

Research on the Nursing Scheduling Based on the optimization Algorithms

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ABSTRACT. *The nursing work is one of the most important work contents in the hospital. The nurse scheduling problem is restricted by many conditions. Good nurse scheduling method can improve the quality of nursing work to ensure patients' life and health. Aiming at the characteristics of themulti-constraints on thenursing practice scheduling and the complexity of the scheduling problem with the increase of the interns'departments, this paper puts forward themulti-constraints nursing practice with therelative constraints as the performance indicators and versatility. This model can satisfy the needs of the nursing practice scheduling in most hospitals in China. By scheduling the nursing interns, the experimental results meet the constraints. The algorithm can be effectively applied to the optimal nursing practice scheduling scheme.*

KEYWORDS: *Intelligent algorithm; Nursing scheduling; Problem research*

1. Introduction

The nursing scheduling based on the intelligent algorithm is arranged by the head nurses according to the working abilities of each nurse, with different shifts, and according to the workload of the next week, the number of the staffs on duty every day is arranged. If there are special circumstances, adjust it in time [1].

2. Background of the Multi-Constraint Nursing Scheduling Problem Based on the Intelligent Algorithm

The head nurses in departments should arrange their shifts reasonably according to the needs of the nursing work, and ensure the adequate staff and the appropriate collocation. At the same time, a flexible scheduling scheme suitable for the emergency in the undergraduate departments should be formulated. Reserve the effective contact information for all nurses in the department, and replenish it in time when additional nurses are on duty. If the medical staff cannot meet the needs, they should submit an application for support to the Department of Nursing. Departments with insufficient temporary nurses submitted written requests to the nursing department. After verifying the facts, the nursing department supported the medical system with the medical system, and the surgical system supported the surgical system with the principle of the flexible support[2].

Nurses are directly in charge of the patients and nurses as doctors are directly in charge of the patients (except the office nurses), and the cooperation between doctors and nurses is good. Nurses take the initiative to communicate with doctors, just as patients are packed in separate beds. Each nurse manages no more than 8 patients, and can spend more time on patients, effectively ensuring the patient safety and promoting the patient rehabilitation.

The new and the old will collocate, with the link-up and transfer of the two classes to adopt a combination of the new nurses and the senior nurses. That is, if new nurses are in the first half of the night, senior nurses should be arranged in the second half of the night, timely check on the working conditions of the last night, and timely supplement to incomplete areas. All shifts adopt this mode of work in order to achieve the quality and the quantity of the work and effectively eliminate errors and the nursing disputes.

Respectnurses, rationally arrange shifts according to the “responsibility system holistic nursing” working mode, fully respect nurses' wishes, meet the clinical needs, and implement the reasonable shifts. Different departments can adopt different ways according to their characteristics, such as “one night in one year”, “two nights in two years”, “two shifts”, “three shifts” and “two-person and two-post” system, and the number of shifts and so on. The head nurses of each department are flexible and reasonable to arrange the shifts according to the specific situations. All posts and holidays can be voluntarily applied for the class recognition. Scheduling forms

are arranged according to the needs of the nursing period. For example, in the operation or the infusion patients with long hours, and the heavy workload at noon, two people can be arranged on duty. Add two shifts for the heavy patients with large workload of the basic nursing in the morning and evening, which can enhance the traditional weak period of the midday and the night shift manpower. In short, according to the nursing workload scheduling, ensure the quality and the safety of the nursing. One to two mobile shifts are scheduled daily. Mobile shifts are operated within the prescribed scope. If they are not notified of work, they can be calculated on the basis of rest. If necessary, they should be on duty within 30 minutes to accept the task[3].

.According to the number of the critically ill patients, the degree of the nursing risk and the size of the workload, the night shift posts in the clinical departments are divided into three categories. One is the nursing unit with the large workload, the high risks and more critically ill patients. There are 11 wards in the first category: ICU, emergency department, cardiology department, respiratory department, neurology department, neonatal room, delivery room, neurosurgery, eight wards, hemodialysis room and operation room. The second type is the nursing unit with the large workload, and the high risks and more critically ill patients. There are 9 types of diseases in the second category: infectious diseases, pediatrics, general surgery 2, general surgery 3, orthopaedics 1, orthopaedics 2, endocrinology, hematodigestive medicine and geriatrics medicine. The third type is the nursing units with less workload, lower risk and fewer critical patients. There are 7 wards in three categories: gynecology, urology, otorhinolaryngology, ophthalmology, nephrology, oncology, burn and plastic surgery.

Nurses under 50 years of age (except the head nurses and the office nurses) must be on midnight shift. The head nurses check the night shift regularly to find out the situation, and adjust the staff on duty according to the need. Specific requirements are as follows: Nursing staff on duty for 1-5 years of service: ≥ 80 /year; Nursing staff on duty for 6-10 years of service: ≥ 60 /year; Nursing staff on duty for 11-20 years of service: ≥ 40 /year; Nursing staff on duty for more than 20 years of service: ≥ 20 /year; Nursing assistant on duty for the head nurses: ≥ 12 /year; Nursing staff on duty ≥ 30 years of service is not scheduled for midday shift and shift adjustment; Each department shall arrange its own shift situation. If it fails to meet the duty requirement due to the special circumstances, it shall be audited by the department and the relevant functional departments and approved by the head of the department in charge.

The nurse scheduling problem is a challenging problem. Due to the particularity of the medical institutions and the nursing work, the nurse scheduling problem usually has a variety of constraints. Good schedules help to inspire the team morale and create a good working atmosphere, thus providing a strong guarantee for the quality of the nursing, and thus ensuring the health and safety of patients, which has great practical significance. At present, most of the hospital shift work is done by hand, which requires more energy and is difficult to ensure the quality of the shift. The computer-based automatic scheduling helps to improve the efficiency and quality of the scheduling, so as to make effective use of the human resources.

3. The Multi-Constrained Problems in the Nursing Scheduling Based on the Intelligent Algorithm

The traditional nursing scheduling regards people as a kind of the cost, passive in the management mode, emphasizing the word "management", while the modern hospital human resource management regards people as a kind of the resource, emphasizing "development". There are many differences among the medical workers in hospitals due to their different educational levels, knowledge levels, work types, personal experience, cultural backgrounds and growth environments, which lead to their different behaviors in hospitals. The differences are embodied in the experience, knowledge and abilities. The existence of the differences will inevitably affect their working efficiency, so according to the characteristics of each nurse, combined with the comprehensive evaluation of nurses' working ages, professional titles, ages, and working abilities, set the posts according to their abilities[4].

The holistic nursing is to carry out the "patient-centered" service aim and provide the continuous, whole-course and comprehensive nursing services for patients. The responsible nurses carry out the responsibility system of 8 hours to work 24 hours, which cultivates nurses' consciousness and ability to manage patients. Nurses with different working abilities and technical levels can take on patients with different conditions and technical requirements. The responsible head nurses are responsible for coordinating, communicating, nursing quality management and patient evaluation, instructing and supervising the work quality of junior nurses. They can give full play to the advantages of the senior nurses with rich experience and strong problem-solving ability, so that senior nurses can obtain a sense of job satisfaction and achievement, realize their self-worth and mobilize the work enthusiasms of nurses to a greater extent, and stimulate the potential of the nursing staff. At the same time, let the junior nurses work and study in a safer, standardized and relaxed working

environment, improve their professional level and working ability quickly, improve the space and time for nurses to grow up, mobilize and reduce the psychological pressure of new nurses on night shift, and ensure the quality of the nursing. It provides the organizational guarantee for patients' holistic nursing.

Character is a stable and habitual way of thinking and the style of behavior that people have formed through the long-term practice under the influence of the social living environment and in the process of the interaction with others. Personality has a great influence on the individual's career achievement. It permeates all the working activities of the individuals, and affects the individual's working attitudes, behaviors and working performances. Therefore, the head nurses should consider the personality characteristics of nurses, try to arrange the positions that can give full play to their specialties, stimulate the enthusiasms of work, and achieve the maximum efficiency of the work. Using the theory of the individual difference to arrange nurses' shifts, understand one's subordinates well enough to assign them jobs commensurate with their abilities, and use talents and employ directors, which can make up for the dissatisfaction of the patients caused by the lack of the clinical experience and the ability to cope with their thinking caused by the recruitment of a large number of the young nurses.

4. Multi-Constraint Mechanism of the Nursing Scheduling Based on the Intelligent Algorithms

The nursing scheduling based on the intelligent algorithm embodies that nurses have only one person on the humanized nursing service to patients and the humanized nursing management to nurses. They begin to do their routine work at 5:30 a.m., such as the patient temperature monitoring, the blood collection, and the preoperative preparation for the first operation and so on. The writing of the nursing documents is partially done after 2:00 succession, after the APN and the routine work. The work was delayed from 5:30 to 6:10, which delayed 40 minutes, increased the sleeping time of patients, and was conducive to the recovery of the disease, which reflected the humanized service to patients, and thus improved the patient satisfaction. At the same time, the APN continuous shift scheduling makes the nurses commute more continuously, and the nurses at work have a better grasp of the patient's conditions. Each group has A and P shifts. When handing over shifts, only the patient's condition of the group is handed over. There is no need to hand over other group's situation. The responsible nursing, especially the P shifts, works continuously for 7 hours, alleviates the pressure of the night shift work, while 10 hours continuous night shift work really achieves the goal. The Ministry of Health advocated the spirit that the clinical nurses should provide the continuous and whole-course nursing services to the patients in charge. Since the APN class was launched in August, no nursing complaints and disputes have occurred, and the letters of the praise have increased significantly. Nurses can feel the harmonious atmosphere in the ward every day, thus truly satisfying patients and nurses.

Satisfying nurses' willingness is integrated into the APN shift scheduling mode to maximize the nurses' job satisfaction, which refers to a person's perception of the work and the degree of the personal preference. Satisfying nurses' willingness to arrange the shifts is on the surface a change in the way of arranging the shifts. In essence, it incorporates the concept of "people-orientation" and "caring for nurses" in the process of arranging the shifts. Before changing the mode of the shift arrangement, the head nurses hold the general practice nurses' meetings to analyze the polarization of the nurses' senior and the junior seniority, and the best structure of nurses should be "olive" or "spindle" with the large middle and small ends. At the same time, due to the increase of the workload, how to maximize the effectiveness of the limited human resources is analyzed. The advantages and disadvantages of the traditional and APN classes are explained. The necessity and feasibility of the shifting mode change are also explained, so that each nurse can talk freely, so as to stimulate the desire for the traditional shifting change. At the same time, the APN class is tested for one month, and if the obstacles in the operation process cannot be solved, it can always go back to the previous traditional scheduling, thus alleviating the pressure of the nurses worried about the APN scheduling.

After the implementation of the APN class for one month, every nurse was surveyed. There were 6 satisfied nurses, 3 basically satisfied nurses and 6 unsatisfied nurses. The reasons for the unsatisfactory collection and arrangement are: (1) Class P is the busiest and the work pressure is great; (2) Class N is too long to concentrate in the morning during the treatment; (3) Young nurses are too tired in Class N for 2-3 consecutive days; (4) Class A before Class N and a day off after Class N are too tired. When asked whether they would like to change back to the traditional shift, only one person would like to change back, so the satisfaction of the nurses after implementing the APN class was low after one month. The head nurse encourages the nurses to choose shifts according to their wishes, and collects their brains to analyze the problems and propose improvement methods. For the young nurses, 2-3 N shifts per round should be replaced by 1+1 day and 2+1 day night shifts to satisfy the nurses' wishes (increasing the cycle of 2-3 day night shifts and reducing the number of the concentrated days per night shift. For example, 3-day night shifts can be changed to 2+1 day and 2-day shifts to 1 day + 1 day). In view of the heavy physical overdraft in the class N, senior nurses in class N arrange the staff to take naps at 1-3

a.m. according to their working conditions to promote the recovery of their physical fitness. In addition, methods such as the rest on the day of class N and taking over from class P after class N are used to solve the discomfort and demand of the nurses in class APN. When APN class was implemented for 2 or 3 months, the satisfaction of nurses was significantly higher than that in January, and the difference was statistically significant.

5. Conclusion

In the subsequent implementation, the head nurses will check the problems in their work from time to time, communicate with each nurse without obstacles, and make the corresponding changes according to the needs of the nurses in different time periods, so as to meet the wishes of each nurse as much as possible. So far, no one is willing to change back to the traditional scheduling, and the implementation method of integrating the wishes of nurses into the APN scheduling mode has been recognized by all nurses, which become a model for other departments to follow.

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