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Original Article

Effect of an inpatient nursing risk early warning and control system in Shanghai: A retrospective study of adverse events



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ABSTRACT

Purpose: To avoid the nursing risk of inpatients, reduce the occurrence of nursing errors and improve the safety of inpatients.

Methods: We established a nursing risk early warning and control system, which includes a safety supervisory network, risk screening and early warning tools, and a risk control process.

Results: The qualified rates of risk control measures to prevent pressure ulcers, unplanned extubation and fall/fall from bed all increased. The incidence of reported nursing errors decreased. The number of mistakes in medication-giving decreased.

Conclusion: The establishment of an inpatient early warning and control system could effectively avoid nursing risk, improve risk prevention abilities, improve patient safety, and improve nursing quality.

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1. Introduction

The early warning of nursing risk is an important component of hospital risk early warning. Several scholars have explored nursing risk early warning systems [1,2] and confirmed that the establishment of such a system could improve the ability of nurses to identify and respond to risks as well as reduce the occurrence of nursing adverse events [3]. However, there is currently a lack of effective and feasible quantitative

indicators and scientific evaluating tools [2] to help nurses identify risk early and improve their ability to control risk. Since 2013, our hospital has used modern computer network technology [4,5] and applied modern and scientific managing tools to establish the Inpatient Nursing Risk Early Warning And Control System (INREWCS). This system, which is based on the nursing risks of fall/fall from bed, medicine usage error, pressure ulcer and unplanned extubation, has improved decision-making and is being used in clinical wards with favorable results.

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2. Establishment of INREWCS

2.1. Establishment of a three-level nursing safety monitoring organizational network

The Department of Nursing set up three-level nursing safety and quality grid architectures which included a nursing safety management committee and a nursing quality management committee. The nursing safety management committee consisted of a high-risk monitoring team, a nursing defects monitoring team, and a nursing quality improvement team. Each team adopted a three-level monitoring system which consisted of the Department of Nursing, the committee and safety supervisors. Each committee contained one group leader, one secretary, and 10–15 experienced nurses or head nurses selected from different wards such as internal medicine, general surgery and geriatrics. Each ward had one safety supervisor responsible for collaborating with the nurses to implement nursing risk monitoring and report information in a timely manner.

2.2. Usage of the inpatient nursing risk early warning tool

2.2.1. Inpatient nursing risk assessment scales

Based on a statistical retrospective investigation and expert meeting, inpatient risk assessment scales for pressure ulcer, unplanned extubation or fall were established. Each of these scales were formatted as checklist tables and integrated in the Hospital Information System. The nurses recorded the risks of pressure ulcer, unplanned extubation or fall either in personal digital assistants (PDAs) or in hospital computers by entering numbers in the tables. Once a nurse finished, the PDA or computer automatically calculated the total scores for each of the three scales. When the score of any scale reached 10, the patient was considered have a risk of pressure ulcer, unplanned extubation or/and fall. At that point, the computers or PDAs would show the appropriate preventive nursing measure, whether it be condition observation, catheter care or health guidance. The nurse then recorded that he/she followed the preventive measures.

2.2.2. Three-color nursing risk warning marks

A three-color warning mark system was used to indicate the extent of vigilance required. The colors were red, yellow, and green, the three colors of traffic lights [6]. For instance, in the case of unplanned extubation, the catheters were divided into three classes, each labeled with a sticker. A green sticker was used to indicate a class III catheter (e.g. nasal catheter etc.), a yellow sticker was used to indicate a class II catheter (e.g., stomach tube, urethral catheter etc.), and a red sticker was used to indicate a class I class catheter (e.g. thoracic duct, arterial indwelling catheter etc.). In the case of medicine usage errors, the three-color system was used for backup medication placement, specialized drug incompatibility, and treatment paths. For backup medication placement, a red color was used for electrolytic drugs, a yellow color was used for nervous system drugs, and a green color was used for insulin. For specialized drug incompatibility, red, yellow and green

warning cards were used to denote different extents of harm caused by incompatible drug mixing. For treatment paths, red, yellow and green marks were used to identify venous access, access by gastrointestinal tract and access by bladder irrigation pipe, respectively.

2.2.3. High-risk medication warning and live-monitoring tools

The Department of Nursing, cooperating with the Department of Information, developed a network information barrier [7], a sort of firewall for high-risk drugs (e.g. allergenic drugs, chemotherapeutics, drugs of high concentrations) and high-volume drugs. When nurses submitted requests from the pharmacy for these types of drugs, the system would remind the nurses of the correct dosages, concentrations and units. For example, when a nurse ordered penicillin for a patient allergic to penicillin, the computer automatically informed the nurse of the allergy and rejected the request. When a nurse administered electrolytic drugs, the system automatically alerted the nurse to be careful with high-concentration electrolytes and reminded the nurse to check the patient's electrolyte test results in order to reduce the risk of a medicine usage error.

The Induction System for Real-time Monitoring of Infusion tool performed real-time monitoring of parameters such as infusion progress and speed of high-risk intravenous drugs. The infusion alarm sensors automatically identified the specifications of the infusion bag, monitored the residual liquid, and sent the information wirelessly back to the nurse station and remote monitoring center. The tool showed the status of the infusion to the nurses and doctors and reminded the nurses when the infusion ended.

2.3. Inpatient nursing risk control system

The Department of Nursing formulated a series of management systems, processes and standards, early warning tools, key monitoring objects, links and more. These included “Rules of Security Network Management”, “Rules of Monitoring and Assessment of Nursing Risk”, “Management Systems of the Key Nursing Objects and Links”, “Management Systems of High-risk Drug Safety” and “Nursing Safety Path and Emergency Handling Process”. The nurses took measures according to the nursing safety path and dealt with accident security issues or risk events according to the corresponding emergency handling process. At the same time, the “work standards” and “evaluation criteria” were made to clarify the different personnel responsibilities and assessment content, respectively.

3. Applications of INREWCS

3.1. System operation

INREWCS performed a quantitative analysis of the input data and a qualitative evaluation and risk analysis, with warning signals issued if thresholds were passed. All inpatients were evaluated when admitted to our hospital, after surgeries or apostasis. Patients with risk assessment scores over the threshold or using high-risk drugs were considered high-risk patients. In risk control, different management measures

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