Yale University in 1976.[1] This system enables the comprehensive consideration of disease severity and complexity and also considers healthcare needs and the intensity of healthcare resource use.[2] The DRG-based payment system is a prospective payment system that no longer depends on the number of individual healthcare items, but instead carries out value-based healthcare payments, thereby rejecting excessive and ineffective healthcare. This approach has brought about an enormous impact and significant challenges to traditional models of hospital operation and management, which have encouraged hospitals to strengthen their healthcare quality management, promote the establishment of reasonable cost accounting systems, and further refine cost management.[3] Labor costs occupy a substantial component of hospital costs and should not be overlooked. The issue of effectively controlling labor costs while also ensuring the value of labor is currently a major problem in hospital cost control that urgently needs resolution.

In this paper, firstly the authors discussed and analyzed the external performance and major existing problems of labor cost control in public hospitals. Second, within the general context of DRG-based payment frameworks, a point cost method based on the resource-based relative value scale (RBRVS) under the premise of adopting comprehensive labor cost was introduced accounting for labor cost control and the data for one DRG was selected to explore a labor cost accounting process that reflects the labor value of medical professionals. Finally, we discussed the feasible pathways for implementing labor cost control.

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Unlike previous studies that conducted labor cost accounting based on departmental cost accounting,[4] this study applied the RBRVS-based point cost method to the labor costs of a single DRG, which was combined with the DRG-based cost accounting system. This allowed for exploring a labor cost accounting method that incorporates the labor value of medical professionals and is suitable for DRG-based cost accounting system of public hospitals. Thus, based on labor cost accounting, we outlined a few considerations concerning the pathways for labor cost control to provide new insights for the implementation of labor cost control in public hospitals.

CURRENT STATUS OF LABOR COST CONTROL IN PUBLIC HOSPITALS

Labor value should be involved in pricing method reform

At present, improvements are urgently needed to guarantee the value of medical professionals at the hospital level. In 2012, the "National Healthcare Service Fee Schedule (2012 version)" used the "relative value of resource consumption" (including technical and risk factors) for the first time in pricing healthcare services, to reflect the labor value of medical professionals. However, this pricing method has not undergone significant improvements in the subsequent implementation process. Moreover, most regions are faced with the impact of unique factors and hence need to strengthen their exploration of this pricing method.[5] Recent studies have incorporated the two factors above in the process of labor cost accounting, but these have not fully considered the labor value of medical professionals.[6] Furthermore, in actual practice, most hospitals have not thoroughly incorporated technical and risk factors in their cost accumulation and assignment due to factors such as the complexity of such operations. Therefore, it is necessary to reflect the labor value of medical professionals further, to better capitalize on their subjective initiative.

Outdated concepts of labor cost control

Due to constraints in financial allocation, public hospitals have inevitably developed a tendency toward revenue generation, while outdated concepts and poor awareness of cost control have also impacted labor cost control. Since labor cost control methods at the level of labor cost accounting are obsolete, it is necessary to achieve cost control by analyzing the factors that influence labor costs. The extensive approach to cost control in public hospitals will most certainly hinder long-term development. Hence, labor cost control should not be overlooked when attempting to achieve a well-run hospital.

Labor cost accounting offers limited support for labor cost control

Following the vigorous promotion of a series of reform measures for public hospitals, including reforms related to DRG-based payment methods in health insurance, the academic community has paid greater attention to the methods of hospital cost accounting. However, researchers have rarely focused on the cost accounting of human resources, which is a strategic factor. Currently, labor cost accounting methods have a limited applicability due to factors such as the individualization of healthcare services and medical department diversity. Furthermore, the absence of labor value in the evaluation process implies that the results of labor cost accounting cannot truly reflect the labor consumption of medical professionals, and hence offers limited support for the reasonable and effective implementation of labor cost control. In addition, hospitals currently have a limited level of informatization, with incomplete functions in their information systems. In contrast, the volume of labor cost data is relatively large and involves numerous cost accumulation departments, which causes difficulties in effective data collection, or direct sharing and integration with other systems for data analysis, thus often necessitating additional processing. This can result in obstacles to labor cost control.

INTRODUCTION OF LABOR COST ACCOUNTING METHODS IN PUBLIC HOSPITALS

Labor costs under the DRG-based payment framework

According to the bottom-up method, the first step under the DRG-based cost accounting method involves item summation[7] to isolate the labor costs of the DRGs and calculate the labor costs of the DRGs separately. Next, based on the clinical pathway, a single DRG is subdivided into different healthcare service items, which then gives: the labor costs of a given DRG = $\sum$ labor costs of each patient, labor costs of a given patient = $\sum$ labor costs of each related healthcare service item.

RBRVS-based point cost method

The RBRVS was first developed by the research team headed by William Hsiao in the United States[8]. It is a method of evaluating the labor value of physicians based on the relative value of resources consumed, which can then be used to compensate physician costs. The point cost method was proposed by Xia *et al.*[9] for the cost accounting of healthcare service items. In this study, the RBRVS-based point cost method was employed for labor cost accounting under the DRG-based payment framework. Under this approach, the labor costs of different healthcare service items that should be considered included job level, number of participants,

duration of consumption, technical difficulty, and risk level. Thus, first-level labor cost points □ job level coefficient × number of participants × composite technical and risk level coefficient. Among these, first, the job level coefficient can be based on historical data, that is, by converting the historical annual income per capita of all healthcare staff for all job levels in the hospital. Second, the number of participants and duration of consumption can be determined based on actual consumption. Third, the determination of the composite technical and risk level coefficient can be determined by adopting surgical *vs.* non-surgical items as the starting point, reviewing a large body of literature, and referencing the rationale behind the determination of various RBRVS coefficients, which is what was implemented in this study. Hence, value assignment for composite technical and risk level = technical difficulty × weight + risk level × weight. Based on the ideas proposed by Xia *et al.*, the technical difficulty, risk level, and weights were determined according to the "National Healthcare Service Fee Schedule" (2012 version), which considers the technical and risk factors in the labor costs of healthcare personnel[10] or based on the scoring of an expert panel.

Additionally, to measure the composite technical and risk level coefficient more accurately, we converted the results of the value assignment into a ten-point system based on the percentage system. Thus, the second-level labor cost points = first-level labor cost points × the number of similar cases. Labor costs of a given case under a given DRG = first-level labor cost points × unit point cost under a given DRG.

CASE ANALYSIS

In the broader context of health insurance reforms centered around the adoption of DRG payment methods, our selection of the case mix in this study is guided by the "China Healthcare Security Diagnosis-Related Group (CHS-DRG) Subdivision Scheme" (version 1.0), issued by the National Healthcare Security Administration in June 2020. This scheme, hereinafter referred to as "CHS-DRG Subdivision Scheme 1.0" , in conjunction with the ongoing DRG reform progress at Hospital A, has led us to focus on patients diagnosed with acute appendicitis (K35.800×001) who underwent appendectomy surgery (47.0901), corresponding to the DRG code GD29 (appendectomy).

DATA SOURCE

The samples used in this study were obtained from Hospital A, and the data used in the accounting calculations were from surveys conducted by the authors and relevant literature.

Division of healthcare items classified in the DRG

The healthcare service items of GD29 were divided according to the "Clinical Pathway for Simple Acute Appendicitis" issued by the former Ministry of Health. The average length of hospital stay was 6.35d, while special disease conditions were not included in preoperative and postoperative tests and postoperative nursing care.

Labor cost calculation of DRG

By converting the ratio of annual income per capita for all job levels in the hospital from the previous year and setting the corresponding points for junior-level jobs at 1, the job level coefficients were determined as follows: nurses: 1 for junior level, 1.25 for intermediate level, 1.43 for mid-senior level and 1.55 for senior level; physicians: 1 for junior level, 1.28 for intermediate level, 1.52 for mid-senior level, and 2.34 for senior level.

Surgical items: (1) According to surveys conducted by the authors, a simple appendectomy can be completed by the attending physician. Thus, the personnel allocated can compose of one attending physician, two junior physicians, and two junior-level theater nurses, and the operation takes 1 h; and (2) Concerning the research ideas of Xia *et al.*[10] on the application of the point cost method in the cost accounting of medical technology items and surgical items, we inferred that technical difficulty accounted for 50% and risk level accounted for 50% in the composite technical and risk level coefficient. Combined with the actual conditions of an appendectomy, the technical difficulty and risk level of this procedure was scored and weighted to give a composite risk score of 21 (percentage system), which gave a composite technical and risk level coefficient of 2.1.

Hence, the first-level labor cost points of surgical items were calculated as follows: (1 × 1.28 + 2 × 1 + 2 × 1) × 1 × 2.1 = 11.088.

Preoperative and postoperative tests: We reached the following conclusions by referencing the cost accounting of medical technology items described by Xia *et al.*[10] concerning the value assignment results and ideas for the technical difficulty and risk level coefficients of plain computed tomography scans (64-slice and above); considering the prices of relevant test items for grade A tertiary hospitals listed in the "Chengdu Compilation of Healthcare Service Items and Prices" (2016 version), which consider technical and risk factors; and using the actual resource consumption of the relevant test items as a basis. In Table 1, items 1 and 2 are relatively simple and routine, which implies that they can be classified as simple operations and assigned the same value.

Therefore, items 1 and 2 were assigned a technical estimate of 5 and a risk estimate of 5; hence, their composite technical and risk level coefficient was 0.5. Item 3 was assigned a technical estimate of 10 and a risk estimate of 14, and hence, its composite technical and risk level coefficient was 1.2. Item 4 was assigned a technical estimate of 32 and a risk estimate of 48, and hence, its composite technical and risk level coefficient was 4. Item 5 was assigned a technical estimate of 36 and a risk estimate of 56, and hence, its composite technical and risk level coefficient was 4.6. Item 6 was assigned a technical estimate of 6 and risk estimate of 8, and hence, its composite technical and risk level coefficient was 0.7. In Table 1, the time consumed by the test items refers to the total duration from the beginning of the test to the final receipt of the report.

Therefore, the first-level labor cost points of test items were calculated as follows: 1.28 × 1 × (0.27 × 2 + 0.27) × 0.5 + 1.28 × 1 × 0.35 × 1.2 + 1.28 × 1 × 0.35 × 4 + 1.28 × 1 × 2 × 4.6 + 1.28 × 1 × 0.2 × 0.7 = 14.8032.

Postoperative nursing care: The nursing care coefficient was determined based on the technical and risk levels of healthcare service items specified in the "National Healthcare Service Fee Schedule" (2012 version), and with reference to the nursing prices of tertiary grade A hospitals listed in the "Chengdu Compilation of Healthcare Service Items and Prices" (2016 version). If third-level nursing care was defined as 1, then second-level nursing care would be 1.2, and first-level nursing care would be 1.4. All other participating nurses were assigned junior-level job titles.

Hence, the first-level labor cost points of postoperative nursing care were given as follows: 1 × 1 × 1 × 1.4 + 1 × 1 × 3 × 1.2 + 1 × 1 × 2.35 × 1 = 7.35.

Therefore, the first-level labor cost points for a disease code of GD29 for appendectomy can be given as follows: 11.088 + 14.8032 + 7.35 = 33.2412, and the second-level labor cost points = first-level labor cost points × the number of patients in the DRG = 33.2412 × 633 = 21,041.6796.

The personnel costs as part of the healthcare operating costs were CNY 93.5 million. According to the benchmark query of CHS-DRG in "Clinical DRGs," we found that the weight corresponding to the GD29 for appendectomy DRG was 4.29%. Hence, the personnel expenditure for this DRG = 9,350 × 4.29% = 401.115 (CNY 10,000), and the unit point cost = 4,011,150/21,041.6796 ≈ 190.629 (CNY). Therefore, the labor costs of one patient for this DRG = 33.4396 × 190.629 ≈ 6,374.558 (CNY).

Based on the analysis of the labor cost accounting results for the DRG GD29, combined with the actual expenditure of patients within the DRG, we can generally conclude that the results reflect the status of labor consumption and capture the labor value of medical professionals. Thus, our findings demonstrate the feasibility of applying this method for labor cost accounting under the DRG-based payment framework. Furthermore, the application of this method in practice can provide a reference for the further adjustment of healthcare service prices, thereby reducing the gap between healthcare service prices and the real labor output of healthcare personnel.

IMPLEMENTATION PATHWAYS FOR LABOR COST CONTROL IN PUBLIC HOSPITALS

Incorporating labor value in the comprehensive and accurate accounting of labor costs

The incorporation of labor value in the comprehensive and accurate accounting of labor costs will facilitate hospitals in their financial analyses, enable more accurate decision-making in labor cost control, and incentivize medical professionals to provide high-quality healthcare services. The RBRVS-based point cost method takes into account both technical and risk factors, thus offering hospitals a different approach to labor cost accounting when carrying out reforms related to DRGs. This method can achieve comprehensive labor cost accounting to a certain extent, thereby laying a foundation for the effective implementation of labor cost control. When promoting reforms related to DRGs, hospitals can establish a shared channel between the DRG system and the hospital human resources database, while also performing matching with healthcare items through clinical pathways (Figure 1) to achieve the "refinement of clinical pathways to the individual level". This would facilitate the collection of labor cost data, refine the management of labor costs, and ultimately benefit labor cost control.

Standardization of clinical pathways to optimize diagnosis and treatment behaviors

The standardized formulation and implementation of clinical pathways are key to the smooth implementation of DRGs, especially when the formulation of clinical pathways suited to hospital development is based on the combination of national clinical pathways with actual hospital practices. Scientific and unified diagnostic and treatment standards, as well as standardized clinical pathways should be established, and the implementation of these standards will provide a better reference and benchmark for general diagnosis and treatment behaviors. The organic integration of DRGs with clinical

Table 1: Cost data of human resources for test items

Test items	Labor consumed	Time consumed (h)	Job level
Routine blood tests	Laboratory physician	0.27 × 2	Intermediate and above
Routine urine tests		0.27	
Four indices of coagulation function		0.35	
Full hepatic and renal function panel		0.35	
Screening tests for infectious diseases		2	
Electrocardiogram	Radiologist	0.2	Intermediate and above

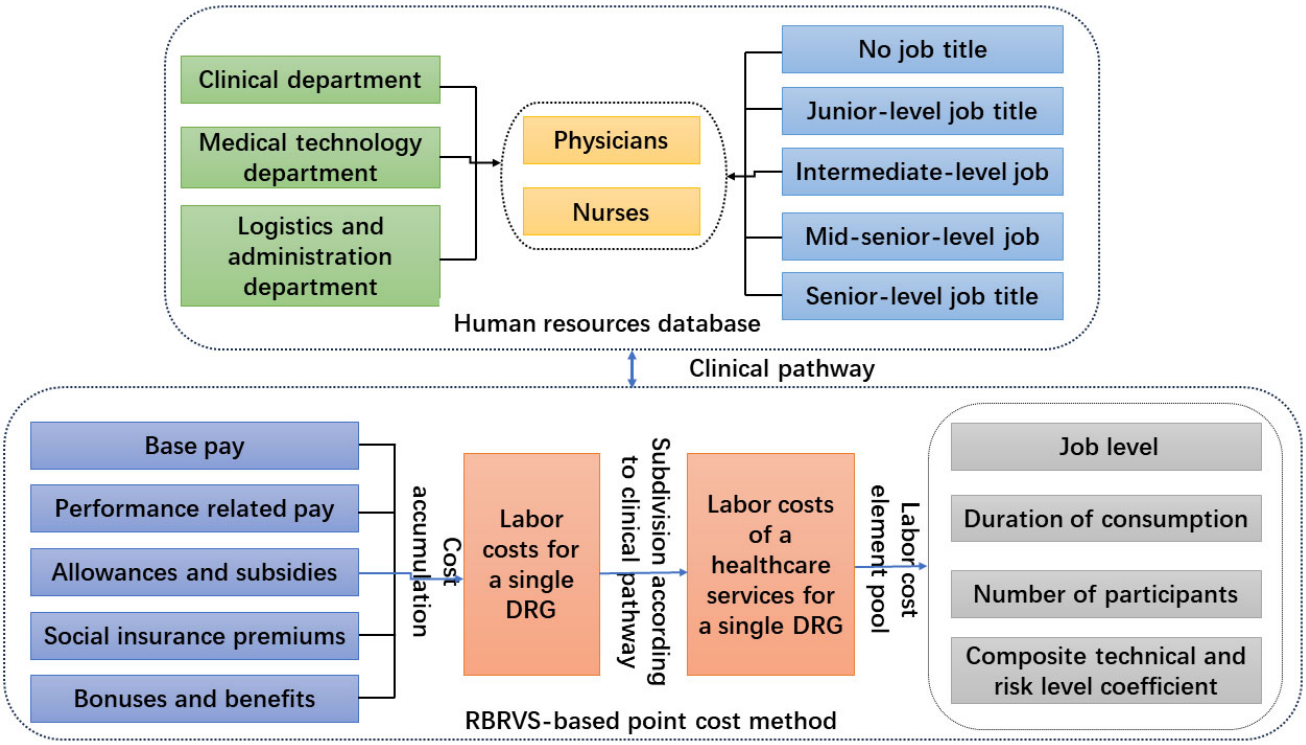

Figure 1. Comprehensive accounting model of labor costs under the DRG-based payment framework.

pathways can promote refined management within the hospital, which will improve its operational efficiency and provide patients with more satisfactory healthcare services.[12]

Rational formulation of job performance coefficient to capitalize on performance evaluation

The RBRVS-based point cost method includes the factors implicit within different healthcare services, such as the risk coefficient, technical level, and resources consumed. The values assigned to the technical difficulty and risk level coefficients of the various items are associated with the job positions of healthcare personnel. Thus, the rational formulation of performance coefficients for different job positions can serve as a basis for the application of the point cost method. Due to variations in the technical requirements and risk levels of different job positions, there will be differences in the performance evaluation of healthcare personnel with different positions. There is a large body of practical evidence demonstrating that the implementation of performance evaluation can improve the work enthusiasm of healthcare personnel, stimulate their potential, encourage them to undertake more technical positions with higher risks, and motivate them to improve their technical level. Personnel with higher competence levels tend to have higher work efficiency, which will greatly improve their input-output ratio, and hence play a crucial role in effectively controlling labor costs. Therefore, the formulation of scientific and rational job performance coefficients will enable us to match the performance evaluation of different positions with the implementation of healthcare items by healthcare personnel. This will facilitate the evaluation of labor resource value based on actual contribution, thus

fully capitalizing on the incentivizing effect of performance evaluation.

Determination of intra-DRG benchmarks to improve professional service efficiency

Within the more general context of the DRG-based payment framework, the CHS-DRG Subdivision Scheme 1.0 takes into account a variety of factors, such as age, disease diagnosis, comorbidities, complications, treatment methods, disease severity and outcomes, and resource consumption when performing subdivision. This implied that patients within the same DRG have an extremely high level of similarity, which can lay the foundation for hospitals to establish benchmarks for items within the DRG. In practice, hospitals can define the intra-DRG benchmarks of general healthcare items with respect to consumption duration and number of participants. A floating range can then be set under these benchmarks, and different incentives can be assigned. Moreover, when setting intra-DRG benchmarks, the complexities and particularities of individual cases should be duly considered to enhance the accuracy of the benchmarks.

CONCLUSION

In this study, the authors combined the exploration of pathways for labor cost control in public hospitals with the ongoing reforms of the DRG-based payment system in health insurance. To enhance the benefits obtained by the hospital, we introduced an RBRVS-based point cost method and proposed new ideas for labor cost control under the DRG-based payment framework. More specifically, significant improvements were made to labor cost control by performing the in-depth integration of the human resource database with the labor cost accounting system under the DRG-based payment framework based on clinical pathways. In addition, by analyzing the factors of labor costs, we proposed specific pathways for the establishment of job performance coefficients and determination of intra-DRG benchmarks, to further enhance the value of labor and achieve labor cost control. Our conclusions have important theoretical implications for improving the labor cost accounting contents of the DRG-based cost accounting system and further investigations on labor cost control in public hospitals, while also providing new ideas for labor cost control in hospitals and having crucial practical implications for sustainable hospital development.

DECLARATIONS

Secondary publication declaration

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Conflicts of interest

There is no conflict of interest among the authors.

Data sharing statement

No additional data is available.

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