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Construction and Implementation of a KPI System for Nursing Vertical Incentive Performance Management Based on Information Construction

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Abstract

Objective: Based on information technology construction, this study aims to establish an informatized management for nursing incentive performance. Through the construction and implementation of a nursing KPI system, the goal is to promote the in-depth development of high-quality nursing care, mobilize the enthusiasm of nursing staff, and drive high-quality hospital development. *Methods*: An informatization platform for nursing incentive performance was constructed. Key KPIs were identified as "job risk, difficulty coefficient of nursing operations, workload, work quality, satisfaction, and custom dimensions." The responsibilities of nursing staff at various levels were clarified, with a focus on positions and shifts with high job risks, high technical requirements, heavy workloads, and significant risks. This approach was used to build a nursing incentive performance allocation and evaluation system. *Results*: After implementation, the turnover rate of nursing staff in 2024 decreased compared to 2023. Nurse job satisfaction, patient satisfaction, and head nurse satisfaction increased compared with pre-implementation levels. The incidence of nursing adverse events (falls, unplanned extubations, pressure injuries, and medication errors) decreased compared to before implementation. The differences were statistically significant ($P < 0.05$). *Conclusion*: The work efficiency, work quality, work enthusiasm, and job satisfaction of nursing staff have all improved, aligning with the trend of hospital operation and management. This provides a tool for continuously promoting hospital nursing performance management.

Keywords

Informatization
Nursing
Incentive performance
KPI system

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1. Introduction

Nursing work is a crucial component of medical and health services. According to the "National Nursing Development Plan (2021–2025)" (No. 15 [2020] of the General Office of the National Health Commission), it is predicted that by the end of 2025, the total number of registered nurses in China will reach more than 5.5 million, accounting for 50%–60% of medical and health institutions at all levels across the country. They are a main force in deepening medical reform, improving services, and benefiting the masses [1]. Reward-based performance reform is a significant lever for activating high-quality development in public hospitals and an essential aspect of hospital quality development. Nurses' reward-based performance is a vital component of the hospital's overall performance management, crucial to the development of the nursing team and nursing discipline [2]. Traditional nursing performance allocation focuses on assessing the economic benefits and medical quality of departments, which does not reflect the contribution of nursing, let alone differences in nurses' work efficiency, labor intensity, and job risks [3–4]. It cannot precisely reflect key performance indicators in the hospital's operation and management process, and cannot meet the current high-speed and high-quality development requirements of hospitals. Therefore, establishing a reasonable nursing performance appraisal system to optimize the performance system's operation and make the distribution of reward-based performance more reasonable, fair, and impartial, better motivating nurses' work enthusiasm, is significant for improving medical service quality and level and promoting high-quality development in public hospitals [5–7]. In this context, based on the information system, our hospital has implemented a key performance indicator (KPI) system under vertical nursing management, gaining some practical experience and providing strong support for establishing refined performance management. The specific content is presented below.

2. Establish information-based management for nursing incentive performance based on informatization

2.1. Set up a nursing incentive performance management team

The nursing incentive performance team consists of 8 members, including 1 hospital party committee secretary, 1 nursing department director, 1 department nursing supervisor, 3 nursing supervisors, 1 nursing incentive performance secretary, and 1 senior software engineer. Their main responsibilities include developing incentive performance allocation and assessment plans for each nursing unit in the hospital, collecting feedback and suggestions, and continuously improving related work regarding nursing incentive performance.

2.2. Framework for nursing incentive performance management

Relying on informatization, a performance management research and development team is established to determine the functional requirements, logical algorithms, calculation methods, presentation forms, and query information of the performance system, ensuring the smooth operation of performance data. Based on data production and usage, nursing incentive performance is divided into two major subsystems: performance measurement and performance inquiry. The performance measurement subsystem is responsible for collecting, calculating, and storing performance data, while the inquiry subsystem handles the output and display of performance results. Query and download permissions are set based on the administrative functions of vertical nursing management to ensure the security of core assets such as performance information and data.

2.3. Design and application of nursing incentive performance software

To improve the efficiency of vertical nursing incentive performance management, the performance software is integrated with the hospital's HIS system and nursing information system. This allows for the digital management of nursing workload, nursing quality, satisfaction, and other performance assessment content across all nursing units in the hospital. Automatic data collection and storage are implemented, enabling the nursing department to dynamically monitor the nursing workload and workload burden in each nursing unit through the performance platform. This facilitates overall planning and arrangement of nursing human resources, fully and effectively fulfilling supervision, coordination, and management functions. Nursing supervisors can also export and save nursing work information for their

respective units, facilitating analysis of existing problems.

3. Construction of a KPI system for nursing incentive performance

Based on standards such as performance evaluation indicators for state-owned public Chinese medicine hospitals, detailed rules for the grading review of tertiary general hospitals/integrated Chinese and Western medicine hospitals, key specialty construction, and nursing quality control requirements, and referring to the theory of Key Performance Indicators (KPI), the authors have constructed a system that takes into account the hospital's overall performance management and development strategy. This system also incorporates the hospital's development characteristics and nursing development needs, guided by the difficulty level of nursing technical operations, reflecting differences in nursing positions and workloads, emphasizing nursing quality and safety, and patient satisfaction. It evaluates the nursing services delivered by nursing staff from multiple perspectives.

3.1. Selection and determination of KPI indicators for nursing incentive performance

By searching nursing performance management-related literature in Chinese and English databases such as Web of Science, Cochrane Library, CNKI, Wanfang Database, and VIP, the study systematically summarized relevant research on nursing performance management by domestic and foreign experts. Referring to the hospital's overall performance management work plan, the authors solicited opinions and suggestions from head nurses and nursing backbones multiple times through group discussions and clinical research. Using the SMART principle (Specific, Measurable, Achievable, Relevant, and Time-bound), the authors calculated, analyzed, summarized, and improved to initially construct a performance evaluation indicator system. The authors then inducted, analyzed, and summarized the data, evaluating and correcting the rationality, feasibility, and effectiveness of the indicator system according to relevant standards. Finally, the authors formed a system of incentive performance KPIs applicable to the vertical management of nursing in the hospital, with key evaluation indicators including nursing position risk, nursing operation difficulty coefficient, workload, work quality, satisfaction, and custom dimensions, ensuring fair, open, and equitable performance evaluation.

Table 1. Risk classification and evaluation of clinical ward positions

Score	Risk Factor 1: Exposure to Toxic/Hazardous Substances or Infectious Diseases	Risk Factor 2: Workload, Overtime Risk	Risk Factor 3: Number of Critically Ill Patients, Technical Skill Requirements for Nurses	Risk Factor 4: Risk of Rapid Patient Condition Changes Requiring Emergency Care	Risk Factor 5: 24-Hour Shift Risk
1	No exposure	Light workload	No critically ill patients; low technical skill requirements	Patients in stable condition; no emergency care needed	No overtime opportunities
2	Rare exposure	Moderately light workload	Few critically ill patients; relatively low technical skill requirements	Patients in generally stable condition; very few emergency cases	Rare overtime opportunities
3	Occasional exposure	Moderate workload	Some critically ill patients; moderate technical skill requirements	Patients with rapidly changing conditions; frequent emergency care	Occasional overtime opportunities
4	Frequent exposure	Heavy workload	Many critically ill patients; high technical skill requirements	Patients with very rapid condition changes; frequent emergency care	Frequent overtime opportunities
5	Daily exposure	Very heavy workload	Many critically ill patients; very high technical skill requirements	Patients with extremely rapid condition changes; almost daily emergency care	Daily overtime

3.2. Standards for risk classification and evaluation of nursing positions

3.2.1. Evaluation basis and methods

Based on the "Clinical Nurse Position Classification and Hierarchical Management Study in Tertiary General Hospitals" and its "Clinical Position Risk Survey Questionnaire," the original questionnaire content and scoring grades were retained. A questionnaire survey method was used to investigate nursing managers and clinical nurses (**Table 1**).

3.2.2. Scoring result statistics method

When calculating the scoring results, the weighting coefficients for nursing managers and clinical nurses each are each set at 0.5. The scorers base their scores on work experience, management experience, daily cognition, etc.

3.2.3. Evaluation of risk impact

Nursing staff across the hospital rated five different risk factors, and the mean value after applying the weighting coefficient was used as the average position risk for the ward.

3.3. Determination of technical difficulty coefficients for common clinical nursing operations

3.3.1. Overview of nursing service items

Based on the actual implementation of clinical work, each nursing unit's performance team organizes information on projects completed independently by nursing staff within the ward, projects completed through collaboration with medical staff, and health education projects. New nursing techniques and projects are noted, and the operational requirements and functional orientations of the projects are clarified. Projects submitted by various nursing units are collected, and duplicates are removed to form a nursing service item database, which mainly includes three categories: nursing items, medical-nursing cooperation items, and health education items. The database is adjusted and supplemented in a timely manner based on the implementation of new nursing service projects and techniques.

3.3.2. Basis for determination

This study selects and determines core clinical nursing operation techniques as the research foundation based on the "Difficulty Table of Common Clinical Nursing Operations" provided in the "Guidance on the Management of Nursing Positions in Tianjin (2018 Edition)" issued by the Tianjin Nursing Quality Control Center. For nursing operation techniques not covered in the table, techniques with similar difficulty coefficients are selected based on their operational complexity, risk level, and skill requirements, and corresponding difficulty coefficient values are assigned. At the same time, the aforementioned technical project library and its difficulty coefficients will be dynamically evaluated and adjusted in a timely manner in combination with the latest policies, technical specifications, and industry standards issued by relevant departments such as the National Health Commission.

3.4. Statistics of nursing workload

Based on the hospital's electronic information digital management system, and fully utilizing computer network information resources according to the characteristics of nursing work and nursing management requirements, the PDA is used to execute medical orders on the basis of assigning point values to each nursing operation. This maximizes the multiplier effect of data elements, providing nursing managers with objective, comprehensive, dynamic, intuitive, and accurate management information, as well as convenient and efficient querying methods. This truly and objectively reflects the nursing workload, nursing efficiency, and the status of nursing work. Based on the implementation of key hospital work, special incentives such as nursing research, companion-free care services, integration of clinical and rehabilitation work, and promotion of appropriate traditional Chinese medicine techniques are established. This fully embodies a unified management model of personnel, finance, materials, responsibilities, rights, and benefits, promotes the development of high-quality nursing work, strengthens the service capability of traditional Chinese medicine, stabilizes the nursing team, and enhances professional belongingness.

3.5. Nursing quality management

Nursing quality management runs through out the entire nursing process and is an important indicator to

measure the level of hospital nursing management [8]. To ensure nursing quality and safety, nursing quality control inspection forms are developed based on grading evaluation standards, key specialty construction, and nursing quality control requirements. The inspection content covers graded nursing, emergency and critical patient care, emergency cart management, implementation of traditional Chinese medicine nursing quality, nursing document writing, and specialized cluster management. The nursing department develops a "Nursing Quality and Safety Inspection Plan" every month, and senior nursing staff are members of the inspection team. Comprehensive supervision and assessment of the quality of nursing work in the entire hospital are conducted irregularly every month according to the inspection plan. A 100-point system is established, and a problem-oriented inspection mechanism is established. Monthly quality control analysis is conducted, corrective measures are developed, and "corrective and zero-clearing" review work is carried out for the problems found in the next month's inspection to achieve closed-loop management, reflecting PDCA, continuously deepening the connotation of high-quality nursing services, and linking the monthly nursing quality assessment scores to the rewarding performance coefficient of the head nurse.

3.6. Satisfaction survey of head nurses

Nursing satisfaction is one of the core indicators to measure the quality of nursing services. It is a method to identify problems in nursing work, improve nursing quality, and enhance nursing services [9]. The head nurse is an important organizer and leader in the ward, and their leadership abilities are conducive to creating a healthy nursing work environment, fostering a good atmosphere, and improving satisfaction. Every month, nursing specialists conduct satisfaction surveys for head nurses through questionnaire surveys, covering three aspects: functional departments, nursing departments, and clinical nurses. The survey content includes ward management, professional ability, communication and collaboration, plan implementation, emergency response, reasonable scheduling, and humanistic care. There are four options: "very satisfied", "satisfied", "basically satisfied", and "dissatisfied." The average of the proportions of "very satisfied" and "satisfied" is used as the satisfaction assessment score for the head nurse. The average of the satisfaction assessment score coefficient and the nursing quality control coefficient is used as the incentive performance coefficient for the head nurse in that month (**Table 2**).

3.7. Customized dimension of nursing care

Nursing research is a crucial process in which nurses integrate nursing theoretical knowledge with clinical practice and continuously elevate it. It is a key aspect that promotes the sustained development of the nursing discipline [10]. However, the burdensome and meticulous nursing workload often leaves nursing staff with little time to read and learn from relevant professional publications, resulting in relatively weak awareness and capability in nursing research [11]. To strengthen and standardize nursing research management and stimulate nurses' interest in research, special incentives for nursing research have been established. The assessment content focuses on high-level developments and efforts such as academic exchanges, paper publications, applications for continuing education projects, scientific research projects, and patent applications. Nurses are encouraged to participate in activities like nursing skill competitions, nursing quality improvement projects, traditional Chinese and Western medicine nursing case competitions, nursing science popularization micro-video selections, and nursing teacher lecture competitions. These efforts aim to better tap into the professional potential of nurses, enhance their comprehensive research capabilities, and promote the output of scientific research achievements (**Table 3**).

4. Management of low-value medical consumables in nursing

Medical consumables are classified into various categories, including high-value and low-value consumables. Compared to high-value consumables, low-value consumables are characterized by their diverse types, low prices, complex specification systems, and wide and frequent application ranges. Their total value accounts for more than 30% of the hospital's total expenditure on consumables [12]. Therefore, improving the management efficiency of low-value consumables has become a research hotspot in current hospital management. The hospital retrieves the most frequently

Table 2. Incentive performance coefficient for head nurses

Satisfaction level	Corresponding performance bonus coefficient	Monthly quality control score	Corresponding performance bonus coefficient
"Very Satisfied" single item ≥80%	1.6	≥90	1.5
≥95%	1.5	85–89	1.4
≥85%	1.4	80–84	1.3
≥75%	1.3	75–79	1.2
≥70%	1.2	70–74	1.1
≥60%	1.1	<70	1.0

Table 3. Nursing research tasks and requirements

Project application	Quality improvement project	Patent application	Paper publication	Higher-level nursing activities	Hospital-level activities
Application and successful approval of provincial/municipal, bureau-level, or nursing association vertical research projects	Completion of one improvement project per ward annually. +2 points per completed project, capped at +5 points	Application for invention patents with completed technology transfer	Publication in SCI, Chinese core journals, or other indexed journals; Submission of conference papers accepted for presentation and academic exchange	Participation in provincial/municipal teaching competitions, case sharing, skill contests, nursing quality improvement projects, etc., with awards/ rankings	Participation in hospital-level continuing education lectures, training sessions, etc.

used and charged low-value consumable categories through the material information management platform and selects the relevant low-value consumables related to nursing work. Based on data such as the total number of inpatient days, total days of deep venous catheterization, and total days of peripheral venous catheterization in each ward, a comparative analysis is conducted between the target and actual consumption values. The target value is set at 20%, and wards exceeding this target are subject to incentive performance penalties and required to submit targeted rectification measures. Simultaneously, wards are urged to establish a base number for low-value consumable requisitions and a base for items circulated in scattered storage based on the actual number of beds used. This limits the scope of use and requisition standards for nursing low-value consumables, avoiding wastage. By reducing consumable waste, requisition costs, and spatial costs, the time spent on inventory management and item retrieval is improved, enhancing overall work efficiency and the nursing team's awareness of consumable control. This gradually achieves optimal inventory management of consumables.

5. Effectiveness and results

The assessment indicators include the resignation rate of nurses, job satisfaction, patient satisfaction, head nurse satisfaction, and the incidence of adverse events. The incidence of adverse events was analyzed using the *t*-test, comparing the results of 2023 and 2024. The specific analysis results are as follows:

5.1. Resignation rate of nurses

The resignation rate of nurses decreased from 1.52% in 2023 to 1.4%, a reduction of 0.12% (**Table 4**).

5.2. Nurse job satisfaction and patient satisfaction

In 2024, there was a significant improvement in nurses' job satisfaction, patient satisfaction, and head nurse

Table 4. Comparison of nurse resignation rates in 2024 and 2023

Year	Number of licensed nurses (persons)	Number of nurses who left (persons)	Nurse turnover rate (%)
2023	660	10	1.52%
2024	785	11	1.40%

Table 5. Comparison of nurse job satisfaction and patient satisfaction in 2024 and 2023

Year	Nurse job satisfaction (%)	Patient satisfaction (%)	Head nurse satisfaction (%)
2023	87.19	98.09	99.03
2024	88.03	98.12	99.16

Table 6. Nursing adverse events in 2024 and 2023

Year	Discharged patients	Unplanned extubations	Falls/falls from bed	Pressure injuries	Medication errors
2023	48,632	3	6	3	3
2024	53,516	2	4	2	2
t-value	-	8.150	6.699	9.193	10.567
P-value	-	0.004	0.009	0.002	0.001

evaluation satisfaction compared to 2023 (**Table 5**).

5.3. Incidence of nursing adverse events

The incidence of nursing adverse events (falls, bed falls, tube dislodgement) in 2024 was significantly lower than in 2023. The difference was statistically significant ($P < 0.05$) (**Table 6**).

6. Discussion

6.1. Leveraging informatization to enhance the level of vertical performance management in nursing

The full implementation of vertical performance management in nursing relies, to some extent, on informatization construction [13]. Given that data quality (accuracy, completeness, and timeliness) is a core prerequisite for the effective execution of nursing performance programs, the nursing department closely aligns with clinical practice needs to systematically design and continuously optimize a vertical nursing performance management information system. The construction of this system should be based on ensuring standardized collection and verification processes for basic data, thereby guaranteeing data reliability and integrity. This provides an objective and verifiable scientific basis for performance management, driving the standardization, scientification, and normalization of incentive performance allocation processes. By relying on the informatization platform, the nursing department establishes real-time data acquisition, processing, and closed-loop feedback mechanisms. This enables dynamic monitoring and precise management of performance results, ensuring that they timely, authentically, and accurately reflect the operational efficiency and development level of nursing units. It also generates clear and positive behavioral guidance for nursing staff. Simultaneously, the system possesses dynamic responsiveness, allowing for timely updates and calibrations of relevant performance indicators and weights based on adjustments to the hospital's strategic priorities and the deepening of the "patient-centered" holistic nursing model. Through these mechanisms, the nursing performance management system is continuously improved, and its goal orientation is optimized. Ultimately, this provides strong evidence-based

decision support for vertical management by nursing administrators, thereby maximizing nursing management efficiency and enhancing nursing service quality and patient safety.

6.2. Establish an effective incentive mechanism to fully mobilize the enthusiasm of nurses

Based on the Key Performance Indicator (KPI) theory and the overall performance management and development strategy of the hospital, combined with the hospital's development characteristics and nursing development needs, the authors use "job risk, nursing operation difficulty coefficient, workload, work quality, satisfaction, and custom dimensions" as the assessment criteria to achieve the overall linkage between nursing KPI performance assessment objectives and hospital work objectives. This breaks the traditional performance distribution method based on professional titles and working years, reflects the performance distribution principle of distribution according to work and excellent performance, and tilts performance bonuses towards positions and shifts with high technical requirements. It better reflects the technology, risk, efficiency, and responsibility inherent in different conditions, treatment methods, and nursing methods, fully mobilizes the enthusiasm and passion of clinical nurses, guides nurses with knowledge, ability, and responsibility to stay in clinical frontline positions, improves nurses' understanding of their own value, and fully mobilizes the enthusiasm of nursing staff to ensure that patients receive safe treatment and care.

In summary, relying on the construction and implementation of a nursing vertical incentive performance system based on the KPI model and informatization, the authors combine quantitative management with performance management to achieve standardized, scientific, and standardized management of nursing incentive performance. This makes nursing performance appraisal more fair, just, scientific, and effective, fully mobilizes the enthusiasm of nurses, enables nurses to achieve their own value while achieving the hospital's strategic goals, and continuously encourages nursing workers to use professional knowledge and skills to strive to provide quality, satisfactory, and safe nursing services to patients, achieving satisfaction from society, patients, and the government.

Disclosure statement

The authors declare no conflict of interest.

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