


Exploring Nurses' Perceptions of Medication Error Risk Factors: Findings From a Sequential Qualitative Study

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Διερεύνηση των αντιλήψεων των νοσηλευτών για τους παράγοντες κινδύνου εμφάνισης λαθών στη χορήγηση φαρμάκων: Ευρήματα από μια διαδοχική ποιοτική μελέτη

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Abstract

A focus group study was conducted to explore nurses' perceptions of medication administration error associated factors in two medical wards of a tertiary hospital. Nurses were invited to participate in focus group discussions. Thematic analysis was employed and identified four themes: professional practice environment related factors, person-related factors, drug-related factors, and processes and procedures. Staffing, interruptions, system failures, insufficient leadership, and patient acuity were perceived as risk factors for medication errors. The findings of this study complement the findings of an observational study which investigated medication administration errors in the same setting. Although some findings were similar, important risk factors were identified only through focus group discussions with nurses. Nurses' perceptions of factors influencing medication administration errors provide important considerations in addressing factors that contribute to errors and for improving patient safety.

Keywords

medication errors, drug safety, nurses, medical wards, focus groups, thematic analysis, Cyprus

Περίληψη

Για την διερεύνηση των αντιλήψεων των νοσηλευτών σχετικά με τους παράγοντες κινδύνου εμφάνισης λαθών στη χορήγηση φαρμάκων, νοσηλευτές από δύο παθολογικά τμήματα τριτοβάθμιου νοσοκομείου προσκλήθηκαν να συμμετάσχουν σε ομάδες εστίασης. Ακολούθησε θεματική ανάλυση και συγκροτήθηκαν τέσσερα θέματα/κατηγορίες: παράγοντες που αφορούν το επαγγελματικό περιβάλλον, το άτομο, τα φάρμακα και τις διαδικασίες. Η στελέχωση, οι διακοπές/παρεμβάσεις, τα συστημικά προβλήματα, η ανεπαρκής ηγεσία και η κατάσταση της υγείας του ασθενούς θεωρήθηκαν ως παράγοντες σχετιζόμενοι με τα λάθη στη χορήγηση φαρμάκων. Τα ευρήματα αυτής της μελέτης συμπληρώνουν τα ευρήματα μιας μελέτης παρατήρησης που είχε διερευνήσει τα λάθη στη χορήγηση φαρμάκων στα δύο τμήματα. Αν και ορισμένα ευρήματα ήταν παρόμοια, ορισμένοι σημαντικοί παράγοντες κινδύνου εντοπίστηκαν μόνο μέσω των συζητήσεων στις ομάδες εστίασης. Οι αντιλήψεις των νοσηλευτών σχετικά με τους παράγοντες που σχετίζονται με λάθη στη χορήγηση φαρμάκων παρέχουν σημαντικές πληροφορίες για την αντιμετώπιση του προβλήματος και για τη βελτίωση της ασφάλειας των ασθενών.

Λέξεις-κλειδιά

λάθη στη χορήγηση φαρμάκων, ασφάλεια φαρμάκων, νοσηλευτές, παθολογικά τμήματα, ομάδες εστίασης, θεματική ανάλυση, Κύπρος

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Introduction

Medication administration errors (MAEs) are common in hospital wards, despite the efforts made to prevent them and patients run the risk of suffering harm as a consequence (Giannetta et al., 2020; Härkänen et al., 2019). Previous research suggests that MAEs (excluding prescription, or dispensing errors) occur in 5% of non-intravenous and 35% of intravenous doses or up to 20% of all doses given (Härkänen et al., 2019). Globally, the cost associated with all medication errors has been estimated by the World Health Organization (WHO) at \$42 billion USD annually (World Health Organization, 2017). In Europe, the annual cost of medication errors had been estimated between €4.5 billion and €21.8 billion (European Medicines Agency, 2013).

Clinical nurses spend an important part of their time administering medicines to inpatients (Härkänen et al., 2015; Michel et al., 2021). In fact, nurses spend approximately 27% of their time on medication-related activities depending on the ward type and on the type of health information technology employed (Moore et al., 2020). Medication administration to inpatients is a complex process, and different healthcare professionals are involved. Individual (staff) related factors (i.e., knowledge, experience), patient characteristics (i.e., medical condition) and system related factors (i.e., workload, communication failures) may influence the medication process (Härkänen et al., 2015; Härkänen, Luokkamäki et al., 2020). Therefore, errors during the medication administration process can be attributed to different factors. Nurses, are, therefore, involved in a prone to error procedure (Giannetta et al., 2020; Härkänen et al., 2015). Since nurses have an important role in this process, it is crucial to explore their perceptions of MAE associated factors, in order to draft targeted plans to limit drug errors and improve patient safety (Härkänen, Luokkamäki et al., 2020).

The United States National Coordinating Council for Medication Error Reporting and Prevention define medication errors as “any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer” (National Coordinating Council for Medication Error Reporting and Prevention, 2021). Medication errors can also be defined as “a deviation from the doctor’s order, a deviation from the manufacturers’ preparation/administration instructions, or deviations from the relevant organization’s guidelines or policies” (Keers et al., 2013).

Regarding MAEs, several definitions have been used in previous research. The Nursing Interventions Classification provides the following definition for medication administration: “preparing, giving and evaluating effectiveness of prescribed and non-prescribed medications” (Butcher et al., 2018). A MAE can be defined as a medication error that occurs while administering a medication to a patient (Baraki et al., 2018). MAEs represent a failure in one of the five “rights” of medication administration (right patient, medication, time, dose, and route) or a failure in the documentation of drug administration (Moore et al., 2020).

Procedural errors are also common during the medication process. Procedural errors include omissions and deviations from safe drug administration guidelines (Härkänen et al., 2015; Savva et al., 2022). In particular, the omission of several procedural steps represents a great proportion of the errors detected during the medication process (Henderson et al., 2021). For example, omitting to disinfect the hands before drug administration or omitting to disinfect the site of injection, constitute errors of omission that have the potential to cause harm to patients and prolonged hospitalization (Härkänen et al., 2019). For the purpose of this study, MAEs and procedural errors that could have been made during drug administration were considered. In particular, a MAE was defined as a deviation from the doctor’s order, a deviation from the manufacturers’ preparation/administration instructions, or deviations from the relevant organization’s guidelines or policies (Keers et al., 2013).

Studies have reported the implementation of different interventions to prevent errors, including technological applications, staff training, improved access to pharmacy services, and improvements in ward systems (European Medicines Agency, 2013; Manias et al., 2020). However, errors are still commonly detected in healthcare settings, particularly in hospitals (Härkänen et al., 2019). MAEs occur in up to 20% of all doses given, however, higher percentages have been reported, depending on the site and on the definitions used (Härkänen et al., 2019; Keers et al., 2013).

The present study is part of a project to investigate medication administration safety in two medical wards of a tertiary hospital in the Republic of Cyprus. Using an observational study on the same two medical wards, we reported drug therapeutic class and patient attributes to be significantly associated with the occurrence of errors (Savva et al., 2022). This was the first report examining medication errors in Cyprus. The present study aimed to collect nurses’ perceptions of these error

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related factors. The observation method is considered to be one of the most efficient, valid and accurate methods for detecting MAEs (Flynn et al., 2002). Nurses' perceptions may reveal information lacking from the observational study. The observational study found that nurses did not disinfect the site of injection before administering an injectable drug, and did not disinfect their hands, but the reasons that led nurses to deviate from basic safety guidelines could not be explained by the observational study. The present study aimed to collect nurses' perceptions of these error related factors and identify any differences between perceived and observed MAE associated factors. The use of more than one method for collecting the data has been shown to produce a clearer picture of the problem (Wisdom & Creswell, 2013). By extending our research to include nurses' perceptions, we hoped to extend our knowledge about the MAE problem and stimulate the development of appropriate actions to reduce MAEs.

Methods

Design

This is an exploratory qualitative study and part of a multiple method project. The theoretical approach followed for the present study was based on the inductive method and thematic analysis, an independent qualitative descriptive approach which is appropriate for identifying, analyzing and reporting patterns (themes) within data (Braun & Clarke, 2006; Vaismoradi et al., 2013). Thematic analysis is considered appropriate when trying to identify and understand individuals' perceptions of a phenomenon (George et al., 2021).

Two focus group discussions were organized to explore nurses' perceptions regarding the factors contributing to MAEs in medical wards. Qualitative data deriving from focus group discussions allow an in depth comprehension of participant's perceptions on the discussion topic concerned, and have been used extensively in previous research aimed to gain insights of participants' perceptions (Escrivá Gracia et al., 2019; Papastavrou & Andreou, 2012). The research team comprised three academics (EP, AM, AC) who are university professors with substantial experience in academic research, one clinical nurse (RN, PhD) with experience in drug administration and who was involved in the conduct of previous research in nursing ethics and rationing (SV) and one pharmacist (BPharm, PhD), with experience in drug administration and special interest in drug safety (GS). None of the researchers were working in or had any kind of relationship with the hospital where the study was conducted. This is crucial as it ensured that there was no undue pressure on the nurses to participate.

The focus group interviews aimed at exploring the perceptions of nurses involved in the medication process in medical wards regarding the risk factors for errors and deviations from the basic medication administration safety guidelines. In comparison with other methods, focus group discussions have several advantages (Freeman, 2006). The sense of freedom and security among participants and the dynamic nature

of a focus group discussion is motivating for participants and creates a suitable environment to elicit the opinions of the group (McLafferty, 2004; Wilkinson & Birmingham, 2003). Furthermore, because "errors" is a sensitive issue that cannot easily be discussed freely, this method gives the opportunity for participants to express their views in a safe environment (McLafferty, 2004; Papastavrou et al., 2014). The study is reported in accordance with the Consolidated Criteria for Reporting Qualitative Studies (COREQ) (Tong et al., 2007).

Participants and Setting

Nurses involved in the medication process in two medical wards of a tertiary hospital in the Republic of Cyprus were invited to participate in the focus group discussions. The hospital provides healthcare services to more than 250,000 inhabitants. Each medical ward has 30 beds and a total of 25 nurses are employed on each ward. An observational study was previously conducted in these two medical wards in order to detect the MAEs and to explore the associated factors. In that study nurses were directly observed by two independent observers administering the medication to inpatients. For this study we aimed to explore the perceptions of nurses who participated in the observational study, thus we invited nurses from these two wards to participate in the focus group discussions.

In order to achieve a comprehensive representation of the nurses involved in the medication process in these medical wards, a purposive sampling approach was implemented. Eligible nurses were identified and approached by the researchers, after consulting with the ward management, and a face-to-face detailed oral explanation about the study was provided, before they provided informed consent and agreed to participate. Inclusion criteria for nurses' participation were the involvement in the medication process and currently working on one of the two medical wards. Nurses with managerial position were excluded to ensure that staff nurses could talk freely about their experiences without reprisal. Heterogeneity was sought for work experience in order to obtain the perceptions of new and experienced nurses (McLafferty, 2004; Papastavrou & Andreou, 2012). Therefore, nurses with a difference in years of work experience and with higher degrees were recruited. Two focus groups were held, each with homogeneity with respect to participants' job rank in order to address any hesitations about expressing their views in the presence of senior colleagues (Papastavrou & Andreou, 2012).

In total, 12 nurses, that met the above criteria, agreed to be enrolled. None of the nurses revoked his/her participation and two focus groups were conducted (Group A=5 nurses, Group B=7 nurses). All of the participants were registered nurses while five of them had additionally a master's degree. Eight of them were female nurses and four were male nurses. Age ranged from 26 to 52 years and they were all Cypriots. Work experience, including experience in the medication process, ranged from 2 to 18 years, and they all worked on one of the two medical wards of the same tertiary hospital where recruitment took place (five from the one ward and seven from the other).

Data collection

Focus group interviews were conducted from January to February 2020 in one of the hospital's meeting rooms. Participants were separated in two focus groups (Group A=5 nurses, Group B=7 nurses). Group A interview lasted 75 minutes and Group B lasted 90 minutes. Focus groups were led by a moderator in the presence of an observer. The moderator (SV) guided the discussion based on a semi-structured interview guide, while the observer (GS) took notes of the conversation as well as the non-verbal signals. The moderator had previous experience of conducting focus group interviews. The moderator and the observer were experienced in the medication process in clinical wards but had no relationship with the medical wards or the participants. Participants were aware of the researchers professional background and that the goal of the study was to promote drug administration safety. The focus group discussion continued until no additional statements or views were expressed (McLafferty, 2004; Papastavrou & Andreou, 2012). Two audio recording devices were used at each focus group to record the conversation for later transcription and analysis. The observer helped to keep issues relevant to medication error by notifying the moderator to steer conversations away from issues irrelevant to the aim of the study. The observer informed the moderator if more details were needed to elaborate on a participant's comment, observed and took notes of participants' reactions and behaviors relevant to the issues raised during discussions. During discussions the observer and the moderator wrote observational notes in order to record incidents, interactions and narratives that could help later during data coding and analysis. All data were strictly confidential. Only the researchers had access during the analysis of the data and the data were always stored in a password-protected form. Data were transcribed in a way that no links between subjects and responses could be made (e.g., by using codes instead of names).

Development of the Interview Guide

It was agreed by the research team to develop a semi-structured guide. The development of the interview guide was based on the findings of the observational study and on a literature review mapping the most common causes of medication errors in clinical settings and created a conceptual basis for the interview (Kallio et al., 2016). Medication error risk factors, as described in literature, were embedded into an initial set of questions and a preliminary semi-structured interview guide was drafted.

The observer and moderator, reviewed the preliminary version and formulated the questions in order to be participant-oriented, non-leading, and clearly worded (Kallio et al., 2016; Papastavrou & Andreou, 2012). The interview guide introduced participants to the topic and included short, conversational, open-ended, and one-dimensional questions (see

Supplemental File). For example, nurses were asked "What would you consider as an error or omission during the administration of medicines to inpatients?" and "In your opinion, what factors may be related to the occurrence of errors?"

Data Analysis

Data analysis included the transcription of the discussions, data coding and analysis based on the thematic analysis method. Interviews were transcribed verbatim by the moderator in order to produce an accurate record of everything said in each of the focus-group interviews (Wilkinson & Birmingham, 2003). Transcripts were organized and coded by two researchers separately (SV and GS). Additionally, during data analysis, the researchers recorded their thoughts in unstructured memos, made independently by each coder in notebooks in order to facilitate the grouping of codes based on content similarity. Data analysis was based on the inductive method and thematic analysis was employed. There are various techniques used for data analysis in the inductive method, however thematic analysis is among the more common ones (Papastavrou et al., 2014; Ritchie & Lewis, 2004). Researchers identified topics that emerged from the discussions, and then verified and expanded these topics through the data. The process was repeated for finding any additional topics that could emerge from the transcribed discussions (Papastavrou & Andreou, 2012; Papastavrou et al., 2014; Ritchie & Lewis, 2004). Coding along with the respective wording were grouped based on their content and similarity. Researchers repeatedly performed this task until consensus was reached. Codes with similar content were grouped together forming separate thematic categories. The objective of this effort was the continuous analysis and synthesis of thematic categories into themes that were directly linked to the interview data. The researchers moved thereafter from independent analysis to team analysis. They compared their coding, memos, and discussed and interpreted the content of several statements and reviewed the differences between their coding until consensus was reached. Researchers did not use any specific software to manage the data.

Ethical Aspects

The study was approved by the National Ethics Committee (EEBK EΠ 2018.01.92) and by the research committee of the Ministry of Health (0479/2018) of the Republic of Cyprus. The study was agreed by the hospital administration and ward management. Participants' names were replaced by a code (i.e., Nurse1, Nurse2 etc.) in order to maintain anonymity and all data gathered were kept confidential and secure after data analysis was finalized. Prior to providing informed consent, all ward nurses were informed about the study. Participation was voluntary and it was made clear that participants would be free to withdraw from the study at any

point, if they wished to do so. Participants were assured of anonymity, thus a link between the data and participants would not be possible. They were also informed that the data will be used only for the study purposes and for improving patient safety in the wards.

Trustworthiness

In order to support the trustworthiness of the findings, the authors employed several techniques proposed by Lincoln and Guba (1985) during the conduct of the study. In particular, credibility was enhanced through prolonged engagement with and persistent observation of the participants in both medical wards. In fact, the moderator and the observer spent extended time with nurses working in the study setting, first during the observational study, which preceded the focus group study, and then before the initiation of the focus groups discussions. Participants were aware of the researchers' professional background and experience. This helped establish a trusting relationship between researchers and participants and in enhancing participants' engagement. During the observation phase (in which the focus group moderator and the observer participated) the researchers gained useful information about participants' behaviors during drug administration, which subsequently helped in recognizing and understanding participants' descriptions about medication error associated factors during the focus group discussions, which also enhanced credibility. Furthermore, after each focus group discussion was finalized, the observer and the moderator remained in the room with the participants, summarized what had been said, in order to obtain additional information which could be relevant with the study topic. Triangulation was achieved by comparing data collected via notes and memos made by the observer and by the moderator, from focus group discussions and from the experienced gained during the observational study. Furthermore, an additional researcher assessed the datasets, the data analysis and the results of the study, establishing investigators triangulation (Sandelowski, 1993).

To ensure dependability and confirmability, the researchers maintained an audit trail of the process and used notes, memos, observations and transcripts of the whole research process. Data coding and analysis was done independently by the moderator and the observer and then an additional researcher assessed data analysis and results. Furthermore, transferability was ensured by implementing a purposive sampling approach to ensure that participants (i.e., clinical nurses) could provide rich descriptions of their perceptions regarding the factors associated with MAEs and the views, perceptions, ideas, and experiences of all nurses who participated in the study could be captured and reflected.

The researchers, prior to initiation of the study, discussed and clarified their understandings and views regarding the research topic in order to identify and contest their personal views related to this topic. Researchers discussed whether

the derived themes were related to the participants' narratives and accurately reflected the perceptions of the participants. Participants were not invited to provide feedback on the findings. However, observations were drawn upon to support interpretations of the data.

Results

From the analysis of data collected from the two focus groups, initially 33 different thematic categories were derived from the codes. In the coding tree chart used during analysis of data, MAE related factors that were rooted in the working environment were mapped under the theme "Professional practice environment and related factors." Data that related nurse or patient factors were grouped under theme "Person related factors" for patient or nurse accordingly. Factors that were relevant to the drugs administered were grouped under theme "Drug related factors" and finally factors that were related to problematic procedures and latent conditions were captured under the theme "Processes and procedures." Each of these themes is described, beginning with the Professional practice environment and related factors as the dominant theme.

Professional Practice Environment and Related Factors

Nurses pointed to issues related to their professional practice environment and working conditions that contributed to MAEs. For instance, nurses explained that factors like inadequate staffing, the shift (morning, evening and night shift), the work organization system, distractions/interruptions, the nature of the ward, problematic communication, leadership and training, can be associated with errors.

Shift and staffing. Shift and staffing were two important working environment factors that are associated with MAEs and were stressed during discussions. Participants explained that during night shifts errors may occur due to physical and mental fatigue which have a negative impact on nurses' performance. As one nurse stated: "At the end of the night shift, nurses are often more exhausted. This can make them prone to errors. You get tired at night" (Nurse 3). In addition, they emphasized that, by comparison with the morning shifts, the night shift is usually understaffed, which can negatively affect the medication round. One nurse mentioned that the medication process can be significantly prolonged in night shifts due to lower staffing levels:

For me there is a big problem in the administration of medicines at the night shift. It takes much longer to finalize medication administration at the night shift. . .night shift is always understaffed. Due to the very low staffing on the night shift, i.e. usually with 3 nurses only, the medication round is carried out by one nurse only and this prolongs the whole process (Nurse 6).

Low staffing levels were identified by the nurses as an important contributing factor to medication errors. They claimed that with low staffing levels (i.e., four or less nurses per shift) additional work is allocated to each nurse creating situations where they are more likely to omit tasks that shouldn't be omitted in order to administer medications on time. Some tasks, like hand disinfection before medication administration, were considered as less important and could be omitted to save time. Nurses reasoned that by omitting these extra tasks they had time to provide other types of nursing care. Understaffing was a common experience shared by the participants and consequently placed nurses in the difficult position of having to make these trade-offs because as one nurse stated: "There is just not enough time" (Nurse 5). The nurses suggested that if staffing levels were appropriate, there would be more time to administer medications following accepted practices, thereby reducing the likelihood of procedural errors related to administering medications.

Work organization system. The organization of work was viewed as an important factor influencing medication errors. Nurses explained that there are two basic types of work allocation in the wards. One is when a number of patients are assigned to a nurse, so that nurse has to provide all the care needed solely for these patients only. Another type is when specific tasks are assigned to each nurse, resulting in 1 or 2 nurses being responsible for administering all medicines to all inpatients. These types of work allocations also varied between day and night shifts. Nurses expressed the view that these variations in organizing nursing work and tasks related to medication administration influenced the likelihood for MAEs. They explained, when tasks are allocated to nurses, a single nurse will have to carry out both; preparation and administration of all medicines to all inpatients. This results in a rather prolonged medication round, meaning that for some patients the medication will not be administered at the right time. Further, if this nurse who has the responsibility to administer all medicines to all inpatients, is exhausted or interrupted or distracted during the process, this could negatively affect his/hers concentration, which increases the risk of an error being made during the medication administration process. As one nurse described:

I believe that the risk of a dosage error is increased when tasks are allocated to nurses. In these cases, usually one nurse will be administering the drugs to all inpatients, and this could, for example, delay the administration of time critical drugs. Particularly when that nurse is fatigued, as on night shifts, or when is interrupted or distracted by visitors or from other ward staff, errors can occur (Nurse 8).

Distractions and/or Interruptions. Distractions and interruptions were perceived as error associated factors. The presence of family members and relatives in the ward during medication rounds, rush hours, a noisy atmosphere in the ward, could cause interruptions and/or distractions during

medication administration. These conditions created a prone to errors working environment. A nurse explained that when the continuity of the medication process breaks from an interruption, it is possible to lose concentration which means that the risk of an error increases or the process may be left unfinished: "When colleagues, doctors or ward visitors interrupt us from our work, we stop what we were doing, we may lose our concentration, make mistakes, or leave the job unfinished" (Nurse 4). Another nurse noted: "The wrong dose or even the wrong medicine may be administered when the nurse is interrupted during administration. . . ." (Nurse 1).

Nurses seemed to be very upset with the management of visitors in the wards. The visitors often interrupt nurses engaged in drug administration to ask for information or assistance. One nurse stated:

The nurse may administer the medication to a patient in ward room 6, for example, and a patient's relative persistently calls that nurse to go check on another patient in another room, and this is not unusual during drug administration (Nurse 4)

Weekends and weekdays. The day of the week was something that participants were invited to discuss. When they were asked if there was a difference in the errors made between weekends and weekdays, most of them stated they do not believe that there is any difference. One nurse stated: "I do not think there is much difference. The atmosphere in the ward can be less noisy or busy during weekends, but visitors and interruptions are still there and in addition, often the staff is reduced during weekends" (Nurse 11). However, some expressed the view that maybe less errors are made in the weekends because of a less busy atmosphere in the ward.

Type of ward. Nurses expressed the view that the type of ward is related to the occurrence of MAEs. As they explained, working conditions may varied between different hospital units. More specifically it was noted from participants' narratives that nurses perceived their workload in medical wards to be significantly higher in comparison with other hospital units. They attributed this to the age and acuity of patients, and the high number of medications required by each patient. One nurse who worked on a medical ward supported this observation adding: "especially in our department many and different types of drugs are administered frequently." (Nurse 3). The nurses recognized that together these factors increased the risk of errors in medication administration.

Communication. As derived from the discussions, problems with communication was considered to be a MAE associated factor. Nurses stated that in many cases they are not informed in time about changes in drug therapy. They explained that sometimes it is difficult to communicate with the doctor when a change to the drug therapy is needed as doctors are not always available during drug administration. One nurse said: "When a drug therapy needs to be changed

or discontinued, is not always reported on time and the nurse administering medicines may not be informed on time” (Nurse 4). Miscommunication between nurses and staff from other hospital units, were also identified as MAEs associated factor, as one nurse explained: “. . .communicating with the other hospital wards, or with the pharmacy is not always the easiest thing, particularly in night shifts or when a drug is not available when needed. . .” (Nurse 3).

Prescriptions that cannot be easily read, were identified as an additional error contributing factor. Nurses stated that currently prescriptions in the wards are handwritten and many of these prescriptions are difficult to be interpret. They also supported the view that an electronic prescription system may help in reducing drug errors.

Staff engagement, motivation, and training. In addition to communication, participants mentioned that the level of motivation, training and engagement of ward nurses can be associated with errors. They mentioned lack of motivation and opportunities for professional training relevant with drug safety, and explained that training enhances engagement in safety principles. Nurses from both focus groups, stated that they have never participated in any kind of training program relevant with drug administration safety. One nurse reported:

“Training is important, even for experienced nurses. The instructions about the medicines, or drug administration guidelines may change, it is not right to just go on with what I know. I think there should have been respective guidance, workshops and trainings for nurses” (Nurse 1)

Leadership. Leadership and management behavior were perceived by nurses as having an important role in preventing MAEs. As a nurse said: “I think the leader has a decisive role. For example, if the leader does not emphasize practices that reduce drug errors, then the rest of the staff will do the same. The leader sets the example. Staff will follow” (Nurse 2). Participants alleged management’s apathy and unconcern for daily practice problems, including drug safety issues. They said that they report the problems to the managers but they feel their concerns are ignored, as one nurse said: *“When we report the problems to the management, they seem not to be listening. . .”* (Nurse 13). It seemed that they felt abandoned in the effort of maintaining an adequate level of quality of care and safety.

Person Related Factors

The second theme that was formed from thematic analysis was the person-related factors and included several characteristics of patients and nurses. Participants expressed the view that some attributes of the nurse or some characteristics of the patient, may have an impact on the number of errors made.

Nurses’ related factors. For nurses, person related factors included work experience, lack of knowledge, work engagement, mental and/or physical fatigue. Physical and mental

fatigue can lead to errors, and this is most probable to occur in the night shift, as one nurse commented: *“At the end of their shift, nurses are exhausted. Particularly in night shifts, nurses can be mentally and physically exhausted. This can make them more prone to errors”* (Nurse 3).

The term professional conscientiousness came to light during discussions. As nurses explained, professional conscientiousness varies among nurses and can be associated with the occurrence of errors. One nurse stated: “A nurse that is unconscientious, careless, or is not devoted to her/his work, then, yes she/he will commit errors or omit some tasks more easily when administering the medicines” (Nurse 6). Participants explained that nurses can differ in their values and understanding of professional ideals, vary in their commitment to professional standards, and have different motives when carrying out their nursing tasks. They may have different job satisfaction levels, different perceptions of their profession or of the important role that their work has for patients. Participants argued that this is the reason why some nurses are more conscientious than others, thus more careful and sensitive when providing nursing care to patients and therefore less likely to engage in inappropriate practices, including medication errors.

Nursing experience was a controversial issue as participants did not agree whether it has an impact on errors or not. They did not seem to support the view that an experienced nurse will commit fewer errors, however, they acknowledged the fact that experience is important, as one nurse noted: “The experience and knowledge you gain when you administer many drugs for many years is important. I think an experienced person can avoid many mistakes” (Nurse 9). Being conscientious seemed to be a more important factor, than just being experienced, as one nurse explained: “I don’t think it has to do with experience. I think it has to do with the individual. If you are conscientious and careful in your work you will make fewer errors, no matter how experienced you are.”

Patients’ related factors. For patients, health condition and age are factors that may influence the occurrence of errors. Nurses stated that they have to be very cautious when they simultaneously administer different medicines to one patient. They supported that often the health condition of a patient with polypharmacy is poor. One nurse commented:

It has to do with the patient’s condition, take for example a patient who cannot swallow tablets and we have to crush them for administration, it’s easy to make a mistake in such circumstances. It can be very difficult to administer medicines to these patients” (Nurse 9).

Nurses also explained that elderly patients with multimorbidity require extensive nursing care which can result in delaying the medication process or in omitting other tasks. One nurse stated:

We have to provide care to elderly patients and this is challenging as they usually need extensive care, so it is easier to commit an error in these cases. It is not the same when you look after a younger patient (Nurse 7).

Drug Related Factors

Some medication related factors, that constitute error risk factors, emerged during the discussions. These included availability of medicines, preparation and administration method/technique, and route of administration. In particular, one of the most important drug related risk factors for nurses was the unavailability of a drug. As a nurse stated: *“A drug that is not available at the time of administration, then it will not be administered. This is an omission”* (Nurse 3).

They also commented that with injectable drugs, particularly with those that need a certain preparation technique for administration, the possibility of an error is increased, as additional steps are required for administration (e.g., reconstitution with the appropriate solution, co-administration, infusion rates etc.). One nurse commented: *“With injectable drugs administration sometimes can be tricky. Several things may go wrong, like a vein rupture, or some injectable drugs must be reconstituted in a specific way before administration, administered at a certain rate, etc.”* (Nurse 1). However, few participants argue that the type of medicine is not an important error associated factor and other factors are more important, like the patient’s acuity.

Processes and Procedures

Nurses described the absence of a total quality management system in the wards and of the lack of written standard operation procedures. Systems and processes, including medication prescription, preparation and administration were not carried out according to a written protocol but rather on experience and on the notion “this is the way we do things here.” Each shift manager could determine the way work will be allocated during shifts, and each nurse could decide how a task will be completed. One nurse commented: *“We prepare the medicines for administration before the medication round begins, we place them on the trolley and the administration begins later, sometimes up to approximately two hours later; it depends on the workload”* (Nurse 9). It appeared that since there were no standard operation procedures in place in the two wards, many tasks were completed based on individuals’ understanding, conscientiousness, experience, knowledge and perceived workload.

Discussion

This study provided insight into the nurses’ perceptions of MAEs related factors in two medical wards of a tertiary hospital. Nurses narratives indicated that individual and working environment related factors can be associated with the

occurrence of MAEs. This finding reflects the James Reason’s theory of error and the accident causation model (1990), where the root causes of errors can be linked to both individual and system related factors. These underlying latent conditions, generate active failures and unsafe acts which penetrate safety barriers and place patient’s health and wellbeing at risk.

Focus group discussions revealed that some working environment factors, such as insufficient staffing, night shift and visitation, contribute to MAE and can lead to substandard health outcomes. Research suggests that MAEs are increased when staffing level is low and in addition, tasks can be skipped in order to finalize medication rounds on time (Härkänen, Vehviläinen-Julkunen et al., 2020; Henderson et al., 2021). Furthermore, previous studies indicated that the number of errors in night shifts was consistently higher than the day shift and this phenomenon was attributed to physical and mental fatigue (Manias et al., 2019; Schroers et al., 2021).

Previous relevant research indicated that there is an association between nursing models of care and patient safety outcomes (Dubois et al., 2013; Fernandez et al., 2012; Moura et al., 2020). In this study, there was a lack of consensus on a preferred model of organizing nursing work for maximizing drug administration safety. Further research is warranted to investigate the association of nursing care model and MAEs.

Interruptions, distractions or communication failures were perceived by nurses as MAEs associated factors. These findings have been reported by previous research as well. (Kavanagh & Donnelly, 2020; Manias et al., 2019; Schroers et al., 2021). Nurses are often interrupted or distracted during their shift by people, pagers, telephone calls, and this can constitute a MAE risk factor.

The importance of leadership and the commitment of managers toward safety is crucial for addressing these safety obstacles (Kiwanuka et al., 2021; Stewart et al., 2020). In this study, participants described linkages between a perceived lack of leadership and MAEs. The nurses’ suggestion that effective leadership is needed to fully integrate safety strategic objectives into all of an organization’s systems to address system failures and promote a positive safety culture is supported by others (Kiwanuka et al., 2021; Stewart et al., 2020).

Our findings suggest that nurses’ attributes such as experience, knowledge and physical fatigue, have a role in the occurrence of MAEs and this is supported by Schroers et al. (2021). Professional conscientiousness was a term that emerged from the discussions and from participants’ narratives. Studies exploring the development of professional conscientiousness among professionals, seem to support these statements made by nurses (Enns & Shapovalova, 2015; Jasemi et al., 2019; Mohammadi et al., 2020). However, the association between MAEs and professional conscientiousness requires further investigation.

With regard to patients’ characteristics, health condition and age were the two factors that were associated with errors. This finding supports previous research (Härkänen et al.,

2015; Shitu et al., 2021). However, research shows that the prevalence of MAEs in pediatric patients is similar to that of adult patients (Chua et al., 2017).

There is evidence that the frequency of MAEs is higher in patients with polypharmacy (Shitu et al., 2021; World Health Organization, 2019). The findings of this study support this and also flag the availability of medicines as an additional MAE related factor. Other drug related factors, such as the pharmaceutical form or the administration route, were considered to be error contributing factors by most of the nurses who participated in this study. However, few participants argued that the type of medicine is not an important error associated factor. Previous research demonstrates that there is an increased risk for MAEs with injectable drugs (Härkänen et al., 2015; Härkänen, Luokkamäki et al., 2020).

This study makes several contributions to the literature. Firstly, it flagged some MAE associated factors that are not investigated or commonly reported by previous similar studies, like professional conscientiousness and leadership. These error related factors should be addressed by future research in order to gain a better understanding of their impact on drug administration safety.

Secondly, this study was part of a multiple method project concerning drug administration safety that included an observational study following by the focus group study conducted in the same setting. The nurses who participated in the focus group discussions, had previously participated in the observational study. Hence it was possible to contrast the observed and the perceived MAE associated factors based on the findings of both studies, thus obtaining a better understanding of the problematic phenomenon.

While some findings from both studies were similar, there were new insights from the focus group study. The focus group discussions indicated that, according to nurses' perceptions, the working environment related factors were the major category of error contributing factors. On the other hand, in the observational study the working environment related factors (i.e., shift, staffing, interruptions) were not identified as significant factors in MAEs. The unavailability of medicines or the patient's poor health condition were not considered during the observational study and thus were not investigated for associations with errors. Similarly, some latent conditions that created an error-prone environment (i.e., communication problems, leadership, professional conscientiousness), came to light via focus group discussions, but were not detected during the observational study.

Limitations

A qualitative design and a purposive sampling approach in two medical wards was followed in this study, meaning that findings cannot be generalized to other settings (Papastavrou & Andreou, 2012; Papastavrou et al., 2014). Nurses working in different settings may have different perceptions regarding the causes of medication errors. In addition, considering the

sensitivity of the topic, and despite the encouraging environment within the focus groups, some participants may have been reluctant to express their views if it would diverge from the rest of the group (Papastavrou et al., 2014; Ritchie & Lewis, 2004). Moreover, even though we used open, general questions during group discussions, and encouraged participants to explore topics in depth and raise their own issues, additional risk factors that nurses' felt relevant may have been missed and thus not reported by this study. Despite these limitations, this study explored nurses' perceptions of MAEs associated factors in the two medical wards and complemented the findings of the previously completed observation study.

Implications for Practice and Future Research

The findings of this study have several implications for clinical practice and future research. It is recommended that nursing leaders and ward managers implement safety management systems, in order to be able to minimize drug administration errors. This should include training, systematically reviewing MAEs, and undertaking remedial actions in cycles of quality improvement. These systems should also contribute to maintaining a work environment with limited distractions/interruptions, include effective workload allocation systems, and staff education to promote motivation and engagement with drug safety principles. These measures can contribute to the establishment of the importance of drug safety in the minds of personnel at all levels.

This study brought to light factors that are associated with drug safety in clinical settings, like nurse conscientiousness and leadership, which may warrant further investigation in order to better understand their association with MAEs. Further research, based on mixed method approaches, should address the association of these factors with MAEs in order to develop targeted interventions.

Conclusion

Nurses' perceptions confirm that medication error is a multifactorial and multidimensional phenomenon that needs collective efforts to minimize and decrease the possibility of placing patients at risk. Error contributing factors have their roots in the working environment conditions, and in the attributes of the medicines, staff, and patients involved in the medication process. In order to develop targeted interventions to tackle the medication error problem in hospitals, a clear picture of the underlying conditions contributing to the problem must be ascertained. It is suggested, where feasible, to use multiple methodological designs for collecting and analyzing data regarding the medication error problem, as different methods may reveal unique risk factors that can be obtained only by one method. Considering nurses' perception of the MAE causes is important for effectively addressing factors that contribute to errors and for improving patient safety.

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Author Contributions

Conception and design of the study: EP, AM, AC, GS. Data collection and analysis: SV, EP and GS. All authors were involved in drafting the manuscript or revising it critically where needed and agreed on the final version for publication.

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Supplemental Material

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