THE UNIVERSITY of ADELAIDE

The Factors Associated With the Occurrence of Medication Errors in the Ministry of Health Hospitals in Saudi Arabia: A Cross-Sectional Study of Nurses

Name: Mohammad Hassan AL Qrishah Student ID: A1636878

Submitted for the degree of

Master of Nursing Science

The University of Adelaide 2017

Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

I also give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

Signature: Mohammad AL Qrishah Date: December 2017

Acknowledgment

I would like to dedicate this work to my father, Hassan AL-Qrishah (may God have mercy on him), and my mother Nasrah AL-Qrishah and my siblings who gave me tremendous support during my study in Australia.

I would like to thank the Government of the Kingdom of Saudi Arabia, represented by the Ministry of Health, which granted me this educational scholarship to study the Master of Nursing Sciences.

I would also like to express my gratitude to Dr Hasnah Banjar and Danielle James for their support and help.

I am grateful for my supervisors Dr Frank Donnelly and Dr Rick Wiechula, for their continual support during various stages of this research.

Abstract

Aim: to investigate the factors associated with occurrence of medication errors (ME) in Ministry of Health hospitals in Saudi Arabia.

Objective: To investigate nurses' views on factors that contribute to medication errors.

Methods: A cross-sectional descriptive survey was undertaken. A convenient sample of 152 nurses from three hospitals was obtained. Respondents were asked to determine factors associated with the occurrence of medication errors

Results: A total of 152 of 300 (50.7%) questionnaires were returned. Exactly half of the respondents had been involved in medication errors once or more during their nursing career, with 26.97% (n= 41) having reported one or more medication errors at some point in their nursing career. A significant number (n= 131 86%) of respondents identified that unclear writing or illegible medication orders or prescriptions was the most significant factor in ME. Other highly significant factors contributing to errors included poor communication between nurses and physicians (n= 118, m=3.99), similarity in the name of medications (n= 114, m=3.92), similarityin the appearance of medications (n= 114, m=3.91), interruptions while preparing or administering medications (n= 101, m=3.71) , stressful working environments (n= 105, m=3.66), and a lack of medication safety education programs (n= 94, m=3.55).

Conclusion: There are a range of factors that contribute to ME, of those the most significant is unclear or illegible medication orders or prescriptions. This study has identified a range of other factors in Saudi Arabian hospitals leading to medication errors, further research could be directed to the appropriate strategies to reduce them.

Table of Contents

List of tables

List Of Figures

Chapter One: Introduction

1.1 Background of the study

Today, the health sector is experiencing steady growth. Thus, providing safe, accessible, and high-quality healthcare services has become a major concern and challenge for healthcare providers worldwide. Healthcare institutions across the world determine how to promote and enhance patient safety through reducing major risks such as diagnostic errors, hospital-acquired infections and medication errors (ME) (Parry, Barriball & While 2015). Globally, the incidence of medication errors (MEs) by nurses varies between 6.6% to 44.6% due to a number of related factors such as lack of understanding of how errors occur, failure to adhere to policy and procedure documents, distractions during preparation of medications and lack of knowledge about medications (Hogg et al. 2012). To emphasize patient safety, healthcare professionals, clinical researchers, and decision makers must focus on the process of reducing MEs.

The issue of patient safety is critically important and involves all parties such as health care institutions, patients and their families, health care professionals and decision- makers, governments and international organizations that oversee the implementation of health policies for example the World Health Organisation. The demand to improve patient safety and care during medication administration has been considered as one of those critical issues. Along with other important issues threatening patient safety; healthcare-associated infections, hand hygiene and workforce safety, medication errors can have sudden and profound consequences for patients. In many safety reports concerning health, MEs were often the second most common adverse incident (Roughead & Semple 2009).

1.2 Aim and objective

The aim of this study was to investigate the factors associated with occurrence of medication errors in Ministry of Health hospitals in Saudi Arabia. The objective was to study nursing staff views and opinions as to what factors they believe

contribute to medication errors.

1.3 The research question

The research question that this review considered is ‘What are the factors associated with the occurrence of medication errors in hospitals?’

1.4 Overview on the healthcare system in Saudi Arabia

Within Saudi Arabia the Ministry of Health (MOH) provides health services free-of- charge for Saudi citizens throughout its institutions such as public hospitals and primary healthcare centres, medical cities, specialized centres and royal clinics. Other Saudi ministries also provide access to free medical services in the following institutions: teaching hospitals affiliated with public universities, health institutions of military sectors (i.e. Ministry of Defence, Ministry of National Guard and Ministry of Interior). As the largest health care provider the MOH provides 60.2% of the health services in the kingdom (Ministry of Health 2014) and constitutes the majority of health services provided (Alkhamis 2012). More recently the MOH is beginning to grant licenses to opening or renewing private healthcare institutions.

Even though access to the free healthcare services in Saudi Arabia has been improving significantly in the past thirty years, challenges to governmental healthcare organisations, their staff and other stakeholders, to improve the quality of healthcare services, remain. The challenges that confront MOH include: increasing demand for free healthcare services coupled with a rise in costs paid by the government, changing patterns of disease (e.g. Middle East Respiratory Syndrome MERS), a severe shortage of local Saudi healthcare professionals, a significant increase in the annual free pilgrim healthcare services, which costs MOH treasury many billions of riyals every year, and at the same time a significant rise in medical errors (Aljuaid et al. 2016; Alkhamis 2012).

1.5 Statement of the Problem

When they are used appropriately and correctly medications play a vital role in promoting the overall health of people and contribute to healing from many diseases. However, because of excessive, inappropriate or under-dosing issues the very widespread use of medications often means the incidence of MEs by nurses is a relatively common occurrence and indeed given the complexity of health care system one that may be expected (Kohn, Corrigan & Donaldson 2000). In large hospital settings nurses may spend up to 40% of their time in preparing, administering and monitoring medications (Cheragi et al. 2013).

1.6 Scope and significance of study

Although mistakes are expected behaviours of humans and some errors are unavoidable, MEs may lead to catastrophic consequences, such as mortality, morbidity and/or disability. Some authors contend that MEs are the most common type of errors in the healthcare field (Anderson & Townsend 2010). In addition to mortality and morbidity ME also contribute in increasing the length of hospital stays and inpatient expenses. Research has identified ME as the most common single preventable cause of adverse events (Brady, Malone & Fleming 2009; Wittich, Burkle & Lanier 2014).

The issues of MEs are not a recent development. According to Phillips, Christenfeld and Glynn (1998) in their review of death certificates in U.S.A between 1983 and 1993 it was found that the number of people who died in 1993 was 7,391, all due to MEs. The causes of deaths varied between incidental poisoning by medications and biological substances and acknowledged errors by patients or healthcare professionals, representing a 2.57-fold increasing comparing with 2,876 people who had died 10 years earlier in 1983. In Australia, recent studies suggested that the overall rate of MEs of inpatients is two errors for every three patients during their admission in hospital (Roughead, Semple & Rosenfeld 2016).

It is noted that it might be difficult to compare the prevalence of MEs from one country to another, or from a healthcare system to another due to the many

definitions usedand the classification systems employed (Inch et al. 2012). What is clear however is that the scale of the problem is enormous and that medication error occurs across many different countries, developed and developing, rich and poor. As an example the Food and Drug Authority in USA, recently suggest approximately 1.3 million people are accidentally

injured from MEs in USA annually (Woo et al. 2015). Walsh et al. (2017) in their systematic review to describe and quantify the economic burden associated with MEs concluded that the financial cost for each error per study ranged anywhere from €2.58 to €111,727. On many fronts including morbidity, mortality and financial burden the study of ME demands a closer and more critical examination.

1.7 Purpose of Study

Investigating the factors that are associated with the occurrence of MEs is one of the first practical steps to understand and then work towards reducing their future occurrence. Because nurses are almost always responsible for giving or injecting medications to the patient in most health care institutions around the world, it is important to ask nursing staff themselves about the causes of MEs and the factors leading to them.

From the researcher's previous experience working in the Ministry of Health in Saudi Arabia, it is suggested that the factors leading to MEs are often noticeable, can be highlighted to better understand the causes and reasons leading to MEs, and there are often effective strategies to minimize their occurrence.

Chapter Two: Literature review

2.1 Introduction

According to Schneider and Whitehead (2013), the successful primary research process involves a thorough literature search and a subsequent critique of the gathered literature. In particular, reviewing the literature in this study is based on the scientific approach elucidated by Schneider and Whitehead (2013). In this chapter, a review of the literature discusses the factors leading to MEs in the clinical settings of hospitals and describes the current medication safety culture in Saudi Arabia. Studies included in the review are those that discuss associated factors, main causes, experiences, and perceptions of nurses toward occurrence of MEs in healthcare settings. The aim was to obtain the characteristics of factors leading directly or indirectly to MEs in multiple hospital settings. This approach enabled the literature review to begin with a broad scope which was then narrowed. Literature describes that the factors that are often associated with medication errors can be classified in six categories: communication, labelling and packaging, transcription, working conditions, pharmacy, and nurses.

2.2 Search strategy

Four electronic databases (The Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Scopus and Google Scholar) were used to search for studies that occurred 2000 to 2017, applying the limiters 'English language', and 'peer review'. These limiters were applied after an initial keyword search reduced the identified published papers from 1,104 to 921 (across the four databases). The keyword search terms were "medication errors", "medication administration errors", "pharmacological knowledge", "patient safety", "interruptions", "poor communication'', ''long working hours", ''nursing'', ''nurse' , "labelling" and "storing".

Studies or reviews that were excluded comprised those involving primary healthcare centres, schools and geriatric care centres. Studies involving students,

trainees or intern nurses were also excluded as this study was centred on the practice setting. Studies that did not include description of any of the main factors, perceptions, or causes of MEs and were specifically aimed at measuring medication error rates pre and post particular intervention strategies were also omitted. It was important to apply a careful selection of literature to be reviewed, to reduce a large amount of studies that might not have informed the research. As the central question concerned MEs in the clinical setting, studies that were undertaken in simulation labs or centres were not considered.

2.3 Literature review

Medication errors are a global concern and are identified clearly as the most common type of error affecting patient safety in healthcare institutions around the world (Brady, Malone & Fleming 2009). Medication errors (MEs) have received a lot of attention because they can lead directly to morbidity, mortality and disability (McBride-Henry & Foureur 2006). An important goal is to reduce these incidences to a minimal level reducing the risk to a patient's health (Parry, Barriball & While 2015). Therefore, this issue has become an important priority in recent times concerning quality managers, clinical leaders and researchers. Research is therefore directed to investigate, assess and examine factors and causes of medication errors in an attempt to reduce these errors to the minimal level and prevent their occurrence in future.

In a significant number of studies, it was found that MEs were often caused by communication factors between healthcare professionals, with unclear physicians' writing, lack of prescription by generic name, illegible prescriber name, illegible medicine name, inadequate allergy documentation and absence of prescriber signature being of concern (Albarrak et al. 2014; Baghaei et al. 2015; Sutcliffe, Lewton & Rosenthal 2004). Albarrak et al. (2014) in their prospective study comprised of 398 handwritten and electronic prescriptions in a teaching hospital in Saudi Arabia, found that failure in communication of information, such as illegible handwritten orders, was a major factor contributing to medication errors.

Moreover, factors related to working conditions such as the heavy workload on nurses, the frantic working environment and interruptions while preparing/ administering medications also contribute to MEs (Brady, Malone & Fleming 2009; Güneş, Gürlek & Sönmez 2014). In particular, the frequency and occurrence of interruptions of nurses preparing or administering medications have been identified as a significant issue with the incidence of MEs in hospitals (Hayes et al. 2015; Westbrook et al. 2010). Biron, Loiselle and Lavoie Tremblay (2009) in their evidence review of studies related to nurses' interruption rates and contribution of work interruptions to medication administration errors, analysed 23 studies. In their analysis, they found that nurses themselves, through face-to-face interactions with other nurses, caused the majority of work interruptions, a significant contributor of MEs.

Nurses who were experiencing fatigue due to long working hours, more than forty hours a week, and performing multiple tasks were also significant contributors to MEs (Baghaei et al. 2015; Rogers et al. 2004). Toruner and Uysal (2012) conducted a cross- sectional descriptive study of 119 paediatric nurses at paediatric inpatients wards in four different hospitals in Turkey. Their aim to collect the perspective of paediatric nurses regarding the causes of medication errors found that long work hours and a high patient to nurse ratio (7:1) were the most common contributors to MEs. Ehsani et al. (2013) in their descriptive study of 94 emergency nurses at an Iranian medical complex, June 2010 to June 2011, found that a lack of staff nurses (nurses with high levels of clinical experience) was an important contributor to medication errors and a significant factor affecting patient safety.

Other investigations of ME have considered the use of unregulated or inconsistent abbreviations during prescribing medication, an issue that has received international attention as one of the largest causes of transcription errors (Alshaikh, Mayet & Aljadhey 2013). Al-Jeraisy, Alanazi and Abolfotouh (2011) undertook a five-week retrospective cohort study at a tertiary referral hospital in Saudi Arabia reviewing physician medication orders and patients' files. Examining 2,380 physicians' orders, they found that the rate of medication errors was 56% and

concluded that the majority of these orders (81.8%) had one or more unregulated abbreviations. Coombes et al. (2011) in their pilot study, of 22 public hospitals in Australia, found a documentation error of some sort in 672 of 715 medication charts (i.e. 94% of the charts). They concluded that the lack of prescription by generic name occurred on 57.8% of medication charts, illegibility of prescriber name on 30.5% of medication charts and undated orders were identified as a missing component on 37.3% of medication charts. A critique of this study is that there was no discussion as to the changes in healthcare staff or policy between pre and post audits. Responses to low compliance rates may have prompted changes to staff training which may have affected final results. Moreover, the methodology that had been used in this study did not contain a record of individual prescribers' experiences, a factor which might have affected the prescribing error rates.

In similar studies it is noted that poor or inappropriate labelling and storing of medications has become a major cause for medication errors in the U.S.A. (Jeetu & Girish 2010). Shultz et al. (2007a, 2007b) further discussed the most common errors by nurses due to the storage and packaging of medications. Firstly, multiple types of similar medications or doses stored in a drug storage bin without dividers, increased the probability of choosing the wrong medication. Secondly, storing medications in storage bins or places without a label, or a lack of clear labels may lead nurses to choose the medication based on the visual properties of the medication (i.e. colour, size, appearance) without conducting a more careful selection. Thirdly, storing large amounts of medications in storage bins, increases the chance of the medication expiring.

A prospective ethnographic study to study the culture, myths, roles and behaviour in two wards in a German hospital was conducted by Taxis and Barber (2004). While direct observation in an ethnographic study is an important tool, Taxis and Babor (2004) unfortunately did not mention in their study if they had sought ethical approval from a recognized ethical committee. Assuming this was approved however their study aimed to explore causes of MEs by 22 staff nurses over a period

of 13 days. They identified 74 MEs while observing 161 preparations and 135 administrations of medications. The authors deduced that a lack of pharmaceutical knowledge, such as training in IV medication preparation and administration, was the major problem in nurses' medication errors. A lack of basic knowledge about medications, lack of training about giving medications and failure to follow the correct procedures in the preparation of medications have also been identified in other studies as contributing to MEs (Anacleto et al. 2005).

Khowaja et al. (2008) completed an exploratory and evaluative study aimed to investigate and evaluate reasons for MEs in a tertiary university hospital in Pakistan. They found in their results that 26.4% of MEs were caused by delayed delivery of medications by pharmacists which then resulted in delays to administration by nurses. Moreover, even though they did not discuss exactly how pharmacists contribute to MEs, they claimed that pharmacists did contribute to a high rate of MEs. Aljadhey et al. (2014) used an exploratory qualitative enquiry using group discussions to explore the major factors contributing to medication safety problems, obstacles and challenges that prevented improving medication safety practice. The study authors then went on to make suggestions to enhance medication safety programs in Saudi Arabia. They concluded that most respondents believed that MEs were often attributed to a lack of medication safety training activities for healthcare providers.

2.4 Medication errors in Saudi Arabia

The overall incidence of MEs is still unknown in Saudi Arabia. However a few studies had investigated the causes and factors associated with occurrence of MEs in hospitalized patients. Al-Jeraisy, Alanazi and Abolfotouh (2011) undertook a retrospective cohort study of medication orders over a period of five weeks in a tertiary care hospital in Riyadh city, the capital of Saudi Arabia. Out of the 2,380 orders investigated, they found that the overall error rate of 56 % of all medication orders. Given this measure of a high ratio of occurrence of MEs it maybe that the same concern exists in other healthcare facilities in the Kingdom. It is also noted

that this study conducted a ‘snapshot’ of medication orders which were all collected during one shift, the day shift. Further studies of other shifts such as night duty might reveal different findings.

The Government of Saudi Arabia, represented by the MOH, is responsible for developing regulations and legislation related to the healthcare system in the Kingdom. The MOH administers more than 220 hospitals around the Kingdom however policies related to the development of medication safety are relatively new. A reporting mechanism was created by the MOH in November 2012 to provide a method for the documentation of all medication errors in a manner that allows review of the types and causes; the aim of this mechanism is to prevent or minimizing MEs. All medication errors should now be documented on the MOH authenticated Medication Error Form (Appendix 1). The medication safety policy stated that MEs documented by all the healthcare facilities in the Kingdom should be sent to the General Administration of Pharmaceutical Care (GAPC) of the MOH in Riyadh. Furthermore, the MEs should be reported to GAPC for the purpose of taking preventive measure and improving the quality of pharmaceutical care services. It is not a function of the new system to criticize or speculate on actions of the staff involved in MEs. Further study to investigate the success of the policy intervention is required.

Alsulami, Conroy & Choonara (2013), conducted a systematic review study on 45 studies from 10 Middle Eastern countries related to MEs. They found that the studies were of poor quality and comparatively few in number of respondents. Moreover, they found that most of the studies were undertaken on adult patients in general hospitals, while studies conducted in paediatric hospitals were very few. Although they concluded that the studies were few and in poor quality, their research was based only on studies published in English. As a result the diversity of language and cultures in the Middle East, such as Arabic, Persian, Turkish and Hebrew may not have been captured as clearly.

2.5 Critique of the literature concerning ME

Despite a thorough review of the literature there appears to be no consensus about the definition of a medication error. Many different terminologies defined and described medication errors resulting in a dispersion of concepts related to MEs. Furthermore, in some studies included in the literature review, the approval of research from an ethical committee did not appear to have been sought; this may weaken the credibility of the information contained in the individual studies. Gaining approval from an ethical committee to conduct a study, looks to minimize or provide for an absence of trauma, harm, discomfort, or anxiety to the participant (Schneider & Whitehead 2013). Moreover many studies reviewed in the literature only noted a small sample size or didn't explain or provide any rational reason or mechanism by which the sample was selected. In a number of studies while it was noted that the MEs were caused by nursing staff, the specific detail of their role in the occurrence of MEs were not addressed in detail.

2.6 Conclusion

This chapter has provided a review of the literature that informed the formulation of the aim, objective and research question guiding the flow of information in this thesis.

Attention has been given to key studies of the prevalent factors associated with occurrence of MEs in hospital settings under six categories: communication-related, working conditions, transcription, nurses, storing and labelling, and pharmacy. Moreover, the role of staff nurses in contributing to MEs, the current situation of medication safety and MEs in Saudi Arabia, and critique of the literature concerning MEs had been further discussed.

A review of the literature has demonstrated that MEs are a complex and multifaceted issue. The future challenges of medication safety in Saudi Arabia have not been thoroughly explored and require further research in order to improve the safety of patients (Aljadhey et al. 2014). The most significant gaps in the existing literature reviewed can be summed up in a number of observations. Firstly, the

number of researchers and studies that have discussed the problem of MEs that have conducted in Saudi Arabia are very few if we compare them to number of researches and studies that discussed the same problem globally. Secondly the studies were conducted and included several health professionals, it is possible that a greater emphasis on nurses will highlight ME from a nursing perspective. Finally, the largest amount of studies reviewed have been based solely on studies published in English.

Chapter Three: Methods

3.1 Introduction

This chapter describes in detail the methods that were used in the conduct of this study. It includes description of the research design, study population (including inclusion/exclusion criteria), recruitment strategies, study settings, sampling, piloting the questionnaire that were administered and outcomes, issues of reliability and validity, statistical analysis, and ethical considerations.

3.2 Study design

A cross-sectional descriptive research design was used in this study. Cross-sectional research design is used often when the purpose of the study is descriptive, in the form of a survey, when there is no hypothesis, and within a population at a given time-point (Levin 2006). ‘‘Cross-sectional descriptive research design relies on describing the issue on its dimension, variations and its importance’’ (Loiselle & Profetto-McGrath 2011, p. 16). In this study, a cross-sectional questionnaire utilizing a descriptive design had been used to investigate the viewpoints of nurses about the factors associated with MEs that occur in the MOH hospitals.

3.3 Study settings

Three MOH hospitals within Saudi Arabia were identified as sites for data collection. These included the Maternity and Children Hospital; a specialized hospital which receives and treats all obstetric, gynaecologic and paediatric cases within the Jeddah region and its remote areas. The King Abdul-Aziz Hospital and Oncology centre is a general hospital which receives and treats all patients with a diagnosis of cancer within Jeddah city. Finally the King Fahad Hospital, the central hospital of Jeddah region. This hospital covers all medical specialities other than obstetric, gynaecologic and paediatric settings. The majority of complicated cases are referred and transferred to this hospital from Jeddah region and its remote areas.

3.4 Sampling

In quantitative studies, sampling is the process of choosing suitable units of interest (Schneider & Whitehead 2013). Consequently, an effective sampling strategy was important in this study firstly, because inappropriate procedures may negatively affect or even jeopardize the integrity and outcomes of the study findings. Secondly to increase the efficiency of a research study, while maintaining representativeness, an effective sampling strategy is required (Schneider & Whitehead 2013). Convenience sampling (or incidental sampling) was used in this cross-sectional descriptive study. Richardson- Tench (2014) note that convenience sampling is an acceptable approach for obtaining respondents however as a non-probability sample the results may be less generalizable to a wider population. To maximise the internal validity of the study, an overall sample size of three hundred nurses (100 from each hospital) was considered a reasonable size to investigate views. A sample size and power calculation were not conducted prior to the data collection as Richardson-Tench (2014, p. 131) note a power calculation is '…only conducted when all data in the study are collected on the same scale of measurement'. Different scales of measurement and different types of data were collected throughout this study.

3.5 Study population

The overall study population targeted for this study included all staff nurses currently working in one of the three different clinical hospital settings.

3.6 The inclusion and exclusion criteria

The inclusion and exclusion criteria of respondents usually has statistical and ethical importance (Salkind 2010). Inclusion criteria afford researchers a number of overall standards to screen potential candidates. Exclusion criteria guide researchers to exclude respondents based on a specific set of standards or requirements (Ingham-Broomfield 2008; Schneider & Whitehead 2013).

To be included in the study, the nurses had to meet the following criteria:

A registered nurse from the clinical setting who provides direct nursing care to patients.

Those nurses who do or have worked across different shifts.

The exclusion criteria applied to staff who:

Do not routinely administer or give medications to patients.

We're not registered as a "registered nurse" in the Saudi Commission for Health Specialties.

3.7 Recruitment strategy

After the approval of the Ethics Research Committee of the MOH (Appendix 2), an official circular to facilitate the mission of the student researcher on 12th June 2017 was sent to the General Director of the Health Affairs in Jeddah with a copy to the directors of the three hospitals. A letter from the School of Nursing of University of Adelaide was also issued to satisfy the regulatory work rules in MOH, essentially to facilitate the task of the student researcher. Flyers had been made by the researcher and provided to the nursing administration office in each hospital to distribute to the nurses who would participate (appendixes 3 (English) & 4 (Arabic)). The nursing administration office in each hospital notified nurses of the opportunity to participate in this study. Communication and coordination of the project was supported by the Nursing Management Office of each hospital in accordance with the regulatory work rules of MOH. The researcher had provided information sessions for the potential participants and a participant information sheet was provided (appendixes 5 (English) and 6 (Arabic)).

3.8 Piloting

The initial study design and data collection tools were to be tested with a small pilot with the input of six nurses in the Maternity and Children Hospital in Saudi Arabia. Piloting the study on small number of candidates may have provided useful insights to study design and process ultimately avoiding the conduct of an inappropriate or

an inadequate research project (Van Teijlingen & Hundley 2002). The aim to pilot this study on a small sample before the intended study was to test the efficacy of the study protocol and the translation of the bilingual questionnaire, to identify if there were any confusing, misunderstanding, or misleading questions which would then be modified. The pilot may have also given some input to the statistical procedures required. However due to an extended delay in the processing of the ethics application and a subsequent requirement of the student to avoid travel to the original intended site for data collection, time available to conduct and review a pilot was lost. The intended study site in the student's home region of Najran, a region of southern Saudi Arabia was deemed by the Australian Department of Foreign affairs as "Do not travel". To comply with university requirements a significant logistical and administrative process was undertaken to identify a new set of hospitals for data collection, those were recruited from a more western aspect of the Kingdom. The HREC were advised that a pilot test would not be conducted.

3.9 Data collection method

In quantitative studies, various methods can be used to collect data (Schneider & Whitehead 2013). The choice of research method is dependent on the nature of the research problem and the issue that could be investigated. In this study, a self-administered questionnaire was designed by the researcher and informed by review of the literature. The questionnaire included demographic attributes such as gender, age, working experience and the viewpoint of nurses regarding the factors associated with medication errors in six categories: communication-related, working conditions, transcription, nurses, storing and labelling, and pharmacy. As there are a significant number of foreign nurses working in the Saudi health care system, the questionnaire was written in two languages, English and Arabic, at a level of language that would be understandable by all of the respondents (appendixes 7 (English) and 8 (Arabic)). The questionnaire was checked to ensure it was grammatically correct and free of value-laden terms and jargon. To enhance participant's anonymity and confidentiality, the respondents were required to put the completed questionnaires in a self-sealing envelope and then to place them in a

sealed box. No identifiable data such as names or staff identification numbers were required.

3.10 Data analysis:

In quantitative research, data analysis is a considered, deliberate and a systematic process (Schneider & Whitehead 2013). The type of statistical analysis used by researchers depends on the aim and purpose and the research question of the study (Elo & Kyngäs 2008). Descriptive statistical procedures have been used in this study to describe, organize and analyse the raw data (Schneider & Whitehead 2013). The types of data collected in this study included ordinal and interval data. Ordinal or ranked data is defined by Richardson-Tench (2014) as data that '…can be ranked in order from first to last in some way'. The variables themselves may not be measurable precisely but can be compared with one another in a ranking. Statistical analysis of the data did explore both descriptive and inferential methods. Descriptive statistical measures are used to describe, summarize and present the data. Categorical variables will be presented using frequency distribution including absolute and relative frequencies along with bar or pie charts (Schneider & Whitehead 2013). The following variables will be presented using frequency distribution tables and pie charts.

1. Gender
2. Age
3. Nationality
4. Area of expertise
5. Highest nursing education qualification
6. Nursing practice experience
7. Average number of hours of work per day
8. Average number of hours of work per week
9. Number of patients directly served per day
10. Attendance at any training program in the previous year
11. Whether any medication error is reported
12. Medication error range observed

Continuous or interval scale variables were summarized and assessed for their suitability to consider measures of central tendency and dispersion. Measures of central tendency provide expected values of the data while measures of dispersion provide an indication of the variability of the data around the expected or representative value. Scale variables where relevant have been summarized using minimum, maximum, mean, standard deviation measures. Therefore, the age of participating nurses and rating score responses to all the items related to nurses' perception of factors associated with medication errors will be summarized using minimum, maximum, mean and standard deviation measures. In the survey, items were scaled on a range of 1 to 5 with 1 representing "strongly agree" and 5 representing "strongly disagree" responses. A mean value of more than 3.0 on a scale of 1 to 5 indicates that on an average, the nurses have agreed to the statement. Further, items under each factor associated with medication error were aggregated to get a total score reflecting the overall concept. For example, responses for "communication and language" and related factor comprised 5 questions or items. Responses to these five items by each nurse was averaged to get a representative score for the nurse associated with that overall factor. A mean score of 3.0 or higher indicated "agreement" with the factor. This process was repeated for each factor to evaluate whether respondents agreed with the factor associated with medication error. As will be discussed to formally test the levels of agreement between factors a right sided t test was used. The IBM SPSS version 23.0 software application was used to perform statistical data analysis.

3.11 Validity and reliability:

During development and prior to distribution, the bilingual questionnaire had been peer- reviewed by four Ph.D. holders and a PhD candidate in nursing science, all who are fluent in both Arabic and English (see appendix 9). Each suggestion to improve the quality and readability of the bilingual questionnaire were discussed and made. The main goals in seeking out expert opinion were to improve the validity of this study and to ensure full compatibility in the meaning between the Arabic and English questionnaire.

The scales used to measure factors associated with medication errors were tested for reliability. Reliability is a measure of whether repeated administration of the scale produces highly correlated responses. If repeated administration of the instrument shows highly correlated responses, the scale is deemed to be reliable. In this study, the reliability of each study scale was assessed using Cronbach's alpha. This is a measure of the internal consistency of a scale. Generally, a cut off value of 0.60 is recommended (Hair et al. 2010) for a scale to be considered reliable. Reliability of all the scales (communication and language, labelling and packaging, transcription, work environment, pharmacy and nurse related factors) in the study were evaluated using Cronbach's alpha measure.

The initial reliability analysis is presented in Table 1. The initial reliability coefficients for all the scales except the Pharmacy scale were greater than 0.7 alpha value, which is acceptable. However, the reliability coefficients for the Pharmacy scale was less than
0.7 alpha value. A closer look at the items from the Pharmacy scale (Table 2) indicated that removing the first item from the scale (i.e. Medication errors occur because of the lack of medication safety education programs in the hospital) did make the scale more reliable. Therefore, this item was removed from the scale and the reliability was recomputed. The final reliability analysis is shown in Table 3. The final Communication and Language, Labelling and Packaging, Transcription, Working Environment, Pharmacy, and Nurses scales were deemed to be reliable for use in subsequent analysis since all respective Cronbach's alphas were greater than 0.7 alpha.

Table 1: Initial reliability analysis

Scale	Number of Items (N)	Cronbach's Alpha
Communication and Language	5	.713
Labelling and Packaging	5	.834
Transcription	2	.701
Working Environment	8	.875
Pharmacy	3	.566
Nurses	5	.908

Table 2: Pharmacy scale - Item-total statistics

The category	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Pharmacy: 21- Medication errors occur because of the lack of medication safety education programs in the hospital	6.901	4.394	.166	.751
Pharmacy: 22- Medication errors occur because pharmacists are not available 24 hours a day	7.046	2.998	.527	.211
Pharmacy: 23- Medication errors occur because of delay in delivering medications from the	6.789	3.134	.472	.305

Table 3: Final reliability analysis

Scale	Number of Items (N)	Cronbach's Alpha
Communication and Language	5	.713
Labelling and Packaging	5	.834
Transcription	2	.701
Working Environment	8	.875
Pharmacy	2	.751
Nurses	5	.908

3.12 Ethical Considerations

Ethical considerations are of utmost concern in order to protect the researcher(s) and most importantly the human respondents (Loiselle & Profetto-McGrath 2011). This study had been reviewed and approved by the Research Ethics Committee of the MOH in Saudi Arabia (IRB Log No. 17-200E) on 7th of July 2017 (see appendix 2), and the Human Research Ethics Committee (HREC) in University of Adelaide (approval number H-2017-114) (appendix 10).

Initially, it was suggested that it was essential to obtain a written consent to participate from the potential nurse respondents' and to ensure that they were able to have a copy of the consent form upon their request. However on further advice from the HREC it was determined that return of the questionnaire would be deemed suitable to indicate consent and a consent form would not be required. A number of information sessions lasting approximately 20 minutes, were provided by the student researcher in each of the study hospitals. At each session the significance of scientific research in the support and development of nursing profession to reduce medication errors was identified. The information sessions also noted the importance of the study to explore the factors contributing to the occurrence of MEs, while also providing an assurance that the information would be confidential and used for scientific and academic research purposes only. It was made clear that the researchers would not be able to, nor were required to, identify any of respondents by name in any reports using information obtained from this questionnaire. Additionally, respondents were given an opportunity to refuse to participate and could withdrawal at any stage of the research without any penalty.

There was a slight chance that some respondents may experience inconvenience or feel uncomfortable recalling medication errors and accidents. If so, the plan was to advise the respondent to seek out the established support unit within the hospital (the psychological guidance department). There were no potential risks to the health or safety of the researcher. As a citizen and registered nurse working within Saudi Arabia, the student researcher is familiar with the work atmosphere and the system

in the MOH hospitals in Jeddah.

All hard copy data have been stored in secure storage areas and when required, on digital media that has been password protected, encrypted, or otherwise secured for storage and transfer. The records and materials are secured by the School of Nursing of the University of Adelaide for a minimum of 5 years.

Chapter Four: Results

4.1 Introduction

This chapter presents the results of the data gathered from the questionnaires of the study. The purpose of conducting the questionnaire was to obtain information about nurses' perspectives regarding the associated factors with occurrence of medication errors in the MOH hospitals in Saudi Arabia. In this chapter a presentation of the data is organised around the key research question driving this study: What are the perceived factors associated with the occurrence of medication errors in MOH hospitals in Saudi Arabia?

Generally, statistical procedures whether descriptive or inferential, enable researchers to regulate, make explicit and then communicate the importance of numeric information (Loiselle & Profetto-McGrath 2011). Incorporation of the findings of research into nursing practice is achieved ideally by understanding and applying fundamentals of statistical analysis and interpretation. Furthermore, a fundamental principle of the interpretation of data includes understanding the type of data that are intended to be analysed (Giuliano & Polanowicz 2008). Selecting the most suitable statistical test can be achieved in three steps. The first step is to consider the nature of the research design and the respondents to be considered. The characteristics of the study group data indicated a homogenous population, those that would have a similar experience in administering medications to patients. Secondly identifying the level of data that would be appropriate, i.e. are the data nominal, ordinal or interval/ratio. The third step is deciding the type of test that should be used, that being a parametric or non-parametric test. The extent of debate in the literature regarding the assumptions determining the selection of parametric and non-parametric statistical tests is relatively broad and at times controversial (ABS 2013; Giuliano & Polanowicz 2008).

A frequency distribution table was used in the initial statistical analysis stage of this study because it is a useful tool to approach analysis of descriptive statistics. It is a prerequisite for developing the various graphs used to display data and the calculation of basic statistics which are used to describe data components such as: mean, median,

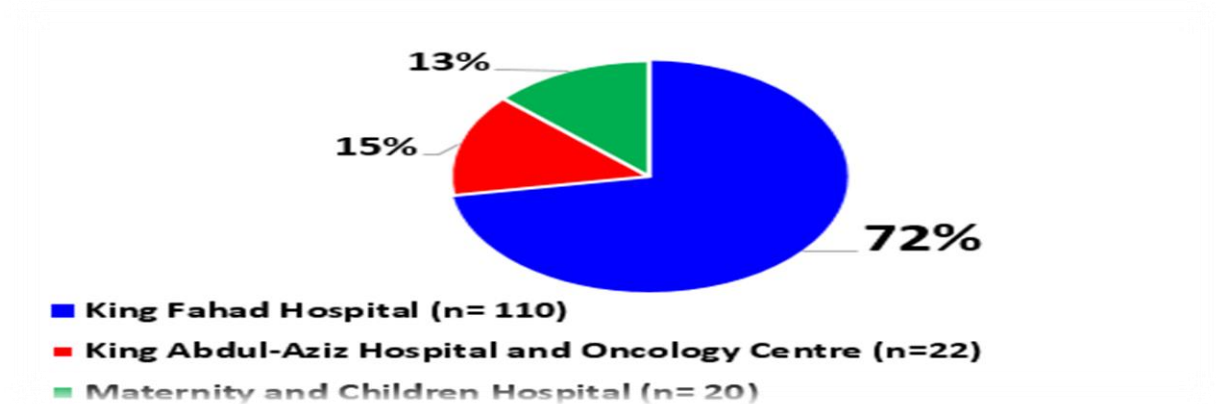
mode, variance and standard deviation. Frequency distributions are generally used to describe both interval and nominal data although they can be used to describe ordinal data. The advantages of frequency distribution are summarizing large amounts of data in a useful format, describing variable types and facilitating graphic presentation of data identifying population characteristics (ABS 2013; Giuliano & Polanowicz 2008).

In this chapter, the descriptive statistical analysis of the research data is explained. This chapter is structured as: response rate, demographic information and background characteristics of respondent nurses in the study and the primary associated factors with occurrence of medication errors as perceived by the respondents.

4.2 Response Rate:

The questionnaires had been distributed manually with the cooperation and coordination of the nursing departments at the three hospitals in Jeddah city. Participation was voluntary and those not wishing to participate did not have any requirement or expectation of returning the survey. Out of 300 surveys distributed, 98 (33%) were not returned and 50 (17%) of the surveys were returned but not useable due to varied reasons, such as the respondents were not currently practicing in clinical settings, currently working in two clinical areas or more, incomplete surveys or the respondent was not a nurse. Eventually, 152 respondents returned completed surveys for a response rate of 51% (152/300). As shown in Figure 1, the highest rate of participants was from King Fahad Hospital (72%), (15%) from King Abdul-Aziz Hospital and 13% was from Maternity and Children Hospital.

Figure 1: Proportion of respondents by hospital



4.3 Demographics and Background Characteristics of the Respondents:

The respondents' demographics and background characteristics are shown in Table 4. Of the 152 respondents, the majority were female 141 (92.8%). The age of the nurses ranged between 23 and 58 years (M = 31; SD = 40.03). A majority of nurses completing the survey were between the ages of 26 and 33 (73.7%). The largest group of respondents were Indian (n= 65, 42.76%). Saudi Arabian nurses consisted of 38 respondents, (25%) of the total and Filipino nurses were 26.3 % (n=40).

Describing the educational level of the respondents, the majority held a Bachelors' degree in nursing (72.37%) with most other nurses having a Diploma in nursing (26.97%). Only one nurse held a postgraduate diploma in nursing. As shown in Table 4, the level of experience of respondents ranged from between less than 2 years and upwards of 13 years; 58 respondents had experience levels which ranged between 2 to 5 years (38.16%). Slightly more than a tenth (12.5%) of the nurses had greater than 13 years of nursing experience.

About a quarter of the respondents work in the medical units (23.7%) making them the highest proportion of participating nurses, emergency departments represented 19.1% of respondents. Other respondents were, 14.5% from intensive care units, 12.5% from orthopaedic, 7.9% from surgical wards, 3.3% from each of paediatric and gynaecology wards, 2.6% from cardiac care units, 2.6% from renal dialysis units, and 0.7% from each of labour and delivery wards, palliative care and operating theatres.

Table 4: Summary of Key Demographic data

Variable	Category	Frequency	%
Gender	Male	11	7.2
	Female	141	92.8
Age group	18-25	13	8.55
	26-33	112	73.68
	34-41	15	9.87
	42-49	10	6.58
	50-58	2	1.32
Nationality	Filipino	40	26.3
	Indian	65	42.76
	Saudi	38	25
	Egyptian	2	1.3
	Sudanese	5	3.29
	Pakistani	2	1.3

Area of nursing practice	**Surgical**	**12**	**7.9**
	Medical	36	23.7
	Labour and delivery	1	0.7
	Emergency	29	19.1
	Paediatric	5	3.3
	Operation theatre	1	0.7
	Gynaecology	5	3.3
	Cardiac care	4	2.6
	Orthopaedic	19	12.5
	Palliative Care	1	0.7
	Intensive care	22	14.5
	Renal dialysis	4	2.6
	Other	13	8.6
Highest nursing qualification	Diploma	41	26.97
	Postgraduate Diploma	1	0.7
	Bachelor	110	72.37
Experience	0 – less than 2 years	8	5.26
	2 - 5 years	58	38.16
	6 - 9 years	49	30.26
	10 - 13 years	18	11.84
	> 13 years	19	12.50

As described in Table 5 the majority of nurses that participated in this study were working 9 hours each day (n=109, 71.7%) some were working 10 hour days (n=21, 13.8%). Only 2 (1.3%) respondents worked 12 hours daily. When respondents described

on average how many patients they provided direct nursing care to in a day, 43.4 % described providing care to between 4 to 6 patients per day, 24.3% provide their care to 1 to 3 patients a day, 21.1% provide their care to 7 to 9 patients a day, 6.6 % provide their nursing care to 10 to 12 patients a day, and 4.6% provide the care to more than 12 patients a day (Table 5).

Table 5: Respondents working conditions

Variable	Category	n	%
Daily working hours	8 hours	20	13.2
	9 hours	109	71.7
	10 hours	21	13.8
	12 hours	2	1.3
Weekly day work	4 days	4	2.6
	5 days	63	41.4
	6 days	81	53.3
	7 days	4	2.6
Patients receiving care	1 - 3 patients	37	24.3
	4 - 6 patients	66	43.4
	7 - 9 patients	32	21.1
	10 - 12 patients	10	6.6
	> 12 patients	7	4.6

In describing training activities in the last two years, a high percentage of nurses (60.5%) indicated that they had attended a training course, seminar or conference related to medication error or medication safety (Table 6).

Regarding the reporting of medication errors, the majority of the nurses (73.03%) participated in the study answered that they had not reported any medication errors during their nursing career either to senior staff or through other reporting or feedback mechanism, while (26.97%) said they had reported medication errors in their nursing career (Table 6).

Table 6: Training and reporting activity

Variable	Category	n	%
Attending training activities	Yes	92	60.5
	No	60	39.5
Reporting medication errors	Yes	41	26.97
	No	111	73.03

As shown in Figure 2, 76 (50%) respondents reported that they have not been aware of medication errors, either directly or indirectly, 68 (44.7%) only described being aware of 1 to 5 MEs across their career. Although still concerning nurses reported in much smaller percentages having been aware of 6 to 10 MEs (n=5, 3.3%) with some aware of 16 to 20 MEs (n=3, 2%).

Figure 2: Awareness of medication errors across career

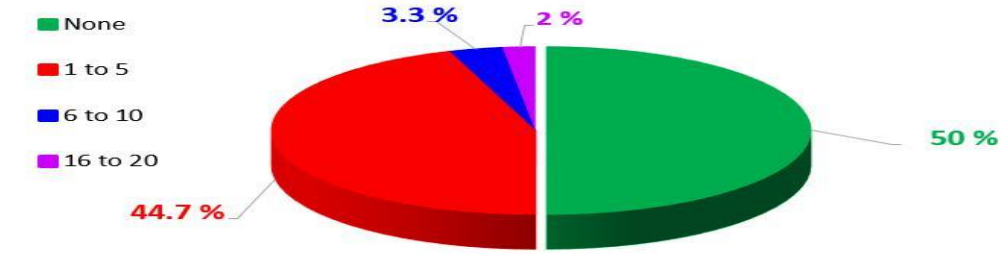


Table 7, describes the awareness of medication errors by nationality. The percentages are calculated as a proportion of the respondents with that nationality. Of the Saudi nurses that responded 17 (44.7%) were aware of 1-5 errors. Similarly for Filipino and Indian nurses who were aware of 1-5 errors the results were 47.5% and 44.6% respectively.

Table 7: Comparison between nationalities awareness of medication errors

Nationality	No. of errors	n	%
Saudi Arabian	1-5	17	44.7
	6-10	1	2.6
	11-15	1	2.6
Filipino	1-5	19	47.5
	6-10	3	7.5
	11-15	0	0
Indian	1-5	29	44.6
	6-10	1	1.5
	11-15	0	0

4.4 Perceived factors that influence medication errors

Table 8 describes the results of questions concerning communication and language related factors. The most significant difference between the variables or conditions is that the majority of nurses either strongly agreed or agreed 86.18% (n= 131) that unclear or illegible orders contribute to medication errors. Also 77.63% (n= 118) of respondents either strongly agreed or agreed that poor communication between nurses and physicians is an associated factor that contributes to medication errors.

Table 8: Frequency distribution of communication and language related-factors

Communication and language related-factors	Study Sample (N=152)					Mean
	n (%)	n (%)	n (%)	n (%)	n (%)	
	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1	
Writing unclear or illegible medication orders or prescriptions.	76 (50)	55 (36.18)	19 (12.5)	2 (1.32)	0	4.35
poor communication between nurses and physicians	55 (36.18)	63 (41.45)	20 (13.16)	6 (3.95)	8 (5.26)	3.99
A language barrier between nurses and patients	32 (21.05)	42 (27.63)	33 (21.71)	28 (18.42)	17 (11.18)	3.29
Medication errors occur more frequently with verbal orders.	41 (26.97)	54 (35.53)	40 (26.32)	5 (3.29)	12 (7.89)	3.70
Frequently changing of medication orders	52 (34.21)	55 (36.18)	29 (19.08)	6 (3.95)	10 (6.58)	3.88
	Mean: 3.84					

Table 9 describes the results of questions concerning labelling and packaging related-factors. The most significant difference between the conditions is noted to be that 75% (n= 114) of respondents either strongly agreed or agreed that similarity in the appearance of medications is a factor associated with the occurrence of medication errors. Similarly, three-quarters of respondents (n= 114) either strongly agreed or agreed that similarity in the name of medications is a contributing factor to medication errors. Also, 65.1% (n=99) of respondents either strongly agreed or agreed that poor labelling of medications is a contributing factor to medication errors.

Table 9: Frequency distribution of labelling and packaging related factors

of labelling and packaging related-factors	Study Sample (N=152)					Mean
	n (%)	n (%)	n (%)	n (%)	n (%)	
	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1	
Storing medications with similar packaging at the same location.	35 (23.03)	61 (40.13)	29 (19.08)	16 (10.53)	11 (7.24)	3.61
Similarity in the appearance of medications.	42 (27.63)	72 (47.37)	28 (18.42)	3 (1.97)	7 (4.61)	3.91
Similarity in the names of medications.	40 (26.32)	74 (48.68)	31 (20.39)	0	7 (4.61)	3.92
medications do not have an alert label	31 (20.39)	56 (36.84)	37 (24.34)	12 (7.89)	16 (10.53)	3.49
medications are poorly labelled	39 (25.66)	60 (39.47)	28 (18.42)	8 (5.26)	17 (11.18)	3.63
	Mean: 3.71					

In relation to transcription related-factors as shown in Table 10, 44.74% (n= 68) of respondents either strongly agreed or agreed that errors made in the medication administration record (Kardex) was one of the factors contributing to medication errors.

Table 10: Frequency distribution of transcription related-factors

Transcription related-factors	Study Sample (N=152)					Mean
	n (%)	n (%)	n (%)	n (%)	n (%)	
	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1	
Nurses use non-standard abbreviations.	25 (16.45)	40 (26.32)	34 (22.37)	28 (18.42)	25 (16.45)	3.08
Errors are made in the medication administration record (Kardex).	21 (13.82)	47 (30.92)	51 (33.55)	15 (9.87)	18 (11.84)	3.25
	Mean: 3.17					

In regard to working environment related-factors, Table 11 describes that two-thirds (66.45%, n =101) of respondents agreed that interruptions while preparing or administering

medications was a contributor factor to medication errors. Meanwhile, 65.13% (n= 99) of respondents agreed that a stressful working environment is a contributor to medication errors.

Table 11: Frequency distribution of working environment related-factors

Working environment related-factors	Study Sample (N=152)					Mean
	n (%)	n (%)	n (%)	n (%)	n (%)	
	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1	
interruptions while preparing or administering medications	37 (24.34)	64 (42.11)	29 (19.08)	14 (9.21)	8 (5.26)	3.71
Staff nurses shortages	46 (30.26)	42 (27.63)	30 (19.74)	26 (17.11)	8 (5.26)	3.61
Heavy workloads of nurses	56 (36.84)	49 (32.24)	30 (19.74)	7 (4.61)	10 (6.58)	3.88
Long working hours	36 (23.68)	44 (28.95)	31 (20.39)	25 (16.45)	16 (10.53)	3.39
Stressful working environment	44 (28.95)	55 (36.18)	26 (17.11)	12 (7.89)	15 (9.87)	3.66
Noisy working environment	23 (15.13)	54 (35.53)	28 (18.42)	22 (14.47)	25 (16.45)	3.18
no suitable place for preparing medications	26 (17.11)	32 (21.05)	35 (23.03)	35 (23.03)	24 (15.79)	3.01
new graduate nurses have a short or insufficient orientation program	36 (23.68)	49 (32.24)	31 (20.39)	16 (10.53)	20 (13.16)	3.43
	Total mean = 3.48					

In Table 12, more than half of nurses (61.84%, n =94) either strongly agreed or agreed that lack of medication safety education programs in the healthcare facility was a contributing factor to medication errors. The results were similar for the delay in delivering medications.

Table 12: Frequency distribution of Pharmacy related factors

Pharmacy related-factors	Study Sample (N=152)					Mean
	n (%)	n (%)	n (%)	n (%)	n (%)	
	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1	
lack of medication safety education programs	33 (21.71)	61 (40.13)	26 (17.11)	20 (13.16)	12 (7.89)	3.55
pharmacists are not available 24 hours	31 (20.39)	56 (36.84)	26 (17.11)	13 (8.55)	26 (17.11)	3.35
delay in delivering medications	43 (28.29)	51 (33.55)	26 (17.11)	15 (9.87)	17 (11.18)	3.58
	Total mean = 3.49					

In Table 13, near to half of respondents (49.34%, n =75) either strongly agreed or agreed that failure to check patient allergy status was a contributing factor to medication errors. The results were very similar for failing to check the patient's ID.

Table 13: Frequency distribution of nurse's related-factors

nurses related-factors	Study Sample (N=152)					Mean
	n (%)	n (%)	n (%)	n (%)	n (%)	
	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1	
Failure to check patient allergy status	25 (16.45)	50 (32.89)	28 (18.42)	23 (15.13)	26 (17.11)	3.16
poor mathematical skills for drug dose calculation	23 (15.13)	44 (28.95)	28 (18.42)	26 (17.11)	31 (20.39)	3.01
failure to check patient's ID	33 (21.71)	43 (28.29)	25 (16.45)	28 (18.42)	23 (15.13)	3.23
Fearing of being punished	25 (16.45)	29 (19.08)	27 (17.76)	41 (26.97)	30 (19.74)	2.99
unaware of using the 'medication administration rights'	23 (15.13)	37 (24.34)	22 (14.47)	38 (25.00)	32 (21.05)	2.88
	Total mean = 3.05					

Table 14 has the 10 highest ranked perceived factors that influence medication errors based on mean Likert scores. The category for each factor is also provided. As shown in Table 14, the significant majority of respondents in this study identified that factors associated with communication within the clinical work environment between nursing staff and doctors, nursing staff and patients or others, hinder communication and are the most significant factors leading to MEs. The factors associated with labelling and packaging, such as similarities in medications names and similarities in the appearance of medications, are the second most important factors leading to MEs in these Ministry of Health hospitals. The factors associated with the clinical work environment (i.e. interruptions while preparing or administering medications and stressful working environment) also ranked highly.

Table 14: Ranking of the most significant factors:

The rank	The factor	Mean	Category
1	Writing unclear or illegible medication orders or prescriptions.	4.35	CL
2	Poor communication between nurses and physicians	3.99	CL
3	Similarity in the name of medications	3.92	LP
4	Similarity in the appearance of medications	3.91	LP
5	Frequently changing of medication orders	3.88	CL
6	Heavy workloads of nurses	3.88	WE
7	Interruptions while preparing or administering medications	3.71	WE
8	Medication errors occur more frequently with verbal orders	3.70	CL
9	Stressful working environment	3.66	WE
10	Medications are poorly labelled	3.63	LP

Legend: CL= Communication and language, LP= Labelling and packaging, WE= Working environment.

Independent sample t-tests

The summary statistics for the 6 category scores are shown in Table 15. The results indicate that, except for the nurses score, the mean score for each scales was higher than 3.0. This suggests that the respondents believed that medication errors were least likely to happen because of something the nurse themselves did wrong. The highest mean score was obtained for the Communication and Language scale.

To maximise the insights gained from the data the researcher conducted a number of independent sample t-tests, to establish if any means between different groups of factors were significantly different. Sullivan and Artino (2013) note the significant controversy surrounding the use of parametric test for data such as generated by Likert scales. The authors however provide well-argued advice that parametric tests such as a t-test can and should be used to explore relationships within Likert scale data. The factors compared were Communication and Language, Labelling and Packaging, Transcription, Working Environment, Pharmacy, and Nurses, each being compared to the respondent reporting medication errors across their career (yes/no). The results of the test are summarised in Table 15 below. The results of the independent sample t-test show that none of the six mean scores were significantly different for the occurrence of medication errors during the course of the respondents' career (yes/no). This non result however does not suggest that there are other factors, not considered in this study (possibly unmeasurable), a number of co-related factors or a number that are not easily measured, which may be responsible for medication errors.

Table 15: Independent sample t-test results

Have you ever reported any medication errors during your nursing career either to senior staff or through other reporting or feedback mechanisms?		N	Mean	SD	t
Communication and Language Score	Yes	41	3.932	.686	.842
	No	111	3.825	.706	
Labelling and Packaging Score	Yes	41	3.820	.774	.482
	No	111	3.751	.774	
Transcription Score	Yes	41	3.329	.998	1.013
	No	111	3.144	1.005	
Working Environment Score	Yes	41	3.637	.805	1.282
	No	111	3.444	.882	
Pharmacy Score	Yes	41	3.659	.938	1.592
	No	111	3.374	1.080	
Nurses Score	Yes	41	3.039	1.033	.357
	No	111	2.969	1.156	

The results of the data analysis report that generally awareness of medication errors are in line with a range of identified factors with varying levels of importance. The factors used for this study (i.e. Communication and Language, Labelling and Packaging, Transcription, Working Environment, Pharmacy, and Nurses) which were thought of as the possible reasons for medication errors were consistently reported. The respondents believed that MEs were most likely to happen because of the communication and language errors, and least likely to happen because of nursing error. An analysis into the perceived factors associated with the occurrence of medication errors during the course of the respondents' career (yes/no) did not find any statistically significant relationship between Communication and Language, Labelling and Packaging, Transcription, Working Environment, Pharmacy, and Nurses. This indicates that there

are factors not considered in this study (possibly unmeasurable or not easily measurable factors) which may be responsible for medication errors.

4.5 Conclusion

The results of the data analysis report that generally awareness of medication errors are in line with a range of identified factors with varying levels of importance. The factors used for this study (i.e. Communication and Language, Labelling and Packaging, Transcription, Working Environment, Pharmacy, and Nurses) which were thought of as the possible reasons for medication errors were consistently reported. The respondents believed that MEs were most likely to happen because of the communication and language errors, and least likely to happen because of nursing error. An analysis into the perceived factors associated with the occurrence of medication errors during the course of the respondents' career (yes/no) did not find any statistically significant ($p \leq 0.5$) relationship between Communication and Language, Labelling and Packaging, Transcription, Working Environment, Pharmacy, and Nurses. This indicates that there are factors not considered in this study (possibly unmeasurable or not easily measurable factors) which may be responsible for medication errors.

Chapter Five: Discussion

The overall aim of this study was to investigate the factors associated with occurrence of medication errors in MOH hospitals in Saudi Arabia. The most significant factors will be discussed further in this chapter. The findings of this study have been compared with studies conducted in different countries to determine the similarity of factors associated with MEs.

5.1 Major findings in each category and its relationship to clinical practice:

5.1.1 Communication and language category:

As indicated in the findings and ranking of factors those with the highest mean scores are factors associated with communication. Indeed the majority of nurses participating in the study suggested that communication and language related-factors made up the highest contributors of factors leading to MEs in MOH in Saudi Arabia. Particularly, the majority of nurses (86.8%, n= 131) believed that unclear or illegible orders are a significant contributor to MEs. In similar studies, Sánchez (2013) identified similar findings that illegible handwriting consisted 26.2% towards the total causes of MEs. Calligaris et. al, (2009) also found that overall 23.9% of prescriptions were illegible and 29.9% of prescriptions were incomplete. Even in settings that claim an advanced and sophisticated health care system, such as the United States, it has been reported that up to 7000 people die as a result of poor or illegible handwriting each year (Caplan 2007). While doctors may know what they have written, when other parties, i.e. nurses and pharmacists are involved they may still have difficulty with interpreting and reading what is written. This is however not a new problem with Lyons et al. (1998) also having concluded that doctors' handwriting was often illegible even when they were asked to write as neatly as they can.

In order to enhance communication in hospital settings among the medical staff, whether doctors, nurses or others healthcare staff, the choice of applying health technology may be an effective solutions to solve this is. Electronic Medication Administration Records

(eMARs) and Computerized Provider Order Entry (CPOE) are health technologies that have helped in substituting the entering of manual medication orders into a computerized electronic system (Robinson et al. 2017). The application of the program helps to enhance the clarity of reading medications' names, reduce the ambiguity and lack of clarity of English letters, particularly if the English language is the only language applied in the clinical hospitals settings of the MOH and the majority of healthcare providers are not fluent in English. CPOE and eMARs have been shown to be associated with enhancing the safety and quality of care in the hospital (Robinson et al. 2017). King et al. (2003) and van Rosse et al. (2009) concluded that implementation of CPOE was associated with a significant decrease of number of MEs in wards that it was applied in. As a result of this study, a suggestion that could be offered to the MOH, would be to trial a local version of an electronic drug administration system in one of the study hospitals, measuring before and after the impact of an electronic medical administration on the rate of MEs.

A significant percentage (77.63%, n= 118) of respondents believe that poor communication between nurses and physicians is an associated factor that contributes to medication errors. Similarly, Topcu et al. (2017) concluded in their study that the majority of MEs were more likely to occur from communication failures between physicians and nurses. Research over the years had shown that the lack of communication of nurses and physicians is associated with errors, frustration, and inefficiencies in the delivery of care (Dingley et al. 2008; Helmreich & Schaefer 1994). Berland and Bentsen (2017) also concluded that poor communication between healthcare workers and general practitioners was more likely to lead to medication errors.

Other research confirms that ineffective communication among healthcare professionals is one of the most significant factors leading to patient harm and medical errors (Dingley et al. 2008). Consequently, poor communication between doctors and nurses has an considerable impact on patient quality of care and outcome (Flicek 2012).

Given the cultural diversity of the workforce and the different education systems from which those nurses have come from, the implications of poor communication to contribute to ME are even more profound. One of the most telling findings from this

study is the imbalance or difference between staff who had been aware of a ME but neglected to report the incident. It is unlikely that improvements to practice will develop unless a greater degree of transparency is applied to the identification and reporting process. A follow up study to determine the reasons why there is a gap in the reporting of MEs is indicated.

5.1.2 Labelling and Packaging category:

Most labelling and packaging related-factors were as a result of similarity in the appearance and names of medications. Comparing between this study and other studies such as Tsuji et al. (2015a) found that nurses often confused the similarities of drug names. On another study, Tsuji et al. (2015b) found that similarity in the appearance and names of medications was more likely to lead to incidents and cause severe harm to patients. You et al. (2015) also found that the similarity of medications' names or labels and similarity of medications appearance was the second most common reason for MEs. Kenagy and Stein (2001) agreed that the confusion of medication names is a main factor to patient injuries or death, and causes about 100,000 injuries each year in the United States of America (USA) (Hoffman & Proulx 2003). Within the USA, look or sound alike medications caused confusion with drug names and caused approximately 25% of all of medication errors that were reported to a national medication error reporting programs in Pennsylvania (PA 2004). MEs are likely to occur due to the similarity of a medications appearance and/or name, because nurses may be tempted to make judgments based on parts of some letters in a medication’s name, or based on outside characteristics of the medication, such as the colour, shape, and size of a drug (Tsuji, et al. 2015a).

5.1.3 Transcription category:

This study identified that most transcription related-factors were errors made in the medication administration record (Kardex). In MOH institutions, they use the genericised trademark term "Kardex" for describing the medication administration record. Other regions or countries may use the term Cardex.

Interestingly in contrast to the present study You et al. (2015) found that errors made in the medication administration record (Kardex) were one of the least common reasons for MEs. However Shahrokhi, Ebrahimpour and Ghodousi (2013), similar to this study found that errors made in Kardex was one of the most common reasons leading to medication errors. Fahimi et al. (2009, p. 173) had defined transcription error as "any deviation in transcribing medication order from the previous step (order on the order sheet, administration nursing note and/or Kardex, documentation of the order in the Pharmacy database)". As suggested above the implementation of an electronic record system may be a significant improvement to the administration of medications in Saudi MOH settings. In the Loyola University hospital in the USA, using a manual entry system for medication orders caused 72.4% of transcription-related errors each month (Barron et al. 2006).

Common transcription errors are often attributed to handwriting, using non-standard abbreviations, mistakes in reading, and misinterpretation (i.e. 'mg' for 'mcg') (Fahimi et al. 2009). Regular testing of staff ability to interpret writing and a process of reviewing medications with similar names and appearances could be an important strategy in addressing this issue.

5.1.4 Work environment category:

Most working environment related-factors identified by nurses are interruptions while preparing or administering medications coupled with stressful working environments. Westbrook et al. (2010) agreed with the present study and found that the incidence of clinical errors and procedural failures had been increasing significantly in line with the frequency of interruptions. They recorded in their observations that interruptions occurred in more than 50% of medication administrations. Each interruption was associated with a 12.7% increase in clinical errors and 12.1% increase in procedural failures. Moreover, they found that 25% of total administrations had at least one clinical error. In addition, Johnson et al. (2017) identified that interruptions lead to errors in the clinical practice and caused procedural failures further threatening patient safety. They found that almost all medication events (99%) were interrupted or potentially

interrupted resulting in inappropriate management and consequences, for instance stopping medication preparation or administration to address the interruption. Moreover, Deans (2005) found in their results that interruptions and distractions was the highest ranked environmental cause (25.3%) of MEs. Each of these items are reflected in the data collected and analysed for this study.

Literature have largely distinguished between three kinds of interruption that many nurses confront: interruptions in the middle of the task, interruptions between tasks (Potter et al. 2005), and system failures (e.g. poor access to equipment and supplies) (Tucker & Spear 2006). Interruptions might be also called distraction, disruption, and break-in-task (Rivera-Rodriguez & Karsh 2010). Interruptions can be described as a significant factor in hospital facilities, the main cause of failures, and contribute to occurrence of errors (McGillis et al. 2010; Monteiro, Avelar & Pedreira 2015; Rivera-Rodriguez & Karsh 2010). For example a possible explanation of interruptions and distractions in the work environment can be anything that disrupts a nurse from the current task bydiverting their attention to another task. Common kinds of interruptions and distractions that may lead to a medication error include a question being asked by a co-worker, hearing or responding to a patients' alarm, nearby noises or electronic devices especially cell-phones. Despite this significant factor being reported again in this study there does not appear to have been progress or development in the systems and process underpinning the administration of medications.

Deans (2005) ranked Stress/high workload as the highest human cause (25.3%) of MEs. Similarly, Abdali, Abdulmutalib and AlNagshabandi (2017) ranked Stress due to workload (88.2%) as the third common factor leads to MEs. Moreover, Pournamdar and Zare (2016) found in their results that the factors related to hospital sections and work environment, such as type of department, high volume of work, and noisy work environment, obtained the highest mean score.

Nursing is one of the jobs that can be obviously describes as a stressful job because nurses should response very quickly to patients' and their families' needs (Chou, Li & Hu 2014; Shahrokhi, Ebrahimpour & Ghodousi 2013). Job stress can be defined as

negative emotive and physical responses, occur when there is no matching between the job requirements with employees' abilities, resources and/or needs (Clegg 2001). Sarafis et al. (2016) found the occupational stress resulting from dealing with death and dying, conflicts with supervisors, and patients' and their families' needs which caused significantly higher job-stress among nurses. Given that this study confirms a number of previously unknown factors in the Saudi health care system, the opportunity to put a range of interventions in place is timely.

5.1.5 Pharmacy category:

Lack of medication safety education programs was the most significant pharmacy-related factor in this study. Aljadhey et al. (2014) found that lack of medication safety programs is most likely one of the challenges that affect the future of medication safety in Saudi Arabia. However, there is a severe lack of studies that discuss the importance and role of medication safety education programs in hospitals in contributing or reduction of MEs.

5.1.6 Nurses category:

Failure to check patient allergy status was the most significant nurse-related factor in this study. Although there is a lack of studies that discuss the relationship and role of failure to check patient allergy status and MEs, MacPherson et al. (2006) disagreed with the present study and found the majority of the self-reported allergies were simply accepted and did not have significant effects on medications errors. However, Jones & Como (2003) assured the need to ensuring the susceptibility profile of each patient to a particular medication before entering into the electronic system.

5.2 Limitations of study:

There were a number of limitations of this study and it is noted that while the results may be indicative of the Jeddah Region there is no suggestion the finding apply to other Ministry of Health hospitals in Saudi Arabia. While many survey / questionnaire have a low response rate the researcher was still disappointed by the return rate of 50.67%. The efforts of the researcher to travel home, provide information sessions and a face to face point of contact with the respondents was hoped to encourage an even higher uptake. Indicating the response

rate in the study is important because it is reflecting the level of transparency in its reporting. Low response rates for individual items on a questionnaire might be refer to a problem, especially if they represent important variables of study (Draugalis, Coons & Plaza 2008).

5.3 Future recommendations:

There are two recommendations of this study which include reviewing medication safety policies and processes created by the MOH. Firstly, this would be to confirm that similar issues to other countries exist and that innovation in things like electronic records could be an important step forward to improve ME. Secondly, this study has clearly identified that further studies are required to explore the culture of medication safety in hospitals of the MOH.

5.4 5.4 Conclusion

The role of the nurse in the prevention of medication errors is both significant and complex. The various factors that can interfere with the safe administration of a medication may be considered separately or as a combination of factors each compounding the risk of an error. Given this and the devastating consequences of medication errors, this study sought to understand more clearly the factors influencing practice in several Saudi Arabian hospitals. The findings suggest that nurses perceive several factors, similar to those reported in literature that contribute to error. The difficulty of unclear or illegible medication orders is a primary factor reported by nurses in Saudi. This issue coupled with the diversity of different nationalities working in the Saudi health care system confirms that communication is one of the most significant factors affecting medication error.

References

Abdali, F, Abdulmutalib, I & AlNagshabandi, E 2017, 'Nurses' View about Contributing Factors and Reducing Strategies regarding Medication Administration Errors', *Journal of Nursing and Health Science*, vol. 6, no. 3, pp. 22-27.

ABS 2013, *Understanding statistics*, Australian Bureau of Statistics Australia.

Al-Jeraisy, MI, Alanazi, MQ & Abolfotouh, MA 2011, 'Medication prescribing errors in a pediatric inpatient tertiary care setting in Saudi Arabia', *BMC research notes*, vol. 4, no. 1, p. 294.

Albarrak, AI, Al Rashidi, EA, Fatani, RK, Al Ageel, SI & Mohammed, R 2014, 'Assessment of legibility and completeness of handwritten and electronic prescriptions', *Saudi Pharmaceutical Journal*, vol. 22, no. 6, pp. 522-527.

Aljadhey, H, Mahmoud, MA, Hassali, MA, Alrasheedy, A, Alahmad, A, Saleem, F, Sheikh, A, Murray, M & Bates, DW 2014, 'Challenges to and the future of medication safety in Saudi Arabia: A qualitative study', *Saudi Pharmaceutical Journal*, vol. 22, no. 4, pp. 326-332.

Aljuaid, M, Mannan, F, Chaudhry, Z, Rawaf, S & Majeed, A 2016, 'Quality of care in university hospitals in Saudi Arabia: a systematic review', *BMJ Open*, vol. 6, no. 2, p. e008988.

Alkhamis, A 2012, 'Health care system in Saudi Arabia: an overview', *Eastern Mediterranean Health Journal*, vol. 18, no. 10, pp. 1078-1080.

Alshaikh, M, Mayet, A & Aljadhey, H 2013, 'Medication error reporting in a university teaching hospital in Saudi Arabia', *Journal of patient safety*, vol. 9, no. 3, pp. 145-149.

Alsulami, Z, Conroy, S & Choonara, I 2013, 'Medication errors in the Middle East countries: a systematic review of the literature', *European journal of clinical pharmacology*, vol. 69, no. 4, pp. 995- 1008.

Anacleto, TA, Perini, E, Rosa, MB & César, CC 2005, 'Medication errors and drug-dispensing systems in a hospital pharmacy', *Clinics*, vol. 60, no. 4, pp. 325-332.

Anderson, P & Townsend, T 2010, 'Medication errors: Don't let them happen to you', *American Nurse Today*, vol. 5, no. 3, pp. 23-28.

Baghaei, R, Ghaderi, C, Naderi, J & Rahim, F 2015, 'The Rate and Type of Medication Errors Made By Nurses: A Study from Northwestern Iran', *Singapore Nursing Journal*, vol. 42, no. 3, pp. 12-16.

Barron, WM, Reed, RL, Forsythe, S, Hecht, D, Glen, J, Murphy, B, Lach, R, Flores, S, Tu, J & Concklin, M 2006, 'Implementing computerized provider order entry with an existing clinical information system', *The Joint Commission Journal on Quality and Patient Safety*, vol. 32, no. 9, pp. 506-516.

Berland, A & Bentsen, SB 2017, 'Medication errors in home care: a qualitative focus group study', Journal of Clinical Nursing

Biron, AD, Loiselle, CG & Lavoie-Tremblay, M 2009, 'Work interruptions and their contribution to medication administration errors: an evidence review', *Worldviews on Evidence-Based Nursing*, vol. 6, no. 2, pp. 70-86.

Brady, A, Malone, A & Fleming, S 2009, 'A literature review of the individual and systems factors that contribute to medication errors in nursing practice', *Journal of Nursing Management*, vol. 17, no. 6, pp. 679-697.

Calligaris, L, Panzera, A, Arnoldo, L, Londero, C, Quattrin, R, Troncon, MG & Brusaferro, S 2009, 'Errors and omissions in hospital prescriptions: a survey of prescription writing in a hospital', *BMC clinical pharmacology*, vol. 9, no. 1, p. 9.

Caplan, J 2007, 'Cause of Death: Sloppy Doctors', *Time*.

Cheragi, MA, Manoocheri, H, Mohammadnejad, E & Ehsani, SR 2013, 'Types and causes of medication errors from nurse's viewpoint', *Iranian journal of nursing and midwifery research*, vol. 18, no. 3, p. 228.

Chou, L-P, Li, C-Y & Hu, SC 2014, 'Job stress and burnout in hospital employees: comparisons of different medical professions in a regional hospital in Taiwan', *BMJ Open*, vol. 4, no. 2, p. e004185.

Clegg, A 2001, 'Occupational stress in nursing: a review of the literature', *Journal of Nursing Management*, vol. 9, no. 2, pp. 101-106.

Coombes, ID, Reid, C, McDougall, D, Stowasser, D, Duiguid, M & Mitchell, C 2011, 'Pilot of a national inpatient medication chart in Australia: improving prescribing safety and enabling prescribing training', *British journal of clinical pharmacology*, vol. 72, no. 2, pp. 338-349.

Deans, C 2005, 'Medication errors and professional practice of registered nurses', *Collegian*, vol. 12, no. 1, pp. 29-33.

Dingley, C, Daugherty, K, Derieg, MK & Persing, R 2008, 'Improving patient safety through provider communication strategy enhancements'.

Draugalis, JR, Coons, SJ & Plaza, CM 2008, 'Best practices for survey research reports: a synopsis for authors and reviewers', *American journal of pharmaceutical education*, vol. 72, no. 1, p. 11.

Ehsani, SR, Cheraghi, MA, Nejati, A, Salari, A, Esmaeilpoor, AH & Nejad, EM 2013, 'Medication errors of nurses in the emergency department', *Journal of medical ethics and history of medicine*, vol. 6.

Elo, S & Kyngäs, H 2008, 'The qualitative content analysis process', *Journal of Advanced Nursing*, vol. 62, no. 1, pp. 107-115.

Fahimi, F, Nazari, MA, Abrishami, R, Sistanizad, M, Mazidi, T, Faghihi, T, Soltani, R & Baniasadi, S 2009, 'Transcription errors observed in a teaching hospital', *Archives of Iranian Medicine (AIM)*, vol. 12, no. 2.

Flicek, CL 2012, 'Communication: A dynamic between nurses and physicians', *Medsurg Nursing*, vol. 21, no. 6, p. 385.

Giuliano, KK & Polanowicz, M 2008, 'Interpretation and use of statistics in nursing research', *AACN Advanced Critical Care*, vol. 19, no. 2, pp. 211-222.

Güneş, ÜY, Gürlek, Ö & Sönmez, M 2014, 'Factors contributing to medication errors in Turkey: nurses' perspectives', *Journal of Nursing Management*, vol. 22, no. 3, pp. 295-303.

Hair, JF, Anderson, RE, Tatham, RL & Black, WC 2010, *Multivariate data analysis*, Prentice Hall, Upper Saddle River, NJ.

Hayes, C, Jackson, D, Davidson, PM & Power, T 2015, 'Medication errors in hospitals: a literature review of disruptions to nursing practice during medication administration', *Journal of Clinical Nursing*, vol. 24, no. 21-22, pp. 3063-3076.

Helmreich, RL & Schaefer, H-G 1994, 'Team performance in the operating room'.

Hoffman, JM & Proulx, SM 2003, 'Medication errors caused by confusion of drug names', *Drug safety*, vol. 26, no. 7, pp. 445-452.

Hogg, A, Scullin, C, Luo, R, Currie, A, Scott, MG & McElnay, JC 2012, 'Do patient bedside medicine lockers result in a safer and faster medicine administration round?', *European Journal of Hospital Pharmacy: Science and Practice*, pp. ejhpharm-2012-000136.

Inch, J, Watson, MC, Anakwe-Umeh, S & Collaboration, YCS 2012, 'Patient versus healthcare professional spontaneous adverse drug reaction reporting', *Drug safety*, vol. 35, no. 10, pp. 807-818.

Ingham-Broomfield, R 2008, 'A nurses' guide to the critical reading of research', *Australian Journal of Advanced Nursing, The*, vol. 26, no. 1, p. 102.

Jeetu, G & Girish, T 2010, 'Prescription drug labeling medication errors: a big deal for pharmacists', *Journal of Young Pharmacists*, vol. 2, no. 1, pp. 107-111.

Johnson, M, Sanchez, P, Langdon, R, Manias, E, Levett Jones, T, Weidemann, G, Aguilar, V & Everett, B 2017, 'The impact of interruptions on medication errors in hospitals: an observational study of nurses', *Journal of Nursing Management*.

Jones, TA & Como, JA 2003, 'Assessment of medication errors that involved drug allergies at a university hospital', Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy, vol. 23, no. 7, pp. 855-860.

Kenagy, JW & Stein, GC 2001, 'Naming, labeling, and packaging of pharmaceuticals', *American Journal of Health-System Pharmacy*, vol. 58, no. 21, pp. 2033-2041.

Khowaja, K, Nizar, R, Merchant, RJ, Dias, J, Bustamante-Gavino, I & Malik, A 2008, 'A systematic approach of tracking and reporting medication errors at a tertiary care university hospital, Karachi, Pakistan', *Therapeutics and clinical risk management*, vol. 4, no. 4, p. 673.

King, WJ, Paice, N, Rangrej, J, Forestell, GJ & Swartz, R 2003, 'The effect of computerized physician order entry on medication errors and adverse drug events in pediatric inpatients', *Pediatrics*, vol. 112, no. 3, pp. 506-509.

Kohn, LT, Corrigan, JM & Donaldson, MS 2000, *To Err is Human: Building a Safer Health System.*, National Academies Press (US), Washington (DC).

Levin, KA 2006, 'Study design III: Cross-sectional studies', *Evidence-based dentistry*, vol. 7, no. 1, pp. 24-25.

Loiselle, C & Profetto-McGrath, J 2011, 'Canadian Essentials of Nursing Edition', Wolters

Kluwer Health, Lippincott Williams & Wilkins, Toronto, Canada.

MacPherson, R, Willcox, C, Chow, C & Wang, A 2006, 'Anaesthetist's responses to patients' self-reported drug allergies', *BJA: British Journal of Anaesthesia*, vol. 97, no. 5, pp. 634-639.

McBride-Henry, K & Foureur, M 2006, 'Medication administration errors: understanding the issues', *Australian Journal of Advanced Nursing, The*, vol. 23, no. 3, p. 33.

McGillis, HL, Pedersen, C, Hubley, P, Ptack, E, Hemingway, A, Watson, C & Keatings, M 2010, 'Interruptions and pediatric patient safety', *Journal of pediatric nursing*, vol. 25, no. 3, p. 167.

Ministry of Health 2014, *Annual Statistical Report*, Ministry of Health, Riyadh, <http://www.moh.gov.sa/Ministry/Statistics/book/Documents/%D8%A7%D9%84%D9%83%D8%A A%D8%A7%D8%A8%20%D8%A7%D9%84%D8%A5%D8%AD%D8%B5%D8%A7%D8%A6%D 9%8A%20%D8%A7%D9%84%D8%B3%D9%86%D9%88%D9%8A%20%D9%84%D8%B9%D8% A7%D9%85%201436%D9%87%D9%80.pdf>.

Monteiro, C, Avelar, AFM & Pedreira, MdLG 2015, 'Interruptions of nurses' activities and patient safety: an integrative literature review', *Revista latino-americana de enfermagem*, vol. 23, no. 1, pp. 169-179.

PA 2004, *Patient Safety Advisory* 4, vol. 1, Patient Safety Authority Pennsylvania, USA.

Parry, AM, Barriball, KL & While, AE 2015, 'Factors contributing to Registered Nurse medication administration error: A narrative review', *International Journal of Nursing Studies*, vol. 52, no. 1, pp. 403-420.

Phillips, DP, Christenfeld, N & Glynn, LM 1998, 'Increase in US medication-error deaths between 1983 and 1993', *The Lancet*, vol. 351, no. 9103, pp. 643-644.

Potter, P, Wolf, L, Boxerman, S, Grayson, D, Sledge, J, Dunagan, C & Evanoff, B 2005, 'Understanding the cognitive work of nursing in the acute care environment', *Journal of Nursing Administration*, vol. 35, no. 7-8, pp. 327-335.

Pournamdar, Z & Zare, Z 2016, 'Survey of Medication Error Factors from Nurses Perspective', *Biology and Medicine*, vol. 8, no. 310.

Richardson-Tench, M 2014, *Research in Nursing : Evidence for Best Practice*, revised edn, Cengage Learning Australia, South Melbourne, Australia.

Rivera-Rodriguez, A & Karsh, B-T 2010, 'Interruptions and distractions in healthcare: review and reappraisal', *Quality and Safety in Health Care*, vol. 19, no. 4, pp. 304-312.

Robinson, EJ, Bergey, MR, Brady, E, Mapp, AM & Goldsack, JC 2017, 'The Impact of an Electronic Medication Administration Record (eMAR) and Computerized Physician Order Entry (CPOE) on Nurse Extender and Unit Clerk Staffing.', *J Nurs Adm*, vol. 47, no. 12, pp. 610-615.

Rogers, AE, Hwang, W-T, Scott, LD, Aiken, LH & Dinges, DF 2004, 'The working hours of hospital staff nurses and patient safety', *Health affairs*, vol. 23, no. 4, pp. 202-212.

Roughead, EE & Semple, SJ 2009, 'Medication safety in acute care in Australia: where are we now? Part 1: a review of the extent and causes of medication problems 2002–2008', Australia and

New Zealand Health Policy, vol. 6, no. 1, p. 18.

Roughead, EE, Semple, SJ & Rosenfeld, E 2016, 'The extent of medication errors and adverse drug reactions throughout the patient journey in acute care in Australia', *International journal of evidence- based healthcare*, vol. 14, no. Medication Safety Issue: 3, pp. 113-122.

Salkind, NJ 2010, *Encyclopedia of research design*, vol. 1, Sage.

Sánchez, AdlMM 2013, 'Medication errors in a Spanish community pharmacy: nature, frequency and potential causes', *International journal of clinical pharmacy*, vol. 35, no. 2, pp. 185-189.

Sarafis, P, Rousaki, E, Tsounis, A, Malliarou, M, Lahana, L, Bamidis, P, Niakas, D & Papastavrou, E 2016, 'The impact of occupational stress on nurses' caring behaviors and their health related quality of life', *BMC nursing*, vol. 15, no. 1, p. 56.

Schneider, Z & Whitehead, D 2013, *Nursing and Midwifery Research methods and appraisal for evidence*, Mosby Elsevier, Australia.

Shahrokhi, A, Ebrahimpour, F & Ghodousi, A 2013, 'Factors effective on medication errors: A nursing view', *Journal of research in pharmacy practice*, vol. 2, no. 1, p. 18.

Shultz, J, Harvie, M, McDonald, D, Manley, J & Cole, M 2007a, 'Standardizing the storage and labelling of medications: Part 1', *The Canadian Journal of Hospital Pharmacy*, vol. 60, no. 2.

Shultz, J, Harvie, M, McDonald, D, Manley, J & Cole, M 2007b, 'Standardizing the storage and labelling of medications: Part 2', *The Canadian Journal of Hospital Pharmacy*, vol. 60, no. 3.

Sullivan, MD. Artino, A 2013 Analysing and Interpreting Data from Likert-Type Scales *Journal of Graduate Medical Education*, vol 5(4)

Sutcliffe, KM, Lewton, E & Rosenthal, MM 2004, 'Communication failures: an insidious contributor to medical mishaps', *Academic Medicine*, vol. 79, no. 2, pp. 186-194.

Taxis, K & Barber, N 2004, 'Incidence and severity of intravenous drug errors in a German hospital', *European journal of clinical pharmacology*, vol. 59, no. 11, pp. 815-817.

Topcu, I, Turkmen, AS, Sahiner, NC, Savaser, S & Sen, H 2017, 'Physicians' and nurses' medical errors associated with communication failures', *JPMA. The Journal of the Pakistan Medical Association*, vol. 67, no. 4, p. 600.

Toruner, EK & Uysal, G 2012, 'Causes, reporting, and prevention of medication errors from a pediatric nurse perspective', *Australian Journal of Advanced Nursing, The*, vol. 29, no. 4, p. 28.

Tsuji, T, Irisa, T, Ohata, S, Kokubu, C, Kanaya, A, Sueyasu, M, Egashira, N & Masuda, S 2015, 'Relationship between incident types and impact on patients in drug name errors: a correlational study', *Journal of pharmaceutical health care and sciences*, vol. 1, no. 1, p. 11.

Tsuji, T, Irisa, T, Tagawa, S, Kawashiri, T, Ikesue, H, Kokubu, C, Kanaya, A, Egashira, N & Masuda, S 2015, 'Differences in recognition of similar medication names between pharmacists and nurses: a retrospective study', *Journal of pharmaceutical health care and sciences*, vol. 1, no. 1, pp. 1-8.

Tucker, AL & Spear, SJ 2006, 'Operational failures and interruptions in hospital nursing', *Health services research*, vol. 41, no. 3p1, pp. 643-662.

van Rosse, F, Maat, B, Rademaker, CM, van Vught, AJ, Egberts, AC & Bollen, CW 2009, 'The effect of computerized physician order entry on medication prescription errors and clinical outcome in pediatric and intensive care: a systematic review', *Pediatrics*, vol. 123, no. 4, pp. 1184-1190.

Van Teijlingen, E & Hundley, V 2002, 'The importance of pilot studies', *Nursing standard*, vol. 16, no. 40, pp. 33-36.

Walsh, EK, Hansen, CR, Sahm, LJ, Kearney, PM, Doherty, E & Bradley, CP 2017, 'Economic impact of medication error: a systematic review', *Pharmacoepidemiology and Drug Safety*, vol. 5, no. 26, pp. 481-497.

Westbrook, JI, Woods, A, Rob, MI, Dunsmuir, WT & Day, RO 2010, 'Association of interruptions with an increased risk and severity of medication administration errors', *Archives of Internal medicine*, vol. 170, no. 8, pp. 683-690.

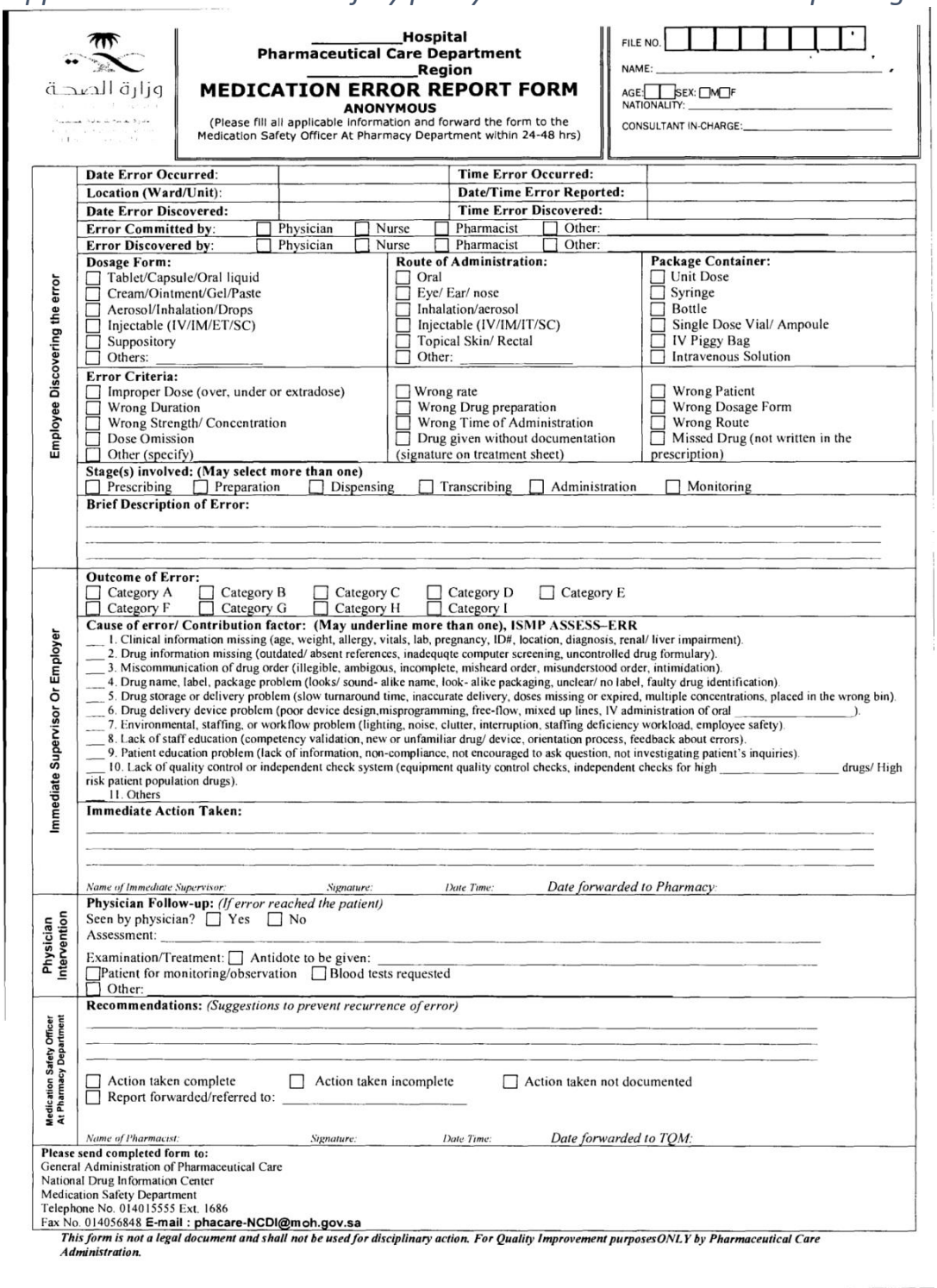
Wittich, CM, Burkle, CM & Lanier, WL 2014, 'Medication errors: an overview for clinicians', in *Mayo Clinic Proceedings*, Elsevier, vol. 89, pp. 1116-1125.

Woo, Y, Kim, HE, Chung, S & Park, BJ 2015, 'Pediatric medication error reports in Korea adverse event reporting system database, 1989-2012: comparing with adult reports', *Journal of Korean medical science*, vol. 30, no. 4, pp. 371-377.

You, M-A, Choe, M-H, Park, G-O, Kim, S-H & Son, Y-J 2015, 'Perceptions regarding medication administration errors among hospital staff nurses of South Korea', *International Journal for Quality in Health Care*, vol. 27, no. 4, pp. 276-283.

Appendices

Appendix 1: Medication safety policy and Medication Error Reporting Form



وزارة الصحة

_____Hospital
Pharmaceutical Care Department
_____Region

MEDICATION ERROR REPORT FORM
ANONYMOUS
(Please fill all applicable information and forward the form to the Medication Safety Officer At Pharmacy Department within 24-48 hrs)

FILE NO. ☐☐☐☐☐☐☐
NAME: _____
AGE: ☐☐ SEX: ☐M ☐F
NATIONALITY: _____
CONSULTANT IN-CHARGE: _____

Employee Discovering the error

Date Error Occurred:		**Time Error Occurred:**	
Location (Ward/Unit):		**Date/Time Error Reported:**	
Date Error Discovered:		**Time Error Discovered:**	

Error Committed by: ☐ Physician ☐ Nurse ☐ Pharmacist ☐ Other: _____
Error Discovered by: ☐ Physician ☐ Nurse ☐ Pharmacist ☐ Other: _____

Dosage Form:	**Route of Administration:**	**Package Container:**
☐ Tablet/Capsule/Oral liquid	☐ Oral	☐ Unit Dose
☐ Cream/Ointment/Gel/Paste	☐ Eye/ Ear/ nose	☐ Syringe
☐ Aerosol/Inhalation/Drops	☐ Inhalation/aerosol	☐ Bottle
☐ Injectable (IV/IM/ET/SC)	☐ Injectable (IV/IM/IT/SC)	☐ Single Dose Vial/ Ampoule
☐ Suppository	☐ Topical Skin/ Rectal	☐ IV Piggy Bag
☐ Others: _____	☐ Other: _____	☐ Intravenous Solution

Error Criteria:		
☐ Improper Dose (over, under or extradose)	☐ Wrong rate	☐ Wrong Patient
☐ Wrong Duration	☐ Wrong Drug preparation	☐ Wrong Dosage Form
☐ Wrong Strength/ Concentration	☐ Wrong Time of Administration	☐ Wrong Route
☐ Dose Omission	☐ Drug given without documentation (signature on treatment sheet)	☐ Missed Drug (not written in the prescription)
☐ Other (specify) _____		

Stage(s) involved: (May select more than one)
☐ Prescribing ☐ Preparation ☐ Dispensing ☐ Transcribing ☐ Administration ☐ Monitoring

Brief Description of Error:
_____
_____
_____

Immediate Supervisor Or Employer

Outcome of Error:
☐ Category A ☐ Category B ☐ Category C ☐ Category D ☐ Category E
☐ Category F ☐ Category G ☐ Category H ☐ Category I

Cause of error/ Contribution factor: (May underline more than one), ISMP ASSESS–ERR
___ 1. Clinical information missing (age, weight, allergy, vitals, lab, pregnancy, ID#, location, diagnosis, renal/ liver impairment).
___ 2. Drug information missing (outdated/ absent references, inadequqte computer screening, uncontrolled drug formulary).
___ 3. Miscommunication of drug order (illegible, ambigous, incomplete, misheard order, misunderstood order, intimidation).
___ 4. Drug name, label, package problem (looks/ sound- alike name, look- alike packaging, unclear/ no label, faulty drug identification).
___ 5. Drug storage or delivery problem (slow turnaround time, inaccurate delivery, doses missing or expired, multiple concentrations, placed in the wrong bin).
___ 6. Drug delivery device problem (poor device design,misprogramming, free-flow, mixed up lines, IV administration of oral _____).
___ 7. Environmental, staffing, or workflow problem (lighting, noise, clutter, interruption, staffing deficiency workload, employee safety).
___ 8. Lack of staff education (competency validation, new or unfamiliar drug/ device, orientation process, feedback about errors).
___ 9. Patient education problem (lack of information, non-compliance, not encouraged to ask question, not investigating patient's inquiries).
___ 10. Lack of quality control or independent check system (equipment quality control checks, independent checks for high _____ drugs/ High risk patient population drugs).
___ 11. Others

Immediate Action Taken:
_____
_____
_____

Name of Immediate Supervisor: *Signature:* *Date Time:* *Date forwarded to Pharmacy:*

Physician Intervention

Physician Follow-up: *(If error reached the patient)*
Seen by physician? ☐ Yes ☐ No
Assessment: _____
Examination/Treatment: ☐ Antidote to be given: _____
☐ Patient for monitoring/observation ☐ Blood tests requested
☐ Other: _____

Medication Safety Officer At Pharmacy Department

Recommendations: *(Suggestions to prevent recurrence of error)*
_____
_____
_____

☐ Action taken complete ☐ Action taken incomplete ☐ Action taken not documented
☐ Report forwarded/referred to: _____

Name of Pharmacist: *Signature:* *Date Time:* *Date forwarded to TQM:*

Please send completed form to:
General Administration of Pharmaceutical Care
National Drug Information Center
Medication Safety Department
Telephone No. 014015555 Ext. 1686
Fax No. 014056848 **E-mail : phacare-NCDI@moh.gov.sa**

This form is not a legal document and shall not be used for disciplinary action. For Quality Improvement purposesONLY by Pharmaceutical Care Administration.

1. If any caregiver observing, or involved in or discovering medication error, he/she shall attend to the "victim", i.e. patient, visitor or hospitals employee etc. and call for help as needed.
2. The caregiver should notify his/her Supervisor or Department Director /Head as soon as possible after the occurrence or discovery of the medication error and if the occurrence is severe, take immediate action.
3.The attending physician must be notified immediately to take action.
4. The Immediate Supervisor Or Employer must be notified to assess the outcome and to take action.
5. The patient shall be monitored for unwanted side effects.
6. **Documenting The Medication Error:**
6.1 The individual discovering the error must initiate documenting the medication error using the Medication Error Reporting Form. If he/she do not document his/her Immediate Supervisor should ask him/her to document it.
6.2 The following information in the Medication Error Report Form must be documented by the individual discovering the error:

- Patient's information
- Date Error Occurred
- Time Error Occurred
- Location (Ward/Unit)
- Date/Time Error Reported
- Date Error Discovered
- Time Error Discovered
- Error Committed by
- Error Discovered by
- Dosage Form
- Route of Administration
- Package Container
- Error Criteria
- Stage(s) involved
- Brief Description of Error

6.3 The following information in the Medication Error Report Form must be documented by the Immediate Supervisor Or Employer:

- Outcome of Error
- Cause of error/ Contribution factor
- Immediate Action Taken

6.4 Immediate Supervisor Or Employer should sign the and forward it to the Pharmacy Department.
6.5 The following information should document by the Immediate Supervisor Or Employer in case of error reached the patient that required physician intervention:

- Physician Follow-up

6.6 The completed Medication Error Report Form should be delivered to the Medication Safety Officer in the Pharmacy Department.

6.7 The following information in the Medication Error Report Form must be documented byMedication Safety Officer at the Pharmacy Department:

- Recommendations

6.8 Medication Safety Officer at the Pharmacy Department should document his/her suggestions to prevent recurrence of error based on his/her assessment of the action taken and document that and sign the Medication error form.

7. The Medication Safety Officer is responsible to send the completed form (and enter the data in the electronic form in MOH website) to the General Administration of Pharmaceutical Care, National Drug Information Center, Medication Safety Department using the Fax No. 014056848 or e-mail : phacare-NCDI@moh.gov.sa , if Medication Safety Officer need to contact the authorized pharmacist he/she should contact through telephone no. 014015555 Ext. 1686.

8. The Medication Safety Officer is responsible to keep all the original completed Medication Error Reporting Form in confidential manner. The Medication Safety Officer must not respond to any request from any employee asking for photocopying any Medication Error Reporting Form to prevent using it against anycare provider for disciplinary action.
9. The Medication Safety Officer is responsible to aggregate the data of all the medication errors reported and formulate a Monthly Medication ErrorsSummary Report .
10. The Director of Pharmacy or designee shall review all Monthly Medication Errors Summary Report.
11.The Medication Safety Officer is responsible to submit the Monthly Medication Errors Summary Report to :

- Quality Department
- PTC Committee
- Patient Safety Committee
- Medication Safety Committee

Note:Also The Medication Safety Officer is responsible to submit Report of independent case (considered as sentinel event) to them.
12. An investigation of the medication errorscauses and contributing factors should be performed and documented by the Medication Safety Officer in coordination by the affected Department(s)/assigned team,or RCA investigation if the case is considered as sentinel event.
13. Necessary action(s) should be taken with follow-up as necessary to decrease reoccurrence and to prevent medication error occurrence.

Appendix 2 Research Ethics Approval of Ministry of Health

Kingdom of Saudi Arabia
Ministry of Health
King Fahad Medical City
(162)

المملكة العربية السعودية
وزارة الصحة
مدينة الملك فهد الطبية
(١٦٢)

مدينة الملك فهد الطبية
King Fahad Medical City

IRB Registration Number with KACST, KSA: H-01-R-012
IRB Registration Number with OHRP/NIH, USA: IRB00010471
Approval Number Federal Wide Assurance NIH, USA: FWA00018774

June 7, 2017
IRB Log Number: 17-200E
Department: External
Category of Approval: EXEMPT

Dear Mohammed Al Qrishah,

I am pleased to inform you that your submission dated May 29, 2017 for the study titled '**The Factors Associated with the Occurrence of Medication Errors in the Ministry of Health Hospitals in Saudi Arabia: A Cross-Sectional Study of Nurses**' was reviewed and was approved. Please note that this approval is from the research ethics perspective only. You will still need to get permission from the head of department or unit in KFMC or an external institution to commence data collection.

We wish you well as you proceed with the study and request you to keep the IRB informed of the progress on a regular basis, using the IRB log number shown above.

Please be advised that regulations require that you submit a progress report on your research every 6 months. You are also required to submit any manuscript resulting from this research for approval by IRB before submission to journals for publication.

As a researcher you are required to have current and valid certification on protection human research subjects that can be obtained by taking a short online course at the US NIH site or the Saudi NCBE site followed by a multiple choice test. Please submit your current and valid certificate for our records. Failure to submit this certificate shall a reason for suspension of your research project.

If you have any further questions feel free to contact me.

Sincerely yours,

F M
Approved
07 JUN 2017
I R B

Prof. Omar H. Kasule
Chairman, Institutional Review Board (IRB)
King Fahad Medical City, Riyadh, KSA
Tel: + 966 1 288 9999 Ext. 26913
E-mail: okasule@kfmc.med.sa

Appendix 3 Flyer (English)

THE UNIVERSITY of ADELAIDE

CARING FOR LIFE

Hi I am Mohammed,

An emergency nurse and a researcher student at the University of Adelaide.

If you are a registered nurse and want to play a role and may help the Ministry of Health to reduce the occurrence of medication errors;

You will find me at the lectures hall of the hospital at break time from 12 noon to 1 pm or from 4 to 5 pm to participate in a nursing research questionnaire! The study is approved from The Research Ethics of Ministry of Health with the number (A00492) and the Human Research Ethics Committee (HREC) of the University of Adelaide with the number (H-2017-114).

The purpose of this questionnaire is to investigate the views of nurses of the factors associated with the occurrence of medication errors.

For more details, you can contact the Nursing Administration office.

See you there!

Appendix 4 flyer (Arabic)

THE UNIVERSITY of ADELAIDE

CARING FOR LIFE

مرحبا أنا محمد،

ممرض طوارئ وطالب باحث في جامعة أديلايد.

يرجى للممرضين والممرضات الذين قد يلعبون دوراً في مساعدة وزارة الصحة في الحد من حدوث الأخطاء الدوائية ،

تجدوني في قاعة المحاضرات في المستشفى في وقت الاستراحة من الساعة ١٢ ظهرا إلى ١ ظهرا أو من ٤ إلى ٥ مساء للمشاركة في استبيان بحثي تمريضي .الدراسة البحثية معتمدة من لجنة الأخلاقيات البحثية في وزارة الصحة برقم (A00492) ولجنة أخلاقيات الأبحاث البشرية في جامعة آديلايد برقم (H-2017-114).

الغرض من الاستبيان هو تقصي آراء الممرضين والممرضات حول العوامل المرتبطة بحدوث الأخطاء الدوائية.

لمزيد من التفاصيل، يرجى التواصل مع مكتب إدارة التمريض بالمستشفى.

اراكم هناك

Appendix 5 Participation information sheet

Attachment 1

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Factors Associated With the Occurrence of Medication Errors in the Ministry of Health Hospitals in Saudi Arabia: a Cross-Sectional Study of Nurses
HUMAN RESEARCH ETHICS COMMITTEE OF UNIVERSITY OF ADELAIDE APPROVAL NUMBER: H-2017-114
RESEARCH ETHICS COMMITTIEE OF MOH APPROVAL NUMBER: A00492
PRINCIPAL INVESTIGATOR: Dr Frank Donnelly
STUDENT RESEARCHER: Mohammad Hassan Al Qrishah
STUDENT'S DEGREE: MNurs

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?
The purpose of this cross sectional study is to investigate the views of nurses of the factors associated with medication errors. The study is exploratory and descriptive in nature. A convenience sample of 100 nurses (participants) will be invited from each of three hospitals within the Ministry of Health, Saudi Arabia.

Who is undertaking the project?
This project is being conducted by Mohammad Hassan Al Qrishah, a student researcher. This research will form the basis for a degree of Master of Nursing Science at the University of Adelaide under the supervision of Dr Frank Donnelly and Dr Rick Wiechula.

Why am I being invited to participate?
You are being invited to participate as you are a registered nurse who in your work setting, provides direct nursing care to patients. Those registered nurses who do not routinely administer or give medications to patients, and who are not registered as a "registered nurse" in the Saudi Commission for Health Specialties are not eligible to participate.

What will I be asked to do?
If you agree to participate you will be required to answer a brief questionnaire. The student researcher will provide a brief information session about the project (15-20 minutes) prior to distribution of the questionnaire.

How much time will the project take?
The questionnaire should take around 30 minutes to complete.

Are there any risks associated with participating in this project?
A small potential risk may be that a participant will be uncomfortable when recalling a previous incident related to a medication error. If so, the participant will be advised to seek out the established support unit (staff counselling service) within the hospital. Information provided may be required by law as evidence in a legal or disciplinary proceeding.

What are the benefits of the research project?
It is anticipated that the main benefit may be to better inform the Ministry of Health to enhance patient safety and ideally reduce the occurrence of future medication errors. It is unlikely there will be any immediate benefits to the participants.

Can I withdraw from the project?
Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time however on submission of the completed questionnaire into the locked collection box there will not be an opportunity to withdraw the data as there will not be any identifying details of participants. If you decide to not participate there is no ongoing impact on any aspect of your work or employment.

1

What will happen to my information?

The completed questionnaires will be collated and a database of responses will be created to provide an opportunity for statistical analysis. The hard copy questionnaires will be stored within the University of Adelaide Nursing School within a locked cupboard. Only the student researcher and the supervisors will have access to the data. Once the data is transcribed into an electronic database, the data will be both password and firewall protected for a period of five years.

The data analysis and findings will be used to satisfy the requirements of a Master of Nursing science program of study. It is intended that the aggregated data and findings will be published in peer review journal and made available to the Ministry of Health through the Nursing Management Offices of the hospitals involved.

At no stage will participants be identified in any aspect of data collection, analysis or publication. As a time limited project there is no requirement or expectation that the data will be used in any future research.

Who do I contact if I have questions about the project?

Participants may contact any member of the research team.

Name	Title	Telephone number	Email	Role
Frank Donnelly	Dr	+61 08 8313 3639	frank.donnelly@adelaide.edu.au	Primary contact - Principal Investigator
Mohammad Hassan Al Qrishah	Mr	0424 495 732	mohammad.alqrishah@student.adelaide.edu.au	Student researcher
Rick Wiechula	Dr	+61 08 8313 3594	rick.wiechula@adelaide.edu.au	Co-supervisor

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2017-114) and The Research Ethics Committee of Ministry of Health (approval number A00429). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding a concern or complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on:

Phone: +61 8 8313 6028 Email: hrec@adelaide.edu.au
Post: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000
Or
Research Coordinator
Directorate of health affairs - Jeddah
Medical Research and Studies Department
Tel: +966126347334; E-mail: research-jeddah@moh.gov.sa

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?

If you agree to participate please complete the questionnaire that is provided to you. Do not identify yourself in any way on the questionnaire. When completed please seal the questionnaire in the envelope provided and deposit into the box provided. Completion and submission of the questionnaire indicates that you understand the project as described in the information sheet and you consent to being involved. Thank you for your consideration in this project.

Yours sincerely,
Dr Frank Donnelly
Mr Mohammad Hassan Al Qrishah
Dr Rick Wiechula

Appendix 6 Appendix information sheet (Arabic)

THE UNIVERSITY of ADELAIDE

ورقة معلومات المشارك

عنوان المشروع البحثي: العوامل المرتبطة بحدوث الأخطاء الدوائية في مستشفيات وزارة الصحة في المملكة العربية السعودية - دراسة مستعرضة للممرضين والممرضات
رقم موافقة لجنة أخلاقيات البحوث الإنسانية في جامعة أديلايد : H-2017 114
رقم موافقة لجنة الأخلاقيات البحثية بوزارة الصحة: A00492
الباحث الرئيسي: الدكتور فرانك دونيلي
الباحث الطالب: محمد حسن ال قريشة
درجة الطالب: ماجستير في التمريض

عزيزي المشارك، عزيزتي المشاركة

أنتم مدعوين للمشاركة في مشروع البحث الموصوف أدناه.

حول ماذا هذا المشروع ؟

الغرض من هذه الدراسة المستعرضة هو تقصي آراء الممرضين والممرضات حول العوامل المرتبطة بحدوث الأخطاء الدوائية. الدراسة استكشافية ووصفية بطبيعتها. سيتم دعوة عينة من 100 ممرض و ممرضة (كمشاركين) من كل مستشفى من ثلاثة مستشفيات من مستشفيات وزارة الصحة بالمملكة العربية السعودية.

من الذي يقوم بالمشروع؟

هذا المشروع يقوم به محمد حسن ال قريشة، طالب باحث. وسوف يشكل هذا البحث أساسا لدرجة الماجستير في علوم التمريض في جامعة أديلايد تحت إشراف الدكتور فرانك دونيلي والدكتور ريك ويتشولا.

لماذا يتم دعوتي للمشاركة؟

يتم دعوتك للمشاركة كممرض/ممرضة مسجل/مسجلة في مكان عملك، وتوفر/توفري رعاية تمريضية مباشرة للمرضى. هؤلاء الممرضين/الممرضات المسجلين/المسجلات الذين لا يقومون بحقن المرضى أو إعطاءهم الأدوية، والذين لم يتم تسجيلهم كممرضين/ممرضات مسجلين/مسجلات في الهيئة السعودية للتخصصات الصحية غير مؤهلين/مؤهلات للمشاركة.

ماذا سيطلب مني أن أفعل؟

إذا كنت توافق/توافقين على المشاركة سوف تكون هناك حاجة للرد على استبيان موجز. سيقوم الباحث الطالب بتقديم جلسة معلومات موجزة عن المشروع (15-20 دقيقة) قبل توزيع الاستبيان.

كم من الوقت سوف يستغرق المشروع؟

يجب أن يستغرق الاستبيان حوالي 30 دقيقة.

هل هناك أي مخاطر مرتبطة بالمشاركة في هذا المشروع؟

قد تكون المخاطر المحتملة صغيرة حيث أن المشارك/المشاركة قد يشعرو بعدم الراحة عند استذكار حادث سابق يتعلق بالأخطاء الدوائية. إذا حدث ذلك الأمر، سيتم نصح المشارك / المشاركة في البحث بالتوجه إلى وحدة الدعم (خدمة تقديم المشورة للموظفين) داخل المستشفى . يمكن أن تكون المعلومات المقدمة بموجب القانون دليلا في الإجراءات القانونية أو التأديبية.

ما هي فوائد مشروع البحث؟

من المتوقع أن تكون الفائدة الرئيسية هي اطلاع وزارة الصحة بشكل أفضل من أجل تعزيز سلامة المرضى والحد الأمثل من حدوث الأخطاء الدوائية في المستقبل. من غير المرجح أن يكون هناك أي فوائد فورية للمشاركين.

3

هل يمكنني الانسحاب من المشروع؟

المشاركة في هذا المشروع طوعية تماما. إذا كنت توافق على المشاركة، يمكنك الانسحاب من الدراسة في أي وقت قبل وضع الاستبيان المكتمل في صندوق جمع مغلق; لن تكون هناك فرصة لسحب البيانات لأنه لن يكون هناك أي تفاصيل تحدد المشاركين. إذا قررت عدم المشاركة فلا يوجد أي تأثير سيجري على أي جانب من جوانب عملك أو وظيفتك.

ماذا سيحدث لمعلوماتي؟

سيتم تجميع الاستبيانات المكتملة وستنشأ قاعدة بيانات للاجابات لإتاحة الفرصة لإجراء التحليل الإحصائي. سيتم تخزين الاستبيانات الورقية داخل كلية التمريض في جامعة أديلايد داخل خزانة مقفلة. فقط الباحث الطالب والمشرفين سوف يستطيعو الوصول إلى البيانات. عندما يتم نسخ البيانات مرة واحدة إلى قاعدة بيانات إلكترونية، البيانات سوف تكون محمية بكلمة مرور وجدار حماية لمدة خس سنوات.

سيتم استخدام تحليل البيانات والنتائج لتلبية متطلبات الدراسة في برنامج الماجستير في علوم التمريض. من المزمع نشر البيانات المجمعة والنتائج في مجلة علمية مُراجَعة وإتاحتها لوزارة الصحة من خلال مكاتب إدارة التمريض في المستشفيات المعنية.

لن يتم في أي مرحلة تحديد المشاركين في أي جانب من جوانب جمع البيانات أو تحليلها أو نشرها. كمشروع محدد الوقت، لا يوجد أي شرط أو توقُّع بأن البيانات سوف تستخدم في أي بحث في المستقبل.

من الذي أتصل به إذا كانت لدي أسئلة حول المشروع؟

يمكن للمشاركين الاتصال بأي عضو من أعضاء الفريق البحثي.

الاسم	البريد الإلكتروني	رقم الهاتف	اللقب	الدور في البحث
فرانك دونلي	frank.donnelly@adelaide.edu.au	+61 08 8313 3639	الدكتور	الباحث الرئيسي
محمد حسن آل قريشه	mohammad.alqrishah@student.adelaide.edu.au	+61 424 495 732	السيد	الطالب الباحث
ريك ويتشولا	rick.wiechula@adelaide.edu.au	+61 08 8313 3594	الدكتور	المشرف المساعد

ماذا لو كان لدي شكوى أو أي مخاوف؟

تمت الموافقة على الدراسة من قبل لجنة أخلاقيات البحوث البشرية في جامعة أديلايد ، رقم الموافقة (H-2017-114) . وتمت الموافقة أيضاً من لجنة الأخلاقيات البحثية التابعة لوزارة الصحة برقم (A00429). إذا كانت لديك أسئلة أو مشاكل مرتبطة بالجوانب العملية لمشاركتك في المشروع، أو ترغب في إثارة مخاوف أو شكوى حول المشروع، فيجب عليك استشارة المحقق الرئيسي. إذا كنت ترغب في التحدث مع شخص مستقل فيما يتعلق بقلقك أو شكوى أو حول سياسة الجامعة للبحوث التي تنطوي على مشاركين بشر ، أو حقوقك كمشارك/مشاركة، يرجى التواصل مع سكرتارية لجنة أخلاقيات الأبحاث البشرية على:

الهاتف: 6028 8313 8 61+
البريد الإلكتروني: hrec@adelaide.edu.au
العنوان البريدي: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000
أو
منسق الأبحاث
مديرية الشؤون الصحية - جدة
قسم البحوث الطبية والدراسات
هاتف: 966126347334
البريد الإلكتروني: research-jeddah@moh.gov.sa

وسيتم التعامل مع أي شكوى أو موضوع مقلق بسرية وبتحقيق الكامل. سيتم إعلامك بالنتيجة.

إذا أردت المشاركة، ماذا أفعل؟
إذا كنت توافق على المشاركة يرجى إكمال الاستبيان الذي تم تقديمه لك. لا تحدد هويتك بأي شكل من الأشكال على الاستبيان. عند الانتهاء يرجى وضع الاستبيان في المغلف ثم وضعه في الصندوق المغلق. يشير إكمال الاستبيان وتقديمه إلى أنك تفهم المشروع البحثي كما هو موضح في ورقة المعلومات وتوافق على المشاركة. شكرا لكم على اهتمامكم في هذا المشروع البحثي.

تفضلو بقبول فائق التحيات،

د. فرانك دونلي
محمد حسن آل قريشه
د. ريك ويتشولا

Appendix 7 English Questionnaire

THE UNIVERSITY of ADELAIDE

Dear participant,

I appreciate your participation in this study.

This study aims to investigate factors associated with medication errors in Ministry of Health hospitals in Saudi Arabia. Your feedback may play a role and help the Ministry of Health to reduce the occurrence of medication errors.

Section 1: Biographical information

1. Your gender: ☐ Male ☐ Female
2. Your age: ____
3. Your nationality: _____

4. Please tick your main area of nursing practice:

☐ Surgical	☐ Medical	☐ Labour and delivery
☐ Emergency	☐ Paediatric	☐ Operation theatre
☐ Gynaecology	☐ Cardiac care	☐ Orthopaedic
☐ Palliative care	☐ Intensive care	☐ Acute care
☐ Renal dialysis	☐ Oncology	☐ Neurology
☐ Other		

5. What is the highest nursing qualification you have obtained?

☐ Diploma	☐ Bachelor	☐ Postgraduate diploma
☐ Masters	☐ PhD/Doctor of Nursing	

1 | Page

6. How many years have you been practicing as a nurse?

☐ 0-2 years ☐ 3–5 years ☐ 6–9 years ☐ 10–13 years ☐ More than 13 years

7. On average how many hours do you work each day as a nurse?

☐ Less than 8 hrs ☐ 8 hrs ☐ 9hrs ☐ 10 hrs ☐ 11 hrs ☐ 12 hrs

8. On average how many days do you work in a 7 day week?

☐ 3 days ☐ 4 days ☐ 5 days ☐ 6 days ☐ 7 days

9. On average how many patients do you provide direct nursing care to in a day?

☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ 10-12 ☐ More than 12 pts

10. In the last two years have you attended any training courses, seminars or conferences related to medication errors or medication safety?

☐ Yes ☐ No

11. Have you ever reported any medication errors during your nursing career either to senior staff or through other reporting or feedback mechanisms?

☐ Yes ☐ No

12. Approximately, how many medication errors have you been aware of during your nursing career either directly or indirectly?

☐ None

☐ 1-5

☐ 6-10

☐ 11-15

☐ 16-20

☐ 20 and above

■ Section 2: Nurses' perspectives of factors associated with medication errors

Please rate your opinion regarding the factors associated with medication errors. Please place an X, under the description that most closely describes your overall opinion.

- Communication and language related-factors	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1- Medication errors occur when doctors write unclear or illegible medication orders or prescriptions.	☐	☐	☐	☐	☐
2- Medication errors occur when there is poor communication between nurses and physicians	☐	☐	☐	☐	☐
3- Medication errors occur when there is a language barrier between nurses and their patients.	☐	☐	☐	☐	☐
4- Medication errors occur more frequently with verbal orders.	☐	☐	☐	☐	☐
5- Medication errors occur more often when doctors make frequent changes to orders	☐	☐	☐	☐	☐

Please rate your opinion regarding the factors associated with medication errors. Please place an X, under the description that most closely describes your overall opinion.

- Labelling and Packaging related factors	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
6- Medication errors occur when nurses store medications with similar packaging at the same location or in close proximity to each other.	☐	☐	☐	☐	☐
7- Medication errors occur because of the similarity in the appearance of medications.	☐	☐	☐	☐	☐
8- Medication errors occur because the names of many medications are similar.	☐	☐	☐	☐	☐
9- Medication errors occur because some medications do not have an alert label.	☐	☐	☐	☐	☐
10- Medication errors occur because medications are poorly labelled	☐	☐	☐	☐	☐

Please rate your opinion regarding the factors associated with medication errors. Please place an X, under the description that most closely describes your overall opinion.

- Transcription related factors	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
11- Medication errors occur because nurses use non-standard abbreviations.	☐	☐	☐	☐	☐
12- Medication errors occur because errors are made in the medication administration record (Kardex).	☐	☐	☐	☐	☐

Please rate your opinion regarding the factors associated with medication errors. Please place an X, under the description that most closely describes your overall opinion.

Working environment related factors	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
13- Medication errors occur because of interruptions while preparing or administering medications	☐	☐	☐	☐	☐
14- Medication errors occur because of staff shortages	☐	☐	☐	☐	☐
15- Medication errors occur because of heavy workloads of nurses	☐	☐	☐	☐	☐
16- Medication errors occur because of long working hours	☐	☐	☐	☐	☐
17- Medication errors occur because the working environment is stressful.	☐	☐	☐	☐	☐
18- Medication errors occur because the working environment is noisy	☐	☐	☐	☐	☐
19- Medication errors occur because there is no suitable place for preparing medications in the ward/unit	☐	☐	☐	☐	☐
20- Medication errors occur because new graduate nurses have a short or insufficient orientation program	☐	☐	☐	☐	☐

Please rate your opinion regarding the factors associated with medication errors. Please place an X, under the description that most closely describes your overall opinion.

- Pharmacy related factors	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
21-Medication errors occur because of the lack of medication safety education programs in the hospital	☐	☐	☐	☐	☐
22-Medication errors occur because pharmacists are not available 24 hours a day	☐	☐	☐	☐	☐
23-Medication errors occur because of delay in delivering medications from the pharmacy	☐	☐	☐	☐	☐

Please rate your opinion regarding the factors associated with medication errors. Please place an X, under the description that most closely describes your overall opinion.

- Nurses related factors	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
24-Medication errors occur because nurses do not check patient allergy status	☐	☐	☐	☐	☐
25-Medication errors occur because nurses have poor mathematical skills for drug dose calculation	☐	☐	☐	☐	☐
26-Medication errors occur because nurses fail to check the patient's identification band	☐	☐	☐	☐	☐
27- Medication errors occur because nurses fear being punished for making an error	☐	☐	☐	☐	☐
28- Medication errors occur because nurses are not aware of using the 'medication administration rights' in their practice.	☐	☐	☐	☐	☐

Appendix 8 Arabic Questionnaire

THE UNIVERSITY of ADELAIDE

عزيزي المشارك، عزيزتي المشاركة

أقدر موافقتكم على المشاركة في هذه الدراسة.

تهدف هذه الدراسة إلى تقصي العوامل المرتبطة بحدوث الأخطاء الدوائية في مستشفيات وزارة الصحة في المملكة العربية السعودية. رأيك قد يلعب دورا و قد يساعد وزارة الصحة في في تقليل حدوث الأخطاء الدوائية.

■ القسم الأول: المعلومات الشخصية:

١- جنسك: ☐ ذكر ☐ أنثى

٢- عمرك: _____

٣- جنسيتك: _____

٤- يرجى وضع علامة X على القسم الذي تعمل / تعملي به حالياً من الأقسام التالية:

☐ الجراحة ☐ الباطنية ☐ المخاض والولادة

☐ الطوارئ ☐ الأطفال ☐ العمليات والافاقة

☐ الأمراض النسائية ☐ العناية القلبية ☐ العظام

☐ العناية التلطيفية ☐ العناية المركزة ☐ العناية الحادة

☐ الغسيل الكلوي ☐ الأورام ☐ الأعصاب

☐ قسم آخر .....

٥- ماهي أعلى المؤهلات العلمية التمريضية التي حصلت/حصلتي عليها؟

☐ دبلوم ☐ بكالوريوس ☐ دبلوم ما بعد البكالوريوس ☐ ماجستير ☐ دكتوراه

٦ - كم عدد سنوات التي مارست/مارستي فيها العمل كـ ممرض/ممرضة؟

☐ من 0 إلى 2 سنة ☐ من 3 إلى 5 سنوات ☐ من 6 سنوات إلى 9 سنوات

☐ من 10 سنوات إلى 13 سنة ☐ أكثر من 13 سنة

٧- في المتوسط ، كم ساعة تعمل / تعملي في اليوم الواحد كممرض/ممرضة ؟

☐ أقل من 8 ساعات ☐ 8 ساعات ☐ 9 ساعات ☐ 10 ساعات ☐ 11 ساعة ☐ 12 ساعة

٨- في المتوسط ، كم عدد الأيام التي تعملها / تعمليها في الأسبوع الواحد من سبعة أيام ؟

☐ 3 أيام ☐ 4 أيام ☐ 5 أيام ☐ 6 أيام

☐ 7 أيام

٩- في المتوسط، كم عدد المرضى الذي تقدم / تقدمي لهم الرعاية التمريضية المباشرة في اليوم الواحد؟

☐ 1 - 3 مرضى ☐ 4 - 6 مرضى ☐ 7 - 9 مرضى ☐ 10 - 12 مريض ☐ أكثر من 12 مريض

١٠- في العامين الماضيين هل حضرت / حضرتي أي دورات تدريبية أو ندوات أو مؤتمرات تتعلق بالاخطاء الدوائية أو السلامة الدوائية؟

☐ نعم ☐ لا

١١- هل سبق لك أن أبلغت عن أي أخطاء دوائية أثناء حياتك المهنية التمريضية سواءً كان البلاغ لرؤساء الوحدة التمريضية بالقسم أو عن طريق رفع تقرير أو تقنية ردود الفعل (Feedback mechanism) ؟

☐ نعم ☐ لا

١٢- تقريباً، كم عدد الأخطاء الدوائية التي كنتَ/كنتِ على إدراك بها طوال ممارستك لمهنة التمريض سواء أكان الخطأ بشكل مباشر أو بشكل غير مباشر؟

لا يوجد	
1 إلى 5	
6 إلى 10	
11 إلى 15	
16 إلى 20	
أكثر من 20 خطأ	

■ القسم الثاني: وجهة نظر الطاقم التمريضي حول العوامل المرتبطة مع حدوث الأخطاء الدوائية

يرجى تقييم رأيك بشأن العوامل المرتبطة بحدوث الأخطاء الدوئية. يرجى وضع علامة **X** على المربع الذي يصف بشكل وثيق رأيك العام.

عوامل تتعلق باللغة والتواصل	أتفق بشدة	اتفق	رأي محايد	لا أتفق	لا أتفق بشدة
١- تحدث الأخطاء الدوائية عندما يقوم الأطباء بكتابة أوامر دوائية أو وصفات طبية بشكل غير واضح أو لا يمكن قراءتها.	☐	☐	☐	☐	☐
٢- تحدث الأخطاء الدوائية عندما يكون هناك ضعف في التواصل بين الطاقم التمريضي والأطباء	☐	☐	☐	☐	☐
٣- تحدث الأخطاء الدوائية عندما يكون هناك حاجز لغوي بين الطاقم التمريضي ومرضاهم	☐	☐	☐	☐	☐
٤- تحدث الأخطاء الدوائية بشكل أكثر تكراراً مع الأوامر الدوائية الشفوية.	☐	☐	☐	☐	☐
٥- تحدث الأخطاء الدوائية في كثير من الأحيان عندما يقوم الأطباء بإجراء تغييرات متكررة على الأوامر الدوائية	☐	☐	☐	☐	☐

يرجى تقييم رأيك بشأن العوامل المرتبطة بحدوث الأخطاء الدوئية. يرجى وضع علامة **X** على المربع الذي يصف بشكل وثيق رأيك العام.

عوامل تتعلق بتخزين الأدوية ووضع الملصق الدوائي	أتفق بشدة	اتفق	رأي محايد	لا أتفق	لا أتفق بشدة
٦- تحدث الأخطاء الدوائية عندما يقوم الطاقم التمريضي بتخزين الأدوية في نفس المكان أو في مكان قريب إلى بعضهم البعض.	☐	☐	☐	☐	☐
٧- تحدث الأخطاء الدوائية بسبب التشابه في مظهر الأدوية.	☐	☐	☐	☐	☐
٨- تحدث الأخطاء الدوائية بسبب التشابه في أسماء الأدوية.	☐	☐	☐	☐	☐
٩- تحدث الأخطاء الدوائية لأن بعض الأدوية لا تحتوي على ملصق تحذيري	☐	☐	☐	☐	☐
١٠- تحدث الأخطاء الدوائية بسبب أن الأدوية التي تأتي من الصيدلية تحتوي على ملصقات رديئة التعريف	☐	☐	☐	☐	☐

يرجى تقييم رأيك بشأن العوامل المرتبطة بحدوث الأخطاء الدوئية. يرجى وضع علامة **X** على المربع الذي يصف بشكل وثيق رأيك العام.

عوامل تتعلق بنسخ وتملية الأدوية	أتفق بشدة	اتفق	رأي محايد	لا أتفق	لا أتفق بشدة
١١- تحدث الأخطاء الدوائية لأن الطاقم التمريضي يقوم باستعمال الإختصارات الغير معتاد استخدامها.	☐	☐	☐	☐	☐
١٢- تحدث الأخطاء الدوائية بسبب وجود أخطاء في سجل إعطاء الأدوية (**Kardex**) .	☐	☐	☐	☐	☐

يرجى تقييم رأيك بشأن العوامل المرتبطة بحدوث الأخطاء الدوئية. يرجى وضع علامة **X** على المربع الذي يصف بشكل وثيق رأيك العام.

عوامل تتعلق ببيئة العمل	أتفق بشدة	اتفق	رأي محايد	لا أتفق	لا أتفق بشدة
١٣- تحدث الأخطاء الدوائية بسبب التشويش الذي يحصل أثناء تحضير أو اعطاء أو حقن الدواء	☐	☐	☐	☐	☐
١٤- تحدث الأخطاء الدوائية بسبب النقص في عدد الممرضين/الممرضات	☐	☐	☐	☐	☐
١٥- تحدث الأخطاء الدوائية بسبب زيادة العبء التمريضي على الممرضين/الممرضات.	☐	☐	☐	☐	☐
١٦- تحدث الأخطاء الدوائية بسبب ساعات العمل الطويلة.	☐	☐	☐	☐	☐
١٧- تحدث الأخطاء الدوائية لأن بيئة العمل مجهدة.	☐	☐	☐	☐	☐
١٨- تحدث الأخطاء الدوائية لأن بيئة العمل مزعجة.	☐	☐	☐	☐	☐
١٧- تحدث الأخطاء الدوائية لأنه لا يوجد مكان مناسب لتحضير الأدوية في الجناح/القسم	☐	☐	☐	☐	☐
١٨- تحدث الأخطاء الدوائية لأن الممرضين/الممرضات حديثي التخرج حضروا برنامج تمهيدي (**orientation**) قصير أو غير كافي	☐	☐	☐	☐	☐

يرجى تقييم رأيك بشأن العوامل المرتبطة بحدوث الأخطاء الدوئية. يرجى وضع علامة X على المربع الذي يصف بشكل وثيق رأيك العام.

عوامل تتعلق بالأمور الصيدلانية	أتفق بشدة	اتفق	رأي محايد	لا أتفق	لا أتفق بشدة
٢١- تحدث الأخطاء الدوائية بسبب النقص في البرامج التثقيفية للسلامة الدوائية في المستشفى	☐	☐	☐	☐	☐
٢٢- تحدث الأخطاء الدوائية لأن الصيادلة غير متوفرين 24 ساعة في اليوم	☐	☐	☐	☐	☐
٢٣- تحدث الأخطاء الدوائية بسبب التأخير في توصيل الأدوية من الصيدلية	☐	☐	☐	☐	☐

يرجى تقييم رأيك بشأن العوامل المرتبطة بحدوث الأخطاء الدوئية. يرجى وضع علامة X على المربع الذي يصف بشكل وثيق رأيك العام.

عوامل تتعلق بالطاقم التمريضي	أتفق بشدة	اتفق	رأي محايد	لا أتفق	لا أتفق بشدة
٢٤- تحدث أخطاء الدواء لأن الممرضين/الممرضات لا يتحققون من حالة الحساسية لدى المريض	☐	☐	☐	☐	☐
٢٥- تحدث الأخطاء الدوائية بسبب افتقار الممرضين/الممرضات لبعض المهارات الحسابية لحساب جرعة الدواء	☐	☐	☐	☐	☐
٢٦- تحدث الأخطاء الدوائية بسبب عدم تحقق الممرضين/الممرضات من سوار هوية المريض.	☐	☐	☐	☐	☐
٢٧- تحدث الأخطاء الدوائية بسبب خوف الممرضين/الممرضات من العقاب الذي قد يترتب على ارتكاب خطأ الدوائي.	☐	☐	☐	☐	☐
٢٨- تحدث الأخطاء الدوائية بسبب عدم إدراك الممرضين/الممرضات لاستخدام "قواعد إعطاء/حقن الأدوية" في ممارستهم التمريضية.	☐	☐	☐	☐	☐

Appendix 9 Validation letter

Mohammad AL-Qrishah
Student # A1636878
2 Searange CT
Grange, 5022, SA
a1636878@student.adelaide.edu.au

Dr Maram Banakhar
Assistant Professor - School of Nursing
King Abdul-Aziz University

April 7, 2017

Dear Dr Maram,

I am in my second year of a Master of Science in Nursing degree at the University of Adelaide. I sincerely ask for your assistance for validation of my questionnaire for my thesis entitled "the Factors Associated with the Occurrence of Medication Errors in Ministry of Health Hospitals in Saudi Arabia: A Cross-Sectional study of nurses". I am being supervised by Dr Frank Donnelly and Dr Rick Wiechula.

The purpose from this cross-sectional descriptive study is to investigate nurses' views on factors associated with occurrence of medication errors in Ministry of Health hospitals in Saudi Arabia.

Your letter of support before 19th April 2017 will be highly appreciated.

Yours sincerely,

Mohammad AL-Qrishah

Encl:

- Research proposal
- Arabic questionnaire
- English questionnaire

Appendix 10 Human Research Ethics Committee of University of Adelaide Approval

THE UNIVERSITY of ADELAIDE

RESEARCH SERVICES
OFFICE OF RESEARCH ETHICS, COMPLIANCE AND INTEGRITY

SABINE SCHREIBER
SECRETARY
HUMAN RESEARCH ETHICS COMMITTEE
THE UNIVERSITY OF ADELAIDE
LEVEL 4, RUNDLE MALL PLAZA
50 RUNDLE MALL
ADELAIDE SA 5000 AUSTRALIA
TELEPHONE +61 8 8313 6028
FACSIMILE +61 8 8313 3700
email: hrec@adelaide.edu.au
CRICOS Provider Number 00123M

Applicant: Dr F Donnelly

School: School of Nursing

Project Title: ***The factors associated with the occurrence of medication errors in the Ministry of Health hospitals in Saudi Arabia: a cross-sectional study of nurses***

THE UNIVERSITY OF ADELAIDE HUMAN RESEARCH ETHICS COMMITTEE

Project No: **H-2017-114** RM No: 0000022387

APPROVED for the period until: **31 July 2020**

Thank you for your responses dated 05.07.2017, 06.07.2017, and 14.07.2017 to the matters raised.

It is noted this study includes Mohammad Hassan Al Qrishah, Masters student.

Refer also to the accompanying letter setting out requirements applying to approval.

for **Professor Paul Delfabbro** **Date: 14 July 2017**
Convenor
Human Research Ethics Committee