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Original Paper

Application Progress of Nursing Information System in China

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Abstract

This paper introduces and summarizes the development background and function, application status and development limitations of nursing informatization, aiming to provide reference for nursing staff to further understand the relevant content of nursing informatization, better apply nursing informatization to clinical practice, and provide reference for clinical nursing informatization in China.

Keywords

nursing, informationization, application, review

1. Introduction

With the continuous development of information technology, the construction and reform of medical information has gradually become an inevitable requirement for the development of hospitals. The "National Nursing Development Plan (2021-2025)"[1] proposed that the rapid development of information technology has created new conditions for nursing. The deep integration of information technology and health services has led to the emergence of new models, new industries and new formats in the field of health and health, which has provided strong support for promoting the innovation of nursing service models, improving the efficiency of nursing services, and leading the high-quality development of nursing. Nursing information system (NIS) [2] is a system for the collection, storage, transmission and processing of nursing information. It mainly involves nurse work system, patient hospitalization information management system, human resource management system and so on. It is an important part of hospital information system. Its development level is closely related to nursing work efficiency, nursing service quality and nursing management level. At present, the application rate of NIS in tertiary hospitals in China is 82.56 % [3]. Due to the late start of China 's nursing information system and the lack of unified clinical nursing information system construction standards, the clinical

application effects of various nursing information systems are uneven, and the ability of nurses to participate in information construction is weak [4-5]. There is a certain gap with developed countries. In view of this, this paper introduces and summarizes the development background and function, application status and development limitations of NIS, in order to provide reference for clinical nursing informatization in China.

2. Background and Function of Nursing Information System

2.1 The Development Background of Nursing Information System

In the 1960 s, the United States took the lead in the construction and use of hospital information systems. The initial information system for nursing information storage, recording and transmission was realized in a non-formatted text form[6]. The construction of nursing informatization in developed countries such as Europe and the United States officially began in the 1970 s [7]. By the 1980 s, nursing information systems had been widely used in hospitals in the United States, Japan, the United Kingdom, the Netherlands, Canada and other countries [8]. In the 1990 s, independent nursing informatics courses and professional degree courses were set up in nursing schools and nursing colleges. The development process of nursing information system in developed countries includes three stages: early nursing, intelligent nursing and remote nursing [9]. The research and application of China's nursing information system started in the 1980 s. In the 1990 s, China began to apply the inpatient nurse workstation system to realize the electronic processing of nursing records and medical orders[10]. After that, with the support of various policies and the rapid development of information technology such as big data, Internet plus, and Internet of Things, the level of nursing information technology in China has been greatly improved. Domestic hospitals have successively introduced or constructed nursing information systems, and applied them to nursing quality management, clinical nursing, nursing safety management, and emergency, ICU, oncology and other specialist care [11-14], which greatly improved the quality and efficiency of nursing work.

2.2 Functions of Nursing Information System

The nursing information system mainly includes the following aspects: ①Optimizing the nursing management process. The nursing information system can achieve real-time electronic medical record management, automated nursing planning and task allocation, drug and material management, significantly optimizing the nursing management process. It can provide intelligent decision-making assistance for nursing management personnel in clinical, human resources, risk, quality, and training assessment aspects by real-time aggregation of clinical nursing and nursing management big data in the ward [15], which is conducive to closed-loop management and continuous improvement of nursing quality. ② Improve the efficiency of nurses' work. The system automates the recording and management of patient information, nursing tasks, and medical orders, reducing manual operations and paperwork, providing real-time data access [16], optimizing task allocation and resource management, thereby significantly improving nurses' work efficiency and reducing errors and repetitive labor. ③

Education and teaching training management. The system provides interactive learning and continuous education opportunities through online education modules and training resources, enabling nursing staff to access the latest medical knowledge and nursing skills at any time, while recording training progress and assessment results to support career development and improve nursing quality. In the post pandemic era, the application of information technology in nursing education has become more widespread. Leveraging 5G network technology, smart education platforms or learning platforms have been built, providing more innovative and efficient teaching methods for the development of nursing education[17]. ④Strengthen data security and privacy protection. The system provides strict access control, data encryption, regular backup and recovery mechanisms to ensure that only authorized personnel can access sensitive information, prevent data leakage and unauthorized access, and effectively strengthen data security and privacy protection. ⑤Allocation of nursing human resources. By monitoring and analyzing the scheduling, workload, and skill matching of nursing staff in real-time, optimized scheduling plans and task assignments are automatically generated to ensure the rational allocation of nursing resources.

3. Current Status of Nursing Information System Application

3.1 Mobile Nursing Information Technology

Mobile nursing information system refers to the extension of nursing work to the bedside with the support of hospital hardware and wireless network, realizing real-time information query and input. ① PDA. PDA has the advantages of simple operation, easy portability, and powerful functions, and is an important tool in modern hospital management. Based on the existing hospital information system (HIS) and electronic medical record system, PDA can achieve bedside care and patient data collection for patients through wireless network technology, freeing nurses from tedious paper input and achieving true paperless office. Gynecological medication has a wide variety of types and concentrated treatment times, making it one of the high-risk departments for medication related adverse nursing events. Shen Xialai [18] used PDA for gynecological medication safety management, which can be used for patient information recognition, medical advice inquiry, identity confirmation, work statistics, consumables inquiry and other operations. The results showed that using PDA system for gynecological medication safety management can significantly improve the quality of medication safety management, reduce the incidence of medication related adverse nursing events, not only improve the satisfaction of nursing staff, but also improve patient satisfaction evaluation. ②Mobile nursing cart. The mobile nursing cart can store medical tools and drugs in a centralized manner, which has great advantages in nurse dispensing and nursing operations. It truly extends the information system from the nurse workstation to the patient's bedside, improves the work efficiency and comfort of medical staff, reduces the risk of cross infection, optimizes space utilization and flexibility, and thus improves the quality of patient care[19]. ③Others. According to a survey by Li Chenfei et al. [20], applying mobile information technology to the continuous care of TKA patients can provide high-quality continuous care services

for patients based on mobile information technology, guide patients to master correct disease knowledge and rehabilitation exercise methods, strengthen patients' compliance with functional exercise, improve patients' self-care ability and satisfaction, and promote the treatment and recovery of their diseases to a certain extent.

3.2 Nursing Quality Improvement System

Nursing quality management and improvement are key to enhancing the level of nursing services. With the rapid development of information technology, applying information technology to nursing has become an important way of hospital management, and information technology has gradually become one of the important tools to promote the high-quality development of nursing [21]. Wang Jing [22] designed and constructed a nursing quality management system based on the hospital information system, with big data analysis and nursing quality control platform as the core; The system includes five modules: nursing quality indicator management, nursing risk management, nursing adverse event reporting management, head nurse electronic work manual management, and nursing quality management. Through the nursing control platform, precise data management of nursing quality management is truly achieved. The platform automatically summarizes the problems existing in each department based on the input results, and feeds back the problems to each department in WORD document format. Each department formulates improvement measures, continuously improves nursing quality, and effectively enhances the effectiveness of nursing quality management. Real time warning information reminders have reduced work omissions, effectively implemented the nursing verification system, standardized the professional behavior of nurses, improved the consistency of patient information obtained by medical staff through synchronous ward rounds in the mobile medical system, strengthened effective communication between medical staff and patients, further improved the quality of medical services, and enhanced patient satisfaction. Wang Yan et al. [23] developed an ICU nursing quality management system based on ICU nursing quality supervision and monitoring indicators that can be integrated with HIS databases, achieving the sharing of nursing electronic medical record information; The system includes four functional modules: information input, nursing quality monitoring and analysis, head nurse planning, and user management. Through inspection, feedback, decision-making, execution, and supervision, it forms a closed-loop management system that can improve the execution power of quality improvement. The timely detection and rectification of nursing quality issues in the department have effectively promoted the improvement of nursing quality. The nursing quality management method that combines information technology with continuous improvement of nursing quality is worth promoting.

3.3 Human Resource Optimization System

Human resources are the most productive, useful, and productive of all available resources, and sufficient high-quality nursing human resources are crucial for maintaining a high level of medical service quality. Faced with the current situation of rapid development of medical technology, continuous improvement of information construction, and insufficient nursing human resources, how to

use information construction to optimize nursing staff management has become a problem that managers constantly solve and improve. Wang Zengyan et al. [24] effectively integrated information technology into the management of human resources in operating rooms, registering the information of operating room nurses in a unified electronic manner for easy query and management by nursing managers, and making reasonable adjustments to leisure nursing staff between different operating areas. Convenient and open performance evaluation and salary management can enhance nurses' awareness of coordinating scheduling, motivate nurses' work enthusiasm, and improve nursing staff satisfaction. The nursing quality management information system constructed by Wang Jing [22] fully utilizes the automatic statistical analysis function of big data through the nursing control platform, and implements dynamic management of nurses based on actual bed nurse ratio, actual nurse patient ratio, and different levels of nurse configuration ratio, dynamically and flexibly allocating nursing human resources at the hospital wide level.

3.4 Nursing Safety - Risk Management System

Nursing risks exist in every nursing activity, and nursing safety management directly affects the quality of nursing services and is a key focus of hospital nursing management [25]. Improving the effectiveness of nursing safety management and reducing the occurrence of adverse events are important issues faced by nursing managers. Wei Daqiong et al. [26] established a three-level nursing safety information network system consisting of the nursing department, department head nurses, and clinical nursing unit head nurses. The system checks and evaluates 24 common risk factors in nursing work daily. The network center (nursing department) uses the network to vertically manage the safety of each clinical nursing unit, timely grasp the dynamic safety information of the whole hospital, timely warn, intervene, and improve the path of the whole hospital, avoid the recurrence of similar adverse events, and reduce the incidence of nursing adverse events. At the same time, with the gradual decrease in the incidence of adverse events, the quality of nursing has been continuously improved, and the satisfaction of patients and doctors with nursing work has also increased. Hu Qiantao et al. [27] constructed a risk warning system for operating rooms based on nursing information management, which includes six risk warning modules: patient safety verification, surgical instrument traceability, surgical consumables management and charging, intraoperative blood transfusion and medication management, pathological specimen management, and intraoperative pressure injury protection. After two years of application, research results show that risk warning based on information systems enables operating room nurses to detect potential or existing risks in nursing work in advance. Operating room nurses can have a clear understanding, that is, know first, inform first, and prevent first. It has the characteristics of high efficiency, convenience, and speed, reflecting timeliness and authenticity, reducing the occurrence of nursing adverse events, ensuring nursing safety, and improving nursing quality.

3.5 Clinical Nursing Information System

At present, most nursing information systems in China are independently developed by hospitals and there is no unified standard. However, most information systems are applied in clinical practice to solve

practical clinical problems. Fu Rongjuan et al. [28] developed a clinical fall prevention information system, which includes two modules: fall prevention clinical practice and fall adverse event management, as well as five basic functions: fall risk assessment, structured risk point screening, personalized intervention measures, evaluation reports and intervention prescriptions, and adverse event reporting. This system has achieved multi team collaboration to jointly focus on patient falls, and has gained good recognition from nurses in terms of professional guidance and improving patient participation in fall prevention. After use, it can reduce the incidence of falls and injuries among patients. Guo Miaomiao et al. [29] built an integrated whole course information management system of "screening diagnosis treatment rehabilitation" for breast cancer patients, making up for the lack of outpatient screening patient management, diagnosis treatment rehabilitation information fracture and insufficient support. The system is based on "Internet plus" and patient demand oriented. The management team provides breast cancer patients with professional health management services throughout the process, which can optimize the diagnosis and treatment process, improve the diagnosis and treatment efficiency, ensure the completion rate of treatment for breast cancer patients, reduce their treatment complications, and improve their satisfaction with cancer care. Li Guwei et al. [30] have established a closed-loop tracking system for quality monitoring of intravenous infusion, which can track and record the entire infusion process, providing accurate and objective data for nursing closed-loop quality inspection. This is beneficial for managers to timely discover potential problems during the infusion process, standardize nursing operations, and improve the safety of intravenous infusion medication.

4. Limitations of Nursing Information System in China

The nursing information system has been popularized and used in major hospitals in China, and has now become an indispensable part of medical nursing activities. Nursing staff in our country have also continuously innovated in the process of system use, contributing to the development of nursing information systems. However, compared to developed countries, the application of clinical nursing information systems in clinical nursing decision-making, intelligent nursing, and remote nursing in China is still in the initial exploration stage, and its construction still has certain limitations:

4.1 Lack of Standardized Language in Nursing Informatization

The nursing information systems currently in operation in our country come from different research and development departments, lacking unified standards for electronic medical records and clinical nursing practices, the nursing information systems between hospitals are relatively independent [31], which can lead to obstacles in sharing nursing information and waste of information resources among hospitals. Introducing standardized terminology in the construction of nursing information systems will help improve information quality. It is recommended that standardized language be set up in the construction of nursing information systems in China, and that the national nursing information classification codes and international nursing practice classification language systems be used in a

standardized manner.

4.2 Nurses Generally Have Low Information Abilities

Research has shown [32] that nurses' lack of knowledge and skills related to information ability can reduce patients' safety index, the comfort level of clinical document system application, and affect patients' health outcomes. Domestic research shows that the information literacy of nurses in China is at a medium to low level [33-34], and their information sensitivity and proficiency in operating nursing information systems need to be improved. Nurses, as end users and practitioners of nursing information systems, are the most familiar and knowledgeable group of people in operating information systems. They possess good information abilities, quality control, problem feedback, and promote the continuous improvement of the information system, which is crucial for promoting the development of nursing information systems in China. Therefore, medical institutions should focus on improving nurses' information abilities by providing training platforms for nursing staff and encouraging them to learn independently to enhance their information abilities.

4.3 A Scientific and Objective Evaluation System and Construction Standards have not yet been Formed

The construction of nursing information systems in China has been carried out in various specialties such as critical care, oncology, and emergency care. However, the lack of scientific and objective construction standards has led to uneven levels of clinical nursing information systems, which cannot timely detect problems in the system and promote clinical nursing practice. After building information systems, only one-time or short-term effectiveness evaluations are usually conducted, lacking long-term continuous application evaluations, and various clinical nursing information systems have not been promoted and continuously developed [35-36]. Therefore, we need a systematic and comprehensive comprehensive evaluation index system to dynamically evaluate the clinical nursing information system, promote system improvement, and provide reference for the standardized construction of the clinical nursing information system.

5. Development and Prospects

In summary, China's nursing information system is in a rapid development stage, bringing great convenience to patients, medical staff, and medical institutions. The nursing information system improves the quality and efficiency of nursing services by integrating and managing patient data. It enhances the scientificity and coherence of nursing work, improves patient experience, and improves the overall operational efficiency of medical institutions by monitoring patient health status in real-time, supporting nursing decisions, optimizing resource allocation, reducing human errors, and achieving cross institutional data sharing. It plays an irreplaceable role in nursing quality control and cutting-edge development of nursing disciplines, but there are also many limitations that cannot be ignored. In the future, the construction of nursing information systems in China should pay more attention to the formation of standardized language, scientific and objective evaluation systems, and construction

standards. Emphasis should be placed on improving the information technology capabilities of nursing personnel, while strengthening the standardized management of nursing information technology to promote the sustainable development of the nursing industry.

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