

Medication Errors by Nurses in Sweden-Classification and Contributing factors

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Abstract

Background: Medication errors are common and can cause serious adverse effects and even death. Registered Nurses (RNs) are usually in the frontline when medication errors occur. In Sweden all health-care providers are required to report to the National Board of Health and Welfare if a patient is put at risk or injured by the health-care system.

Aims and objectives: To develop taxonomy for classification of reported medication errors and factors contributing to the errors.

Design: This study is a method developing study classifying reported medication errors made by nurses.

Method: This was an in depth analysis of 33 reported medication errors made by RNs. Content analysis was used for categorization of the errors and the contributing factors.

Results: Six main-categories of errors were identified: 1) Wrong dose, 2) Wrong drug, 3) Dose(s) missed, 4) Unauthorized or unordered drug, 5) Wrong route, 6) Drug administered despite documented allergy. Six main-categories of contributing factors on the individual levels were identified: 1) Negligence, forgetfulness or lack of attentiveness, 2) Practice beyond scope, 3) Lack of knowledge, 4) Communication errors, 5) Proper protocol not followed and 6) Disease or drug abuse. Six main categories on the system level were identified: 1) Organizational routines and culture, 2) Location of medication and look-alike medication, 3) Role overload, 4) Interruption or distraction, 5) Pressure from patient/patient's family or staff members and 6) Lack of adequate guidelines or information.

Conclusions: This study has captured characteristics of medication errors and of the nurses held responsible and their work context. The results show that medication errors occur in a complex interaction between human and system factors.

Keywords: Medication errors; Registered nurses; Adverse events; Contributing factor; Lack of attentiveness

Introduction

Medication errors are common and can cause serious adverse effects and even death. Registered Nurses (RNs) are particularly exposed to the risk of making medication errors since they are involved in the whole medication process and are usually the last link to the patient [1,2]. Various studies have classified medication errors and their contributing factors in order to develop taxonomies [3,4]. There is, however, limited research based on severe reported medication errors made by nurses. Previous studies of predictors of nurses' medication errors have focused on observation and minor errors [5-7] or what RNs imagine being predictive or what errors they remember having done during their career [8-14]. It is likely that there is a difference between imagined error scenarios and true reported medication errors [15]. We know very little about how severe medication errors made by nurses, occurs and the factors that contributes to its emergence.

Aim

The aim is to develop taxonomy for classification of reported medication errors where nurses were held responsible and contributing factor regarding the individual nurse as well as work condition (system factors).

Methods

In Sweden all health-care providers are required to report adverse events caused by treatment in the health-care system to the National

Board of Health and Welfare (NBHW) [16]. In 2005, 1050 medical errors were reported to the NBHW. All medication errors where a nurse was held responsible (n=33) were selected for this study and the case files were scrutinized. The files include relevant data from patient records, nurse characteristics, description of the event from the responsible RN and by co-workers and the final assessment of the NBHW. A qualitative content analysis was followed in accordance with the analysis procedure described by Graneheim and Lundman [17]. Categories of errors were created in relation to our findings and current literature [18,19]. Representative examples and quotes are presented for each category.

Ethics

The study was approved by the Research Ethics Committee, Karolinska Institute, Stockholm, Sweden. Identifying characteristics of patients and nurses were masked.

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Results and Discussion

The analysis showed six categories of errors. For each error, more than one contributing factor was identified. A contributing factor explains the underlying causes of an error by analyzing the circumstances [20]. The contributing factors were split into six categories of system factors referring to work- and organization conditions and six categories of individual factors referring to the individual nurse. The categories are listed below and illustrated by an example.

Categories of medication errors

Wrong dose administered: (Too high dose, too low dose, wrong dilution). A newborn baby was treated with vancomycin. The diluting was supposed to be done in two steps. Accidentally step two was never done and the child was administered too much of the drug.

Wrong drug given due to mix-up of the drugs: A subcutaneous venous port was to be flushed with heparin but insulin was administered instead due to a mix-up of the bottles.

Dose(s) missed: A patient treated with vitamin B₁₂ injections every three months did not get any injections for more than 6 months because the nurse had not made any note in the work schedule.

Unauthorized/unordered drug administered: (Medication not ordered, not contacting a physician when required, acting without discipline) The RN treated a patient's dyspnea with terbutaline not ordered by a physician and without contacting a physician.

Wrong route of administration: (Oral solution given intravenously; Injection given intramuscularly instead of intravenously). A RN administered an oral solution in the patient's central venous catheter.

Drug administered despite documented allergy: The nurse gave alimemazine to a patient from the list of "general directives" without noticing that the patient, according to his medical record, was allergic to the drug.

Categories of system factors as a contributing factor

Organizational routines and culture: An appropriate organization with safe written and implemented rules and routines is essential in modern health care. Organizational routines and culture do not always support safe practice and inappropriate routines may put patients at risk [21]. A small child was given a too high dose of a vaccine. The fluid volume ordered was 0.05 ml. The routine was to draw 0.6 ml, a 12-fold larger dose, into the syringe and discard some of the fluid before administering the injection. In this case the nurse did not discard enough fluid.

Location of medication and look-alike medication: Inappropriate location of medication and look-alike medication is an important contributing factor to errors [10,22]. A nurse administered 5 ml of Insulin instead of Heparin in the patient's subcutaneous venous port. In this ward, Heparin and the Insulin were kept in two plastic boxes next to each other on a bench in the medication room. The boxes looked the same and were not transparent. One box was labeled Heparin and the other one Insulin. The boxes contained loose bottles of the different drugs. The bottles were the same size and labeled with the same color. The responsible RN stated that "the bottles were confusingly alike and the concentration was the same".

Role overload: Role overload can be defined as lack of balance in the extent of expectations, where there is insufficient time to carry

out all of the expected functions. As other researchers, we found that workload factors often contribute to errors [8,11,23,24]. One nurse told "I was alone and the medication administration must be done at all the wards at the same time."

Interruption or distraction: Distraction during medication preparation and administration is a well-known contributing factor [9,10,25-27]. One nurse who accidentally had given a newborn baby vancomycin in wrong concentration stated: "During the dilution which is done in two steps I was interrupted several times". RNs should not be expected to prepare or administer medication in a distracting environment [26]. Nurse Leaders can change this situation by not accepting distractions during medication preparation and administration.

Pressure from patient, patient's family or staff member: We propose "Pressure from patient, patient's family or staff member" as a system factor not found in previous literature. An old man was anxious and unable to sleep. The assistant nurse found the situation urgent and informed the RN that the patient usually gets an injection when anxious. In the medical chart, the RN read that the patient was prescribed haloperidol injections, and injected a delayed-action preparation. The delayed-action preparation was, however, ordered once every third months. A short-acting oral solution was ordered "when needed". The RN mixed up the orders. The RN stated that "the assistant nurse was eager to give the patient something as quickly as possible she told me "You have to give him something at once, we can no longer accept this. He usually gets an injection".

Lack of adequate guidelines or information: Correct and available guidelines and patient information is essential for care safety. A small child was given a dose of morphine tenfold higher than ordered due to unclear guidelines. During an operation, RN one had drawn morphine 10 mg/ml into a syringe according to the guidelines as she was used to. Then she was replaced by RN two, who administered the content of the syringe believing that it was diluted according to the guidelines that she was used to. She stated "I read morphine on the label but did not notice that the concentration was 10 mg/ml. I gave the patient the morphine believing that it was diluted to 1mg/ml according to the guidelines".

The NBHW investigation discovered that there were two different guidelines used in the unit at the same time.

Factors relating to the individual nurse

Negligence, forgetfulness or lack of attentiveness: This category implies that the RN did not pay enough attention during the medication process. An RN who had accidentally taken a bottle of Morphine instead of Acetaminophen told "I didn't expect more than one bottle in the cupboard, and there was only one... but the wrong one. I took for granted something you cannot take for granted."

Human factors are a frequently cited cause of error. The most competent persons can make mistakes and error-alerting processes and systems must be created [28].

Practice beyond scope: This category means that an RN administers an unauthorized drug or dose. One RN who had administered a higher dose of morphine than ordered told "The patient had severe pain. The doses ordered in the medical record had resulted in inadequate pain relief. In the morning he was to be transferred to another hospital and I wanted to convince myself that he would have a painless journey."

RNs occasionally have to make their own decisions in complex situations. Guidelines cannot cover every situation.

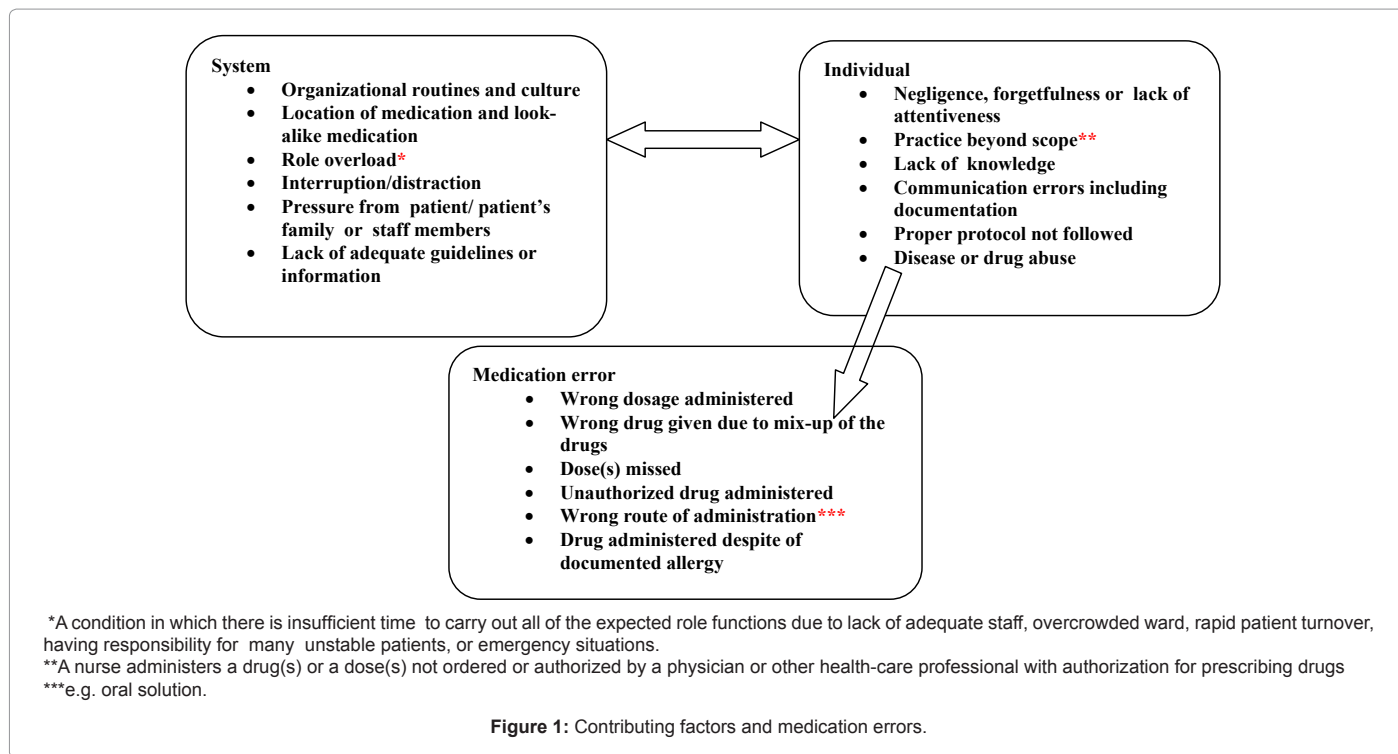


Figure 1: Contributing factors and medication errors.

Lack of adequate knowledge: The nurse lacked essential skills or knowledge to perform the task adequately and safe. A patient was prescribed iron to be administered intravenously but the nurse accidentally injected the drug intramuscularly due to lack of knowledge. The nurse was temporarily hired and was not familiar with the drug. There were no guidelines available and the patient's medical chart did not contain any information of the administration route.

The medication management process in nursing practice is complex [8]. Nurses are often held accountable for keeping knowledge and skills up-to-date [29,30]. We cannot blame the individual nurse only for lack of knowledge. Health-care leaders must take responsibility for the nurses' continuous education. Lack of knowledge of drug administration amongst health-care professionals is also a system failure [30].

Communication errors including documentation: Human communication is essential for providing safe and high-quality care. The patient returned from a hospital stay to his nursing home. Two nurses cooperated. Nurse one received the patient and his attached medical documents. Nurse two was busy in rounds together with the physician in charge. None of the nurses read the patient's medical documents and therefore missed the prescribed antibiotics. They both took for granted that the other nurse was responsible for this task. This resulted in the patient not getting any antibiotics for three days. Nurse one stated: "I thought that my colleague together with the physician would scrutinize the documents and the medication prescriptions". Nurse two stated: "I presumed that the nurse who took care of the patient when he arrived from hospital also would be the one responsible for the medical record and possible prescriptions".

Proper protocol not followed: Nurses sometimes bypass protocols and guidelines to use their time more efficiently or to accommodate a patient's immediate needs [31].

The nurse wanted to make sure the patient understood the medication regime before a short-term leave from the hospital, and therefore wrote the regime on a piece of paper. Unfortunately, she wrote the wrong doses. This resulted in the patient getting too much anti-arrhythmic drugs for a week. The nurse stated "His Swedish was not very good and I was not sure he understood everything so I wanted to clarify the regime to him and wrote it down plain and clear. It was a good thought but ended up very badly."

Disease or drug abuse: It is well-known that drug abuse exists among nurses as well as in other professions. In this study, one nurse suffering from drug addiction used the patient's morphine herself.

Conclusion

This study has captured characteristics of medication errors reported to the authorities and of the nurses held responsible and their work context. The results show that medication errors occur in a complex interaction between human and system factors (Figure 1). We have proposed taxonomy of medication errors by nurses to use in larger studies.

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