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Experience of nurses about medication errors

A Literature Review

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Abstract

Medication errors compromise patient safety rights by causing morbidity or in worst scenarios mortality. The globe spends US$ 42 billion on costs associated with medication errors annually. Europe's 15% of annual hospital expenditure is used on treating accidents due compromised patient safety. WHO in 2017 launched a campaign on "medication without harm". Nurses play a key and diverse role in the medication management process.
The study aimed at reviewing the literature on the experiences of nurses about medication errors. A comprehensive search in CINAHL and MEDLINE databases gave rise to seven articles included in review whose results were then analyzed using content analysis. Three main categories that emerged from the analyzed data were perceived factors associated to medication errors, barriers to reporting medication errors and the perceived successful strategies in addressing medication errors.
To enhance patient safety, there is need for an individual blame free culture, an effective error reporting system in clinical settings coupled with clearly defined guidelines and rules concerning medication errors. Nurses' workload needs to be reduced through increased staffing and decreased non clinical tasks. There is need for proper training on medication management to reduce medication errors by new nurse.

Keywords: Medication errors, nurses´ experience

Miscellaneous

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1 Introduction

Non-maleficence, is an ethical principal that compliments patient safety by emphasizing that health care workers must not cause harm to patients (Marianna & Paraskevi, 2011). Even though the nursing profession is primarily known for providing care and alleviating suffering, the occurrence of unintended errors in the nursing process such as medication administration errors can cause prolonged stay in hospital, morbidity and in worse scenarios mortality (Ma et al., 2017,59).

Increased availability of medicinal options for treating every health condition coupled with coexistence of chronic medical conditions and polypharmacy especially in the aging population, increases probability in occurrence of medication errors (Duerden & Payne, n.d, 19; Boostani et al., 2019). As explained by Mueller, Neuspiel & Fisher (2019), pediatric patients are more exposed to medication errors due aspects of weight based medication calculation, inadequate mental development and care issues involving legal status which predisposes them to violated rights during care. Kaushal et al in Mueller et al., (2019) reveled 55 occured errors per 100 admisions in pedriatic hospitals.

Even though seeming to be less common, medication errors are a growing public health concern as research reveals that the globe spends US$ 42 billion on costs associated with medication errors annually, which constitutes almost 1% of global expenditure on health (WHO 2017). In the United States, it is estimated that 7000 preventable deaths occur due to medication errors and the U.S government spends close to two billion dollars on adverse drug events that could be initially prevented (Ma et al., 2017, 57).

According to Björkstén, Bergqvist, Andersén-karlsson, Benson, & Ulfvarson (2016), nurses´ spend 40% of their working hours on medication management and administration. As part of their diverse and dynamic roles in health care institutions, nurses are required to

acquaint themselves with knowledge and skills that promote safe administration of medication, monitoring, documenting and comprehensively communicating to other health care professionals (Dnp & Ne, 2015).

Although medication errors can happen at any of the stages of medication process which sequentially involves prescribing, transcribing and documenting, dispensing, administering and monitoring (Williams, 2007), nurses are usually holding a unique position right before administering medication in that they have an ability to prevent causing harm to the patient through identification of errors the previous stages (Kavanaugh, n.d. 84).

This thesis paper therefore aims at shading light on the experience of nurses with medication errors through reviewing the existing literature.

2 Background

2.1 Prevalence of Medication errors

According to the United States National Coordinating Council for Medication Error Reporting and Prevention, medication error is defined 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. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use." (NCC MERP, 1998)

In Europe, up to 4.7% of preventable drug adverse events that occur in primary care settings and consequently leading to hospital admission are as a result of medication errors("Creation of a better medication safety culture in Europe : Building up safe medication practices Expert Group on Safe Medication Practices (P-SP-PH / SAFE)," n.d. 8). Medication administration errors have continued to be a cause for mortality as a review of U.S death certificates by the institute of medicine (IOM), indicated 7,391 and 2,876 deaths due to medication errors in the year 1993 and 1932 respectively. Furthermore, medical errors were ranked to be the eighth leading cause of death in the United States as it was estimated preventable medical errors claim the lives of 44,000 to 98,000 hospitalized Americans each year (Kohn, Corrigan, & Molla, 2000, 31).

According to Baker et al., 2004, a study by the Canadian adverse events revealed that In the year 2000, one or more adverse events were experienced by 7.5% of adults admitted to acute care hospitals in Canada. A review of literature on the extent of medication errors and adverse drug reactions in acute care hospitals in Australia indicates that for every three patients, two errors are made upon admission and at least one prescribing error and

two discharging errors related to medication per patient occur. In addition, with medication administration errors due to wrong timing being excluded, one out of ten medications administered in hospital are errors (Bpharm et al 2016,).

A study conducted by the Finnish association of patient safety revealed that about 1000 estimated hospital deaths are as a result of errors made by health care professionals and that about a billion euros which constitutes 4% of the health care system's budget is spent on caring for patients suffering the consequences of errors which include medication errors caused by health care professional. A retrospective study on data retrieved from web-based error reporting database from Kuopio university teaching hospital in 2010, had 671 medication errors out of 1,617 errors in that year (Härkänen, Turunen, Science, Saano, & Vehviläinen-julkunen, 2013)

2.2 Nurses' role in medication administration

Even though the action of administering drugs seems easy, the process is complex in nature and calls for nurses to poses pharmacological and medical calculation knowledge couple with other competencies such as contraindications to use, drug-drug interactions, potential adverse drug reactions, patient monitoring, patient teaching, and documentation (Chu & Ed, 2016).

In many health care settings, medication after being prescribed by physicians or a specialized nurse is later prepared and administer by nurses. It is worth noting that different countries have different policies, laws and regulations that govern the practices of prescribing, dispensing, storing, supplying and administering medications (Guidance to Nurses and Midwives on Medication 2007, 5) although trends indicate a change in that nurses in 13 European countries are being granted prescribing rights to certain medications (Maier, 2019). In addition, the defined eligible individual that can administer medications, check the medication and at what stage the check is to be made is unique to every

country and organization. In Australia according to Westbrook et al., (2021), the policy requires independent double-checking both by registered nurses and enrolled nurses holding a diploma right before administering medication.

Regardless of the unit of operation, a culture that emphasizes on high quality and safe pharmacotherapy must be employed. Every organization has a key role to play in safe medication administration through its adopted medication management process. According to a publication of Social and Health Ministry in Finland (2021), the medication process allows for assessing the need for medicine, planning the treatment which is unique to every patient and the implementation of the drug therapy. The need for monitoring and evaluation cannot be overemphasized as it determines the continuity or changes in medications. A safe process demands continuous inter-professional cooperation, pharmacovigilance management and offering guidance to individual patients just as shown in Figure 1 below.

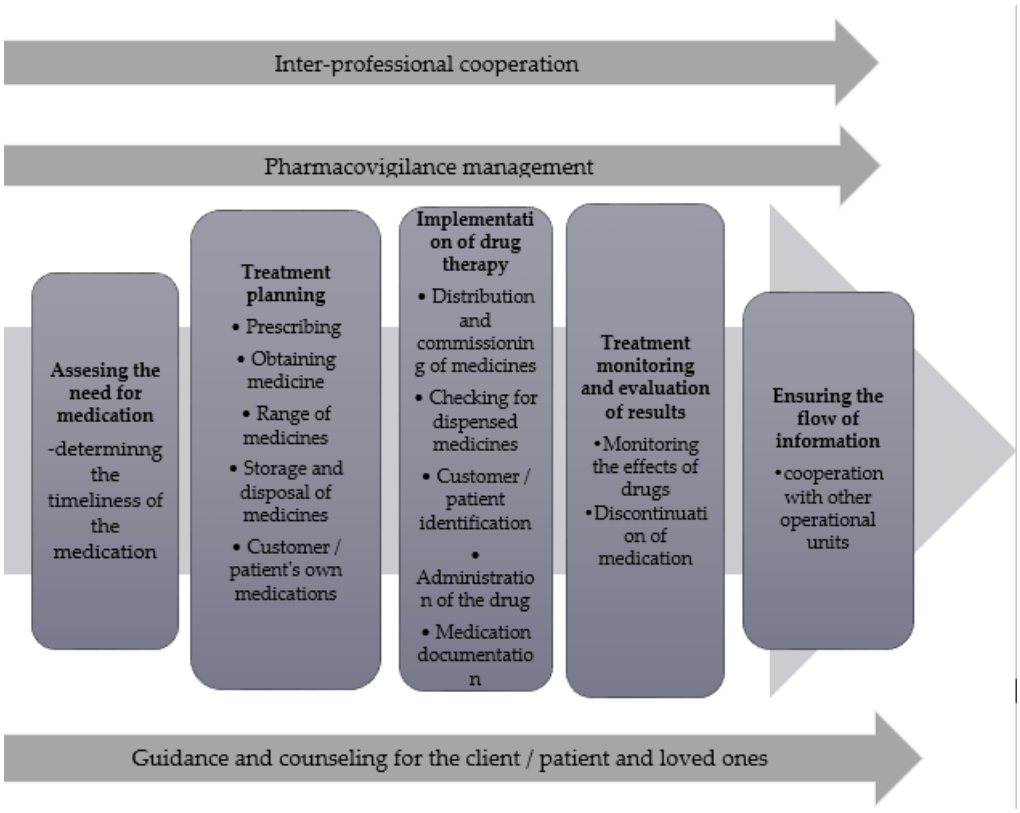

Figure 1. Medication management process (Source Sosiaali- ja terveysministeriö, 2021 in Finnish)

This responsibility of nurses in medication administration therefore demands there consistent alertness and ability to observe the basic 6 rights each time a drug is being administered. Edwards and Axe (2012) and Elliott and Liu (2010) explain the need for nurses to be sure that the right drug is given to the right patient, with the right dose, through the right route, at the right time and the right documentation should be done in order to safely administer medication.

Documentation is an important part of the nurse's work as lack of documentation means a particular task as not been carried out. This is particularly of importance since multiple individuals and professions participate in the care for patients, documentation is not only used for clinical decision making but also as a means of communicating to colleagues and other members of the multi professional team. It is of keen importance to acknowledge that documentation is not limited to successful tasks but also should be done even for failed tasks or nearly failed (Papathanasiou & Stiliani, 2014).

2.3 Strategies used in mitigating medication errors.

According to Hodgkinson and colleagues (2006), throughout the medication process, procedural strategies aimed at preventing the occurrence of medication error are more effective than strategies aimed at individuals, in this plight strategies such as computerized physician order entry (COPE) aims at enhancing safety in the medication orders by allowing physicians to make electronic written orders. In addition, the computer based system does not only make sure the ordered medication is clear and complete but makes it possible for physicians to see available potential doses through drug calculation, routes for drugs prescribed and can screen for potential drug adverse interactions and allergies. A

study by Prgomet, Li, Niazkhani, Georgiou, & Westbrook (2017), showed a great association between the use of COPE and medication prescribing errors in an intensive care unit with 85% reduction in errors..

Bar-coded medication administration (BCMA) systems ensures that the right dose and drug are given via the right route at the right time and to the right patient. The system gives a visual alert to the nurse who is administering medication if there are any contradiction in the five rights of medication administration upon scanning the identification bracelet on the patient (Agrawal, 2009 ,p682).

The significance of good communication in a healthcare setting cannot be overemphasized as it entails elimination of interruption from other nurse when dealing with medication, requires standardize procedure of doing things, a common and clear language with abbreviations that are understood by everyone and encourages for dialogue with co-workers on tasks carried already or not yet done to prevent omission or overdose e.g. giving injections (Brunetti, 2014, p57).

Safe medicalization administration requires that nurses attain both good skills and sufficient knowledge in pharmacology and medical calculations (Hilmer, Hons, & Hons, 2016,46). According to Tshiamo, Kgositau, Ntsayagae, & Sabone (2015,21), training attained from the basic nursing curriculum is not enough to ensure safe medication administration unless coupled with continuous development and empowerment with knowledge in their working life.

This continuous professional development could be done through reading new guidelines, attending workshops and refresher courses in medication management (Bull et al., 2017,3). This strategy has also begun extending to nursing students having their practices in hospitals as UK introduced national prescribing competency test that needs to be passed before having practice in a public hospital (Hilmer et al., 2016,46). In Finland, the University of

Turku has developed a medication passport to enhance medication competence in graduating nursing students. The four on the passport include medication level at university, medication administration skills, medication calculation skills and special skills in medication management.

One of the common strategies that have been employed to address the safety of patients is the development of error reporting systems by different countries and unions. The reporting systems do not deviate from the common goal of providing care without harm but enhance it by providing a basis for learning from mistakes made in the healthcare system even though every situation is unique (WHO, 2012).

Different countries have developed data bases that are concerned with the reporting and prevention of medication error incidents, in Canada the Medication Incident Reporting and Prevention System (CMIRPS), and in addition Institute of Safe Medication Practices in Canada and US a software called ERR that can be accessed on the internet. Furthermore has an ability to perform an analysis that determines the root cause of the medication error as well as recording and tracking of errors. Finland in 2007, developed a voluntary Patient Safety Incident Reporting System, HaiPro, which enables nurses and other healthcare professionals to anonymously report adverse events and near misses in their everyday work, including medication errors (Holmström & Kinnunen, 2015,72) .

In addition to empowering patients with information about their health, proper patient education is key in prevention of medication errors. Patient education entails that the patient has information about the disease, what medication, how it works, any potential side effects and when to call when such symptoms appear (Hilmer, Hons, & Hons 2016,45) .Considering that patients are taken care by a multi-professional team and that medication administration is not limited to the hospital setting, this predisposes an insufficiently informed or educated patient is at higher risk. Nurses however need to assess the health literacy level and the mental orientation of each patient (Jenkins & Vaida 2007, 46).

In view of preventing medication errors among elderly patients in primary healthcare setting, most European countries are shifting to the use of automated dose dispensing services, a system that allows for the for the automatic distribution of medications taken on a daily basis by a machine (Sinnemäki et al., 2013). Apart from reducing the workload for nurses in these settings, it improves patient safety as the human error in medication distribution is eliminated (Sinnemäki et al., 2017).

The rule of double check is a common strategy that has been employed by many healthcare settings. It demands that medication is checked by at least two nurses that have the right to administer medication before being given to a patient (Abdulmutalib & Safwat2020,88; Schwappach, Pfeiffer, & Taxis, 2016)

3 Aim, purpose and research questions

The aim of the research is to explore and review the literature on the experiences of nurses about medication errors. This study is of significance as its findings could be used to enhance the strategies put in place by nurses individually and health care institutions to improve patient safety through avoiding the occurrence of medication errors.

Research question: What are the nurses´ experiences related to medication errors?

4 Methodology

4.1 Literature review

To bring to light the experiences of nurses with medication errors, findings from previous multiple primary research articles relevant to the topic were analyzed. Since literature review does not only summarize but also critically analyses and synthesizes existing knowledge on a specific topic of interest, it helps nurses to easily keep up to date with existing literature in the nursing field and provide a foundation for the development clinical guidelines (Liberati et al 2009, 1).

This comprehensive literature review not only makes it possible for the reader to use lesser time in acquainting themselves with knowledge but also effectively addresses research question in manner that no single study can as it integrates findings from diverse primary sources (Snyder 2019,2). There are a number of ways that can be used to carry out a literature review and the choice is mostly driven by the purpose of the review (Whittemore & Knafl 2005, 547). Considering that this research aims at answering the research question through analyzing the findings from previous multiple primary studies that are relevant to the topic, comprehensive literature review will be done (Frederiksen & Phelps, n.d,4).

According to Coughlan, Cronin, & Ryan (2015), conducting literature review broadly involves selecting a topic, literature searching and gathering , reading and analyzing the literature and writing the review. In this work, the phases sequentially involved defining the purpose of the research and the questions it aims to answer, thorough search and selection of articles from two databases, evaluation of literature, analyzing the content of the literature and reporting the findings.

4.2 Literature search

The search of literature on the experiences of nurses with medication administration was conducted on the 29th April, 2021. Having been recommended by Bettany-saltikov (n.d. 78) and JAMK librarians to be reliable evidence based sources for research done in the nursing field, CINAHL and MEDLINE are the two data bases from which the primary studies were extracted following a predetermined inclusion and exclusion criteria as shown in Table 1 below.

Inclusion	**Exclussion**
Primary research	Literature reviews
Published in English	Not relevant to the topic
Peer reviewed article	Does not answer the research question
Access to full text	Research does not include nurses´ experience
Published between 2010 and 2021	
Answers the research question	

Table 1. Inclusion and exclusion criteria

The search terms used in both databases were (**Nurse** or **Nurses** or **Nursing**) AND (**Experience** or **Perceptions** or **Attitudes** or **Views** or **feelings**) AND **medication errors**. As one of the measures to minimize the bias in article selection, the search of literature was comprehensively done with pre-determined inclusion and exclusion criteria and the articles chosen were aimed at answering the research question (Piper 2013,4). As pre-determined by the criteria of inclusion, articles considered in this study had to be primary and peer reviewed studies, written in English, accessible full text to JAMK students and published between the year 2010 and 2021. The data search was done in CINAHL and MEDLINE which yielded 98 and 38 articles respectively. A total number of 136 articles was then revised on the basis of title which led to the exclusion of 93 article as these were either not primary researches or not in the nursing professional or they were concerning nursing students. The remaining 43 articles were then revised on the basis of abstract and this gave

rise to only 18 articles which were then revised on the basis of full text. After reading through the 18 articles, only 7 articles were considered for inclusion in this study as the excluded 11 were not answering the research question. Figure 2 below shows the article search process and how the author came up with the 7 articles used in this study.

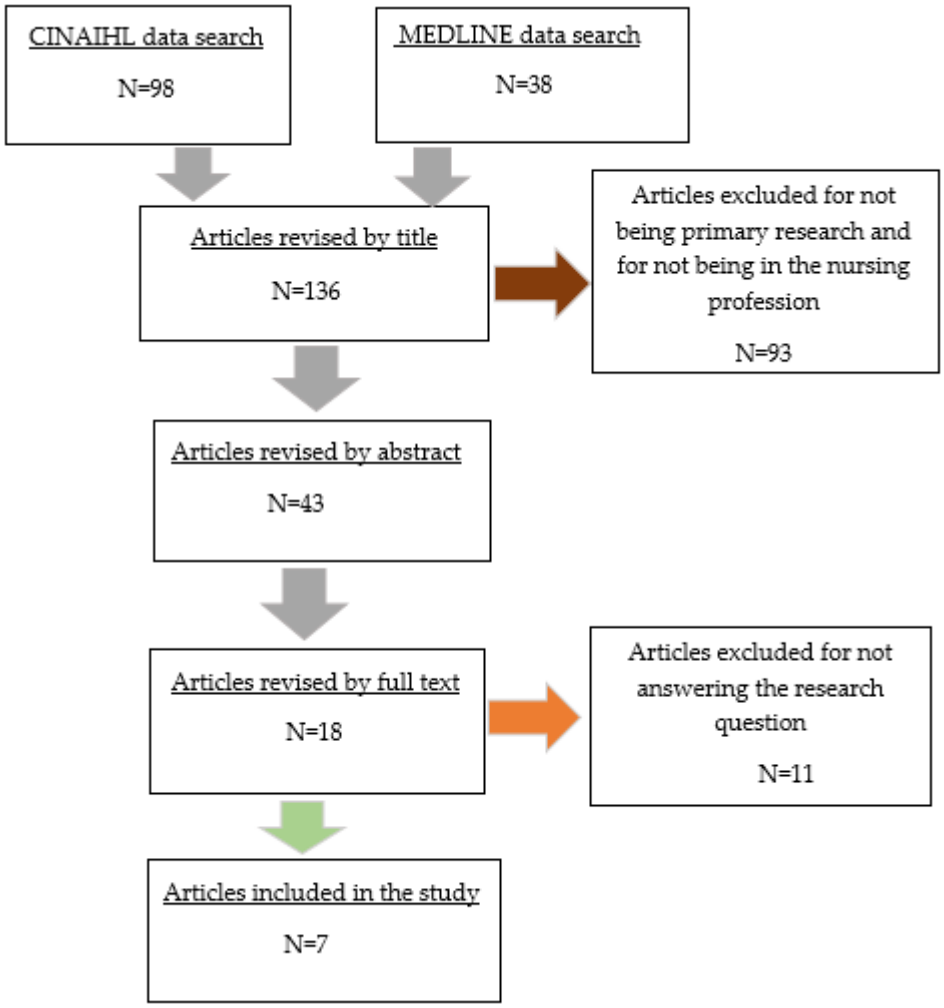

Figure 2: The article search process

Studies included in the study

This study used seven articles (N=7) for which two of the researches were conducted in Saudi Arabia (Al-otaibi, Maowed & Al-harbi, 2012; Hammoudi, Unit, & Ismaile, 2018), two in Ethiopia (Wondmieneh, Alemu, Tadele, & Demis, 2020;Feleke, Mulatu, & Yesmaw, 2015) and the others in Iran (Mansouri, Mohammadi, Adib, Lili, & Soodmand, 2019), Finland (Ahonen, Kervinen, & Turunen, 2015) and Australia (Alomari, Wilson, & Solman,

2018). Four of the articles used descriptive, cross-section survey (Al-otaibi, Maowed & Al-harbi, 2012; Hammoudi, Unit, & Ismaile, 2018; Mansouri, Mohammadi, Adib, Lili, & Soodmand, 2019 and Ahonen, Kervinen, & Turunen, 2015) while Feleke, Mulatu, & Yesmaw, 2015 and Wondmieneh, Alemu, Tadele, & Demis, 2020 used a prospective, observational cross-sectional and quantitative cross sectional survey respectively. Alomari, Wilson, & Solman, 2018 used a mixed method study design. Appendix 2 presents the summary of all the studies used in this review.

4.3 Data analysis

Owing to its accessibility and less requirement of technological knowledge the author used content analysis in analyzing the set of data. As a method of analysis oftenly used in nursing, contents analysis allows for the researcher to identify, analyze and report observed patterns referred to as themes within a set of data (Braun & Clarke 2008,79). As explained by Krippendorff (1980) in Elo & Kyngäs 2007, content analysis yields a condensed but yet an extensive description of a phenomenon aimed at providing knowledge, new insights, a representation of facts and a practical guide to action.

In analyzing the data, the researcher followed a six step process described by Clarke and Braun 2006 that is characterized by familiarizing, coding, theme generating, theme reviewing, theme defining and naming and producing of a report after writing.

In detail, the researcher thoroughly read the articles and created codes in an excel spread sheet through word for word and line by line highlighting of information according to the meaning and content in relation to the experiences of nurses with medication errors (Nicholson, Murphy, Larkin, Normand, & Guerin, 2016, 4). Comprehensive and descriptive themes were then made by searching for any existing relationship among codes and combining different codes.

In reviewing the categories, data extracts collected and combined to form the categories were read by the researcher to test for consistency and to identify any data that was not coded in the initial stage. Additionally the researcher carried out an examination to ensure

that the formed categories were a true reflection of the whole data set and thereafter, categories were defined, named and analyzed in depth before writing a report on the findings (87-90).

4.3 Critical appraisal of data

Alluding to the huge number of articles available in the databases, the researcher carried out a critical appraisal of the seven articles included in the study in order asses their quality. According to Young & Solomon (2009), Critical appraisal aims at assessing the validity of the data, completeness of reporting, methods and procedures, conclusions and the compliance with ethical standards through applying varied rules of evidence to a study.

In accordance with Hawker, Payne, Kerr, Hardey & Powell (2002), the researcher followed a three phased process of critical appraisal by assessing for relevance, extracting data and scoring for methodological rigor through the use of a critical appraising tool that assess the title and abstract, introduction and aims, method and data, sampling, analysis of data, ethics and bias, results, generalizability, and implications and usefulness of a study. (1,290)

The tool uses numerical value allocation to each assessed segment of the study in determining the quality with the mark of 4 being "good", 3 being "fair", 2 being "poor" and 1 being "very poor". The researcher read through the included articles, created a table and assigned the scores (see Appendix 1). All the seven included studies in this review were above average with a calculated summed score above 32 as the tool has a lower limit score of 9 and an upper limit score value of 36 (Hawker et al. 2002).

5 FINDINGS

The analysis of the seven articles gave rise to three main categories related to the experiences of nurses about medication administration errors. The four main categories were factors associated to medication administration errors, barriers to reporting medication administration errors and percieved succesful stretegies in mitigating medication administration. Table 2 below illustrates how three main categories emerged from eight different subcategories.

Perceived Factors associated to medication errors	• *Environmental factors* • *Health care professional factors* • *Patient related factors* • *Medication related factors*
Perceived Barriers to reporting medication errors	• *Fear of reporting* • *The reporting process*
Perceived successful Strategies in addressing medication errors	• *Technological strategies* • *Observed medication procedures*

Table 2. The main categories and subcategories

5.1 Perceived factors associated to medication errors

5.1.1 Environmental factors

Environmental factors such interruption at the time of administering medication was found to be one of the major factors contributing to the occurrence of medication administration errors. The clinical environmental has many sources of interruptions such as

those form doctors or colleagues, calls from other personnel or from patients and their family members (Härkänen et al., 2013; Al-otaibi & Al-harbi, 2012; Wondmieneh, 2020; Alomari et al., 2018).

High nurse to patient ratio or inadequate staffing of wards as a clinical environmental factor can lead to the occurrence of medication errors as it translates into huge workload for nurses and consequently leads to errors such as wrong timing or even wrong calculated dose due increased rush in nurses´ daily work routine (Hammoudi, Unit, & Ismaile, 2018; Feleke et al., 2015; Al-otaibi & Al-harbi, 2012). Inadequate space in the medication room coupled with too many nurses during the time of medication administration has been found to be one of the contributory factors to medication error as such an environment creates room for destructions and interferes with the quality and time used in medication preparations (Alomari et al., 2018; Härkänen et al., 2013).

5.1.2 Factors related to healthcare professionals

In the clinical environment, nurses work collaboratively with other healthcare professionals to enhance the health of patients but unfortunately the reviewed literature indicates that some factors that could contribute to the occurrence of the medication error are linked to healthcare professionals.

Notable issues in the findings include the lack of clarity and incompleteness of orders made by physician which consumes nursing time as nurses then have to follow up doctors (Hammoudi et al., 2018; Alomari et al., 2018). A study by Hammoudi et al., 2018, revealed that pharmacists sometimes prepared medication wrongly or delivered wrong doses and the need of giving substitute medications increased the risk to medication error occurrence.

According to the analyzed data, a number of attributes related to nurses can contribute to the occurrence of medication errors. These include fewer number of years in work experience, the low level of education, lack of training in medication safety and

insufficient pharmacological knowledge (Härkänen et al., 2013; Wondmieneh, 2020 & Feleke et al., 2015).

5.1.3 Medication attributed factors

According to Härkänen et al., 2013, medication associated factors such as the route of administration other than oral, number of regularly used medication coupled with special instructions and times of administration are contributing factors to the occurrence of medication errors. Feleke et al., 2015 also found that medication administered intravenously were more prone to medication errors than those administered orally and that similarities in medication appearance, packaging and names could be potential causes for errors in medication administration.

5.1.4 Personal attributes of patient.

In relation to the patient's personal factors, the findings indicate that taking care of patients with an acute condition such as those in the intensive care unit presents increased risk of medication error occurrence (Al-otaibi & Al-harbi, 2012).

5.2 Perceived barriers to reporting medication administration errors

5.2.1 Fear of reporting

The data analysis highlights many fears that hinder nurses from reporting an occurred errors. Precisely the fears in relation to the managerial culture of medication errors in the work environment were fear receiving negative feedback and blame if something bad such a morbidity or mortality had to happen to the patient, fear of being seen as incompetent by colleagues and the fear of receiving financial and legal penalties such as losing the job (Al-otaibi & Al-harbi, 2012; Hammoudi et al., 2018; Mansouri et al., 2019).

5.2.2 The reporting process

The reporting process presented barriers in that nurses expressed lack of clarity in what was deemed to be a medication error and which error to report (Alomari, Wilson, Davidson, & Lewis, 2015; Mansouri et al., 2019). Specifically an error of wrong timing or missed dose was not seriously considered worth of reporting as compared to an error involving wrong dose or wrong medication. According to Hammoudi et al., 2018, nurses strongly consider the expectation of giving medication as precisely as ordered by physicians to be unrealistic. The same study revealed that nurses felt that both making a report on an occurred error and informing the doctor is a time consuming process.

5.3 Perceived successful strategies in addressing medication errors

5.3.1 Technological strategies

A study by Al-otaibi & Al-harbi 2012, noted that perceived successful technological strategies in mitigating medication errors included the barcode medication administration, computerized physician order, smart infusion pumps and automated dispensing machines.

5.3.1 Observed medication procedures

Just as the study by (Wondmieneh, 2020) recognizes an increase in the risk of medication administration error if nurses do not follow the recommended guidelines for medication administration, Härkänen et al., 2013 highlights a common successful procedural strategy of double-checking medications to be useful in reducing medication administration errors.

6.0 Discussion

The reviewed literature on the experiences of nurse about medication errors indicate that nurses perceive existence of factors that are associated to medication errors, barrier to reporting an occurred error and strategies that have successfully been used in addressing medication errors.

Results from (Feleke et al., 2015; Al-otaibi & Al-harbi, 2012; Härkänen et al., 2013) indicate that the nurse to patient ratio is a strong associated to medication errors as a low nurse to patient ratio translates into increased workload, creates a busy environment for nurses and affects the quality of care given by nurses. This is in consistent with studies that tried to assess the relationship between nurse to patient ratio and the quality of care as Paulsen (2018) showed that understaffing of healthcare settings increased the patient mortality risk. A study aimed at finding the association of working hours and patient safety competencies with adverse nurse outcomes by Son, Lee, & Ko, (2019), found that nurses´ patient safety competencies reduced with increased working hours as long working hours have a negative effect on the quality of care.

In order to employ organizational specific strategies that will effectively address medication errors, there is need for nurses to freely and truthfully give reports about occurred errors but the results strongly indicate that several fears hinder nurses from doing so (Al-otaibi & Al-harbi, 2012; Hammoudi et al., 2018; Mansouri et al., 2019). This strongly calls for managers to employ strategies such as identification free reporting system like HaiPro and a work culture that motivates nurses to discuss the errors and learn from them (Holmström & Kinnunen, 2015).

The results indicate that nurses work experience is strongly associated to medication error suggesting that nurses with greater than 10 years of experience are less prone to making

errors. A report on the State of the world's nursing by WHO (2020) indicates that the number of nurses in the world has increased by 4.7 million within 5 years i.e. between 2013 and 2018. In this regard, there is need for managers and policymakers to concentrate more on other strategies that could help build competence in the new nurses and reduce medication errors. These strategies could include, training programs on safe medication coupled with the technological strategies as the results from Al-otaibi & Al-harbi (2012) indicated.

The results reveal the lack of clarity concerning the classification of what a medication error is and which errors need to be reported. Trends show that nurses do not see the need to report a missed dose or wrong timed dose. A study Mcbride-henry (2006), also suggested a variation in what different hospitals considered as medication errors. This indicates the need for every healthcare setting put up rules and guidance and to clearly define what medication administration errors are and the need to report all (Härkänen et al., 2013).

Findings indicate that nurses perceive the process of error reporting to be time consuming and hence hindering them to reporting. The study by Hammoudi et al., (2018) found an average reporting rate of 25.8% which suggests low reporting rate among nurses. Not knowing the different forms of reporting systems that exist in different institutions, this points to the need of a less complicated, precise and easy to fill kind of report in relation to medication administration errors.

The findings from Al-otaibi & Al-harbi (2012), indicate that nurses perceive taking care of patients that are having an acute illness increases the risk medication errors. Farzi, Irajpour, Saghaei, & Ravaghi (2017), agrees that medication errors in the intensive care units are more likely to occur than in other clinical setting due to the busyness of the environment and that patients there are more prone to drug interaction due to multiple medication.

Patient's complex conditions, multiple underlying diseases, and the number of patient's drugs have caused medication interactions, low dosage, or giving the medication at a wrong.

Medication attributed factors such as route of drug administration other than oral, similarities in names, apearance and packaging of medication were noted by nurses to increase the risk of medication errors. Interestingly Prot et al.,(2005), in study aimed at finding the determinants of medication administration errors in a pediatric ward showed that not only oral but also intravenous route of admistration reduced the risk of medication errors. Alluding to the fact that routes not limited opthalamic,auricular and transcutenous are rarely used unlike oral and intravenous.

Medication errors caused by similarities in the name and packaging of medications commonly refered to as look alike and sound alike "LASA" are unfortunately common. A study by Bryan, Aronson, Williams, & Jordan (2021) revealed that of all the precsriptions made yearly in the United Kingdom, about 2.2 million errors related to sound alike and look alike. Different studies including the WHO (2007) publication on solutions to patient safety have highlighted the need for clarity in the physician orders especially for orders made on phone and those involving hand written orders.

7.0 Ethical considerations

7.1 Ethics in the study

According to Marianna & Paraskevi 2011, ethics in research are rules set to guide morals of the researchers with a primary aim of protecting the human participants of the research through principles not limited to beneficence, non-maleficence, informed consent and confidentiality. Additionally, West 2019, recognizes that an obtained informed concern not only promotes autonomy of the individual participants but also protects them from harm. All the included articles in the study followed the ethical guidelines by obtaining formal informed consent from the participants, getting permission from organizations and research committees, ensured confidentiality by not collecting personal information such as names of the participants just as emphasized by polonski n.d.

This study was generally guided by ethical principles of scientific research and princely carried out in accordance with 'Ethical Principles for JAMK University of applied science' (JAMK, 2018) and `Ethical recommendations for thesis writing at universities of applied sciences'(ARENE, 2020). The author executed the literature review process as described by Coughlan et al., (2015).

7.2 Validity and reliability

Validity in research is the degree to which result reflect truthfulness and Leung (2015), explains that validity looks at how suitable the research question is in relation to the desired outcome, the research design in relation to the employed methodology and tools of analysis and how appropriate conclusions are in relation to the research sample. While reliability according Drost (2004) aims at measuring the consistency of the findings of the study i.e. if a study aimed at same investigation, on a different population at a different time would yield similar results.

In view of ensuring both validity and reliability, the author as described by Eldridge (n.d.), was consistent in maintaining objectivity through the use of recommended research

methods which were clearly explained and documented. The author carefully and truthfully carried out the research from planning through to analysis and reported results that a true representation of the data (Elo, Kääriäinen, Kanste, & Pölkki, 2014). As a requirement for degree nursing students by Jyväskylä University of Applied Sciences, this review of literature done by a bachelor's degree student as a thesis was solely conducted with the view of deepening the researcher's knowledge on the chosen topic and to yield knowledge that could be used by different healthcare settings in relation to medication administration errors. In this view, this is a non-funded study and is free from biasness that could be presented by funding.

The author comprehensively searched for articles answering the research question from two valid databases CINAHL and MEDLINE using a predetermined inclusion criteria in order to avoid biasness during the article selection process. The article selection process was explained and a step by step illustration of how the author arrived at the seven included articles was provided. Being one of the major concerns in literature reviews, plagiarism was avoided by consistently referencing the presented data both in the text and in the list of references.

7.3 limitations of the study

Despite the stated strengths, the study had its limitations that would have come from the use of only two databases during the article search. Additionally, being a bachelor's thesis carried out by a student trying to avoid extra costs in studies, the search was limited to only articles that were accessible to JAMK students and this implies that good informative articles attracting an extra cost might have not been included in the study.

Having being conducted by one unexperienced researcher, another limitation to the study could be owed to lack of a complementary point of view as the content analysis was done by one researcher and not two or more as recommended by Hawker (2002). The language biasness in search restrictions to articles published in English language poses a likelihood of missing out of potential articles published in other languages.

8.0 Conclusion and reccommendations for future studies

The results gave rise to three important categories about the perception of nurses in relation to medication errors. If critically looked into, all the themes silently present a road map to managers of health care settings on the need for several strategies to enhance and promote patient safety.

Fear, having come out as one of the major barriers to reporting medication administration error imposes the need to build both an individual blame free culture and an effective error reporting system.

There is need for clearly defined guidelines and rules concerning what constitutes medication errors and what procedure to follow after the occurrence of an error as the study highlights lack of clarity on errors as a barrier to reporting.

Patient safety enhancement through proper training on medication management can help medication errors by new nurse. Decreasing of the workload could be done through reducing the number of nonclinical tasks that nurses do in daily routine and increasing staffing as both consequently increases the quality of nursing care offered.

Minimizing distractions in the environment compliments safe medication management but few studies have been done on strategies that could be used to achieve it. Also future studies on medication errors could take a different point of view by accessing the perceptions of ward managers on medication errors.

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Appendices

Appendix 1. Critical Appraisal of the articles (Hawker et al. 2002)

AUTHOR	1 Abstract /Title	2 Introductio	3 Methods and data	4 Samplin	5 Data Analysis	6 Ethics and bias	7 results	8 Transferbility or	9 Implications and	Total	Comments
Wondmieneh, Alemu, Tadele, & Demis, 2020; Ethiopia	4	4	4	4	4	3	4	4	4	35	
Al-otaibi, Moawed & Al-harbi, 2012	3	4	4	4	4	4	3	4	3	33	
Feleke, Mulatu, & Yesmaw, 2015	4	4	4	4	4	4	4	4	4	36	
Hammoudi, Ismaile & Yahya 2018	4	4	4	4	4	4	4	4	4	36	
Mansouri, Mohammadi, Adib, Lili, & Soodmand, 2019;	3	4	4	4	4	4	4	4	4	35	
Alomari, Wilson, & Solman, 2018	4	4	3	4	4	4	4	3	3	33	
Ahonen, Kervinen & Turunen, 2015;	4	4	3	4	4	4	4	4	4	35	

Appendix 2. Summary of reviewed articles.

No	Author and country of study	study	Aim(s) and purpose	partici-pants	Methodology: design, data collection and analysis	Key findings of study
1	Wondmieneh, Alemu, Tadele, & Demis, 2020; Ethiopia	Medication administration errors and contributing factors among nurses.	To assess the magnitude and contributing factors of medication administration error among nurses in tertiary care hospitals.	298 randomly selected nurses working tertiary care hospitals.	A hospital-based, cross-sectional study - Data collected using a structured self-administered Questionnaire - Data coded, cleaned, edited analyzed in SPSS.	Factors such as the lack of adequate training unavailability of a guideline for medication administration inadequate work interruption during medication administration and night duty shift)] were significant predictors of medication administration errors.
2	Al-otaibi, Moawed & Al-harbi, 2012; Saudi Arabia	Nurses 'medication errors in emergency pediatrics departments	To assess nurses' perceived contributory factors of medication errors perceptions on the use medication technology as a strategy to reduce its occurrence.	200 registered nurses were selected from the two of the major tertiary healthcare facilities which were equipped with pediatric emergency department	A descriptive cross-sectional design -A self-administered questionnaire developed by the researchers was used for data collection. Analysis of data was done using SPSS 17.0 statistical software. . In addition, independent t-tests, and analysis of variance (ANOVA) was calculated with appropriate post-hoc tests to determine if there were significant differences between the means. A significance	3 top rank factors contributing to medication errors were interruptions during medication pass , shortage of nursing staff and caring for high acuity patients -all four types of medication technologies: barcode medication administration, computerized physician order entry, smart infusion pumps were perceived as very helpful in reducing medication errors. -several demographic characteristics, years of clinical experience and the years of attending pharmacology courses were found significantly related with medication errors.

					level of .05 was used for all of the analysis. .	
3	Feleke, Mulatu, & Yesmaw, 2015; Ethiopia	Medication administration error: magnitude and associated factors among nurses in Ethiopia	To assess the magnitude and associated factors of medication administration errors among nurses in an inpatient department.	82 nurses were interviewed and observed.	Participants were selected using non-probability convenience technique. Data collected using a pre-tested structured questionnaire and observations . Data were checked for completeness and entered into EPI INFO version 3.5.3 statistical software and analyzed using SPSS version 20. Multiple logistic regression was used to identify variables independently associated with MAE.	The majority of the medications had documentation error, followed by technique error and time error. Variables which were significantly associated with medication administration error include nurses between the ages of 18–25 years and 31–40 years, work experience of less than or equal to 10 years ,nurse to patient ratio of 7–10 and greater than 10,interruption of the respondent at the time of medication administration , night shift of medication administration and age of the patients with less than 18 years
4	Hammoudi , Ismaile & Yahya 2018; Saudi Arabia	Factors associated with medication administration errors and why nurses fail to report them Conducted in four tertiary.	Assessing the factors contributing to the occurrence and reporting of medication errors from the nurse's perspective.	500 validated questionnaires were distributed to nurses. The response yielded a convenient sample of 367 nurses.	Descriptive cross-sectional study - Data were analyzed using SPSS software .	The main factors associated with medication errors by nurses were related to medication packaging, nurse–physician communication, pharmacy processes, nurse staffing and transcribing issues. The main barriers to the reporting of errors by nurses were related to the administrative response, fear of reporting and disagreements regarding the definitions of errors.

						medication orders, workload and staff rotation.
5	Mansouri, Mohammadi, Adib, Lili, & Soodmand, 2019; Iran	Barriers to nurses reporting errors and adverse events.	To assess nurses' views about major barriers to reporting errors and adverse events in intensive care units.	A questionnaire was completed by 251 nurses across seven hospitals	-cross-sectional analytical study - statistical analyses were performed using the software package SPSSv21.	the study identified three main areas that prevented the reporting of incidents—fear of the consequences after reporting an error, procedural barriers and management barriers.
6	Alomari, Wilson, & Solman, 2018; Australia	Pediatric Nurses' Perceptions of Medication Safety and Medication Error.	To explore the perceptions of nurses in a pediatric clinical setting as to why medication administration errors occur.	33 registered nurses (RNs), two enrolled nurses (ENs), and one assistant in nursing (AIN)	Data collection included a direct observation of nurses during medication preparation and administration, audit based on the medication policy, and guidelines and focus groups with nursing staff. A thematic analysis was undertaken by each author independently to analyze the observation notes and focus group transcripts. Simple descriptive statistics were used to analyze the audit data.	Workload, frequent interruptions to process, poor physical environment design, lack of preparation space, and impractical medication policies are identified as barriers to safe medication practice.
7	Ahonen, Kervinen & Turunen, 2015; Finland	The factors associated with medication errors in adult medical and surgical inpatients.	To describe the frequency, types, and severity of medication errors in medical and surgical inpatients as well as to	32 registered nurses were assessed administered 1058 medications to 122 inpatients in	A cross-sectional study using direct observations and medication record reviews. - The data were processed using the SPSS	At least one error was found in 22.2% (235/1058) of administered medications, 63.4% of which were medication administration errors and 18.3% of which were documentation errors. Of the medication administration

			study the relationship between medication errors and associating factors.	four medical and surgical wards at a university hospital.	-Associations between medication errors and related factors were analyzed using logistic regression analysis. - A stepwise regression only included the statistically significant factors ($p < 0.05$) in the final model.	errors, 59.1% involved an incorrect administration technique. 3.4% of errors caused harm to patients. Statistically significant factors that increased the risk of medication errors included every other weekday, except Sunday; morning shifts; increased rushes; nurses asking for help; and increased number of medications that patients used. Factors that decreased the risk of errors included administering medications through an oral route, double-checking the drugs, and additional people in the medication room at the same time.

Appendix 2. The data analysis process

Raw entry	Descriptive codes	Subcategory	Category
Similarities in the appearance, names and packaging of many medications.	similarity in medications	Medication factors	Associated factors to MAEs
did not explicitly consider missed doses a reportable error	Lack of clarity	Reporting process	Barriers to reporting MAEs
lack of clarity for staff about what constitutes an error and what should and should not be reported	Lack of clarity	Reporting process	Barriers to reporting MAEs
significant amount of the nursing time on the day shift is spent on the medication process	medication eating up time and creating busyness	Environmental factors	Associated factors to MAEs
The requirement for two nurses to double check every drug has resulted in the medication room being crowded during these times	crowdedness due to double checking (space)	Environmental factors	Associated factors to MAEs
Another contributing factor was the level of interruptions nurses encountered during the medication process	interruptions during medication process	Environmental factors	Associated factors to MAEs
Doctors should be more proactive in ensuring that clear documentation for active medication orders are available on the medication charts without nurses having to prompt them to do so.	doctors to complete orders without nurses prompting them	Factors from healthcare professionals	Associated factors to MAEs
Lack of space in the medication room	space	Environmental factors	Associated factors to MAEs
pharmacists delivered incorrect doses to the unit	wrong dose from pharmacists	Factors from healthcare professionals	Associated factors to MAEs
reporting a medication error took too much time	too much time consumed in reporting	Reporting process	Barriers to reporting MAEs
contacting the physician about a medication error took too much time	too much time consumed in reporting to the doctor	Reporting process	Barriers to reporting MAEs
nursing administration focused on the individual rather than looking at the systems as a potential cause	Blame put on nurse and not the system	Management factors	Barriers to reporting MAEs

no positive feedback was given for passing medications correctly	no positive feedback correctly given medication	Management factors	Barriers to reporting MAEs
other nurses would think that they were incompetent if they made medication errors	Being looked down upon by colleagues and lack of support	Management factors	Barriers to reporting MAEs
Fear of legal repercussions such as getting a criminal record, going to prison or having to pay money to compensate the family	Fear of financial and legal penalties	Fear of reporting	Barriers to reporting MAEs
work experiences, level of education and age of nurse	Nurse Personal attributes	Nurse related factors	Associated factors to MAEs
Smart infusion pumps , automated medication dispensing ,computerized physician order entry , and barcode medication administration all were helpful in decreasing MAE-	successful technical strategies for MAE	Use of technology	Factors reducing MAEs
Interruptions and distractions, such as noise, rush, answering a phone or patient call, distractions created by a patient or other personnel, and additional people in the medication room. Having a student also causes distractions	Distraction at work	Environmental factors	Associated factors to MAEs
increased number of regular medications taken, increased number of medications that were taken as needed, and increased times of day when medications other than those administered orally or intravenously were taken	High number of medications and given at different times	Medication related factors	Associated factors to MAEs
Double-checking medications and patients name, seeking clarity from colleagues.	Followed procedures	Observed Procedures in the medication process.	Factors reducing MAEs
No computers and calculators in the medication room is another concern	Lack of resources in the medication room	Environmental factors	Associated factors to MAEs

Route of medication and type of medication		Medication factors	Associated factors to MAEs
Nurse to patient ratio was also found to be one of the strong predictors of MAE	Huge patient to nurse ratio	Environmental factors	Associated factors to MAEs
The patient´s age, number of medication in use and condition of the disease	Personal attributes of patient	Patient related factors	Associated factors to MAEs
Nurses could be blamed if something happened to a patient as a result of a medication error or even lose their job	Blame and possibility of losing the job	Fear of reporting	Barriers to reporting MAEs
25 Raw entries	25 Descriptive Codes	7 Subcategories	3 Main Categories