

Research on the Nursing Hierarchical Management Model Based on Disease Cybernetics

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Research Article

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Abstract

Purpose

Based on the disease cybernetics model and combined with clinical practice, this study explores the management model for nursing talent cultivation.

Methods

The disease cybernetics model was applied to analyze the nursing talent training approach, and a nursing hierarchical management model was constructed by integrating specific clinical practices. Clinical Department A adopted this model, while Clinical Department B served as the control group without any special management models. Training outcomes of head nurses in both departments were collected and statistically analyzed.

Results

The nursing hierarchical management model included four modules: work module design, module responsibility allocation, module responsibility rotation, and acting head nurse mechanism. Statistical analysis showed that the head nurse training efficiency in Clinical Department A was significantly higher than that in Department B ($P < 0.05$).

Conclusion

The nursing hierarchical management model is conducive to nursing talent cultivation, featuring strong adaptability, easy implementation and definite effects. **Implication for Nursing Management:** Nursing management should integrate flexible management with refined operation, develop a tiered nursing management talent cohort, and propel clinical nursing toward excellence in both clinical practice and management.

Introduction

Since Florence Nightingale founded the modern nursing education system in the mid-19th century, nursing science has undergone an evolution of more than 160 years^[1]. It has gradually developed from a simple disease-assisted nursing practice to an interdisciplinary integration, forming a multi-dimensional nursing theoretical and knowledge system that covers Nursing Psychology, Nursing Management, Nursing Education, Nursing Ethics and other fields^[2]. Nursing science has thus become one of the indispensable core supporting forces in the cause of medical and health care. In this developmental process, the iteration and improvement of nursing systems have always been the

cornerstone driving the standardized, professional and innovative development of the discipline—the emergence of each system responds to the upgrading of clinical needs, drives the improvement of nursing quality, and exerts a profound influence on the establishment of nurse–patient safety, nursing efficiency and industry standards.

Tracing the development context, during the Florence Nightingale era, the establishment of systems such as ward cleanliness standards and basic nursing norms reduced the mortality rate of the wounded from 42% to 2.2% during the Crimean War, which empirically proved for the first time the decisive role of institutionalized management in nursing quality^[1]. In the 1920s, Nie Yuchan promoted the standardization of higher nursing education with the integrated “theory–practice” teaching model, pioneering higher nursing education in China and cultivating a large number of professional talents with high standards, thus laying a solid foundation for the localized development of the discipline^[3]. In the early days of the People's Republic of China, in order to provide timely and effective treatment for the wounded, Li Xiufang created the “Three Checks, Seven Verifications” system for treatment and nursing documents, which greatly reduced the incidence of errors and accidents and improved nursing quality as well as the cure rate of the wounded^[4, 5]. Entering the 21st century, nursing systems have shown an increasingly diversified trend. The three–level nursing ward round, hierarchical nursing, holistic nursing, nursing hierarchical management model, the 9S management theory, PDCA cycle and other systems^[6–11], either strengthen specialized competence (e.g., three–level nursing ward round), implement stratification based on fixed standards (e.g., nursing hierarchical management model), or focus on process and quality improvement (e.g., the 9S management theory, PDCA cycle). All of them take improving nursing quality and ensuring patient safety as the core, and emphasize procedural standardization and full–staff implementation.

However, the existing systems generally overlook the dynamic training and flexible management of nursing management professionals, which renders them poorly adapted to scenarios such as staffing shortages, inadequate nursing talent reserves, and constrained team development momentum in the initial stage of technological innovation. Based on the disease cybernetics model and in combination with the nursing practice in clinical wards and departments of hospitals, we have developed a nursing hierarchical management model with the aim of exploring effective approaches and methods for nursing talent development in practical work. The details are presented in this report as follows.

Materials and Methods

General Data

This study selected cross–sectional data at a single time point from a certain hospital, with a focus on the number of nursing staff and the head nurses trained in Clinical Department A and Clinical Department B (other clinical departments excluding Clinical Department A). The hospital had a total of 395 nursing staff and 29 head nurses in all; among them, Clinical Department A had 45 nursing staff and trained 10 head nurses, while Clinical Department B had 350 nursing staff and trained 19 head nurses.

Hospital Overview: Clinical Department A of the hospital was established in 2008. Owing to nursing staffing shortages and other challenges, a nursing hierarchical management model was adopted and has been implemented continuously up to the date of data collection for this study. Clinical Department B of the hospital has expanded from 5 departments in 2008 to 28 departments (including the Outpatient and Emergency Department), and none of these departments has adopted a nursing hierarchical management model or any other special management systems.

Development Overview of Clinical Department A: Initially established with more than 10 beds, the department has gradually expanded to 2 wards (nursing units) with a total of over 80 beds. It is the only key specialty of its kind in the region and the host unit of the Professional Committee of the Regional Medical Association.

Date of Data Collection: April 2023

Theoretical Model and Its Methodology

In this study, the theoretical model and a series of methodologies of disease cybernetics were adopted^[12, 13], with targeted goal design, systematic analysis and feedback mechanism establishment conducted for the training of nursing talents in the clinical departments of the hospital.

Nursing Hierarchical Management Model

Based on the nursing practice in the clinical departments of the hospital, a nursing hierarchical management model was developed, with the key points of the methodology and system presented as follows: (1) Work module design: According to the actual development and construction status, nursing work in the wards of clinical departments was divided into several modules, generally 7 to 10 modules, including basic modules, subdivided modules and extended modules; (2) Module responsibility mechanism: The head nurse assumes overall responsibility for the modules but is only in charge of 1 to 2 modules, while the remaining modules are assigned to 2 to 4 core nurses, with each responsible for 1 to 3 modules; (3) Rotation mechanism for module responsibility: A rotation system for module management was established, under which the responsibility for module management is rotated every 6 to 12 months in light of the characteristics of different modules; (4) Head nurse agent mechanism: The acting head nurse mechanism can be implemented one year after the operation of the module rotation mechanism, specifically as follows: when the head nurse is on a business trip or on leave, a core nurse designated by the head nurse shall perform the duties of the head nurse.

Statistical Analysis

Data were statistically analyzed using SPSS 22.0 software. Quantitative data were expressed as mean $\pm$ standard deviation, and comparisons were performed using the t-test or Fisher's exact probability test. A P-value < 0.05 was considered statistically significant.

Results

Construction of a Nursing Talent Management Model Based on Disease Cybernetics

The disease cybernetics model comprises four elements^[12, 13], which correspond to nursing talent management and are specified as follows: (1) Nursing practice in accordance with the laws of diseases. This can be described as adherence to clinical diagnosis and treatment norms, nursing operation norms and other relevant standards; (2) Nursing work objectives of clinical departments. The short-term objectives include zero nursing errors, positive nurse-patient and nurse-physician relationships, a stable nursing team, excellent professional competence, sound logistical support and environmental hygiene in wards, and other such goals, which can be summarized as high-quality nursing services and optimal support work; the long-term objective is to achieve a state of perfect medical care in the nursing work of clinical departments; (3) A system analysis model for nursing work in clinical departments, see Fig. 1 for details; (4) A feedback mechanism model for nursing management in clinical departments, see Fig. 2 for details.

Head Nurse Training in Clinical Departments A and B

The number of head nurses trained in Clinical Department A was $n_{1-1} = 9$; the number trained in Clinical Department B was $n_{2-5} = 14$.

Comparison of Head Nurse Training Based on the Number of Nursing Staff

Based on the number of nursing staff as the baseline, Clinical Department A trained 9 head nurses from 45 nursing staff, with a training efficiency of 20%; Clinical Department B trained 14 head nurses from 350 nursing staff, with a training efficiency of 4%. The training efficiency of Clinical Department A was 5 times higher than that of Clinical Department B, and the difference was statistically significant ($P < 0.05$). See Table 1 for details.

Table 1
Comparison of head nurse training efficiency based on nursing staff size between Clinical Department A and B in a certain hospital

item	nursing staff	number of head nurses trained	training efficiency (%)
Clinical Department A	45	9	20
Clinical Department B	350	14	4
Total	395	23	5.8

Table footnote: Data are presented as n (percentage). P < 0.05 was considered statistically significant.

Comparison of Training Efficiency Based on the Initial Number of Departments

Based on the baseline number of departments, Clinical Department A produced 9 head nurses from its initial 1 department, with a training efficiency of 900%. Clinical Department B produced 14 head nurses from its initial 5 departments, with a training efficiency of 280%. The training efficiency in Clinical Department A was 3.2 times higher than that in Clinical Department B, and the difference was statistically significant (P < 0.05). Details are shown in Table 2.

Table 2

Comparison of head nurse training efficiency based on initial number of departments between Clinical Department A and B in a certain hospital

item	initial number of departments	number of head nurses trained	training efficiency (%)
Clinical Department A	1	9	900
Clinical Department B	5	14	280
Total	6	23	380

Table footnote: Data are presented as n (percentage). P < 0.05 was considered statistically significant.

Discussion

The Importance of Nursing Management System Construction

There is a consensus on the necessity of a management system in nursing practice. Every milestone development in the nursing profession has originated from a systemic revolution. Ms. Florence Nightingale^[14] led a nursing team to conduct thorough investigations of wounded patients in field hospitals, identified the lethality of wound infections, and implemented classified management of the wounded. She guided the nursing team to provide differentiated care according to injury severity, achieving the remarkable reduction of the mortality rate from 42% to 2.2% within a short period. This also laid a comprehensive foundation for the establishment of nursing schools and the nursing discipline. In the 1950s, Ms. Li Xiufang developed the “Three Checks, Seven Verifications” system^[15], which rapidly reduced the clinical medical error rate to less than 10% and laid a systemic foundation for the pursuit of a “zero error rate”.

Around 2000, to address the shortage of nursing staff and weak management in newly established clinical wards, our research team systematically defined and categorized the tasks undertaken by

nursing teams in the wards, clarified corresponding responsibilities and management objectives, and assigned 1–2 nurses to assist head nurses in management. After several years of exploration and practice, around 2005, a nursing hierarchical management model was proposed and institutionalized as a standardized methodology. It was successively implemented in more than 100 clinical departments across over 40 hospitals nationwide, achieving favorable outcomes, and the nursing hierarchical management model was gradually refined. Based on the model obtained from the systematic analysis of nursing practice in clinical wards using the disease cybernetics model (see Fig. 1), it is clear that the improvement of management systems and the executive capacity of teams and individuals play crucial and mutually reinforcing roles. From the perspective of long-term development mechanisms, the progressive improvement of management systems and protocols (including the nursing hierarchical management model) is essential to further promote development (see Fig. 2). The nursing hierarchical management model is an integral part of the nursing system and methodology. As an innovative management system, it focuses on the training of management capabilities among nursing staff and exerts its effect as an institutional approach.

With the continuous development of social economy, the number and scale of hospitals in China have increased significantly over the past two decades, and the demand for nursing talents as well as job requirements have also been changing. Therefore, full attention should also be paid to the innovation of nursing management systems and the cultivation of nursing management talents^[16].

Mechanism and Effect of the Nursing Hierarchical Management Model

In China, the three-level nursing ward-round system established by Li et al.^[6] and the nurse hierarchical management system proposed by Fang et al.^[9] are limited to post allocation based on fixed professional titles or competency levels (e.g., N1–N4). Although these systems have addressed problems such as insufficient standardized management and weak quality control in clinical nursing, they fail to achieve dynamic training of nursing management talents. In foreign countries, 9S management^[10] focuses on the standardization of environment and procedures, relying on top-down institutional constraints, which can hardly stimulate the initiative and development potential of nursing staff. In contrast, the PDCA cycle^[11] emphasizes closed-loop management, continuous improvement and full participation, which mainly solves problems including non-standard procedures and inefficient quality control in clinical nursing management, but is difficult to adapt to the practical challenges of limited manpower and heavy workload in the initial stage of department construction^[17, 18].

The study department in this research was founded in 2008 and had developed into an outstanding specialized department of the hospital by 2016. It is also the only key specialized department of this discipline in the region and the chair unit of the Professional Committee of the Regional Medical Association. Data show that despite its short establishment period, the department has achieved remarkable development outcomes. Undoubtedly, nursing practice has played a vital role in its

disciplinary construction and development. Particularly notably, it has also achieved outstanding results in cultivating nursing talents for the entire hospital. Benefiting from the hierarchical management system, nursing practice in Clinical Department A has not only guaranteed and promoted the development of the department itself but also cultivated 9 head nurses for the whole hospital, accounting for 39.13% of the total number of head nurses in the hospital. The proportion of cultivated head nurses relative to the total number of nursing staff in the department reached 20%, markedly higher than the hospital average of 5.8% and five times that of Clinical Department B. After adjusted chi-square test, the statistic was 15.82 and $p < 0.001$. There was a statistically significant difference in the proportion of head nurses to nursing staff between the two groups, with the proportion in Clinical Department A being significantly higher than that in Clinical Department B.

Compared with traditional systems, the nursing hierarchical management model is centered on dynamization and practical application. It not only solves the problem of clinical operation under staff shortage during the department establishment period, but also constructs a talent training mode that integrates training into daily work. Judging from the 20% training efficiency achieved in Clinical Department A, this system provides a replicable approach for cultivating nursing management talents in settings with staff shortages and resource constraints.

Through practice and outcome analysis, the nursing hierarchical management model has achieved remarkable breakthroughs in discipline construction and nursing talent cultivation, mainly owing to the following aspects: (1) By dividing nursing work in clinical wards into several modules, the management boundaries and responsibilities between physicians and nurses in the clinical department are clarified, which helps improve the overall management of the department; (2) Since most management tasks are assigned to key nurses in charge, much energy of head nurses is freed up, enabling head nurses to focus on the overall development of the department and the handling of key issues or tasks at various stages; (3) When key nurses take charge of specific work modules, their work initiative is enhanced; meanwhile, work effectiveness and efficiency are greatly improved due to concentration. In the process of daily practice, key nurses' management ability in relevant modules is also significantly improved, and their overall competence can achieve a qualitative leap after 2–3 years of rotation; (4) The role of key nurses enhances the sense of competition among other nursing staff and stimulates their initiative and enthusiasm, thus rapidly promoting the competence of the entire nursing team.

The combined effects of the above measures have improved the overall competence of the nursing team and the quality of nursing care in the department, while significantly reducing nursing errors. They have also effectively addressed the shortage of staff during the initial stage of department establishment or when the volume of inpatients exceeds capacity.

The Importance of Cultivating Nursing Management Talents

Clinical nursing work mainly includes: (1) Nursing operational skills, such as venous access establishment, medication administration, blood collection, and various other nursing procedures. These

skills are directly related to patient experience and medical quality, and have long been highly valued in school education and clinical practice. (2) Management work in clinical departments is also an important part of nursing. Such work affects medical technical level and patient experience either directly or indirectly. Unfortunately, during school education, nursing management–related courses are mostly supplementary and lack targeted training modules, resulting in a lack of management thinking and basic methodological preparation among nursing students. After entering clinical practice, although there are scattered management trainings (such as brief pre–job guidance and daily experience passing from seniors), most of these trainings rely on personal experience, lack standardized methodological guidance (e.g., systematic teaching of management tools and practical training pathway design), and no specialized management system has been established, which cannot guarantee the effectiveness and sustainability of management ability training^[19, 20]. This imbalance in training not only restricts the development of nursing management talents, but also leads to an “empirical” dilemma in clinical nursing management, making it difficult to meet the requirements of management efficiency and quality in complex diagnosis and treatment scenarios.

Based on the above, it is of great practical significance to explore and innovate training methods for nursing management talents. This study focuses on addressing the issue of “the lack of scientific methodological mechanisms and specialized systems” in existing training models. By concentrating on methodological innovation in nursing management talent training, a management ability training pathway suitable for clinical needs is constructed. It not only fills the gap between school education and clinical training in management ability development, but also provides talent support for clinical nursing management. Ultimately, it promotes the transformation of clinical nursing from “high–quality operation” to “dual excellence in both operation and management”, so as to improve the overall quality of nursing services.

The Significance of Disease Cybernetics in This Study

The four core elements of the disease cybernetics model provide a scientific theoretical framework and standardized analytical method for this study on nursing management talent cultivation. Its core logic of “guidance by scientific laws, goal orientation, systematic decomposition, and dynamic optimization” is precisely compatible with the needs of clinical nursing management talent development.

At the practical level, the nursing hierarchical management model is based on following disease laws and decomposes clinical nursing work into standardized modules. Guided by progressive objectives, it realizes the training of key nurses and the output of management talents through 6–12 months of module–based rotation. Relying on the head nurse agent mechanism, it achieves hierarchical transformation, and dynamically optimizes module design and rotation cycle based on indicators such as head nurse cultivation rate and nursing quality. In this way, the theoretical model has been effectively implemented into clinical nursing management practice.

Conclusion

The nursing hierarchical management model is a nursing talent management system explored and gradually matured through long-term practice. It consists of four components: work module design, module management mechanism, module rotation mechanism, and head nurse agent mechanism. It demonstrates good adaptability to scenarios such as staff shortage and insufficient nursing talent reserve in the early stage of department establishment. With clear and easy-to-implement operational procedures, it achieves reliable effects in practical cases. This system is compatible with existing systems and suitable for wide promotion.

Declarations

Conflict of interest

All authors have approved the final version of this manuscript and declare no financial or non-financial competing interests.

Ethical approval

Ethics approval for this study was obtained from the Medical Ethics Committee of Health Medicine College, Guangzhou Huashang University (No. 202603001). The study was conducted in accordance with the ethical principles stated in the Declaration of Helsinki. All participants were informed of the study purpose and assured of confidentiality. Participation was voluntary, and participants could withdraw at any time without penalty.

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Author Contribution

Lu Z.F. was responsible for material preparation, data collection, and data analysis. Xie M.Y. drafted and revised the initial manuscript and prepared Figure 1 and Figure 2. All authors contributed to the revision of the manuscript and approved the final version for publication.

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Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Figures

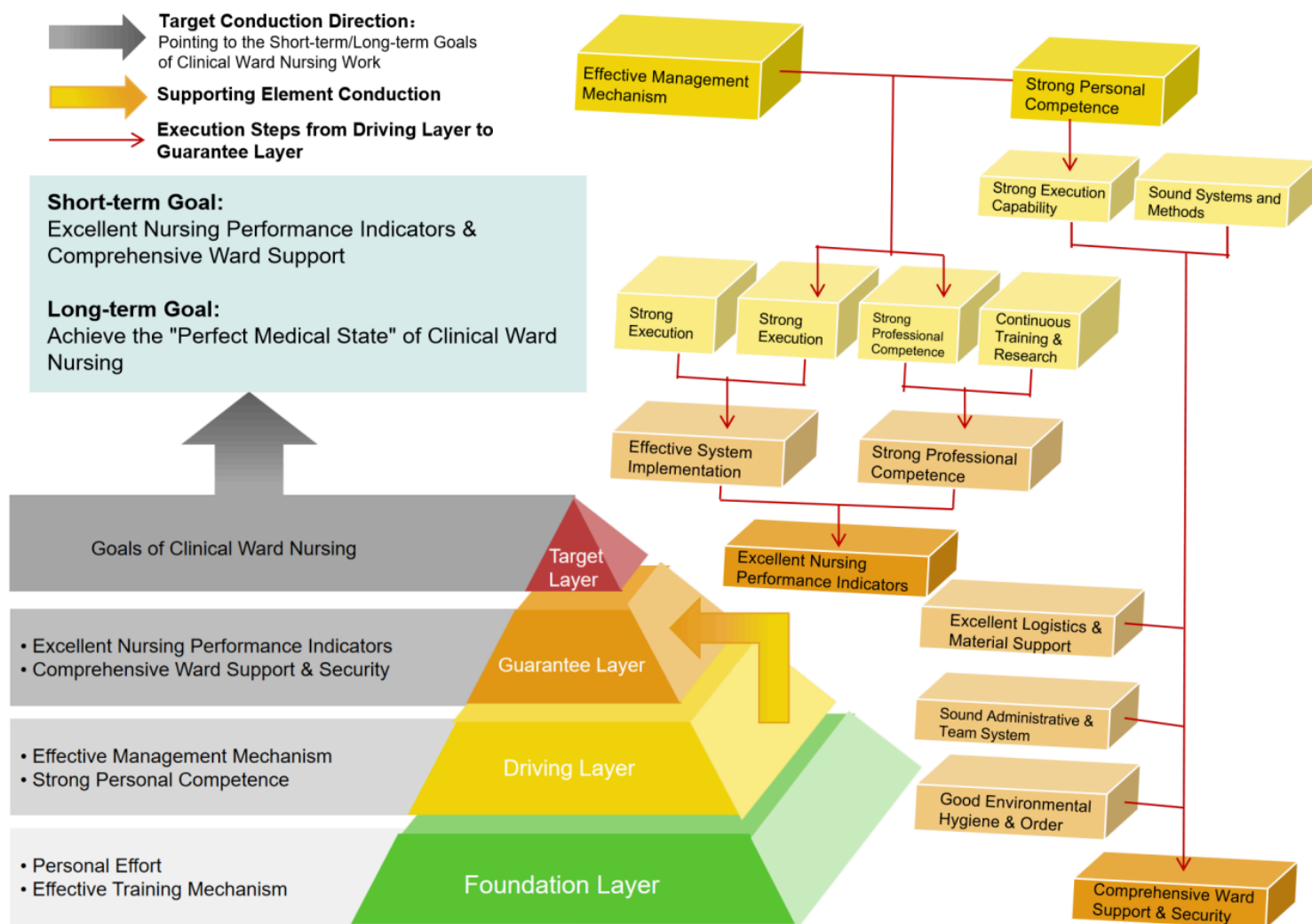


Figure 1

Schematic diagram of the analysis model for nursing work in clinical departments

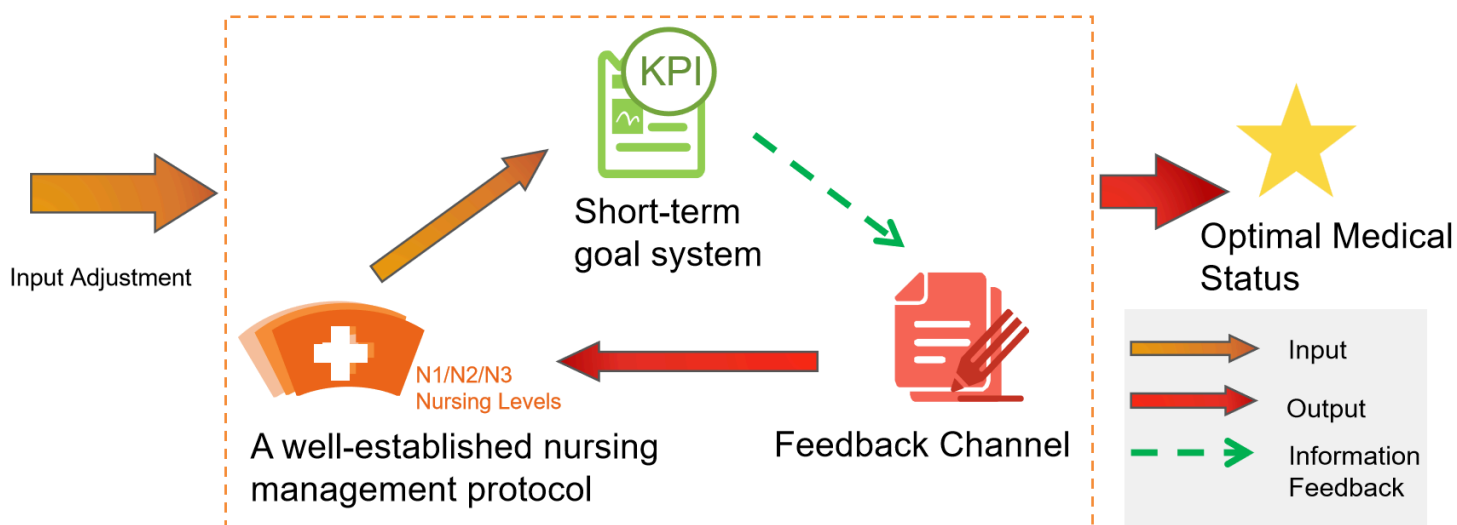


Figure 2

Schematic diagram of Nursing Management Feedback Mechanism in Clinical Wards

