Deanship of Graduate Studies

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Assessment of Nurses Perception towards Medication Errors in Palestinian Hospitals

Reda Radwan Sabri Silmi

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Assessment of Nurses Perception towards Medication Errors in Palestinian Hospitals

Prepared By:

Reda Radwan Sabri Silmi

B.Sc. Pharmacy- Al Quds University-Palestine

Supervisor

Motasem Hamdan, Ph.D.

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Prepared by: Reda R. Silmi

Registration No.: 21210057

Supervisor: Motasem Hamdan, Ph.D.

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The names and signatures of the examining committee members are as follows:

Head of committee: Dr. Motasem Hamdam	Signature: ……
Internal examiner: Dr. Hussein Hallaq	Signature: ……
External examiner: Dr. Hussein Jabareen	Signature: …….....

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Declaration

I certify that this thesis submitted for the degree of masters, is the result of my own research, except where otherwise acknowledged and that this thesis –or any part of the same material- has not been submitted for a higher degree to any other university or institution.

Signature: …….

Reda Radwan Sabri Silmi

Date: July 04, 2015

Dedication

To my parents

To my husband

To my sisters and brothers

To my friends

For the endless love, support and encouragement…

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First of all, all praise and thanks to Allah, for granting me strength and knowledge to successfully complete this research.

I have been influenced and helped by many people during my master's study, and during the work on my thesis. I would like to take this opportunity to express my gratitude to them.

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Abstract

Background: Medication errors are one of the most common causes of accidental errors affecting patients' safety and can cause serious consequences for patients. Medication errors are underreported worldwide, particularly in developing countries. Which lead to the lack of information regarding the problems of medication errors.

Aim: To assess the input from nurses' regarding several issues in medication error, exploring their perception towards medication error causes, types, rate, and reporting. which might help in pinpointing some areas in medication safety issues where there is potential for making improvement to be reflected in the nurses practices regarding medication managements at hospitals.

Methods: A cross-sectional design was used. Data was collected using a self-administered questionnaire. The study was conducted in three hospitals; public, private, and NGO. A total of 267 nurses participated in the study.

Findings: The overall response rate was (57.17%). Female were 59.8%, and males 40.2%. The most perceived causes of MEs were lack of pharmacological knowledge and skills (82%), and heavy workload and shortage of staff (77.7%). As for the most common types of MEs, wrong medication dose (57.5%) and wrong time (53.2%) were the most prevalent. The mean number of committed MEs in the past 12 months was 1.94, and the mean number of reporting medication errors in the past 12 months was 1.6. With regard to the most common type of medications involved in MEs, antibiotics was given the highest frequency in MEs.

Regarding the level of harm resulted from medication error that occurs in the past 12 months, the higher frequency was for MEs causing temporary harm to patients (28.2%). Moreover, participants from the NGO and public hospitals scored higher than private hospital participants in

regard to shortage of nursing staff and heavy work overload cause (P<0.001). Also 57.9% of participants with bachelor's degree indicated the effect of lacking pharmacological knowledge and skills more than diploma and graduate studies participants (P<0.001). Finally a statistically significant relationship was found in the frequency of committing MEs (P=0.001) and frequency of reporting MEs (P<0.001) in relation to the hospital ownership.

Conclusions: the results of the study indicate that there are areas of potential improvements in Palestinian hospitals. Medication safety interventions should be formulated to address strategies to reduce and eliminate medication errors.

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تقييم وجهة نظر التمريض تجاه الأخطاء الدوائية ـ المستشفيات في فلسطين

إعداد: رضا رضوان سلمي

إشراف: د. معتصم حمدان

ملخص الدراسة

خلفية الدراسة: تعتبر الأخطاء الدوائية واحدة من أكثر الأسباب شيوعاً في التسبب بأخطاء غير مقصوده تؤثر على سلامة المرضى. هنالك قصور في التبليغ عن الاخطاء الدوائية في مختلف انحاء العالم وبالذات في البلدان النامية. مما يؤدي الى عدم توفر المعلومات الكافية عن الاخطاء الدوائية نتيجة غياب نظام واضح يحدد طريقة الإبلاغ عن الخطأ الطبي والتعامل معه.

الهدف: تقييم آراء التمريض فيما يتعلق بالاخطاء الدوائية. واستكشاف وجهة نظرهم عن اهم الاسباب المؤدية للأخطاء الدوائية، واكثر انواع الاخطاء الدوائية شيوعا، والتعرف على ارآهم فيما يتعلق بالابلاغ عن هذه الأخطاء. مما قد يساعد في ابراز نقاط الضعف في السلامة الدوائية في المستشفيات، ليعطي فرصة وامكانية لتحسين اماكن الضعف، لينعكس على ممارسات التمريض فيما يتعلق بإدارة الادوية.

المنهجية: اعتمدت الدراسة منهج الوصف التحليلي من خلال دراسة مقطعية حيث تم جمع البيانات بواسطة الاستبانة. أجريت هذه الدراسة في ثلاثة مستشفيات، مستشفى حكومي، ومستشفى أهلي، ومستشفى خاص. بلغ عدد المشاركين في الدراسة من التمريض 267 ممرض وممرضة.

النتائج: بلغت نسبة الاستجابة بالبحث 57.17%، حيث كانت نسبة المشاركة من الأناث 59.8% ومن الذكور 40.2%. أظهرت الدراسة أن أكثر الاسباب المؤدية لحدوث الأخطاء الدوائية من وجهة نظر التمريض كانت نقص المعرفة والمهارات الدوائية الكافية لدى التمريض (82%)، يتلوها النقص في عدد الكادر التمريضي مع وجود ضغط عمل كبير في الاقسام (77.7%). بالنسبة لأنواع الاخطاء الدوائية، اظهرت الدراسه ان اعطاء المريض الجرعة الخطأ من الدواء (57.5%)، واعطاء الدواء في موعد خطأ (53.2%) كانتا أبرز الانواع.

أظهرت الدراسة ايضا أن متوسط عدد الأخطاء الدوائية التي ارتكبها التمريض خلال السنة الماضية كانت 1.94، بينما كان متوسط عدد الاخطاء الدوائية التي تم الأبلاغ عنها من قبل التمريض خلال السنة الماضية 1.6. اما فيما يخص أكثر الأنواع الدوائية شيوعا وتكرارا بالاخطاء الدوائية، أعطيت المضادات الحيوية أعلة مرتبة مقارنة مع الانواع الأخرى. تطرقت الدراسة الى تحديد مستوى الأذى الذي سببته

الأخطاء الدوائية، حيث كانت الأخطاء الدوائية التي تسببت بحدوث ضرر مؤقت للمريض (28.2%) أعلى نسبة من المضاعفات من وجهة نظر التمريض.

أظهرت الدراسة فروقات ذات دلالة احصائية بين المستشفيات الثلاثة و النقص في عدد الكادر التمريضي مع وجود ضغط عمل كبير في الاقسام ($P<0.001$)، حيث أن نسبة المشاركين بالدراسة بالمستشفى الحكومي والأهلي ممن يعتقدون ان النقص في عدد الكادر التمريضي وضغط العمل من مسببات الأخطاء الدوائية كان أكثر مقارنة بالمستشفى الخاص. أيضا كشفت الدراسة عن وجود علاقة ذات دلالة احصائية بين مستوى التحصيل العلمي و نقص المعرفة والمهارات الدوائية الكافية لدى التمريض ($P<0.001$). أظهرت الدراسة ايضا علاقة ما بين تكرار ارتكاب الاخطاء الدوائية والابلاغ عنها مع المستشفيات ($P<0.001$).

الخلاصة: خلصت الدراسة الى أن هناك العديد من مجالات التحسين الممكنة في المستشفيات الفلسطينية فيما يتعلق بالسلامة الدوائية. حيث يجب أن يكون هناك استراتيجيات واضحة تتعلق بالسلامة الدوائية للتقليل والقضاء على الأخطاء الدوائية بالمستشفيات.

Table of Content

List of Figures

List of Tables

List of abbreviations

BA	Bachelor's Degree
CCU	Cardiac Care Unit
FDA	Food and Drug Administration
ICU	Intensive Care Unit
IHI	Institute for Healthcare Improvement
IOM	Institute Of Medicine
ISMP	Institute for Safe Medication Practices
IV	Intravenous
LASA	Look Alike and Sound Alike
ME	Medication Error
MAE	Medication Administration Error
MoH	Ministry of Health
NGO	Nongovernmental Organization
OB/Gyn	Obstetrics and Gynecology
PMC	Palestinian Medical Complex
SPSS	Statistical Package or the Social Sciences
UK	United Kingdom

List of Annexes

Chapter One

Introduction

1.1 Introduction

In the current healthcare arena there is a great interest in patient safety worldwide. Patient safety is defined as the freedom from accidental injuries during the course of medical care and encompasses the activities aimed to avoid, prevent or mitigate adverse outcomes which may result from health care. Safety is a key component of quality within any health care organization (Expert Group on Safe Medication Practices, 2006).

One of the fundamental areas and top priority topics of patient safety is medication safety; since the drug adverse events are the most frequent type of adverse events. Medication therapy is considered as one of the most common medical treatments provided by healthcare professionals to patients. Before medication reaches the patients it passes through many stages staring from prescription, transcription, dispensing, and administration, which involve different healthcare professionals; physicians, pharmacists and nurses.

Medication administration in hospitals is the last stage of the medication process, where nurses play the key role in this stage, to ensure the safe administration of medication to patients. It is an everyday part of nurses practice; a routine and basic part of their tasks (Lin & Ma, 2009).

Medication errors are one of the most common causes of accidental errors affecting patients' safety and can cause serious consequences for patients, in addition to affecting the healthcare costs. It occurs when human and system factors interact with the medication process to produce an unintended and potentially harmful outcome (Owusu Agyemang & While, 2010).

Based on several studies on medication error around the world medication errors are underreported, particularly in developing countries. Which lead to the lack of information regarding the problems of medication errors.

The purpose of this study is to explore the nurse's views regarding several issues of medication errors in three selected hospitals in Palestine.

1.2 Problem statement and justification

Patient safety is one of the most important and fundamental elements of healthcare. Providing care, improving health and protecting patients and people who are seeking health is all what healthcare is about. In the recent years, medication errors are known to be one of the most important reasons for death of the in patients and outpatients (Taheri, et al., 2013).

The involvement of medication as the most common type of treatment in healthcare, the multiple steps in medication management process, and the participation of different healthcare professionals, create a higher risk and greater potential for medication errors to occur. The Institute of Medicine's (IOM) first Quality Chasm report, To Err Is Human: Building a Safer Health System, stated that medication-related errors (a subset of medical error) were a significant cause of morbidity and mortality; they accounted "for one out of every 131 outpatient deaths, and one out of 854 inpatient deaths". Medication errors were estimated to account for more than 7,000 deaths annually (Hughes & Blegen, Patient Safety and Quality: An Evidence-Based Handbook for Nurses, 2008) . In addition, Stencel and Dobbin (2006) reported that an average of 400,000 preventable drug-related injuries occur each year in hospitals, 800,000 occur in long-term care settings and 530,000 occur in outpatient clinics in the United States. These incidents account for extra medical costs amounting to $3.5 billion annually (Lin & Ma, 2009).

Little is known about medication errors in Middle Eastern countries in general, and in Palestine particularly there is a lack of studies investigating medication error problems. The current study

was conducted to assess the input from nurses' regarding several issues in medication error, exploring their perception towards medication error causes, types, rate, and reporting.

1.3 Significance of the study

Medication safety is a common and important health priority in many countries. Several studies from various countries have reported that 3.7–16.6% of total hospital admissions were associated with adverse events "any undesirable experience associated with the use of a medical product in a patient", a substantial proportion of which were attributed to medication use. The impact is significant, as medication errors harm an estimated 1.5 million people and kill several thousand each year in the United States of America (USA), costing the nation at least US$ 3.5 billion annually (Aspden, et al., 2015).

There is no available information regarding the number, types and causes of medication errors in Palestine, since there is no reporting system for medication errors to capture the MEs in different medical setting. Exploring nurses' perception regarding multiple issues related to medication errors might help in pinpointing some areas in medication safety issues where there is potential for making improvement in nurses practice regarding medication managements at hospitals. Also it could be helpful in increasing the awareness of policy makers to medication safety topics.

1.4 Objectives of the study

The aim of this study is to explore nurses' perceptions about several issues related to medication errors in Palestinian hospitals.

1.5 Specific objectives

- To identify the causes of medication errors as perceived by nurses.
- To identify the types of medication errors as perceived by nurses.

- To identify the types of drugs involved in medication error as perceived by nurses.
- To explore nurses' views about reporting medication errors.
- To identify the frequency of error, and the level of harm caused by medication error as perceived by nurses.
- To study the relationships between nurses characteristics and perceptions regarding medication errors.

1.6 Limitations

This study is one of the few studies which attempt to explore nurse's perception about medication errors in Palestine. However, the study has some limitations:

- The study investigates only the nurse's perceptions and views regarding MEs, while other healthcare providers contribute to MEs such as (Physicians and Pharmacists).

- The sample of this study is selected from 3 hospitals in Palestine, thus the findings cannot be generalized to other hospitals.

- Low response rate at Al-Makassed Hospital, there was lower participation compared to the other two hospitals.

- Hesitancy to share information with the researcher was noticed from nurses.

- Duplication of responses in the third section, and part one in the fourth section in the questionnaire; participant were asked to recall the committed and reported MEs done by them and/or by their colleagues.

1.7 Study Assumption

- Participants understood all the sections in the questionnaire and fill it out properly, and complete all sections.

- Participants fill out the questionnaire honestly and accurately.

Chapter Two

Literature review

2.1 Introduction

The literature review in this chapter is organized around multiple areas: 1) History of medication errors; 2) local, regional and international studies; 3) causes of medication error; 4) types of medication error; and 5) reporting of medication error.

2.2 History of medication errors

Medicine embraces a variety of healthcare practices developed in order to maintain, restore, and improve health by preventing and treating illness. Medicine, in the broadest definition of the word, is a dangerous undertaking. It can and does prolong and improve the lives of patients, but can also cause them great harm (Schachter, 2009).

Medicines have proven to be very beneficial for treating illness and preventing disease. This success has resulted in a dramatic increase in medication use in recent times. Unfortunately, this increase in use and expansion of the pharmaceutical industry has also brought with it an increase in hazards, error and adverse events associated with medication use (WHO, 2011).

The reality that medical treatment can harm patients is one that the healthcare community has had to come to terms with over recent years. In particular, adverse events associated with medication appear among the chief causes of this harm while patients reside in hospitals and are known to be responsible for a large proportion of hospital admissions (Keers, et al., 2013).

There has been a massive increase in the number and variety of medications available. These may have different routes of delivery, variable actions (long acting or short acting), and there are drugs with the same action and formulation but with different trade names. The process of delivering

medications to patients is often shared by a number of health-care professionals. Communication failures can lead to gaps in the continuity of the process (WHO, 2011).

Medication administration errors were used by researchers studying the quality of the output of drug distribution systems back in the 1960's when the unit dose drug distribution system was being developed. The history of the definition and terminology used when discussing medication errors is important to be aware of when evaluating the literature. "**Adverse drug events**" are defined as an injury from a drug-related intervention, which can include prescribing errors, dispensing errors and medication administration errors - this term has been used in the medical literature in particular (Flynn, 1999).

The National Coordinating Council for Medication Error and Prevention defines a **medication error** as "any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems including: prescribing; order communication; product labeling, packaging and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use" (NCCMERP, 2015).

Based on the report of The Institute of Medicine's (IOM) "*To Err Is Human: Building a Safer Health System"*, the IOM put a report in 2007 on medication safety, *Preventing Medication Errors*. This report emphasized the importance of reducing medication errors, improving communication with patients, continually monitoring for errors, providing clinicians with decision-support and information tools, and improving and standardizing medication labeling and drug-related information (Hughes, et al., 2008).

2.3 Prevalence of Medication Errors

2.3.1 International Studies

The third goal of the Joint Commission National Patient Safety Goals (2009) is to improve the safety of using medications. The Audit Commission (2001) of the National Health Service (NHS) in the UK estimated that medication errors accounted for about 20% of deaths from all adverse events. In Taiwan, The Taiwan Joint Commission on Hospital Accreditation (TJCHA) reported that deaths because of medical adverse events were estimated to be 6000–20,000 yearly. Medication errors were the leading errors (22.2%) among the 13 types of medical negligence (Hsaio, et al., 2009).

In 2008, researchers estimated that potentially preventable adverse drug events kill 7,000 Americans annually and that medication errors that result in harm are the number-one cause of inpatient fatalities. While error rates vary widely among facilities, experts believe at least one medication error occurs per hospital patient every day (Anderson & Townsend, 2010).

Prescribing and drug administration appear to be associated with the greatest number of medication errors (MEs), whether harm is caused or not. Recent systematic reviews of medication administration error (MAE) prevalence in healthcare settings found that they were common, with one reporting an estimated median of 19.1 % of 'total opportunities for error' in hospitals. A significant proportion of MAEs are associated with actual or potentially harmful effects (Keers, et al., 2013).

In terms of financial impact on the healthcare system, drug related morbidity and mortality costs the United States between 76.6$ to 136$ billion annually. Further, the negative consequences of medication errors in terms of reputation, psyche, and loss of life are immeasurable. It has been estimated that 2 out of every 100 hospital admissions will experience a preventable adverse drug event and the occurrence of a preventable adverse drug event increases hospitalization costs by $4,700 per event. Application of these figures to a 700-bed hospital yields an increased cost of approximately $2.8 million annually. Overall, the cost of medication errors has not been clearly

defined and data in the pediatric and psychiatric population are scare. Most of the available data are from the hospital setting and related to additional costs incurred (Brunetti & Suh, 2012).

2.3.2 Local and Regional studies

Regional studies

Many studies had been conducted in the Middle East discussing the medication errors in general, many of them focused on administration errors from nurses' perception. The Middle Eastern region is strategically, politically and economically important for the whole world. There are fifteen countries between western Asia and northern Africa which make up the Middle Eastern region (Al-Sulami, et al., 2012).

Medication errors (MEs) are under-reported in all countries, particularly in developing countries. MEs present a universal problem and can cause serious consequences for patients, especially those with acute complex medical conditions (Al-Sulami, et al., 2012).

A study was conducted in Jordan in 2007, aim to describe Jordanian nurses' perceptions about various issues related to medication error, it was considered as the first nursing study about medication errors in Jordan, a convenient sample of 799 nurses from 24 hospitals was obtained. The study examined the rate, causes, and reporting of medication errors. The study findings conclude that the average number of recalled committed medication errors per nurse was 2.2, the rate of medication errors reported to nurse managers was 42.1% and that the main cause of medication errors was poor quality or damaged labels/packaging of medication (Marayyan, et al., 2007).

In 2010 another study was conducted in Jordan, to determine the factors contributing to medication errors and related areas for improvement, as perceived by nurses. The study concluded that a wide range of factors perceived as contributing factors of medication errors were identified. These results provide valuable information that could be used to improve the medication system in Jordan (Al-Shara, 2011).

Another study was conducted in Iran (2011), to determine the incidence and reporting rate of medication errors as reported by Iranian nurses and their relationship with work conditions in hospitals. A descriptive-analytical design was carried out in six hospitals. Through a stratified multiple stage sampling, 300 nurses were selected. Based on the study result they conclude that the establishment of an efficient reporting system, documentation of errors and removal of obstacles to reporting may result in reduced frequency of medication errors (Joolaee, et al., 2011).

In 2012 a study examining the medication errors causes and reporting behaviors as perceived by nurses was conducted in Egypt. A quantitative cross-sectional descriptive design was used at three hospitals, with a convenient sample size of 186 nurses. The study findings pinpoint that nurses should have staff development in regard to various issues related to medication errors, particularly defining and reporting these errors (Manal & Atalla, 2012).

In Saudi Arabia, a study was conducted in 2013 to assess the input from nurses based on their clinical experiences towards perception of occurrence and reporting of medication administration errors, as well as the extent to which errors are reported on their units. A descriptive cross-sectional survey using self-report questionnaire, with a convenience sample of 253 nursing staff. The study was carried out in all departments of King Khalid Public Governorate Hospital in Hafer El-Batin at Kingdom Saudi Arabia. Results of the study suggested five categories for reasons of why MAEs occur and three categories for reasons of why MAEs are not reported. Nurses perceived low percentages of MAEs reporting (AL-Youssif, et al., 2013).

Local Studies

In 2007, a study was conducted in Palestine to determine whether appropriate dosage adjustments were made for drugs that are nephrotoxic, excreted, or metabolized (TEM medications) by the kidney in patients with renal impairment, investigating medication dosing errors in hospitalized patients with renal impairment. A cross-sectional study of a group of 78 hospitalized patients, where data regarding patients' clinical, laboratory findings and medications whether they were prescribed at hospital or at discharge were collected from patients' medical files. Evaluation of

appropriate dosing was based on Physician Disk Reference (PDR). Dosage adjustment was necessary for 193 TEM medications, after analyzing 193 TEM medications with guidelines for adjustment the results indicated that 73.58% (142) were found to be inappropriate dosing and 26.42% (51) were found to be appropriate dosing. The most common inappropriate medications were ranitidine, antibiotics, and digoxin. Approximately 77.5% of the unadjusted medications were prescribed during hospitalization (Sweileh, et al., 2007).

Despite the fact that the above study is not related to nurses' view regarding medication error, it worth to be mentioned since it is the first study conducted in Palestine related to medication errors. Published research in medication errors in Palestine is very rare, and there is no available information regarding the prevalence of MEs in Palestine. Also there isn't any statistical figure to measure the size of the problem in Palestine, and very little attention is given to it. Most or even all Medication errors are not documented nor reported. Although MEs information is scarce and unavailable in Palestine, it doesn't meant that the problem doesn't exist.

Another study was conducted in Gaza (2011), aimed to assess the unit-dose drug dispensing system (DDS) and the ward-stock DDS utilized in Gaza hospitals to explore which system is more beneficial. It was quantitative, comparative cross-sectional design utilized structured interviews with pharmacists and head nurses, missing drug registration sheets and drug administration observation checklists. Results of the study indicated that the number of missing units per drug item dispensed (mean: 3.4 and 1.8 respectively) and medication administration errors per patient (mean: 1.8 and 0.9 respectively) were statistically significantly lower in the hospital using the unit-dose DDS than the ward-stock DDS (Al-Adham & Abu Hamad, 2011).

A recent study exploring nurse's perception towards the main types, leading factors, and reporting attitude of medication errors, was conducted at the same time the current study was being developed. The study conducted in 6 North West Bank governmental hospitals in 2014. A descriptive cross sectional study, using a self-administered questionnaire, with sample size was 200 nurses. The study concluded that personal factors and shortage of nurses and heavy workload on governmental hospitals are the main contributing factors to MEs (Al-Sarawan, 2014).

2.4 Medication administration errors: Causes and Types

Medication Administration Errors

Medication passes through 4 stages before it reaches the patients; prescription, transcription, dispensing and Administration. Involving different healthcare professionals in the process physicians, pharmacists and nurses. According to several studies, medication errors usually occur during the prescription and administration stages and can account for between 65% and 87% of all medication errors (Tang et al., 2007).

Drug administration forms a major part of the clinical nurse's role. Medicines are prescribed by the doctor and dispensed by the pharmacist, but the responsibility for correct administration rests with the nurse. Nurse's practice includes preparing, checking and administering medications, updating knowledge of medications, monitoring the effectiveness of treatment, reporting adverse reactions and teaching patients about their drugs (O'SHEA, 1999).

Drug administration remains a traditional task of nurses, consuming up to 40% of work time and involving significant responsibility. Administering the correct drugs to patients is a basic but extremely important requirement for a competent nurse, but this task is becoming more complex and difficult (Tang et al., 2007).

A medication administration error was defined as a deviation from the prescriber's medication order as written on the patient's chart, manufacturers' preparation/administration instructions, or relevant institutional policies. Ward level medication dispensing/preparation errors were considered administration errors; while prescribing and pharmacy dispensing errors were excluded (Keers, et al., 2013).

2.4.1 Cause of medication errors

Classifying and identifying the causes of medication errors is considered the first step in the analysis of MEs, hence understanding the causes and categorizing them will be helpful in evaluating the MEs events. Administration medication errors can be classified as system, individual or environmental factor. Most of the studies identified the contributing factors of MEs without categorizing them under any category, while some studies did categories them.

Many factors can lead to medication errors. The Institute for Safe Medication Practices (ISMP) has identified 10 key elements with the greatest influence on medication use, noting that weaknesses in these can lead to medication errors; they include: 1) patient information, 2) drug information, 3) adequate communication, 4) drug packaging, labeling, and nomenclature, 5) medication storage, stock, standardization, and distribution, 6) drug device acquisition, use, and monitoring, 7) environmental factors, 8) staff education and competency, 9) patient education, and 10) quality processes and risk management (Anderson & Townsend, 2010).

A study describes nurse perceptions about medication errors was done in 2004 stated three top causes of medication errors as perceived by nurses; physicians handwritings difficult to read or illegible, ranked as the top cause , followed by nurses are being distracted and exhausted. (Mayo & Duncan, 2004). While according to Osborne (1999) who conduct a study investigates nurses' perceptions of medication errors and appropriate reporting, the main cause was failure to identify the patient (35%) followed by fatigue and exhaustion (25%) (Osborne, Blais, & Hayes, 1999).

In 2005 an Australian study identified and described the incidence of medication errors among registered nurses, the type and causes of these errors. A total of 154 registered nurses from six clinical areas were selected at a major regional hospital. Results of the study highlighted the human factors contribution in MEs as reported by nurses; Stress/high workload. (25.3%), and Fatigue/lack of sleep (16.5%) were reported as the most common human causes of errors. While the major two environmental causes of MEs were interruptions and distractions (25.3%), and poor communication between nurses/doctors (12.7%). The study also examine the communication

factors as reported by nurses were illegible handwriting (16.5%) and misreading (12.7) % were the most common causes (Deans, 2005).

In a study conducted in Jordan in 2007, were a convenient sample of 799 nurses from 24 hospitals was studied using self-administered questionnaire. The highest three perceived causes of medication errors were poor quality or damaged medications labels/packaging, followed by nurses confusion by different types and functions of infusion devices, and the third one was nurses distraction by other patients, coworkers or events on the unit (Marayyan, Shishani, & Al-Faouri, 2007).

According to the Institute of Medicine (IOM) report, the majority of medical errors do not result from individual recklessness or the actions of a particular group--this is not a "bad apple" problem. More commonly, errors are caused by faulty systems, processes, and conditions that lead people to make mistakes or fail to prevent them. Thus, mistakes can best be prevented by designing the health system at all levels to make it safer--to make it harder for people to do something wrong and easier for them to do it right. Of course, this does not mean that individuals can be careless. People still must be vigilant and held responsible for their actions. But when an error occurs, blaming an individual does little to make the system safer and prevent someone else from committing the same error (IOM, 1999).

2.4.2 Types of medication error

There are two main types of medication errors; preparation errors and administration errors.
In order to minimize medication errors, the Department of Health (2004) has identified the five 'rights' of drug administration; right medication, right dose, right time, right route, and right patient. While the American Society of Hospital Pharmacists' Council on Clinical Affairs (1982), cited by DH (2004) and O'Shea (1999), have identified nine types of medication error, namely: omission error; unauthorized drug error; wrong dose error; wrong route error; wrong rate error; wrong dosage form error; wrong time error; wrong preparation error; and incorrect administration technique (Owusu Agyemang & While, 2010).

A study conducted in 2007 in Taiwan, using a semi structured questionnaire developed by a focus group of nine registered nurses discussed medication errors along with other researcher. The study found that the two leading error types were, the wrong dose accounted for 36·1% and wrong drug accounted for 26·4%, based on breaking down reports of violations of the five rights (Tang, et al., 2007).

Another study examined medication error types in hospitalized cardiovascular patients. Data were collected for 54 months from September 1, 1995, through February 18, 2000, during which 24 538 patients were admitted to the cardiology wards. There were 14 983 documented interventions, including 1112 medication errors with textual descriptions. The results showed that the most commonly identified types of medication errors were administration of the wrong drug (36.0%) or wrong dose (35.3%) (Allen LaPointe & Jollis, 2003).

A study conducted in Jordan in 2011, to identify types, stages and issues perceived as contributing factors to medication errors. A self-administered questionnaire was used, a total of 126 of registered nurses responded or completed the questionnaire. Results of the study shows that the highest types of medication errors occurred when the medication is delivered to the wrong patient (26.2% of the total medication errors) followed by 22.2% due to wrong dosage (Al-Shara, 2011).

In the Australian study (2005), the most common errors types as perceived by nurses were administering a dose of medicine at the wrong time (31.6%) and missing a dose of medication (16.5%) (Deans, 2005).

2.5 Reporting of Medication Error

Reporting medication errors is one of the major issues in today's health care environments. Preventing medication errors is linked to the accurate reporting of these errors (Mayo & Duncan, 2004). Reporting medication errors is fundamental to gathering information on incidents, helps health professionals learn how to improve the medication-use process, and prevents or minimizes future incidents (Lin & Ma, 2009). When reporting is inadequate, problems of medication errors will not be identified.

Medical and nursing staff underreport medication errors, either actual or potential, for a variety of reasons. Barriers to reporting medication errors include the perceived fear of punishment by fines or administrative reprimand, loss of one's job, or loss of professional license or credibility. One recent observational study reported by the Institute for Safe Medicine Practice noted the incidence of drug error reports by nursing staff in a single hospital to be as low as 0.07% (Schmidt & Bottoni, 2003).

A study conducted in in Saudi Arabia (2013) to assess the input from nurses based on their clinical experiences towards perception of occurrence and reporting of medication administration errors. Results of factor analysis for not reporting MAEs showed three categories ranked as: fear reasons, followed by administrative reasons, then disagreement over time - error definition reasons. Fear reasons included fear from the patient, family or physician to develop a negative attitude or may sue the nurse if a ME is reported, and fear from reporting adverse consequences of ME. Administrative reasons included inappropriate response by nursing administration with the severity of the error, blaming of nurses if something happens to the patient as a result of the ME, no positive feedback is given for passing medications correctly and focusing on the individual rather than looking at the systems as a potential cause of the error when medication errors occur. Indeed a punitive environment to error reporting was an important feature due to culture of blame within healthcare without organizational leadership and support. Disagreements over time - error definition reasons included disagreement of nurses with hospital's definition of a ME, unrecognized an error occurred; too much time for filling out an incident report and for contacting the physician about a ME (AL-Youssif, et al., 2013).

Nurses' views about reporting medication errors were studied in Jordan in 2007. Results showed that the most frequent reasons related to nurses' failure to report medication errors were because nurses were afraid that they might be subjected to disciplinary actions or even lose their job, followed by Nurses' did not think the errors were serious to warrant reporting. In the same study the frequency of reporting MEs using incident report was measured as perceived by nurses, only 42.1% of MEs were reported to nurse's managers (Marayyan, et al., 2007).

In 2009 a study conducted in Taiwan. A cross-sectional study was conducted involving a survey of 14 medical surgical hospitals. A structured questionnaire was completed by 605 participants, to explore the prevalence of MAEs and the willingness of nurses to report them. Results showed that most nurses had a willingness to report MAEs (87.7%) if no punishment ensued; however, 11.3% were not willing to report medication errors. The top five reasons why nurses were unwilling to report were concerns related to taking medical responsibility (74.3%), receiving punishment (73.1%), medical disputes (70.6%), distrust from patients (70.3%), and a lack of ill effects of MAEs on the patient's condition (69.9%). While the primary reasons for wanting to report medication errors were concern for the patient's physical health (98.2%) and ethical issues such as the nurse suffered from guilt due to her carelessness and unintentional actions (93%) (Lin & Ma, 2009).

A study conducted in Israel in 2008, investigating medication error reporting among Israeli nurses, emphasized a personal barrier to nurses reporting their own failures. A questionnaires were distributed to 235 Nurses. Results indicated that only 60% of nurses reported their errors, while 91% reported discovering errors in their colleagues' work, implying that most nurses are aware of errors that they do not always report. Other finding was related to the negative correlation between the rate of errors and rate of error reporting, namely, that the higher the error frequency, the more errors went unreported to management. Possible explanations for this are the potential negative consequences for the error reporter and for the ward's professional image (Kagan & Barnoy, 2008).

For nurses, administering medication to patients is an important aspect of their daily routine. Sometimes only the nurse knows about the medication error; hence, in those cases, voluntary reporting of medication errors to the department is the nurse's responsibility. But currently, health care providers typically do not inform the patient or the patient's guardians about medication errors unless injury or death results (Lin & Ma, 2009).

Chapter Three

Conceptual Framework

3.1 Introduction

This chapter includes the operational definitions of the study dependent and independent variables. The variables in this study were selected based on their impact and relation with the aim of the study; exploring nurses perception towards several issues related to medication error. The selection of these variables was established after revising the literature of related research topics.

3.2 Operational definition

3.2.1 Perception

Perception is a key concept in this study, as the main objective is to explore nurses' perception towards several issues in medication errors. Perception is a mode of apprehending reality and experience through the senses, thus enabling discernment of figure, form, language, behavior, and action. Individual perception influences opinion, judgment, understanding of a situation or person, meaning of an experience, and how one responds to a situation. A common way of defining perception is "how we see things." However, perception is a process involving not only the senses but also complex underlying mechanisms (Munhall, 2008).

3.2.2 The dependent Variables

The study consisted of 6 main domains, were some domains include a number of item underneath it.

Causes of medication error

Medication errors could occur at any phase of medication process, and it can be classified as prescribing errors, dispensing errors, administration errors, and transcribing errors. This study focuses on administration medication errors.

The factors that contribute to medical errors are complex and multifaceted, but can generally be divided into two sub-groups; those caused by systems errors and those caused by individual health care professionals. The person approach seeks to attribute causes to the individual whereas the system approach proposes that human error is to be expected. Reason proposes the "Swiss Cheese Model" to illustrate the multiple contributing factors that all can line up simultaneously to enable error to happen, in the event the systems defenses, barriers and safeguards are not effective (Brady, et al., 2009). Once the etiology factors for medication errors have been identified and detected, the application of proper measures is essential for the error prevention and consequently the reduction of medication errors incidence by nurses (Karavasiliadou & Athanasakis, 2014).

This domain investigates the causes of medication errors as perceived by nurses. A 13 possible causes of medication error were listed in the survey, they were selected from various studies after revising related literature. All items were measured on a 5-point Likert scale.

Table 3.1: Causes of medication error

Possible Causes of medication errors
• Medication error occurs when the physician's writing on the doctor's order form is difficult to read or illegible. • Medication error occurs when the medication labels/packaging are of poor quality or damaged. • Medication error occurs when there is confusion between two drugs with similar name or shape (Look Alike and Sound Alike). • Medication error occurs when there is shortage of nursing staff and existence of heavy work overload. • Medication error occurs due to improper medication storage on the nursing station and medication trolleys. • Medication error occurs when the drug order is complicated, such as orders for chronic, critical, or complex conditions. • Medication error occurs when nurses lack pharmacological knowledge and skills. • Medication error occurs due to poor mathematical skills of nurses. (Calculating Medication dose). • Medication error occurs more often with new graduates of doctors and nurses who have limited experience.

- Medication error occurs when the hospital staff fails to follow policies and procedures for safe drug administration.
- Medication error occurs due to the poor communication between nurses and physicians.
- Medication error occurs due to the poor communication between nurses and pharmacists.
- Medication error occurs when nurses are distracted or interrupted by other patients, coworkers or events at the unit.

Types of medication error

Observation of the quintuple rules in administration of drugs (right time, right patient, right dose, right method and right medication) provides a framework to improve safety in the profession of nursing (Taheri, et al., 2013).

Barker et al (2002) provided definitions for six of these types of medication errors:

- Omission error: failing to administer a prescribed dose.
- Unauthorized drug error: administering a dose of medication that was not prescribed.
- Wrong dose error: a dose containing the wrong strength.
- Wrong route error: administering medications in a different route than ordered (e.g. oral instead of intravenous).
- Wrong dosage form error: administering a dose in a different form than prescribed (e.g. tablets instead of liquid).
- Wrong time error: administering a dose of medication more than 60 minutes before or after the prescribed time (Owusu Agyemang & While, 2010).

The other 2 type's definition is:

- Wrong patient: administering a dose of medication to patient other than the one it was prescribed for.
- Wrong rate: administration of an intravenous dose of medication either slower or faster than the recommended rate.

This domain explores the nurses' view regarding the types of medication administration errors that occurs at their departments. This domain included 8 types of MAEs, they were selected after the revision of related previous studies. All 8 items were measured on a 5-point Likert scale.

Table 3.2: Types of medication errors

Types of medication administration errors
• Administration of the drug to the wrong patient. • Administration of a wrong drug. • Administering a wrong dose of the drug (a dose containing the wrong strength). • Administering the drug in a wrong route of administration (administering the drug in a different route than order). • Administering the drug in a wrong dosage form. (Administering a dose in a different form than prescribed). • Administering the drug at a wrong time (more than 60 min before or after the prescribed time). • Failing to administer a prescribed dose (Omission error). • Administration of an IV Drug at the wrong rate (IV rate too fast or too slow).

Frequency of committed errors

This domain measures the number of recalled committed medication error at each department by nurses during the last twelve months. It was taken from the modified Gladstone's scale of medication error (Mayo & Duncan, 2004). But some modifications were applied on the question based on expert's recommendation in the validity test, the committed errors were investigated as per the department not per nurse.

A scale from (0-10) was used, to measure the committed error as per nurses' remembrance.
Most of the studies in the literature which examined the frequency of MEs were observational studies.

Reporting of medication errors

This domain consisted of multiple sections, examining the frequency of reported medication error as per nurses' remembrance, exploring nurses' views regarding reporting of MEs such as knowledge about MEs, and reasons for not reporting MEs. This domain also investigate the methods of reporting and to whom errors are being reported.

Frequency of reporting medication errors

The rate of medication errors reported to nurses' managers was examined in the modified Gladstone's study; a percentage of reporting of all committed medication error over the course of nurses' career using an incident reports. However, in the current study the frequency of reported medication errors recalled by nurses during the last twelve months in each department was measured using a scale from (0-10).

According to the literature it is estimated that only those errors that are considered potentially life threatening are reported. Errors that are considered "minor" or errors that are intercepted before reaching the patient are almost never reported (Balas, et al., 2004).

Nurses views of reporting medication errors

Assuring MAE reporting is of great significance for the patient, the hospital, and the nurse. For the hospital, the end result of the underreporting of medication errors is weakening internal quality improvement andincreasing risk management opportunities due to inadequate data. The end result for patients of underreporting of MAEs includes an increased potential of adverse outcomes, due to the failure of the hospital to identify and correct systems related problems amenable to correction. Underreporting of MAEs allows the nurse, however, to avoid being blamed, counseled, or labeled by others as incompetent. The nurse may also not report errors by other nurses, either because of empathy with the nurse committing the error or the desire to avoid being ostracized by other staff (Al-Youssif, et al., 2013).

Some reports indicate that nurses were hesitant to report medication errors mostly because of a fear of being blamed, of losing their jobs and professional prestige, or of the adverse consequences from reporting. By focusing on learning from mistakes rather than blaming organizational policies, the rate of nurse error reporting could increase, and it would be easier to share errors, to discuss them and to identify the causes (Güneş, et al., 2014).

This section consisted of 9 statements exploring the nurses' views on reporting of medication errors. 5 items in this section were taken from the modified Gladstone's scale of medication error, while the rest were created based of previous studies in the literature.

These items can be categorized into 4 groups, nurses knowledge about MEs, nurses reasons of not reporting, follow up on reported errors, and presence of policies and procedure for reporting MEs.

Table 3.3: Nurses' views on reporting medication errors

Nurses views regarding reporting of medication errors
Nurses knowledge about MEs • I am usually sure what constitutes a medication error. • I am usually sure when a medication error should be reported. • Have you ever failed to report a medication error because you did not think the error was serious to warrant reporting?
Reasons for not reporting MEs • Have you ever failed to report a medication error because you were afraid that you might be subject to disciplinary action or even lose your job? • Have you ever failed to report a medication error because you were afraid of the reaction you will receive from the nurse manager or coworkers? • Do you feel comfortable reporting a medication error?
Follow-up on reported MEs • Is there any action taken or follow-up on the reported medication error? • Is there any clarification of the reported medication error, or any corrective action to avoid the repetition of such errors?
Presence of policies and procedure of reporting MEs • Is there a policy and procedure for reporting medication error at the hospital you are working at?

Types of medications involved in MEs

A systematic review study of MEs, revealed that some studies which investigate the most common types of medication involved in MEs mentioned the medication names, and others listed only the therapeutic class. Most of the errors were related to antihistamine drugs, antibiotic medications and anticoagulant drugs. In addition, medications reported in studies conducted on pediatric patients found that antihistamines, Paracetamol (Analgesic), electrolytes and bronchodilator drugs were the most common drugs associated with errors (Alsulami, et al., 2012).

A study in Taiwan (2007) asked participating nurses to recall a significant error in which they had been involved in person, and the results showed that many types of medications were involved in errors, but antibiotics were involved in more than one-third; the remaining errors involved electrolytes, analgesics, hypoglycemic agents, and others, such as cardiovascular or gastric drugs (Tang, et al., 2007).

In this study 6 types of therapeutic classes of medications were selected based on revising the literature of related topics. Participants were asked to rank the 6 therapeutic classes from (1-6) based on their frequency in medication errors, were 1 indicates the most frequent and 6 the least frequent.

Table 3.4: Therapeutic class of medications involved in medication errors

Therapeutic classes involved in medication errors
Antibiotics
Anti-diabetics
Antithrombotic
Electrolytes
Analgesics
Antiarrhythmic

Harm level resulted from medication error

Patient harm is the estimated degree of severity for the patient following a medication error and an outcome of a medication error (Wolf, et al., 2000).

Revising the literature of related previous studies to this domain shown that the majority of studies did not assess the clinical consequences of reported MEs, and most studies reported the severity of the MEs were prospective studies (Alsulami, et al., 2012). Due to universal under-reporting, the real number of incidents and harm rates remains unknown (Hsaio, et al., 2009).

In the IHI Global Trigger Tool, the definition used for harm is as follows: unintended physical injury resulting from or contributed to by medical care that requires additional monitoring, treatment or hospitalization, or that results in death (Griffin & Resar, 2009).

In this study the harm level resulted from medication errors was measured using the NCC MERP Index of categorizing harm (Griffin & Resar, 2009). It was measured by asking the participants to recall the medication errors which were committed by them or by their college at their working departments and select what was the harm level resulted from it, so this domain measures the harm from nurse's perception only.

Table 3.5: Harm Level resulted from medication error

Harm levels resulted from medication errors
• Temporary harm to the patient and required intervention • Temporary harm to the patient and required initial or prolonged hospitalization • Permanent patient harm • Intervention required to sustain life • Patient death

3.2.3 The Independent Variables

The independent variables in this study were selected based on previous studies that showed an influence of the independent variables on the perception of nurses regarding several issues in medication errors.

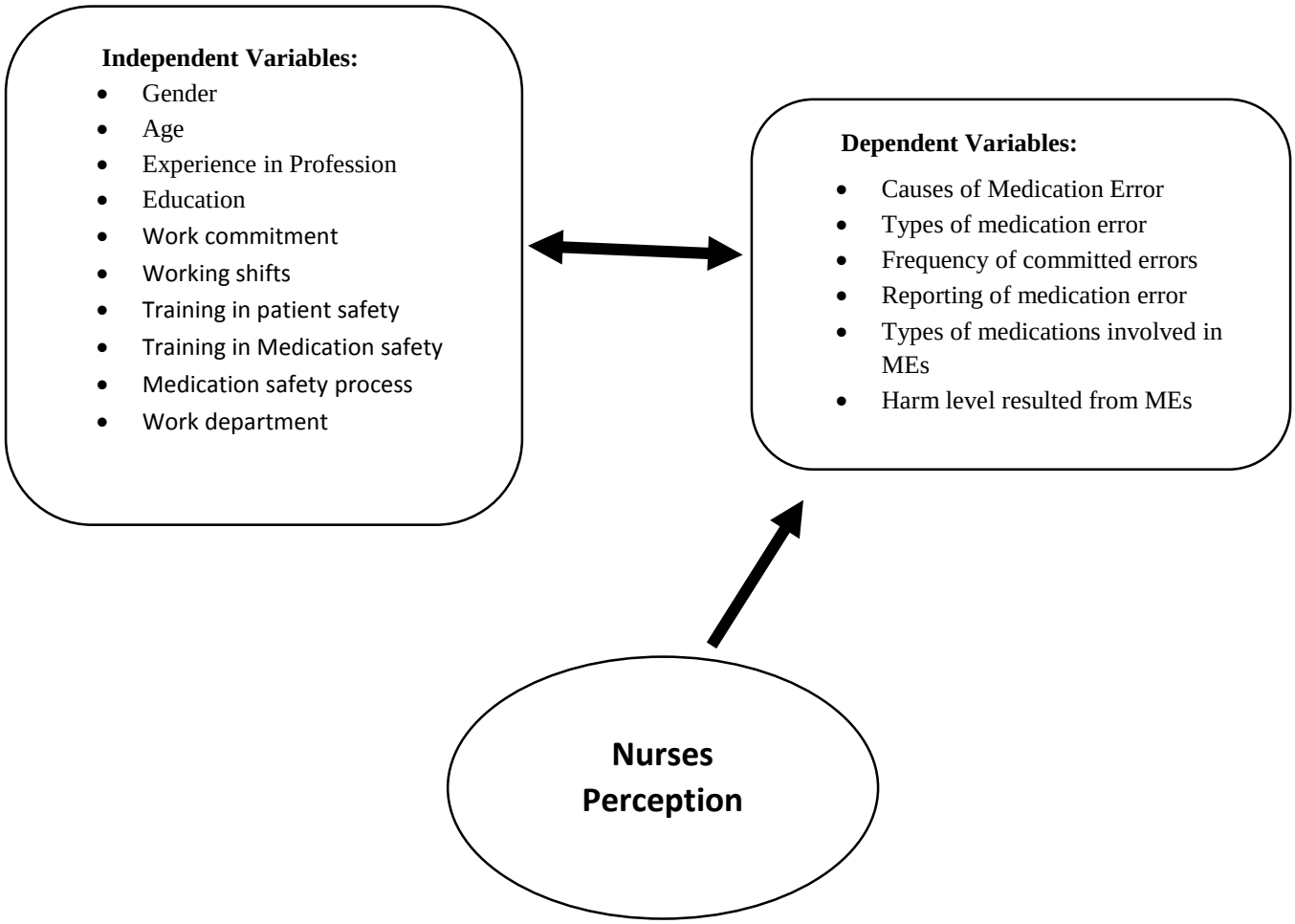
The Jordanian study which used the modified Gladstone's scale, used the following independent variable's; age, gender, level of education, years in practicing nursing, work commitment, worked shifts, and hospital work setting (Marayyan, et al., 2007). While a study conducted in Korea (2007) used the following individual characteristics; age, gender, work position, working area, hours worked, years of experience at current hospital, and years in current unit (Kim, et al., 2007).

In this study the most important independent variables were selected and used:

- **Gender**: categorized into male and female respondents
- **Age**: referred to the age of respondents. Data was categorized into three groups; (<30) (30-40) (>40).
- **Experience in Profession**: representing the years spent by respondents working in nursing profession. Data was categorized into three groups; (<5) (5-10) (>10)
- **Level of Education:** characterizes the level of education obtained by respondents. It was categorized into three groups (Diploma, bachelor's, Graduate studies)
- **Work commitment:** referred to the type of work commitment of respondent at the hospital; working full-time or part time.
- **Working shifts:** represents the respondent working shifts at the hospital. Classified into three options (Day, Night, and Rotating)
- **Training in patient safety:** referred to the respondent history of having any training in topics related to patient safety.
- **Training in medication safety:** referred to the respondent history of having any training in topics related to medication safety.
- **Availability of medication safety process in the hospital:** this is referred to the availability of medication safety process at the hospital were the respondent is working.

- **Primary hospital work department:** represents the working area of respondents. It was categorized into 9 departments (ICU, CCU ,Neonatal-ICU, Pediatrics-ICU, Pediatric Ward, General Medical Ward, General Surgical Ward, Gynecology and Obstetrics Ward, Orthopedic ward).

Figure 3.1: Conceptual framework model



Chapter Four

Methodology

4.1 Introduction

This chapter describes the research design, sampling methodology, instruments, validity & reliability of the instruments, pilot study, data collection method, data analysis, and ethical considerations.

4.2 Research design

A quantitative, cross-sectional survey design was used in this study to explore nurse's perception toward medication errors in certain hospitals in Palestine. The study was conducted between January and February 2015.

4.3 Study Setting

The study was conducted in three hospitals; governmental, private, and Non-governmental hospitals. The three hospitals are located at three different districts, Palestinian medical complex (PMC) in Ramallah, Arab specialty hospital in Nablus, and Al-Makassed Hospitals in East Jerusalem.

4.4 Study Population and sample

The study population consisted of all licensed nurses working in the inpatient departments at the selected three hospitals. Outpatient and emergency departments were excluded as the study focuses on the medication errors during the administration phase of medication management process. The total number of the population is 467 nurses.

The inclusion criterion was:

- Nurses worked at the selected hospital for at least 12 months. This criterion was set to guarantee that nurses are involved in administering medications.
- Fully employed registered nurse. Students were excluded from the study.

Sample Size

A Convenience sampling was used to obtain at least 60% of the total population which is 467 nurses. Out of the 467 delivered questionnaire, a total of 267 nurses responded and completed the survey.

Table 4.1: Study population and sample size

Hospital	**Population size**	**Sample size**
Palestinian medical complex	173	109
Arab Specialty	90	58
Al-Makassed	204	100
Totals	**467**	**267**

4.5 Instrument

The study instrument was designed by the researcher through revising the literature of earlier studies and utilizing related tools. The questionnaire was not adapted in any previous study, some questions were taken from the modified Gladstone instrument; 5 points in the first domain "causes of medication error", the third part "Frequency of committed errors", and section one in the fourth part "frequency of reported errors", and the first 5 questions in the second section in part four "nurses views about medication errors". The tool questions was created after an extensive research in the literature.

The survey starts by collecting the participant's characteristics, such as gender, age, and experience in profession, work commitment, educational level, hospital's work department, and trainings in patient and medication safety. And it includes 7 parts (Annex 1).

The first part includes the nurse's perceptions towards the causes of medication errors; a Lickert scale scored at 5 points was used to measure the nurses' degree of agreement or disagreement on a 13 possible cause of medication error. The second part also consists of 5 points Lickert scale, measuring the nurses' agreement or disagreement on the types of medication error that occurs at each department. The third part asked the participants to recall the number of committed MEs at their department. The fourth part consist of 3 sections, the first section asked the participants to recall the number of reported MEs at their departments for errors committed by the nurse himself or his colleagues, the second section contains a Yes/No questions exploring the nurses views regarding the reporting of medication error, the third section includes 2 closed-ended items.

The fifth section consists of a ranking question for medications involved in MEs based on the frequency of their association with medication errors. The sixth part includes a yes/no questions measuring the level of harm resulted from MEs, five levels of harm are listed based on The Institute for Healthcare Improvement "IHI" criteria.

The last part of the survey is an open ended question, which gives the participants the opportunity to provide any solutions and strategies that would be helpful for reducing and preventing medication error problems at hospitals.

The questionnaire was developed in English and then translated into Arabic. Back translation was done to evaluate the quality of the translation by translators' native in both languages. The Arabic version was distributed for participants.

4.6 Data collection

A permission to conduct the study was received from the three hospitals as a first step in the data collection process (Annex 3). The study tool is a self-administered questionnaire, it was distributed and collected back by the researcher at the study setting in 2 hospitals; PMC and Arab Specialty hospitals, and the researcher hired someone to distribute and collect the survey at Al-Makassed hospital, after giving him the proper training and direction on the collection process.

Confidentiality of collected information and anonymity of participants was assured to all participants. The researcher explained to the participants that questionnaires will be handled by the researcher only and not shared with the hospital management.

The survey cover letter explained the purpose of the study to the participants, informing them that the participation in the study is voluntary, also it provides a definition of two key concepts in the study. The data collection was conducted over 2 month period, between January and February 2015. The collection process at each hospital took from 2- 3 weeks covering the 3 shifts to ensure the coverage of the maximum number of nurses at each department.

The most apparent challenge the researcher face is the high work-load on the nurses in the three hospitals, leading to delay in filling out the survey, requesting multiple visits to the same department by the researcher. Another challenge was the complaints received from part of the participants on the long time required to fill out the questionnaire.

4.7 Data Analysis

Data were entered and analyzed using the statistical Package for the Social Sciences (SPSS version 18) software. Descriptive statistical analysis was generated for all the questionnaires variables. The mean of the items in the first 2 domains “causes and types of MEs” was converted to 100-

point scale. The percentages of positive responses were calculated where positive responses in positively worded survey items were "agree and strongly agree".

Chi-squared tests were used to test significance of the association between respondent characteristics and the causes of medication errors, the types of medication errors, and the frequency of committing and reporting medication errors. Lastly, ANOVA test was used to assess the relationship between the respondents' characteristics and the average ranking of the therapeutic class involved in medication errors. P value of (<0.05) was considered as significant.

It worth to note that 6 surveys were excluded for one of the following reasons:

- Respondent characteristics information were not completed.
- Less than one entire part of the survey is completed.
- Giving the same rating (answers) for the same section for two parts or more.

4.8 Validity and Reliability

Validity

Validity is often defined as the extent to which an instrument measures what it purports to measure (Kimberlin, 2008). There are several types of validity; construct validity, content validity, and Criterion-related validity.

Content validity addresses how well the items developed to operationalize a construct provide an adequate and representative sample of all the items that might measure the construct of interest (Kimberlin, 2008). Content validity usually depends on the judgment of experts in the field, and therefore the questionnaire was sent to a group of experts to examine the entire tool and offer their opinion on its content (Annex 4). Comments from experts were collected and reviewed, some comments were taken into account; adding some questions in the first part and fourth part, rephrasing some questions, and minor changes in wording.

Reliability

The reliability is defined as the major criterion for assessing the instrument quality and adequacy". It measures the consistency with which it measures the target attributes (Polit & Hungler, 1999). The reliability of the tool in this study was estimated using Cronbach's alpha coefficient (Cronbach's alpha). Cronbach's alpha is a measure of the internal consistency of a test or scale; consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test (Tavakol & Dennick, 2011).

Cronbach's alpha was measured for the first 2 domains, causes of MEs 0.813, and for the types of MEs domain 0.877. This is considered a high reliability of the questionnaire.

4.9 Pilot study

After developing the questionnaire a pilot study was conducted on a sample of 15 registered nurses in a hospital other than the study setting.

The pilot study was conducted to help the researcher in obtaining useful feedback from the participants regarding the questionnaire clarity and to explore if there is any possible problems in the tool construction. Minor feedbacks were received, in the overall the questionnaire questions were understood by the participants and they didn't find any difficulties filling it out. Pilot testing questionnaires were not included in the analyzed data.

4.10 Ethical consideration

The study was approved by the three hospitals and a written permission letter was provided (Annex 3). Nurses were notified about the significance and purpose of the study. They were informed that filling and completing the instrument is voluntary, return of the questionnaires was considered

consent of the participant. Participants were assured of the confidentiality of all the information provided in the questionnaire, no name or identifying data were requested. Also the study was approved by the research review committee at the School of Public Health at Al-Quds University.

Chapter Five

Results

5.1 Introduction

This chapter represents the results of the study. Including the characteristics of the participants, the mean score, standard deviations, and percentages of positive responses toward the study domains. It also provided analysis of the study dependent variables and the independent variables.

5.2 Response Rate

Of the 467 surveys distributed, 267 were returned, from which 6 surveys were disqualified as incomplete filled items. The overall response rate was 57.17%. The response rate in Al-Makassed (49%) was lower than the response rate in the PMC (63%) and Arab specialty hospitals (64.4%).

Table 5.1: Response rate

Hospital	**Population size**	**Sample size**	**Response rate**
Palestinian Medical Complex	173	109	63%
Arab Specialty	90	58	64.4%
Al-Makassed	204	100	49%
Totals	**467**	**267**	**57.17%**

5.3 Characteristics of participants

More than half of the participants were female (59.8%), while the male represents (40.2%). Most of the participants were from the age group 30 – 40 (58.2%). (42.1%) of the respondents have less than 5 year's experiences in nursing profession. And for the education level the majority of respondents have a bachelor's degree (55.6%). Almost all the participants work in a full time base (93.5%). Rotating between shifts constitute the majority of respondents working shifts (68.2%).

(64%) of the participants said that they get training in patients safety topics, while (48.7%) get training in medication safety. (88.9%) of the respondents said that there is a medication safety process at the hospital where they currently are working at, (81.2%) said that the process is implemented at the hospital.

Table 5.2: Characteristics of the participants

Variable	Frequency	Percent (%)
Gender		
Male	105	40.2
Female	156	59.8
Age		
Less than 30 years	71	27.2
From 30-40 years	152	58.2
More than 40 years	38	14.6
Experience in Nursing profession		
Less than 5 years	110	42.1
5-10years	89	34.1
More than 10 years	62	23.8
Education Level		
Diploma	79	30.3
bachelor's degree	145	55.6
Graduate studies	37	14.2
Work commitment		
Full-time	244	93.5
Part-time	17	6.5
Shifts		
Day	69	26.4
Night	14	5.4
Rotating	178	68.2

Training in Patient safety		
Yes	167	64.0
No	94	36.0
Training in medication safety		
Yes	127	48.7
No	134	51.3
Presence of medication safety process in the hospital		
Yes	232	88.9
No	29	11.1
Implementation of medication safety process		
Yes	212	81.2
No	49	18.8
Work Department		
ICU	23	8.8
CCU	38	14.6
ICU/ NEW BORN	31	11.9
ICU/ CHILD	17	6.5
CHILD	22	8.4
Internal Medicine	20	7.7
Surgery	46	17.6
Obstetrics and Gynecology	46	17.6
Orthopedic	18	6.9
Total	**261**	**100%**

5.4 Causes of medication Error

This domain examined the factors contributing to medication errors as perceived by nurses. The results showed that the highest perceived causes of medication errors were medication error occurs

when nurses lack pharmacological knowledge and skills, presented by a mean score of 74.25 and 82% of positive responses. The second perceived cause was medication error occurs when there is shortage of nursing staff and existence of heavy work overload, presented by a mean score of 75 and 77.7 positive response. And 72.8% of positive responses were for medication error occurs when nurses are distracted or interrupted by other patients, coworkers or events at the unit, and when there is confusion between two drugs with similar name or shape (LASA), presented by a mean score of 69.25 and 67.5 respectively.

Table 5.3: Perception of nurses towards causes of medication errors

	Mean (SD)	**Mean score**	**% Positive response**
Medication error occurs when nurses lack pharmacological knowledge and skills.	3.97 (0.90)	74.25	82.0
Medication error occurs when there is shortage of nursing staff and existence of heavy work overload.	4.00 (1.06)	75.0	77.7
Medication error occurs when nurses are distracted or interrupted by other patients, coworkers or events at the unit.	3.77 (1.05)	69.25	72.8
Medication error occurs when there is confusion between two drugs with similar name or shape (LASA).	3.70 (0.99)	67.5	72.8
Medication error occurs more often with new graduates who have limited experience.	3.75 (0.93)	68.75	72.4
Medication error occurs due to poor mathematical skills of nurses.	3.67 (0.94)	66.75	68.5
Medication error occurs when the hospital staff fails to follow policies and procedures for safe drug administration.	3.60 (0.99)	65.0	65.6
Medication error occurs due to the poor communication between nurses and physicians.	3.56 (1.01)	64.0	65.5
Medication error occurs when the physician's writing on the doctor's order form is difficult to read or illegible.	3.52 (1.21)	63.0	63.3
Medication error occurs when the medication labels/packaging are of poor quality or damaged	3.54 (1.12)	63.5	62.9

Medication error occurs due to improper medication storage on the nursing station and medication trolleys.	3.39 (1.12)	59.75	56.7
Medication error occurs when the drug order is complicated, such as orders for chronic, critical, or complex conditions.	3.43 (0.96)	60.75	55.5
Medication error occurs due to the poor communication between nurses and pharmacists	3.37 (1.04)	59.25	55.1

5.5 Types of medication error

The respondents were asked in this domain to rate the types of medication errors based on nurses' prospective. The highest positive response (57.5%) was for administering a wrong dose of the drug, followed by administering the drug at a wrong time presented in (53.2%) of positive responses. However, administering the drug in a wrong route of administration and administering the drug in a wrong dosage form were the lowest scored types of MEs, presented by (38.8%) and (41.0%) respectively.

Table 5.4: Types of Medication errors as perceived by nurses.

	Mean (SD)	**Mean score**	**% Positive response**
Administering a wrong dose of the drug (a dose containing the wrong strength).	3.29 (1.09)	57.25	57.5
Administering the drug at a wrong time (more than 60 min before or after the prescribed time).	3.23 (1.11)	55.75	53.2
Administration of an IV Drug at the wrong rate (IV rate too fast or too slow)	3.15 (1.15)	53.75	49.8
Administration of a wrong drug.	3.08 (1.19)	52.0	48.3
Failing to administer a prescribed dose (Omission error).	3.02 (1.27)	50.5	47.1
Administration of the drug to the wrong patient.	3.02 (1.27)	50.5	45.3
Administering the drug in a wrong route of administration (administering the drug in a different route than order).	3.03 (1.14)	50.75	41.0

Administering the drug in a wrong dosage form. (Administering a dose in a different form than prescribed).	2.93 (1.13)	48.25	38.3

5.6 Frequency of medication error committed

The respondents were asked in this domain to recall the number of committed medication errors that occurs at their departments during the last twelve months. The result showed that the mean of recalled committed medication errors was 1.94 (SD=0.74) per nurse. The table below shows the frequency of committed MEs categorized into three groups where the highest percentage of committed errors was 45% for the group (1-3) medication errors.

Table 5.5: Frequency of committed medication errors as perceived by nurses.

	Frequency	**% Percent**
Zero medication error	78	30.1
1 -3 medication errors	118	45.6
more than 3 medication errors	63	24.3
Total	**259**	**100.0**

5.7 Reporting of medication error

5.7.1 Frequency of reporting medication error

The frequency of reporting medication errors by nurses to the administration of the hospital was examined in this domain; respondents were asked how many times they reported ME during the past 12 months, for errors committed by them or by their colleagues. The results showed that (50.2%) of nurses did not report any error. And (39.8%) of nurses report from 1-3 MEs, and only (10%) reported more than 3 MEs. However, the mean of reported medication errors was 1.6 (SD=0.66).

Table 5.6.1: frequency of reporting medication errors

	Frequency	% Percent
Zero medication error	131	50.2
1 -3 medication errors	104	39.8
more than 3 medication errors	26	10.0
Total	**261**	**100.0**

5.7.2 Nurses views regarding reporting of medication errors

Concerning the nurses' views about reporting medication errors, results showed that (88.5%) of respondents are usually sure when to report medication errors. And (88.1%) usually sure what constitutes the MEs. Only (16.9%) of nurses failed to report a medication error because they were afraid to lose their job and afraid of the reaction they will receive from the nurse manager or coworkers. (81.5%) of respondents feels comfortable reporting a medication error. Most of the participants believe that action is taken regarding the reported medication errors (88.0%), and that there is clarification of the reported medication errors, presented by (87.6%).

Table 5.6.2: Nurses views towards reporting of medication errors

	Mean (SD)	Yes F (%)	No F (%)
I am usually sure when a medication error should be reported.	0.88 (0.32)	230 (88.5)	30 (11.5)
I am usually sure what constitutes a medication error.	0.88 (0.32)	230 (88.1)	31 (11.9)
Is there any action or follow-up taken regarding the reported medication error?	0.88 (0.32)	228 (88.0)	31 (12.0)
Is there any clarification of the reported medication error, or any corrective action to avoid the repetition of such errors?	0.88 (0.33)	227 (87.6)	32 (12.4)

Is there a policy and procedure for reporting medication error at the hospital you are working at?	0.86 (0.35)	221 (85.7)	37 (14.3)
Do you feel comfortable reporting a medication error?	0.82 (0.38)	212 (81.5)	48 (18.5)
Have you ever failed to report a medication error because you did not think the error was serious to warrant reporting?	0.28 (0.45)	74 (28.5)	186 (71.5)
Have you ever failed to report a medication error because you were afraid of the reaction you will receive from the nurse manager or coworkers?	0.17 (0.37)	44 (16.9)	216 (83.1)
Have you ever failed to report a medication error because you were afraid that you might be subject to disciplinary action or even lose your job?	0.17 (0.37)	44 (16.9)	216 (83.1)

5.7.3 To whom nurses report medication errors

Most of the participants report medication errors to the head nurse (66.3%). Followed by reporting to the doctor in-charge (44.8%). (22.6%) of respondents report the incidence of medication errors to their colleague.

Table 5.6.3: To whom nurses report medication errors

	Yes F (%)	**No F (%)**
The Head nurse	173 (66.3)	88 (33.7)
Doctor in-charge	117 (44.8)	144 (55.2)
Nursing Supervisor	85 (32.6)	176 (67.4)
Colleague	59 (22.6)	202 (77.4)
Quality and patient safety officer	29 (11.1)	232 (88.9)
Medical supervisor	19 (7.3)	242 (92.7)

5.7.4 Method of reporting medication errors

The majority of respondents use written and verbal method of reporting, constituting (67.4%). And only (8.8%) use the written method solely of reporting.

Table 5.6.4: Method of reporting

	Frequency	% Percent
Verbally	62	23.8
Written	23	8.8
Both	176	67.4

5.8 Medication involved in Medication errors

The respondents were asked to rank 6 therapeutic classes based on their involvement and frequency in committed medication errors as per their perception. Number 1was given to the highly involved therapeutic class, and 6 to the least involved medication in MEs. The results showed that Antibiotics was given the highest frequency in MEs; the mean was 2.25 (SD=1.59). Electrolytes was in the second place; the mean was 3.01 (SD=1.61). While Anti-Diabetic and Anti-arrhythmic were the least ranked between the 6 therapeutic classes.

Table 5.7: Medication involved in medication errors as ranked by nurses

	Mean	SD
Antibiotics	2.26	1.59
Electrolytes	3.01	1.61
Analgesics	3.57	1.51
Antithrombotic	3.76	1.50
Anti-diabetics	4.06	1.47
Anti-arrhythmic	4.32	1.68

5.9 Harm level resulted from medication error as perceived by nurses

Respondents were asked to recall the harm level resulted from medication errors committed during the last 12 month. (28.2%) of nurses have committed errors that cause a temporary harm to the patient. While medication errors that cause a temporary harm requiring initial or prolonged hospitalization represents (19.1%) of respondents. However (8.4%) of participants committed errors resulted in patient death.

Table 5.8: Harm Level resulted from MEs as perceived by nurses

	Mean (SD)	**Yes F (%)**	**No F (%)**
An error occurred and caused a temporary harm to the patient.	0.28 (0.45)	74 (28.2)	188 (71.8)
An error occurred and caused a temporary harm requiring initial or prolonged hospitalization.	0.19 (0.39)	50 (19.1)	212 (80.9)
An error occurred which required an intervention necessary to sustain life.	0.12 (0.32)	32 (12.2)	230 (87.8)
An error occurred and resulted in permanent harm.	0.09 (0.28)	24 (9.2)	238 (90.8)
An error occurred and resulted in patient death.	0.08	22 (8.4)	240 (91.6)

5.10 Study domain by hospital and participants' characteristics

5.10.1 Causes of MEs with participants characteristics who responded positively.

Chi-square test was used to assess the relationship between the study independent variables and the causes of medication errors (Annex 5). The results show that there is a significant association between the hospitals and 6 of the possible causes of medication errors. Where 44.8% of the participants from Al-Makassed indicated significantly the effect of illegible physician's writing on the doctor's order, compared to 21.8% of the participants from Arab specialty hospital (P= 0.001).

Confusion between two drugs with similar name or shape (LASA) was indicated as a cause of medication errors by 43.7% of Al-Makassed Participants in comparison with 18.9% of Arab specialty hospital (P=0.012). Poor communication between nurses and physicians (P=0.001), and improper medication storage on the nursing station and medication trolleys (P=0.037) also were indicated more significantly by the participants from Al-Makassed than other hospital participants. However, the participants from the PMC indicated the effect of distraction or interruption at the department more significantly (P=0.003), where 44.7% of the participants from the PMC indicated it as a cause of MEs, compared to 14.7 of the participants from Arab specialty hospital. Participants from Al-Makassed and PMC scored higher than Arab specialty hospital participants in regard to shortage of nursing staff and heavy work overload cause (P<0.001).

No significant differences were found between any of the causes of MES in relation to the gender of participants. Whereas, the age of participants show significant differences with one of the causes of ME; confusion between two drugs with similar name or shape (LASA) (P= 0.043), 53.7% of the age group (30-40 years) in comparison with 16.8% of the age group (>40 years). There is no significance differences in the causes of MEs in relation to the experience in nursing profession.

A strong relationship exist between 5 causes of MEs and the educational level of the participants, participants who had bachelor's degree scored higher in shortage of nursing staff and heavy work overload (59.6%) in comparison with 25.1% of participants with diploma degree (P=0.003), where 57.9% of participants with bachelor's degree indicated the effect of lacking pharmacological knowledge and skills (P<0.001). New graduates who have limited experience was indicated as a cause of MEs by 57.1% of participants with bachelor's degree in comparison with 17.5% of participants with graduate studies degree (P=0.004). 60.8% of participants with bachelor's degree indicated poor communication between nurses and physicians as a cause of MEs, while only 24% of participants with diploma degree indicated it as a cause (p=0.009).

Working shifts of the participants has a moderate relation with 2 causes of MEs; where 64.2% of participant's working on rotating shifts indicated illegible physician's writing on the doctor's order

as a cause of MEs in comparison with 31.5% of participant's working on morning shifts only (P=0.04). Confusion between two drugs with similar name or shape (LASA) was indicated by 70% of participants working on rotating shifts (P= 0.035).

However, the participant training in medication safety topic show significant association with 4 causes of MEs; nurses who get training in medication safety scored higher in illegible physician's writing on the doctor's order as a cause of MEs 54.5% (p=0.009). Whereas, Poor mathematical skills of nurses indicated by 53.1% of participants who got training in medication safety (P=0.024). Also 55.4% of participant's who get training in medication safety indicated improper medication storage on the nursing station and medication trolleys as a cause of MEs (P=0.009).

However, training in patient safety topics show relationship with two cause of MEs, where 69% of participants who get training in patient safety indicated hospital staff failing to follow policies and procedures for safe drug administration as a cause of MEs (P=0.015). 69.6% of participant's who get training in patient safety indicated the effect of improper medication storage on the nursing station and medication trolleys (P=0.021).

Implementation of policies and procedures show relationship with 4 causes of MEs; 85.3% of participants who said that they have medication safety policies and procedures implemented at the hospital they are working at indicated confusion between two drugs with similar name or shape (LASA) as a cause of MEs (P= 0.006), 85.7% indicated the effect of new graduates who have limited experience (P=0.003), 84.9% indicated poor mathematical skills of nurses as a cause (P=0.020), and 85.4% indicated the effect of hospital staff fails to follow policies and procedures for safe drug administration (P=0.015).

The relationship between the participants unit of work with shortage of nursing staff and heavy work overload was statistically significant (P=0.014), also with poor mathematical skills of nurses (P=0.033). Where 17.2% of participants working at CCU department indicated shortage of nursing

staff and heavy work overload as a cause of MEs in comparison with 6.9% of participants working at internal medicine and orthopedic departments. And regarding poor mathematical skills of nurses it was indicated as a cause by 18.4% of participants working at surgical department in comparison with 6.7% of participants at internal medicine and orthopedic departments.

5.10.2 Types of MEs with participants characteristics who responded positively.

Chi-square test was used to assess the relationship between the study independent variables and the types of medication errors (Annex 6). No significant differences were found in any of the types of MEs in relation to the participants' gender, age, experience in nursing profession, implementing policies and procedures of medication safety, and training in medication safety (P>0.05).

There is a significant association between the hospitals with 2 types of MEs; where participants from AL-Makassed indicated significantly more wrong time as a type of MEs (46%) in comparison with (13.7%) of Participants from Arab Specialty hospital (P=0.005). Whereas, omission error was indicated by (46.3%) of participants from Al-Makassed in comparison with (38.2%) by participants from the PMC **(**P=0.031).

The participants' educational level has a statistically significant association with wrong time and omission error types, where (57.7%) of participants with bachelor's degree indicated omission errors as a type of MEs that occur at the department in comparison with (22%) of Participants with diploma degree (P=0.003). Working shifts of the participants has a moderate relation with wrong time errors; (74.8%) of nurses working on rotating shifts indicated wrong time as a type of medication error in comparison with (2.9%) of nurses working at night shift (P=0.022).

Training in patient safety topic show a significant association with wrong dose medication errors, (58.7%) of participants who get training in patient safety indicated wrong time as a type of MEs (P=0.025). Participants unit of work showed significant differences with 3 types of MEs; wrong

patient, wrong drug, and wrong dose (P<0.05). (16.9%) of nurses working at the surgical department indicated wrong patient MEs in comparison with (6.8%) of participants working at pediatric-ICU, and (3.4%) of participants working at orthopedic departments.

5.10.3 Therapeutic classes involved in MEs with hospital and participants characteristics.

Analysis of variance (ANOVA) test was used to examine the relationship between the average ranking given by the participants for the medications involved in MEs with hospital and participant characteristics (Annex 7). A significant differences were found in the ranking of anti-thrombotic, electrolytes, and anti-arrhythmic medications in relation to study hospitals (P<0.05). The Arab specialty hospital nurses gave anti-thrombotic medications the highest rank (mean=3.29) in comparison with AL-Makassed hospital (mean= 3.96) (P=0.03). The PMC nurses gave electrolytes the highest rank (Mean=2.79) in comparison with Arab specialty hospital (mean=3.58) (P=0.01). No significant differences were found in drugs ranking in relation to the participant's gender.

Antibiotics and anti-arrhythmic ranking showed significant association with the participant's age group, whereas the age group (> 40 years) gave the antibiotic the highest rank (mean= 1.97) in comparison with the age group (<30 years) which gave it the lowest rank (mean= 2.72) (P=0.016). Whereas the age group (< 30 years) gave anti-arrhythmic medications the highest rank (mean =3.8), and the age group (30-40 years) gave it the lowest rank (mean= 4.53) (P=0.01). The experience in nursing profession has a significant relationship with the ranking of antibiotics and anti-arrhythmic medications (P<0.05). Nurses with experience more than 10 years gave antibiotics the highest rank (mean=1.9) (P=0.004), while nurses with less than 5 years' experience gave anti-arrhythmic medication the highest rank (mean=3.91) (P=0.003).

The educational level show significant differences with electrolyte therapeutic class, where participant's with graduate study degree rank electrolytes at a higher position than (mean=2.76) participants with diploma degree (mean=3.48) (P=0.008). Medication safety policies and procedure implementation at hospitals has a significant association with antibiotics (P<0.05).

Nurses who said that they have policies and procedures for medication safety implemented at their hospitals gave antibiotics a higher rank (mean=2.16) in comparison with those who didn't have policy and procedures (mean= 2.71) (P=0.028).

There is also a significance relationship between the unit of work and anti-diabetics medications (P=0.02), the surgical department gave it the highest rank (mean=3.7) while the pediatric-ICU department gave it the lowest rank (mean= 5).

5.10.4 Frequency of committed and reported MEs with hospital and participants' characteristics

Chi-square test was used to assess the relationship between the study independent variables and the frequency of committing and reporting medication errors (Annex 8). There is a statistically significant relationship in the frequency of committing MEs (P=0.001) and frequency of reporting MEs (P<0.001) in relation to the hospitals. The PMC scored the highest in (zero MEs committed) (46.2%), while Al-Makassed scored the highest in (more than 3 MEs committed) (58.7%). However, regarding the frequency of reporting MEs al-Makassed scored the highest in (1-3 reported MEs) (51%) and (more than 3 MEs reported) (69.2%), and the PMC scored the highest in (zero errors reported) (56.5%).

Significant differences were found between the frequencies of reporting medication errors with the gender of participants. Male scored higher in (1-3 MEs reported) (52.9%). While female scored (67.9%) in (zero MEs reported), and 69.2% in (more than 3 MEs reported) (P=0.003). A significant differences were also found between the age group of the participants and the frequency of reporting MEs (P=0.006). The age group (30-40 years) scored the highest with the frequency of MEs reported, (56.5%) in the group (zero MEs reported), (57.7%) in group (1-3 MEs reported), and (69.2%) for more than 3 MEs reported group.

The educational level of the participants showed a strong association with the frequency of committing MEs (P< 0.001). Where nurses with bachelor's degree scored the highest in committing MEs. (68.3%) of participant with bachelor's degree indicate committing more than 3 MEs in comparison with (7.9%) of participants with diploma degree. In regards to the association of educational level with the frequency of reporting MEs, also there was significant relationship (P=0.009); nurses with bachelor's degree scored the highest in reporting MEs. Where (60.6%) of the participant's indicate committing (1-3 MEs) in comparison with (10.6%) of participants with graduate study degree.

The unit of work showed significant association with both the frequency of committing MEs (P= 0.02), and frequency of reporting of MEs (P= 0.006). (19.5%) of the Participants from the obstetrics and gynecology department indicated committing (1-3 MEs), in comparison with (5.1%) of the participant from orthopedic department. And for committing more than 3 MEs participants from surgical and pediatric departments scored the highest (17.5%) in comparison (4.8%) of the participants from obstetrics and gynecology department.

Regarding the reporting of MEs frequency, 23.7% of the participants working at the obstetrics and gynecology department indicated not reporting any MEs, compared to (2.3%) of the participant working at pediatric-ICU department. Whereas, (19.2%) of participants working at Pediatric department indicated reporting more than 3 MEs in comparison (3.8%) of participants working at orthopedic department.

However, no significant differences was found between the frequency of reporting and committing with experience in nursing profession, shifts, Training in Medication safety, training in patient safety, and implementation of medication safety policies and procedures (P>0.05).

For the open end question, 111 of respondents fill out this section providing solutions and strategies which they believe it would be helpful for reducing medication errors at hospitals, the followings are the most common recommendations received from respondents:

- Increase nurses staff in hospitals.
- Improve nurse's pharmacological skills and knowledge, specifically medication scientific and trade names.
- Availability of clinical pharmacist at hospitals
- Implementing policies and procedure for medication preparation and distribution, especially for electrolyte solutions.
- Availability of a blame-free environment where nurses are able to report medication errors without fear of reprimand or punishment.
- Availability of a non-punitive reporting system.
- Use the five rights of medication administration; the right patient, the right drug, the right dose, the right route, and the right time.
- Availability of inpatient pharmacy in hospitals 24 hours a day.

Chapter Six

Discussion

6.1 Introduction

This chapter discusses the results of the study survey on exploring nurses' perceptions about several issues related to medication errors in Palestinian hospitals. The purpose of this study is to help in pinpointing some areas in medication safety issues where there is potential for making improvement to be reflected in the nurses practices regarding medication managements at hospitals. This chapter presents discussion of the findings, conclusion and recommendations of the study.

The response rate in Al-Makassed hospital was lower than the response rate in the PMC and Arab Specialty Hospitals., Lower cooperation of the nurses at Al-Makaseed was observed probably due to the high workload at the hospital. However the overall response rate in this study was (57.17%) similar to a study conducted in Palestine (59%) (Al-Sarawan, 2014), and study in Jordan (57%) (Marayyan et al., 2007). Higher than the response rate in a study conducted in Australia (51%) (Deans, 2005), but lower than a study conducted in Egypt (72.3%) (Al-Youssif, et al., 2013), and in Turkey (75%) (Güneş et al., 2014).

6.2 Causes of medication errors

Since MEs are a persistent problem in nursing practices, many studies in the literature examined the factors that contribute to the occurrence of MEs in clinical nursing practice. The survey examined the nurse's perception towards 13 possible cause of medication errors where the positive responses ranged from 55.1% to 82%.

The results of this study indicated that nurses believed that multiple causes are involved in medication errors. Where the main causes perceived by nurses were lack of pharmacological

knowledge and skills (82%), shortage of nursing staff and existence of heavy work overload (77.7%), interruption and distraction (72.8%), similar packaging confusion (72.8%), and new graduates who have limited experience (72.4%). The results are consisted to a great extent with other studies which examined the factors contributing to MEs. Table 6.2, presents the most frequent 4 main contributing factors to MEs based on findings in some studies in the literature.

In a study examined the Medication error in Middle Eastern countries, the main contributory factors involved in medication errors were lack of pharmacological knowledge of physician and nurses, heavy workload, new staff, and miscommunication between healthcare professionals (Alsulami, Conroy, & Choonara, 2012). In Al-Shara's study which was conducted in Jordan the most common cause were heavy workload, and new staff (Al-Shara, 2011). Similarly, a study conducted in 6 governmental hospitals in North West bank in Palestine to assess the nurses' perception regarding MEs (Al-Sarawan, 2014) showed that the most perceived causes of MEs by nurses were, heavy workload, inadequate staff, tiredness, stress, and distraction.

Table 6.1: Classification of the main contributing factors to MEs in the literature.

Author & country	**Contributing factors of MEs**
Al-Sarawan Palestine (Al-Sarawan, 2014)	1. Heavy work load 2. Inadequate staff 3. Stress 4. Lack of sleep
Mrayyan et al. Jordan (Marayyan, et al., 2007)	1. Poor quality or damaged labels/Packaging 2. Confusion with different types and function of infusion devices 3. Distractions 4. Set of infusion device incorrectly
Al-Shara Jordan (Al-Shara, 2011)	1. Heavy workload 2. New staff 3. Personal neglect 4. Unfamiliarity with medication
Mayo & Duncan US	1. Illegible physicians writing of the order 2. Distractions 3. Tiredness and exhaustion

(Mayo & Duncan, 2004)	4. Confusions between two medications with similar names
Tang et al. Taiwan (Tang, et al., 2007)	1. Personal neglect 2. Heavy workload 3. New staff 4. Unfamiliarly with the medication
Mahmood et al. Canada (Mahmood, Chaudhury, & Valente, 2011)	1. Poor training of health staff 2. Overwork, stress or fatigue 3. Registered nurse to patient ratio 4. Health staff not working as a team
Jones & Treiber Georgia (Jones, 2010)	1. Illegible physicians hand writing on prescription chart 2. Failure to follow the 5 rights 3. Registered nurses to patient ratio 4. Unclear verbal orders

Lack of pharmacological knowledge and skills was given the highest score in our study which contradicts with Gladstone's study where distractions were ranked the highest cause (Gladstone, 1995). But it was similar to a qualitative study conducted to identify the systems failure that underline medication errors, the results indicated that the most common cause was lack of drug knowledge, accounting for 29% of 334 errors that occurred in a 6 month's period (O'SHEA, 1999). The result in our study may be explained by the fact that in Palestine there is a lack of continuous education for nurses to update their knowledge in general and particularly in pharmacological knowledge. Since pharmacological knowledge is essential for nurses as they are accountable for drug administration to patients.

However the second cause of MEs as perceived by nurses was shortage of staff and heavy workload. Similar to our results, a study in Taiwan (2007) indicated that an increased workload is the second major factor contributing to medication errors, mostly because of patients' dependency and understaffing (Tang F- I, 2007). This result could be explained by the fact that Palestinian hospitals particularly governmental hospitals suffer from shortage of nursing staff, which might cause nurses to modify some protocols in drug administration practices due to time pressure, resulting in error prone situations. Based on a report conducted by the Independent Commission for Human Rights (ICHR) "The reality of government hospitals in the Palestinian National

Authority territories" it indicated that governmental hospitals in the West Bank are suffering from a severe shortage of nurses in proportion to the number of patients, where the international standards require a nurse per bed. Also, some countries such as Sweden, Germany, Qatar and Israel require a nurse for every 1,000 or 1,500 citizen. In West bank there is one nurse per 2,000 citizens (Allawneh & Basheer, 2009).

On the other hand, distraction/interruption was the main third contributing factor to MEs as perceived by nurses as per our study. The result in this study was consisted with Mrayyan's study (2007) were distractions was ranked as the third top cause of MEs. In Mayo & Duncan (2004) study, distractions was the second major cause of MEs, while in Gladstone's study (1995) it was the top main cause of MEs. This concurs with Deans' (2005) study, who found that distractions and interruptions were the major environmental issue contributing to nursing making errors during medication administration. This result might be linked with the second cause of MEs in our study, where distraction could occur when each nurse carry out multiple and several tasks at the same time due to the shortage of staff and heavy workload. In an increasingly frenetic work environment, interruption, distraction and difficulty in retaining focus are key issues in the administration of drugs (Brady, et al., 2009). Sources of distractions varies; it could be caused by patients, coworkers, and physicians, even phone ringing and alarm ringing might distract nurses.

In regards to the association between the contributing factors with participants and hospital characteristics. There was a statistically significant relation between educational level of participants with lack pharmacological knowledge and skills ($P<0.001$). Boggs et al. (1988) tested nurses' knowledge of three commonly-administered drugs and sought to determine if a relationship existed between level of knowledge and educational background or experience, they found an identifiable difference between staff members with different educational qualifications. Nurse managers and educators had a better knowledge of medications than those nurses who were responsible for administering them (O'SHEA, 1999).

Also significant difference was found with training in medication safety ($P=0.003$), were 52.8% of nurses who get training in medication safety indicated lack of pharmacological knowledge and

skills as a contributing factor of MEs, nothing was found in the literature regarding this relation. This result might be explained by the fact that nurses who get trainings in medication safety are aware of the most common causes and contributing factors involved in MEs.

Furthermore, this study showed highly statistically significant correlation between the second and third main causes of MEs in this study in relation to hospitals; shortage of nursing staff and heavy work overload ($P<0.001$) and distraction and interruption ($P=0.003$). The results showed that 43.8% of participants working at the PMC hospital indicated shortage of staff and heavy work-load as a cause of MEs, while only 14.3% of participants working at Arab specialty hospital indicated it as a contributing factor. Similarly 44.7% of PMC nurses indicated distractions as cause, in comparison with 14.7% of Arab specialty hospital nurses. This result may be explained that PMC is a governmental hospital were most of governmental hospital suffering from lack of nursing staff, heavy workload which might leads to distracting and interrupting nurses while practicing drug administration. Whereas the Arab specialty hospital is a private hospital were this issue is not marked as it is in the governmental hospitals.

6.3 Types of medication errors

This study investigated the perception of nurses towards the types of MEs that occur at their departments. The findings indicated that the most 3 common types of MEs as perceived by respondents were administrating a wrong dose of drug (57.5%), administering the drug at a wrong time (53.2%), and administration of an IV drug at the wrong rate (49.8%). Similar to Deans' study (2005) where wrong IV rate was the third main type of medication error, and wrong time was the top main type of MEs, and contradicts with it regarding the main type; administration of wrong dose, where it was the least frequent type of MEs (Deans, 2005). In a study conducted in Taiwan (Tang's, 2007) the results were almost similar; the top main types of MEs were wrong dose, wrong drug, followed by wrong time.

Al-Shara's study (2010) found that choosing the wrong patient and the wrong dose were the two leading types of MEs, and the main types of MEs were wrong time, and wrong IV drug rate, while wrong dose was not one of the top main types, which contradicts with our results.

Moreover, the results were consistent with a systematic review of the literature related to medication errors in Middle Eastern countries (2012), where wrong dose was the most common type of error reported in 12 studies investigated the types of MEs (Alsulami, et al., 2012). Also it corresponds with a study by the FDA that evaluated reports of fatal medication errors from 1993 to 1998, the most common error involving medications was related to administration of an improper dose of medicine, accounting for 41% of fatal medication errors (Strickland & McCarthy, 2014).

Wrong dose, and wrong time were the most common types of MEs as perceived by nurses in this study, which could be related to the leading causes of MEs as perceived by the nurses who participated in this study. Administration of the wrong dose of medication other than the one ordered by physicians, may be linked with poor mathematical skills of nurses which were presented in this study by 68.5% of positive responses, also with the main contributing factor to MEs as per the result of this study; lack of pharmacological knowledge and skills.

In regards to the wrong time of administering medication errors; a study investigated the prevalence and causes of wrong time medication administration errors at a tertiary care hospital in Pakistan found that out of 39,386 wrong time administration ME, 6% were early administered and 94% lately administered. Reasons for late administration were delay in dispensing the medication from the pharmacy, nurses being busy with other critical tasks, or nurses forget to mark the administration of medication (Kirmani, 2013). Another possible explanation for the delay may be found in the frequency of participants reported heavy work-load and shortage of staff as the second major cause of MEs in this study, where stressful work-load, multiple tasks per nurse, and understaffing affect the administration of medication in the proper time.

Our results show significant difference between wrong dose MEs of medication in respect to participants training in patient safety (P=0.025), and the participants unit of work (P=0.036). Tangs' study (2005) found that there is a relationship between the units of work and dosing errors, the pediatric department was involved 10 folds in dosing errors. Whereas, in this study the surgical department was highly involved in dosing errors (18.8%), and pediatric departments least involved (8.7%).

6.4 Frequency of committing and reporting medication errors

Although medication errors are the most frequently identified errors that occur in healthcare settings in the United States, their extent and scope have proven difficult to quantify. Relying almost exclusively on a system of voluntary report, researchers estimate that 5% or less are reported and that only those resulting in patient harm are consistently identified (Jones, 2010).

In this study participants were asked to recall the committed MEs which occur at the department they are working at during the last 12 months. Results showed that 30.1% of the participant nurses report that zero errors were committed at their department, while 45.6% reported that 1-3 MEs was committed per year, and 24.3% committed more than 3 MEs. This may be explained either by the fact that nurses tend to choose not reporting any error or low number of error (1-3 MEs) because they were afraid to tell the real number and did not feel comfortable giving such information in a survey fearing of identification. Or it could be that nurses are not aware for what constitutes MEs and not really sure when to consider an incident as a ME. In Palestine there isn't enough education and awareness regarding MEs.

However in a similar study conducted in intensive care unit and neonate units in Iranian hospitals (2013), the results contradict with the findings of this study where 11.8% of nurse's participating in the study declared that they had not made any medication error during the past 6 month, while 37.8% made 1or 2 ME, 41.2% made 3 or more MEs (Taher et al, 2013).

Whereas, in Mrayyans' study (2007); they asked the participants about the total errors committed over the course of their career, and the results were similar to our study, where 22.1% did not commit any MEs, 56.5% of participant reported committing 1-3 MEs, and 21.4% committed more than 3 MEs. Also a study examined nurses' perception on the medication error at one of the hospitals in Malaysia (2009), found that (52.17%) subjects committed medication error at least once throughout their experience in nursing profession (Hassan, et al., 2009).

In another study conducted in Saudi Arabia (2014) exploring nurses' perception of medication administration errors, the results showed that the mean of the frequency of medication admiration error, was 1.4 per nurse (SD = 1.3) times per month (Aboshaiqah, 2014). Whereas in this study the mean of recalled committed medication errors was 1.94 per nurse (SD=0.74) per 12 months. In Mayo & Duncan (2004) the mean number of errors recalled was 4.9 per nurse, and most nurses (68.3%) recalled making 2 to 5 errors over their career.

With regards to frequency of reporting MEs, nurses were asked to recall the number of reported MEs to the management during the past 12 months at the departments they are working at. Results showed that 50.2% of nurses did not report any error, 39.8% of nurse's report from 1-3 MEs, and only 10% reported more than 3 MEs. This result demonstrate that MEs were underreported by nurses, and indicated that the problem of underreporting errors in Palestine is a serious issue. This could be explained by the fact that MoH hospitals lack a clear policies and procedure for reporting medical error in general, and specifically MEs. However, when participants were asked about the committed errors 30% of nurses answered that they did not commit any ME, compared to 50% of nurses answered that they did not report any ME, here we should consider that out of the 50% who did not report ME 20% did commit an error and did not report it while the rest 30% already did not commit an error to report it.

This result is consistent with a study conducted in Palestine, assessing the attitudes of physicians and nurses towards incident reporting, the study investigated the number of reported medical errors and events in the past 12 month, where the highest percentage was for respondents not reporting any error 65.5%, 30% of respondents reported 1-3 errors, and only 4.3% of respondents reported

more than 3 errors (Rashed & Hamdan, 2015). In Mrayyan's study (2007), nurses reported that 42.1% of all committed MEs were reported to nurse managers using incident report. And 45% in Mayo & Duncan's study (2004) similar findings were also found in a study conducted in Palestine (2013) at 11 general public hospitals in the West Bank. About 53.2% of the respondents reported that they had not reported any event in the past 12 months, 22% reported one to two events, 12.7% reported three to five events and 12.2% reported more than five events (Hamdan & Saleem, 2013).

In Mrayyan's study (2007), nurses reported that 42.1% of all committed MEs were reported to nurse managers using incident report. And 45% in Mayo & Duncan's study (2004) similar findings were also found in a study conducted in Palestine at 11 general public hospitals in the West Bank. About 53.2% of the respondents reported that they had not reported any event in the past 12 months, 22% reported one to two events, 12.7% reported three to five events and 12.2% reported more than five events (Hamdan & Saleem, 2013).

A significant differences were found between hospitals and reporting of MEs ($P<0.001$), where 56.5% of participants from PMC hospital did not report any MEs during the past 12 month, compared with 22.1% of participants from Al-Makassed, and 21.4% of participants working at Arab Specialty Hospital. Significant differences were also found in the frequency of committing MEs in relation to hospitals ($P=0.001$). Where 46.2% of participants working in PMC hospital did not commit any error, and 56.5% did not report any ME. While participant from AL-Makassed hospital 26.9% did not commit any ME, and 22.1% did not report any ME. This might be due to the absence of incident reporting at MoH hospitals, along with nurse's fear of reporting incidents due to prevalence of punitive culture at MoH hospital. Whereas, in Al-Makassed hospital they has a reporting system of incidents since it is one of the JCI accreditation requirements.

In Lin and Ma's study (2009), they found that The odds of nurses' willingness to report medication errors increased by nearly three times in private hospitals, and over three times in nonprofit hospitals, when compared to public hospitals. This may be because private and nonprofit hospitals have more flexible and open organizational climates than public hospitals. Nurses who worked in public hospitals faced a rigid hierarchal authority, and in those climates, the filing of incident reports could have been a barrier to promotion. (Lin & Ma, 2009)

The participant's level of education had a significant association with the frequency of committing MEs (P<0.001), and with the frequency of reporting MEs (P=0.009). Participants with Baccalaureate degree has a higher frequency in declaring committing MEs, and reporting of MEs to management more that participants with diploma and graduate studies.

6.5 Reporting of medication errors

In this study the researcher explored nurses perception regarding several issues in reporting of MEs. Findings showed that 88.5% of the participants are sure when a medication error should be reported. It's higher than Mrayyans' study where 78.8% of participants were sure when MEs should be reported, and close to Mayo & Duncan's study were 91.3% of nurses know when to report an error. While in Al-Sarawan' study conducted in Palestine 67% of participants were sure when to report MEs. Also 88.1% of participants in this study were sure what constitute a ME, higher than Mrayyans' study where 82.8% of participant were sure what constitute MEs, and lower than Mayo & Duncan's study; 92.6% were sure about what constitute MEs. The differences might be related to the nurses' knowledge about MEs and to the agreements over the definition of MEs.

Nurse's views regarding the reason of not reporting MEs were also examined. Where 28.5% of participants fail to report MEs because they didn't think the error was serious to warrant reporting. Lower than Al-Sarawan' study 45% of participants fail to report for this reason, and Mrayyans's study where 41.1% of Participants fails to report because error was not serious enough.

Only 16.9% of participants fail to report MEs because nurses were afraid of the reaction they will receive from the nurse manager or coworkers, and being afraid of disciplinary action or even lose their job. This result is much lower than similar studies, whereas in Al-Sarawans study 40% fail to report due to fear from managers and 37% due to disciplinary actions. In Mrayyans study 76.9% did not report due to fear of manager and 19.6% due to fear of disciplinary actions. In Rashed and

Hamdan's study 74.8% of participants fail to report due to fear of administrative sanctions. This result might not be reflecting the real situation, as in comparison with other studies in Palestine and Jordan, the percentage of nurses who fear to report due to disciplinary actions and manager reaction is much higher. Maybe the participants fear confessing that they did not report MEs due to the reasons listed above, as management do not protect reporters of errors from negative consequences reinforcing their fears. Fear of these negative consequences can lead to reporting errors only when a patient is harmed or when the error could not be "covered up" (Wolf & Hughes, 2008)

Berntsen (2004) advocates finding a non-punitive, safe and confidential way to share root case analysis and error preventions strategies amongst institutions, but it is widely acknowledged that creating a no-blame culture that encourages the reporting required to achieve this at an institutional and systems level is a slow process (Berntsen, 2004).

6.6 Therapeutic classes involved in medication errors

Few studies discussed the medication and therapeutic classes involved in MEs, most of the studies which discuss this issue referred back to hospitals documentation of MEs or to patient's medical records. Some studies involved the medication names, and others listed only the therapeutic class (Alsulami, Conroy, & Choonara, 2012). However, due to the lack of documentation of MEs in Palestine, and difficulties to reach patients' records and search in it. We asked the nurses to rank 6 therapeutic classes of medication based on their involvement and frequency in committed medication errors as per their perception

The results showed that Antibiotics was given the highest frequency in MEs; the mean was 2.25. Electrolytes was in the second place; the mean was 3.01. While Anti-Diabetic and Anti-arrhythmic were the least ranked between the 6 therapeutic classes. This result was similar to Tangs' study (2007), where Antibiotics were involved in more than one-third of MEs, electrolytes were the second type of medications involved in MEs (Tang, et al., 2007). In another study examining the responses and concerns of healthcare providers to medication errors, the results concurs with our study, where Antibiotics were also the first type of medication associated with MEs (Wolf, et al.,

2000). Hsaio's study (2009), indicates that Antibiotics were associated in more MEs (Hsaio, et al., 2009).

Although the participants in this study were from different department, but most of them agreed that antibiotics were the most common therapeutic class involved in medication errors, this might be explained by the fact that there is irrational use of antibiotics, irrationality is in the types, doses, duration, and indication of antibiotics leading to increase their probability to be involved in MEs.

A significant association were found between therapeutic classes involved in medication errors in relation to hospital and participants characteristics. A significant difference were found in Anti-arrhythmic drugs in relation to hospitals, where Arab Specialty hospital gave it a higher rank than other hospitals (P=0.003). And another significant difference were found between Antibiotics in relation to nurses experience in profession, nurses with more than 10 years' experience gave antibiotics the higher rank (P=0.004).

6.7 Harm level resulted from medication errors

The majority of studies in the literature did not assess the clinical consequences of reported and committed MEs. In this study, results showed that the harm level resulted from medication errors committed during the last 12 month as perceived by nurses was as the following, 28.2% of the respondents have committed errors that cause a temporary harm to the patient. While medication errors that cause a temporary harm requiring initial or prolonged hospitalization represents (19.1%) of respondents. However, 22 of the participants (8.4%) reported that medication errors occur at their departments (either by them or by their colleagues) resulted in patient death, this result might indicate that there is an urgent need to investigate more on the MEs by going back to patient's medical records and dig more into it.

Similarly in Hsaio's study (2009) they investigated the consequences of adverse events on patient after drug administration errors, where 17.4% reported causing mild harm to the patient, and 4.9% cause serious and sever consequences.

While in wolf's study (2000), results showed that the injury suffered by patients was not severe overall according to the harm scales, where 75.9% of participants indicated that the patients suffered no harmful effect. This could be explained that nurses' fear to declare such information, also might be due to the underreporting of medication errors, leading to giving incorrect numbers of incident and keeping the harm level rate unknown.

6.8 Conclusion

This study was set to assess and explore nurses' perception towards medication errors and related issues in Palestinian hospitals. The results show that the most contributing factors leading to MEs as perceived by nurses, were lack of knowledge and skills, and shortage of nursing staff and heavy workload; indicating the need for engaging nurses in training programs in medication safety, and demonstrate the necessity to increase the nursing staff at hospital departments. Additionally, the study help in identifying the most common types of MEs; wrong strength and wrong time as the most common types. However, the frequency of committing and reporting MEs was also highlighted in this study reveal a lack of formal incident reporting of MEs, which explains the shortage of knowledge about medication errors. The findings regarding the therapeutic classes of medications highly involved in MEs was compatible with other studies where antibiotics were ranked as the top main therapeutic class involved in MEs.

The results in general show that there are areas of potential improvements in Palestinian hospitals, medication safety interventions should be developed along with a clear protocols and polices to address strategies to reduce and eliminate medication errors, to make it harder for nurses to do something wrong and easier for them to do it right.

6.9 Recommendation

Based on the study results, the followings are the main recommendations to decrease the medication errors and improve medication safety at hospitals:

- Nurses education regarding medication safety, and increasing their awareness regarding the problem of MEs, through integrating medication safety into health education.
- Improve nurse's pharmacological skills and knowledge, specifically medication scientific and trade names.
- Increasing the nursing staff at hospital wards, to decrease the workload.
- A clear definition of medication errors must be stated by hospitals.
- Activating and implementing medication safety policies and procedures.
- A formal incident reporting system to report medication errors comprehensively and accurately should be developed.
- Create working environment that is supportive and non-punitive to encourage nurses to report MEs.
- Increase the number of clinical pharmacists at hospitals.
- Ensure the availability of inpatient pharmacy in hospitals 24 hours a day.

Areas of future research

- Conducting observational studies to explore medication errors in depth.
- Conducting research involving physicians, to explore their views in medication errors.
- Conducting research involving policy makers, and administration levels, to explore their views on medication errors issues.
- Conducting research to identify interventions that reduce medication error among nurses.
- Conducting research to evaluate medication errors during the whole medication process, not only preparing and administration medication errors.

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Annexes

Annex 1: Study Questionnaire (English version)

Demographic characteristics of Participants

Please answer the following questions:

1. **Gender** : ☐ Male ☐ Female
2. **Age**: …….
3. **How long have you been a practicing nurse?** ……
4. **Check highest level of education:**

1. Diploma	2. Bachelor's degree
3. Post-graduate higher diploma.	4. Postgraduate studies (master/Doctorate)

5. **What is your work commitment?**

1. Full-time	2. Part-time

6. **Which shift do you work?**

1. Day	2. Evening	3. Night	4. Rotating

7. Did you get any **training in patient safety** topics? ☐ Yes ☐ No

8. Did you get any training specific to **medication safety**? ☐ Yes ☐ No

9. Is there a **medication safety process** in the hospital you are currently working on?
☐ Yes ☐ No
If yes, is it implemented? ☐ Yes ☐ No

10. What is your primary hospital **work department**?
    1. ICU
    2. CCU
    3. Neonatal-ICU
    4. Pediatrics-ICU
    5. Pediatric Ward
    6. Burn Unit
    7. Emergency Room
    8. General Medical Ward
    9. General Surgical Ward
    10. Gynecology and Obstetrics Ward
    11. Operating Room
    12. Outpatient
    13. Other: (Please describe): _____.

Section 1: Causes of Medication Error

Below is a list of possible causes of medication error; please read each statement carefully and indicate the degree of your agreement or disagreement.

		Strongly agree	agree	Neutral	disagree	Strongly disagree
1.	Medication error occurs when the physician's writing on the doctor's order form is difficult to read or illegible.	1	2	3	4	5
2.	Medication error occurs when the medication labels/packaging are of poor quality or damaged.	1	2	3	4	5
3.	Medication error occurs when there is confusion between two drugs with similar name or shape (LASA).	1	2	3	4	5
4.	Medication error occurs when nurses are distracted or interrupted by other patients, coworkers or events at the unit .	1	2	3	4	5
5.	Medication error occurs when there is shortage of nursing staff and existence of heavy work overload.	1	2	3	4	5
6.	Medication error occurs when nurses lack pharmacological knowledge and skills.	1	2	3	4	5
7.	Medication error occurs more often with new graduates of doctors and nurses who have limited experience.	1	2	3	4	5
8.	Medication error occurs when the drug order is complicated, such as orders for chronic, critical, or complex conditions.	1	2	3	4	5
9.	Medication error occurs due to poor mathematical skills of nurses. (calculating Medication dose)	1	2	3	4	5
10.	Medication error occurs when the hospital staff fails to follow policies and procedures for safe drug administration.	1	2	3	4	5
11.	Medication error occurs due to the poor communication between nurses and physicians.	1	2	3	4	5
12.	Medication error occurs due to the poor communication between nurses and pharmacists.	1	2	3	4	5
13.	Medication error occurs due to improper medication storage on the nursing station and medication trolleys.	1	2	3	4	5

Section 2: Types of Medication Errors

Please read carefully each point and indicate the degree of your agreement or disagreement with each statement regarding the types of medication error that occur at your department.

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1.	Administration of the drug to the **wrong patient.**	1	2	3	4	5
2.	Administration of a **wrong drug.**	1	2	3	4	5
3.	Administering a **wrong dose** of the drug (a dose containing the wrong strength).	1	2	3	4	5
4.	Administering the drug in a **wrong route of administration** (administering the drug in a different route than order).	1	2	3	4	5
5.	Administering the drug in a **wrong dosage form.** (Administering a dose in a different form than prescribed).	1	2	3	4	5
6.	Administering the drug at a **wrong time** (more than 60 min before or after the prescribed time)**.**	1	2	3	4	5
7.	Failing to administer a prescribed dose (**Omission error).**	1	2	3	4	5
8.	Administration of an IV Drug **at the wrong rate** (IV rate too fast or too slow)	1	2	3	4	5

Section 3: Frequency of medication error committed

In your estimation, how many medication errors occur at your department in the past 12 months? Circle the correct answer:

0☐ 1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐ 8☐ 9☐ 10☐ more than ten, please specify-------

Section 4: Reporting of medication error

Part one: How many times did you report a medication error to management (the medication error that you or your colleges have committed) in the past 12 months? Circle the correct answer:

0☐ 1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐ 8☐ 9☐ 10☐ more than ten, please specify-------

Part two: Please check the most appropriate response

		Yes	No
1.	I am usually sure what constitutes a medication error	1	2
2.	I am usually sure when a medication error should be reported.	1	2
3.	Have you ever failed to report a medication error because you did not think the error was serious to warrant reporting?	1	2
4.	Have you ever failed to report a medication error because you were afraid that you might be subject to disciplinary action or even lose your job?	1	2
5.	Have you ever failed to report a medication error because you were afraid of the reaction you will receive from the nurse manager or coworkers?	1	2
6.	Do you feel comfortable reporting a medication error?	1	2
7.	Is there any action or follow-up taken regarding the reported medication error?	1	2
8.	Is there any clarification of the reported medication error, or any corrective action to avoid the repetition of such errors?	1	2
9.	Is there a policy and procedure for reporting medication error at the hospital you are working at?	1	2

Part three:

1. **To whom do you report a medication error incident: (you can select more than one option)**

1.Head Nurse	2. Doctor In-charge
3. Nursing Supervisor	4. Medical supervisor
5. Quality & Patient Safety officer	6. Colleague
7. Other……	

2. **How do you report a medication report?**

1. Verbally
2. Written
3. Both

Section 5: Medication categories involved in medication error

Please read the following **medication categories** carefully and rank them based on the frequency of their association with medication errors.
Rank number 1 to number 6. (#1 is the most frequent and #6 the least frequent)

Antibiotics	
Anti-diabetics	
Antithrombotic	
Electrolytes	
Analgesics	
Antiarrhythmic	

Section 6: Harm level resulted from medication error

Please read the following statements regarding the harm level resulted due to medication error and specify the level of harm resulted from medication error that occurs at your department in the past 12 months. (Answer in yes or no)

		Yes	**No**
1.	An error occurred and caused a **temporary harm** to the patient.	1	2
2.	An error occurred and caused a **temporary harm requiring initial or prolonged hospitalization.**	1	2
3.	An error occurred and resulted in **permanent harm.**	1	2
4.	An error occurred which required **an intervention necessary to sustain life.**	1	2
5.	An error occurred and resulted in **patient death.**	1	2

Section 7: Recommendations to prevent/reduce Medication Errors

Please specify some solutions and strategies that you believe it would be helpful for reducing and preventing medication error problems at hospitals.

Annex 2: Study Questionnaire (Arabic Version)

جامعة القدس

عمادة الدراسات العليا

كلية الصحة العامة – برنامج السياسات و الإدارة الصحية

دراسة إدراك التمريض للأخطاء الدوائية

عزيزي المشارك في هذه الدراسة

تحية طيبة و بعد،

يهدف هذا البحث الى التعرف على آرائكم و وجهات نظركم حول العديد من القضايا المتعلقة بالأخطاء الدوائية.

تتكون الاستبانة من بعض المقولات و الآراء ذات علاقة بالأخطاء الدوائية. تشمل على اسباب وانواع الاخطاء الدوائية وتكرار حدوثها والمضاعفات الناتجة عنها، والابلاغ عنها، واصناف الادوية الاكثر تكرارا بالاخطاء الدوائية.

الرجاء الإجابة عن الأسئلة حسب طريقة الإجابة الموضحة لكل سؤال في كل قسم. تستغرق اجابة هذه الإستبانة من ١٠ – ١٥ دقيقة. لتعبئة هذه الإستبانة نرجو اعطاء وجهة نظرك الخاصة والتي قمت بلمسها او تجربتها خلال عملك في القسم.

وأخيراً، نود أن ننوه الى أن المشاركة في الدراسة طوعية و أن السرية التامة حول هوية الشخص الذي قام بتعبئة الاستبانة مضمونة في هذا البحث. كذلك نود اعلامكم بانه لن يكون بمقدور إدارة المشفى أو الباحثون معرفة هوية المشاركين في البحث، حيث ستتم معالجة المعلومات بشكل عام وليس بشكل خاص.

الباحثون، جامعة القدس، كلية الصحة العامة

تعريفات:

الأخطاء الدوائية: أي حدث يمكن تفاديه والوقايه منه والذي قد يسبب أو يؤدي الى استخدام الدواء بصورة غير مناسبه أو الحاق الأذى بالمريض/ة، نتيجة لخلل في أي مرحلة من مراحل استخدام الدواء، ابتداءً من ظروف تخزين الدواء، ووصف الدواء بواسطة الطبيب/ة المعالج، ومن ثم تحضير وصرف الدواء، وثم اعطاء الدواء للمريض/ة من قبل الممرض/ة وصولاً الى مرحلة مراقبة المريض/ة.

السياسات والاجراءات المتعلقة بإعطاء الأدوية: مجموعة من القواعد والمبادئ التوجيهية الخاصة باعطاء الادوية والتي يتم اعتمادها لضمان تحقيق عملية اعطاء دواء آمنة وسليمة وصحيحة، مثل تحديد الاشخاص المؤهلين لاعطاء الادوية، والتأكد من الحقوق الخمسة لاعطاء الادوية (المريض الصحيح، والدواء الصحيح، والجرعة الصحيحة، وطريقة الاعطاء الصحيحة، والموعد الصحيح).

معلومات عامة عن المشاركين بالبحث

ستساعد هذه المعلومات في تحليل نتائج الاستبيان، الرجاء الاجابة عن الاسئلة التالية:

1. الجنس: ☐ ذكر ☐ أنثى

2. العمر: ----------.

3. **كم المدة التي أمضيتها في مهنة التمريض ----------.**

4. **الرجاء تحديد مستوى التحصيل العلمي:**

1. دبلوم (سنتين)	2. بكالوريوس
3. دبلوم عالي	4. دراسات عليا (ماجستير/دكتوراه)

5. **ما هو نظام الدوام الذي تعمل به؟**

1. دوام جزئي	2. دوام كامل

6. **في أي المناوبات غالبا تعمل:** (يمكن اختيار اكثر من اجابه)

1. دوام نهاري	2. دوام مسائي	3. دوام ليلي	4. تناوب

7. **هل حصلت على أي تدريب أو دورة تتعلق بموضوعات سلامة المرضى؟** ☐ نعم ☐ لا

8. **هل حصلت على أي تدريب او دورة تتعلق بالسلامة الدوائية؟** ☐ نعم ☐ لا

9. هل يوجد سياسات واجراءات للسلامة الدوائية بالمشفى الذي تعمل به حاليا؟ ☐ نعم ☐ لا

9.1 إذا كانت الإجابة نعم. **هل هذا النظام مطبق ومعمول به؟** ☐ نعم ☐ لا

10. **ما هو القسم الرئيسي الذي تعمل به بالمستشفى؟**

14. قسم العناية المكثفة **(ICU)**
15. قسم العناية القلبية **(CCU)**
16. قسم العناية المكثفة/حديثي الولادة
17. قسم العناية المكثفة/ الأطفال
18. قسم الأطفال
19. قسم الحروق
20. غرفة الطوارئ
21. قسم الباطني
22. قسم الجراحة
23. قسم أمراض النساء والولادة
24. غرفة العمليات
25. العيادات الخارجية
26. غير ذلك (الرجاء التحديد) ----------.

القسم الأول: أسباب الأخطاء الدوائية

الرجاء اختيار مدى موافقتك أو رفضك على الجمل التالية فيما يتعلق بالأسباب المحتملة لحدوث الأخطاء الدوائية في القسم الذي تعمل به.

		أوافق بشدة	أوافق	محايد	لا أوافق	لا اوافق بشدة
1	تحدث الأخطاء الدوائية عندما يكون خط الطبيب على الأمر الطبي المتعلق بالدواء غير مقروء أو من الصعب قراءته.	1	2	3	4	5
2	تحدث الأخطاء الدوائية عندما يكون لاصق التعليمات (Labels) على عبوة الدواء تالف، أو غير موجود، أو ذات نوعية رديئة.	1	2	3	4	5
3	تحدث الأخطاء الدوائية عندما يكون هناك خلط/التباس بين الأدوية ذات الأسماء أو الأشكال المتشابهة (Look alike and sound alike medication "LASA").	1	2	3	4	5
4	تحدث الأخطاء الدوائية عندما يتم مقاطعة أو تشتيت انتباه الممرض/ة أثناء العمل بالقسم من قبل المرضى، الطاقم الطبي، أو حدث ما بالقسم.	1	2	3	4	5
5	تحدث الأخطاء الدوائية عندما يكون هناك نقص في عدد الكادر التمريضي مع وجود ضغط عمل كبير في الاقسام.	1	2	3	4	5
6	تحدث الأخطاء الدوائية عندما يفتقر الممرض/ة الى المعرفة والمهارات الدوائية الكافية.	1	2	3	4	5
7	تحدث الأخطاء الدوائية في كثير من الأحيان مع الخريجين الجدد من الاطباء والممرضين ممن يملكون خبرة محدودة.	1	2	3	4	5
8	تحدث الأخطاء الدوائية عندما تكون تعليمات اعطاء العلاج الدوائي معقد، مثل علاج الحالات المرضية المزمنة، والحرجة، والمعقدة.	1	2	3	4	5
9	تحدث الأخطاء الدوائية نتيجة لضعف الممرض/ة بالمهارات الحسابية "Mathematical skills" (فيما يتعلق بحساب الجرعات الدوائية).	1	2	3	4	5
10	تحدث الأخطاء الدوائية نتيجة لعدم التزام الكادر الطبي بالسياسات والإجراءات المتعلقة بسلامة إعطاء الأدوية.	1	2	3	4	5
11	تحدث الأخطاء الدوائية نتيجة لضعف/ لخلل في التواصل بين الأطباء والكادر التمريضي.	1	2	3	4	5
12	تحدث الأخطاء الدوائية نتيجة لضعف/ لخلل في التواصل بين الصيادلة والكادر التمريضي.	1	2	3	4	5
13	تحدث الأخطاء الدوائية نتيجة لسوء تخزين وترتيب الأدوية في عربات الأدوية ومحطات التمريض (Nurse station).	1	2	3	4	5

القسم الثاني: أنواع الأخطاء الطبية

الرجاء اختيار مدى موافقتك أو رفضك على الجمل التالية فيما يتعلق بأنواع الأخطاء الدوائية التي تحصل بقسمك.

		اوافق بشدة	أوافق	محايد	لا أوافق	لا اوافق بشدة
1	إعطاء الدواء للمريض الخطأ **"wrong patient"** .	1	2	3	4	5
2	إعطاء الدواء الخطأ **(wrong drug)**.	1	2	3	4	5
3	إعطاء الجرعة الخطأ من الدواء**"wrong dose"** (جرعة تحتوي على التركيز الخطأ).	1	2	3	4	5
4	إعطاء الدواء بطريقة إعطاء خاطئة **"wrong route of administration"** (إعطاء الدواء بطريقة مغايرة عن تعليمات الطبيب)	1	2	3	4	5
5	إعطاء الشكل الصيدلاني الخطأ من الدواء.**"wrong dosage form"** (إعطاء الدواء بشكل صيدلاني مختلف عن ما وصفه الطبيب)	1	2	3	4	5
6	إعطاء الدواء في موعد خطأ **"wrong time"** (أكثر من 60 دقيقة قبل او بعد الموعد المحدد)	1	2	3	4	5
7	عدم إعطاء الجرعة الدوائية نهائيا **"Omission error"**	1	2	3	4	5
8	إعطاء الأدوية والمحاليل الوريدية بمعدل خاطئ **"wrong rate"** (أسرع أو أبطء من المعدل المحدد للجرعة).	1	2	3	4	5

القسم الثالث: تكرار ارتكاب/حدوث الأخطاء الدوائية

حسب تقديرك، كم عدد الأخطاء الدوائية التي حدثت في القسم الذي تعمل به خلال ال 12 شهر الماضية؟ ضع اشارة صح امام الإجابة الصحيحة:

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ أكثر من 10 الرجاء التحديد--------.

القسم الرابع: الإبلاغ عن الأخطاء الدوائية

الجزء الاول: حسب تقديرك، كم عدد الأخطاء الدوائية التي قمت بالإبلاغ عنها (سواء انت قمت بإرتكبها او أحد زملائك) خلال ال 12 شهر الماضية؟ ضع اشارة صح امام الإجابة الصحيحة:

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ أكثر من 10 الرجاء التحديد--------.

الجزء الثاني: الرجاء الاجابة على الاسئلة التالية بنعم او لا:

		نعم	لا
1.	في أغلب الاحيان أكون متأكد عما يشكل "**الخطأ الدوائي**"	1	2
2.	في أغلب الاحيان أكون متأكد متى يجب الإبلاغ عن حدوث خطأ دوائي.	1	2
3.	هل حدث أنك لم تقم بالإبلاغ عن خطأ دوائي لاعتقادك بأن الخطأ لم يكن خطيرا؟	1	2
4.	هل حدث بانك لم تقم بالإبلاغ عن خطأ دوائي بسبب الخوف من تعرضك للإجراءات التأديبية أو حتى فقدان العمل؟	1	2
5.	هل حدث بانك لم تقم بالإبلاغ عن خطأ دوائي بسبب الخوف من ردة فعل مديرك أو ردة فعل زملائك؟	1	2
6.	هل تشعر بارتياح عند قيامك بالإبلاغ عن خطأ دوائي؟	1	2
7.	هل يتم أتخاذ اجراءات معينة ومتابعه للأخطاء الدوائية التي يتم الأبلاغ عنها؟	1	2
8.	هل يتم توضيح الأخطاء الدوائية المبلغ عنها والعمل على أخذ اجراءات تصحيحية لتفادي تكرار هذه الأخطاء؟	1	2
9.	هل يوجد أي سياسة واجراءات للتبليغ عن الأخطاء الدوائية بالمشفى الذي تعمل به حاليا؟	1	2

الجزء الثالث: الرجاء اختيار الإجابة الأنسب:

1. من الأشخاص الذين تقوم بإبلاغهم بوقوع الخطأ الدوائي: (يمكن اختيار اكثر من اجابه)

1.رئيس التمريض	2.الطبيب المسؤول
3.مشرف التمريض	4. المشرف الطبي
5.مسؤول الجودة وسلامة المريض	6.أحد زملائك
7.غير ذلك ----------	

2. كيف تقوم بالإبلاغ عن الخطأ الدوائي في حال حدوثه:

1. شفهيا
2. كتابيا
3. بالطريقتين

القسم الخامس: الأخطاء الدوائية حسب فئات الأدوية:

الرجاء قراءة الأصناف الدوائية التالية ومن ثم ترتيبها حسب الأصناف الأكثر تكرارا بالأخطاء الدوائية

قم بترتيبها من 1 الى 6 (بحيث 1 الأكثر تكرارا و 6 الأقل تكرارا)

المضادات الحيوية (Antibiotics)	
أدوية علاج السكري (Anti-diabetics)	
مضادات التخثر (Antithrombotic)	
المحاليل الوريدية (Electrolytes)	
المسكنات (Analgesics)	
مضادات اضطراب النظم (Antiarrhythmic)	

القسم السادس: المضاعفات الناتجة عن الأخطاء الدوائية

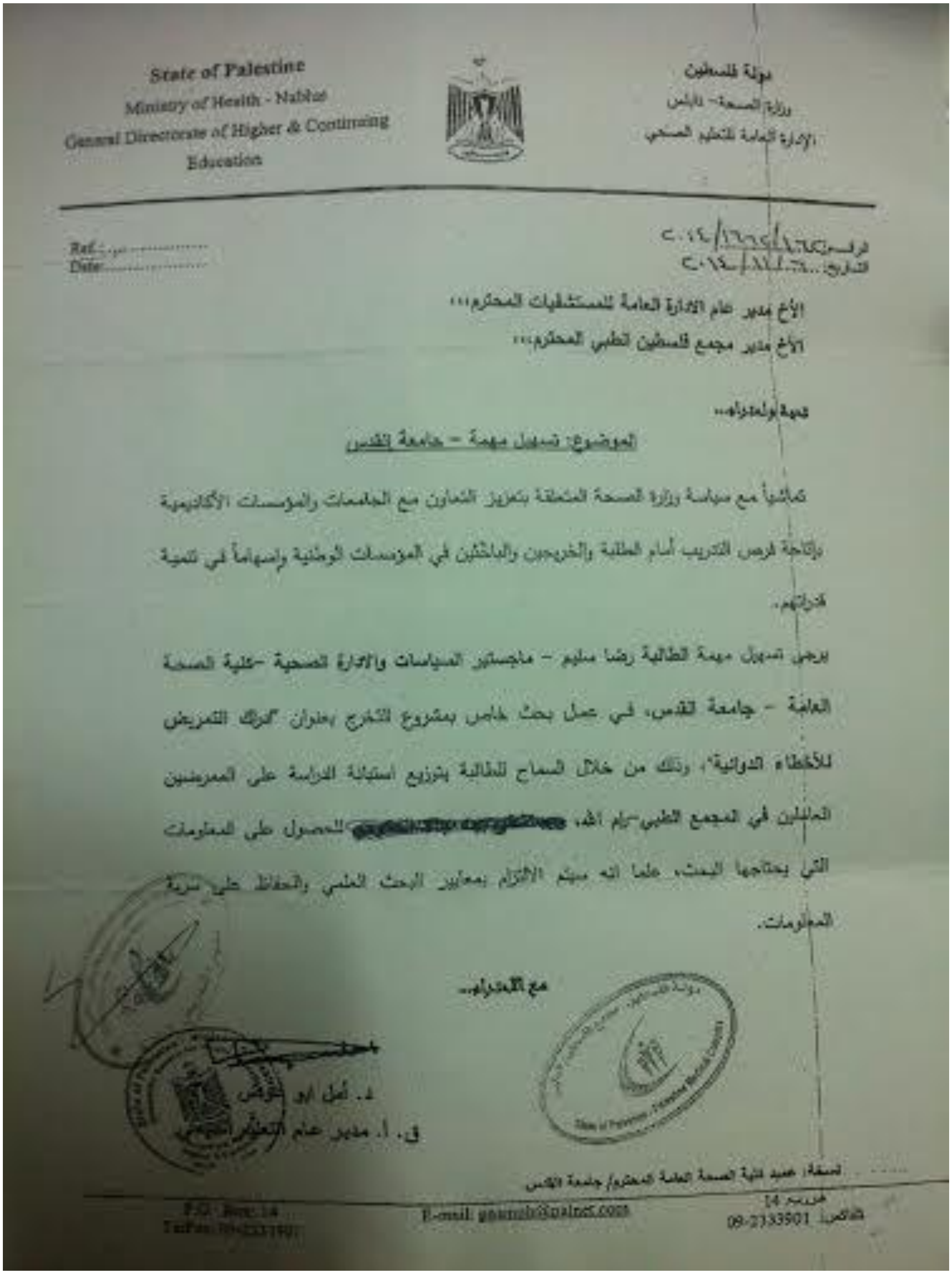
الرجاء قراءة الجمل التالية المتعلقة بالمضاعفات الناتجة عن الأخطاء الدوائية، وتحديد مستوى الأذى الذي سببته الأخطاء الدوائية التي حدثت في القسم الذي تعمل به خلال ال 12 شهر الماضية؟ (أجب بنعم أو لا)

		نعم	لا
.1	حدث خطأ دوائي وتسبب بضرر مؤقت للمريض (Temporary harm)	1	2
.2	حدث خطأ دوائي وتسبب بضرر مؤقت للمريض وتطلب ذلك إلى إدخال المريض للمشفى أو إطالة فترة مكوثه بالمستشفى. (Temporary harm requiring initial or prolonged hospitalization)	1	2
.3	حدث خطأ دوائي وتسبب بضرر دائم للمريض (Permanent harm)	1	2
.4	حدث خطأ دوائي وتطلب ذلك إلى تدخل ضروري لإبقاء المريض على قيد الحياة (An intervention necessary to sustain life)	1	2
.5	حدث خطأ دوائي وتسبب بوفاة المريض (Patient death)	1	2

القسم السابع: توصيات لتفادي/تقليل الأخطاء الدوائية بالمستشفيات

الرجاء اضافة الحلول والاستراتيجيات التي تعتقد انها ستساعد على الحد والتقليل من مشكلة الأخطاء الدوائية بالمستشفيات.

Annex 3: Permission letters from hospitals



State of Palestine
Ministry of Health - Nablus
General Directorate of Higher & Continuing Education

دولة فلسطين
وزارة الصحة- نابلس
الإدارة العامة للتعليم الصحي

Ref.: ....
Date: ....

الرقم: [illegible]
التاريخ: [illegible]

الأخ مدير عام الادارة العامة للمستشفيات المحترم،،،
الأخ مدير مجمع فلسطين الطبي المحترم،،،

تحية واحترام،،

الموضوع: تسهيل مهمة – جامعة القدس

تماشياً مع سياسة وزارة الصحة المتعلقة بتعزيز التعاون مع الجامعات والمؤسسات الأكاديمية وإتاحة فرص التدريب أمام الطلبة والخريجين والباحثين في المؤسسات الوطنية وإسهاماً في تنمية قدراتهم.

يرجى تسهيل مهمة الطالبة رضا سليم – ماجستير السياسات والادارة الصحية -كلية الصحة العامة – جامعة القدس، في عمل بحث خاص بمشروع التخرج بعنوان "ادراك التمريض للأخطاء الدوائية"، وذلك من خلال السماح للطالبة بتوزيع استبانة الدراسة على الممرضين العاملين في المجمع الطبي-رام الله، [redacted] للحصول على المعلومات التي يحتاجها البحث، علما انه سيتم الالتزام بمعايير البحث العلمي والحفاظ على سرية المعلومات.

مع الاحترام،،

د. أمل أبو عوض
ق. أ. مدير عام التعليم الصحي

نسخة: عميد كلية الصحة العامة المحترم/ جامعة القدس

P.O. Box: 14
Tel/Fax: 09-2333901
E-mail: [illegible]
ص.ب 14
تلفاكس: 09-2333901

Annex 3: Permission letters from hospitals

المستشفى العربي التخصصي
Specialized Arab Hospital (SAH)

التاريخ: ٢٠١٦-١-٢٧

الدكتوره امل ابو عوض المحترمه
مدير عام التعليم الصحي / جامعة القدس

بعد التحيه ..

لا مانع لدينا من تسهيل مهمة الطالبه رضا سليم – ماجستير السياسات والاداره الصحيه في عمل البحث الخاص بمشروع التخرج وذلك من خلال السماح للطالبه بتوزيع استبانة الدراسه على الممرضين للحصول على المعلومات التي يحتاجها البحث .

مع الاحترام ..

المدير الطبي
د. سمير الخياط

بالمرجو - يشرفنا قبولكم

Annex 3: Permission letters from hospitals

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

Annex 4: list of Experts Group for questionnaire validity

No.	Name	Position
1.	Asma Imam, Ph.D.	Associate Professor of Health Management - Al-Quds University
2.	Abedalrouf Saleem	Quality Planning Department – Ministry of Health
3.	Salwa Massad	Research Manager, WHO Palestinian National Institute of Public Health
4.	Tahani Fattouh, MSc.	Clinical pharmacy, Drug Information Department Director, MoH
5.	Buthina Ganem	Public Health Officer, World Health Organization
6.	Hussein Hallak, Ph.D.	Associate Professor of Pharmacy, Al-Quds University.
7.	Anan Rashid	Patient safety specialist, MoH.

Annex 5: Causes of medication errors with participants' characteristics who responded positively

	Illegible physician's writing on the doctor's order		labels/packaging are of poor quality or damaged		Confusion between two drugs with similar name or shape (LASA)		Distraction or interruption at the department		Shortage of nursing staff and heavy work overload.		Lack pharmacological knowledge and skills		New graduates who have limited experience	
Hospital	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
PMC	55	33.3	65	39.6	71	37.4	85	44.7	89	43.8	94	43.9	84	44.4
Al-Makassed	74	44.8	65	39.6	83	43.7	77	40.5	85	41.9	82	38.3	74	39.2
Arab Specialty	36	21.8	34	20.7	36	18.9	28	14.7	29	14.3	38	17.8	31	16.4
	χ^2= 13.4	P= 0.001	χ^2= 0.824	P= 0.662	χ^2= 8.82	P=0.012	χ^2= 11.80	P= 0.003	χ^2=18.53	P<0.001	χ^2= 4.13	P=0.127	χ^2= 5.57	P=0.062
Gender	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Male	60	36.4	65	39.0	78	41.1	80	42.1	87	42.9	85	129	81	42.9
Female	105	63.6	100	61	112	58.9	110	57.9	116	57.1	39.7	60.3	108	57.1
	χ^2= 2.78	P=0.62	χ^2= 0.267	P= 0.349	χ^2=0.19	P=0.383	χ^2=1.02	P=0.193	χ^2=2.62	P= 0.07	χ^2=0.129	P= 0.420	χ^2= 1.96	P=0.103
Age	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
< 30 years	51	30.9	48	29.3	56	29.5	53	27.9	60	29.6	59	27.6	50	26.5
30-40 years	89	53.9	94	57.3	102	53.7	109	57.4	115	56.7	125	58.4	108	57.1
>40 years	25	15.2	22	13.4	32	16.8	28	14.7	28	13.8	30	14	31	16.4
	χ^2=3.79	P=0.15	χ^2= 1.153	P= 0.562	χ^2= 6.31	P= 0.043	χ^2= 0.229	P= 0.892	χ^2=2.62	P= 0.269	χ^2=0.304	P=0.859	χ^2= 1.88	P= 0.391
Experience in profession	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
< 5 years	71	43.0	69	42.1	83	43.7	77	40.5	87	42.9	92	43.0	77	40.7
5-10 years	56	33.9	60	36.6	61	32.1	67	35.3	69	34	70	32.7	65	34.4
>10 years	38	23.0	35	21.3	46	24.2	46	24.2	47	23.2	52	24.3	47	24.9
	χ^2= 0.186	P= 0.91	χ^2=1.88	P= 0.39	χ^2=1.26	P=0.53	χ^2= 0.77	P= 0.679	χ^2=0.252	P=0.881	χ^2=1.022	P=0.60	χ^2=0.695	P= 0.706

Education	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
diploma	50	30.3	48	29.3	52	27.4	51	26.8	51	25.1	53	24.8	48	25.4
BA	90	54.5	91	55.5	106	55.8	108	56.8	121	59.6	124	57.9	108	57.1
Graduate studies	25	15.2	25	15.2	32	16.8	31	16.3	31	15.3	37	17.3	33	17.5
	χ^2= 0.384	P= 0.825	χ^2= 0.501	P=0.778	χ^2=5.44	P= 0.066	χ^2=5.17	P=0.075	χ^2=11.45	P=0.003	χ^2= 21.23	P<0.001	χ^2= 10.89	P= 0.004
shifts	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Morning	52	31.5	48	29.3	51	26.8	53	27.9	50	224.6	59	27.6	51	27
Night	7	4.2	6	3.7	6	3.2	9	4.7	11	5.4	12	5.6	9	4.8
Rotate	106	64.2	110	67.1	133	70	128	67.4	142	70	143	66.8	129	68.3
	χ^2= 6.45	P= 0.04	χ^2=3.81	P=0.149	χ^2= 6.71	P= 0.035	χ^2=1.14	P=0.564	χ^2=1.54	P=0.462	χ^2= 1.039	P= 0.595	χ^2=0.541	P=0.763
Training in Medication safety	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Yes	90	54.5	84	51.2	98	51.6	91	47.9	100	49.3	113	52.8	96	50.8
No	75	45.5	80	48.8	92	48.4	99	52.1	103	50.7	101	47.2	93	49.2
	χ^2= 6.22	P= 0.009	χ^2=1.158	P=0.172	χ^2= 2.38	P= 0.08	χ^2= 0.163	P= 0.395	χ^2=0.133	P=0.415	χ^2= 8.172	P=0.003	χ^2= 1.25	P=0.164
Training in Patient safety	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Yes	112	67.9	110	67.1	128	67.4	124	65.3	134	66	144	67.3	127	67.2
No	53	32.1	54	23.9	62	32.6	66	34.7	69	34.0	70	32.7	62	32.8
	χ^2= 2.95	P=0.057	χ^2= 1.82	P= 0.112	χ^2=3.47	P=0.044	χ^2= 0.495	P=0.287	χ^2=1.62	P=0.132	χ^2= 5.63	P= 0.015	χ^2=3.066	P=0.05
Policies & procedure implementation	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Yes	133	80.6	135	82.3	162	85.3	159	83.7	169	83.3	180	84.1	162	85.7
No	32	19.4	29	17.7	28	14.7	31	16.3	34	16.7	34	15.9	27	14.3
	χ^2= 0.113	P= 0.435	χ^2=0.334	P=0.334	χ^2= 7.46	P= 0.006	χ^2= 2.76	P= 0.071	χ^2=2.45	P=0.087	χ^2= 6.49	P= 0.012	χ^2=9.05	P=0.003
Department	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
ICU	17	10.3	15	9.1	17	8.9	14	7.4	19	9.4	16	7.5	18	9.5
CCU	24	14.5	23	14	26	13.7	29	15.3	35	17.2	34	15.9	26	13.8
ICU-Neonate	16	9.7	20	12.2	26	13.7	22	11.6	26	12.8	25	11.7	23	12.2

ICU-pediatric	13	7.9	13	7.9	14	7.4	16	8.4	16	7.9	15	7	16	8.5
Pediatric	17	10.3	16	9.8	18	9.5	20	10.5	19	9.4	19	8.9	16	8.5
Internal medicine	11	6.7	9	5.5	9	4.7	14	7.4	14	6.9	14	6.5	13	6.9
surgical	27	16.4	27	16.5	36	18.9	34	17.9	32	15.8	38	17.8	33	17.5
OB&Gyn.	28	17	30	18.3	33	17.4	29	15.3	28	13.8	39	18.2	30	15.9
Orthopedic	12	7.3	11	6.7	11	5.8	12	6.3	14	6.9	14	6..5	14	7.4
	χ^2= 7.26	P= 0.508	χ^2= 5.65	P= 0.686	χ^2=13.75	P= 0.088	χ^2=12.14	P=0.145	χ^2=19.15	P=0.014	χ^2= 7.03	P= 0.533	χ^2= 6.768	P= 0.562

	Complicated drug order		**Poor mathematical skills of nurses**		**Fails to follow policies and procedures for safe drug administration**		**Poor communication between nurses and physicians**		**Poor communication between nurses and pharmacists**		**Improper medication storage on the nursing station and medication trolleys**	
Hospital	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
PMC	65	44.8	76	42.5	74	43.3	67	39.2	63	43.8	52	35.1
Al-Makassed	57	39.3	71	39.7	69	40.4	78	45.6	59	41	65	43.9
Arab Specialty	23	15.9	32	17.9	28	16.4	26	15.2	22	15.3	31	20.9
	χ^2= 3.51	P= 0.172	χ^2= 1.535	P= 0.464	χ^2= 3.94	P= 0.139	χ^2= 13.23	P=0.001	χ^2=4.37	P= 0.112	χ^2= 6.57	P=0.037
Gender	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Male	63	43.4	76	42.5	67	39.2	74	43.3	59	41	61	87
Female	82	56.6	103	57.5	104	60.8	97	56.7	85	59	41.2	58.8
	χ^2= 1.405	P= 0.145	χ^2=1.176	P= 0.172	χ^2= 0.227	P= 0.365	χ^2= 1.91	P= 0.105	χ^2= 0.074	P=0.443	χ^2=0.138	P=0.404
Age	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
< 30 years	42	29	51	28.5	50	29.2	50	29.2	40	27.8	46	31.1
30-40 years	85	58.6	99	55.3	98	57.3	97	56.7	83	57.6	81	54.7
>40 years	18	12.4	29	16.2	23	13.5	24	14	21	14.6	21	14.2

	χ^2= 1.41	P= 0.4942	χ^2= 2.24	P= 0.326	χ^2= 1.24	P= 0.53	χ^2= 1.045	P= 0.593	χ^2= 0.059	P= 0.971	χ^2= 2.64	P=0.267
Experience in profession	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
< 5 years	63	43.4	76	42.5	77	45	75	43.9	64	44.4	71	48.0
5-10 years	52	35.9	59	33	58	33.9	61	35.7	51	35.4	47	31.8
>10 years	30	20.7	44	24.6	36	21.1	35	20.5	29	20.1	330	20.3
	χ^2= 1.71	P=0.423	χ^2= 0.394	P= 0.821	χ^2= 2.50	P=0.285	χ^2=2.96	P=0.228	χ^2= 2.33	P=0.311	χ^2=5.05	P=0.08
Education	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Diploma	39	26.9	46	25.7	43	25.1	41	24	39	27.1	42	28.4
BA	87	60	104	58.1	106	62	104	60.8	84	58.3	84	56.8
Graduate	19	13.1	29	16.2	22	12.9	26	15.2	21	14.6	22	14.9
	χ^2= 2.65	P=0.266	χ^2= 6.243	P= 0.044	χ^2=8.59	P=0.014	χ^2=9.32	P= 0.009	χ^2=1.56	P=0.458	χ^2= 0.606	P=0.738
shifts	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Morning	37	25.5	49	27.4	47	27.5	49	28.7	40	27.8	43	29.1
Night	8	5.5	6	3.4	10	5.8	10	5.8	6	4.2	10	6.8
Rotate	100	69	124	69.3	114	66.7	112	65.5	98	68.1	95	64.2
	χ^2=0.147	P=0.929	χ^2= 4.58	P=0.101	χ^2= 0.594	P=0.743	χ^2= 1.67	P= 0.434	χ^2=1.07	P=0.583	χ^2=2.928	P=0.231
Training in Medication safety	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Yes	75	51.7	95	53.1	85	49.7	86	50.3	67	46.5	82	55.4
No	70	48.3	84	46.9	86	50.3	85	49.7	77	53.5	66	44.6
	χ^2= 1.227	P= 0.163	χ^2=4.443	P=0.024	χ^2= 0.218	P=0.368	χ^2= 0.53	P=0.275	χ^2= 0.584	P= 0.261	χ^2= 6.22	P=0.009
Training in Patient safety	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Yes	99	68.3	117	65.4	118	69	117	68.4	97	67.4	103	69.6
No	46	31.7	62	34.6	53	31.0	54	31.6	47	32.6	45	30.4
	χ^2= 2.607	P= 0.069	χ^2=0.470	P=0.291	χ^2= 5.42	P=0.015	χ^2=4.23	P= 0.43	χ^2= 1.58	P=0.129	χ^2=4.66	P=0.021

Policies & procedure implementation	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Yes	120	82.8	152	84.9	146	85.4	140	81.9	117	81.3	117	79.1
No	25	17.2	27	15.1	25	16.4	31	18.1	27	18.8	31	20.9
	χ^2= 0.503	P=0.291	χ^2=5.088	P=0.020	χ^2= 5.61	P=0.015	χ^2=0.135	P=0.416	χ^2= 0.000	P=0.448	χ^2= 1.05	P=0.193
Department	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
ICU	11	7.6	16	8.9	16	9.4	13	7.6	9	6.3	12	8.1
CCU	26	17.9	26	14.5	26	15.5	31	18.1	23	16	25	16.9
ICU-Neonate	16	11	22	12.3	18	10.5	20	11.7	16	11.1	17	11.5
ICU-pediatric	14	9.7	16	8.9	12	7	13	7.6	9	6.3	11	7.4
Pediatric	14	9.7	19	10.6	15	8.8	17	9.9	12	8.3	12	8.1
Internal medicine	7	4.8	12	6.7	12	7	10	5.8	11	7.6	7	4.7
surgical	24	16.6	33	18.4	31	18.1	27	15.8	30	20.8	27	18.2
OB&Gyn.	25	17.2	23	12.8	33	19.3	30	17.5	28	19.4	29	19.6
Orthopedic	8	5.5	12	6.7	8	4.7	10	5.8	6	4.2	8	5.4
	χ^2= 13.38	P=0.099	χ^2= 16.76	P=0.033	χ^2= 6.001	P= 0.647	χ^2= 11.29	P=0.185	χ^2= 8.98	P=0.344	χ^2= 7.76	P=0.457

Annex 6: Types of medication errors with participants' characteristics who responded positively

	Wrong patient		Wrong drug		Wrong dose		Wrong route		Wrong dosage form		Wrong time		Omission error		Wrong rate	
Hospital	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
PMC	50	42.4	53	42.1	69	46	49	45.8	44	44	56	40.3	47	38.2	59	45.4
Al-Makassed	45	38.1	55	43.7	55	36.7	37	34.6	37	37	64	46	57	46.3	49	37.7
Arab Specialty	23	19.5	18	14.3	26	17.3	21	19.6	19	19	19	13.7	19	15.4	22	16.9
	χ^2= 0.04	P= 0.98	χ^2= 5.70	P= 0.05	χ^2= 2.95	P=0.22	χ^2=1.37	P=0.50	χ^2=0.33	P=0.84	χ^2=10.63	P=0.005	χ^2=6.95	P=0.031	χ^2= 2.01	P= 0.36
Gender	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Male	53	44.9	57	45.2	67	44.7	45	42.1	36	36	57	41	47	38.2	54	41.5
Female	65	55.1	69	54.8	83	55.3	62	57.9	64	64	82	59	76	61.8	76	58.5
	χ^2=1.96	P= 0.101	χ^2= 2.54	P= 0.07	χ^2= 2.88	P=0.058	χ^2=0.25	P=0.35	χ^2=1.2	P=0.16	χ^2=0.075	P=0.442	χ^2=0.39	P=0.30	χ^2=0.18	P= 0.38
Age	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
< 30 years	35	29.7	35	27.8	46	30.7	32	29.9	33	33	43	30.9	37	30.1	43	33.1
30-40 years	64	54.2	68	54	81	54	59	55.1	53	53	76	54.7	70	56.9	71	54.6
>40 years	19	16.1	23	18.3	23	15.3	16	15	14	14	20	14.4	16	13	16	12.3
	χ^2= 1.42	P= 0.49	χ^2= 3.07	P= 0.21	χ^2= 2.78	P=0.24	χ^2=0.80	P=0.66	χ^2=2.80	P=0.24	χ^2=2.17	P=0.33	χ^2=1.16	P=0.55	χ^2=4.77	P= 0.09
Experience in profession	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
< 5 years	49	41.5	52	41.3	65	43.3	50	46.7	46	46	57	41	52	42.3	56	43.1
5-10 years	44	37.3	45	35.7	50	33.3	37	34.6	32	32	53	38.1	38	30.9	45	34.6
>10 years	25	21.2	29	23	35	23.3	20	18.7	22	22	29	20.9	33	26.8	29	22.3

	χ^2=1.26	P=0.53	χ^2=0.28	P=0.86	χ^2=0.20	P=0.90	χ^2=2.87	P=0.23	χ^2=0.99	P=0.60	χ^2=2.55	P=0.27	χ^2=1.62	P=0.44	χ^2=0.30	P=0.86
Education	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
diploma	34	28.8	32	25.4	40	26.7	29	27.1	27	27	33	23.7	27	22	31	23.8
BA	61	51.7	70	55.6	87	58	60	56.1	56	56	81	58.3	71	57.7	77	59.2
Graduate	23	19.5	24	19	23	15.3	18	16.8	17	17	25	18	25	20.3	22	16.9
	χ^2=5.02	P=0.08	χ^2=5.98	P=0.05	χ^2=2.22	P=0.32	χ^2=1.50	P=0.47	χ^2=1.49	P=0.47	χ^2=7.62	P=0.022	χ^2=11.71	P=0.003	χ^2=5.53	P=0.063
shifts	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
Morning	28	23.7	36	28.6	36	24	27	25.2	25	25	31	22.3	**32**	**26**	29	22.3
Night	8	6.8	5	4	10	6.7	5	4.7	4	4	4	2.9	4	3.3	7	5.4
Rotate	82	69.5	85	67.5	104	69.3	75	70.1	71	71	104	74.8	87	70.7	94	72.3
	χ^2=1.45	P=0.48	χ^2=1.32	P=0.51	χ^2=1.97	P=0.37	χ^2=0.35	P=0.83	χ^2=0.87	P=0.64	χ^2=7.26	P=0.026	χ^2=2.16	P=0.33	χ^2=2.31	P=0.31
Training in Medication safety	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
yes	62	52.5	66	52.4	73	48.7	55	51.4	44	44	64	46	65	52.8	57	43.8
no	56	47.5	60	47.6	77	51.3	52	48.6	56	56	75	54	58	47.2	73	56.2
	χ^2=1.30	P=0.15	χ^2=1.35	P=0.15	χ^2=0.000	P=0.54	χ^2=0.54	P=0.27	χ^2=1.40	P=0.14	χ^2=0.81	P=0.21	χ^2=1.63	P=0.12	χ^2=2.40	P=0.77
Training in Patient safety	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
yes	76	64.4	83	65.9	88	58.7	72	67.3	61	61	92	66.2	80	65	77	59.2
no	42	35.6	43	34.1	62	41.3	35	32.7	39	39	47	33.8	43	35	53	40.8
	χ^2=0.017	P=0.501	χ^2=0.37	P=0.31	χ^2=4.32	P=0.025	χ^2=0.86	P=0.21	χ^2=0.67	P=0.25	χ^2=0.62	P=0.25	χ^2=0.11	P=0.41	χ^2=2.54	P=0.71
Policies & procedure implementation	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
yes	**90**	**76.3**	100	79.4	118	78.7	87	81.3	79	79	108	77.7	97	78.9	98	75.4
No	28	23.7	26	20.6	32	21.3	20	18.7	21	21	31	22.3	26	21.1	32	24.6

	χ^2=3.46	P=0.045	χ^2=0.55	P=0.27	χ^2=1.51	P=0.14	χ^2=0.001	P=0.55	χ^2=0.52	P=0.28	χ^2=2.42	P=0.08	χ^2=0.85	P=0.22	χ^2=5.79	P=0.012
Department	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**	**(N)**	**(%)**
ICU	14	11.9	16	12.7	17	11.3	11	10.3	12	12	14	10.1	13	10.6	15	11.5
CCU	**18**	**15.3**	17	13.5	25	16.7	17	15.9	17	17	19	13.7	20	16.3	22	16.9
ICU-Neonate	14	11.9	17	13.5	22	14.7	11	10.3	11	11	18	12.9	14	11.4	18	13.8
ICU-pediatric	8	6.8	9	7.1	9	6	6	5.6	5	5	8	5.8	7	5.7	9	6.9
Pediatric	12	10.2	13	10.3	13	8.7	12	11.2	7	7	12	8.6	12	9.8	11	8.5
Internal medicine	**15**	**12.7**	14	11.1	10	6.7	10	9.3	7	7	11	7.9	11	8.9	6	4.6
surgical	20	16.9	21	16.7	28	18.7	15	14	16	16	21	15.1	15	12.2	21	14.6
OB&Gyn.	13	11	14	11.1	16	10.7	17	15.9	22	22	28	20.1	24	19.5	19	14.6
Orthopedic	4	3.4	5	4	10	6.7	8	7.5	3	3	8	5.8	7	5.7	9	6.9
	χ^2=19.54	P=0.012	χ^2=18.87	P=0.016	χ^2=16.48	P=0.036	χ^2=5.35	P=0.71	χ^2=9.26	P=0.32	χ^2=3.98	P=0.85	χ^2=7.40	P=0.49	χ^2=8.87	P=0.35

Annex 7: Therapeutic classes involved in medication errors with hospital and participants characteristics

	Antibiotics		Anti-diabetics		Antithrombotic		Electrolytes		Analgesics		Anti-arrhythmic	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Hospital												
PMC	2.06	1.40	4.06	1.32	3.8	1.53	2.79	1.68	3.56	1.41	4.72	1.48
Al-Makassed	2.33	1.72	4.16	1.44	3.96	1.41	2.96	1.47	3.48	1.61	4.08	1.77
Arab Specialty	2.56	1.66	3.87	1.80	3.29	1.53	3.58	1.62	3.97	1.53	3.92	1.75
	F=1.84	P=0.16	F=0.68	P=0.50	F=3.53	P=0.03	F=4.37	P=0.01	F=0.71	P=0.49	F=5.78	P=0.003
Gender												
Male	2.22	1.53	4.06	1.53	3.87	1.50	3.13	1.61	3.40	1.57	4.32	1.63
Female	2.29	1.63	4.06	1.43	3.69	1.50	2.93	1.61	3.69	1.47	4.31	1.72
	F=0.14	P=0.70	F=0.001	P=0.97	F=0.90	P=0.34	F=0.99	P=0.31	F=2.34	P=0.12	F=0.002	P=0.96
Age												
< 30 years	2.72	1.70	4.17	1.48	3.66	1.53	2.93	1.72	3.75	1.50	3.80	1.85
30-40 yrs	2.13	1.48	3.98	1.50	3.77	1.48	3.10	1.59	3.47	1.53	4.53	1.60
>40 years	1.97	1.65	4.18	1.33	3.89	1.53	2.82	1.48	3.68	1.45	4.45	1.51
	F=4.20	P=0.016	F=0.55	P=0.57	F=0.30	P=0.73	F=0.58	P=0.55	F=0.93	P=0.39	F=4.70	P=0.01
Experience in profession												
< 5 years	2.64	1.63	4.11	1.47	3.58	1.57	3.12	1.76	3.66	1.48	3.91	1.88
5-10 years	2.06	1.54	3.87	1.49	3.88	1.45	3.0	1.54	3.52	1.58	4.69	1.41
>10 years	1.90	1.47	4.26	1.42	3.90	1.45	2.84	1.45	3.50	1.47	4.52	1.52
	F=5.54	P=0.004	F=1.40	P=0.24	F=1.31	P=0.26	F=0.59	P=0.55	F=0.32	P=0.71	F=5.98	P=0.003
Education												
Diploma	2.24	1.53	4.08	1.67	3.54	1.53	3.48	1.60	3.59	1.53	4.06	1.73
BA	2.73	1.63	3.97	1.35	3.77	1.50	2.82	1.58	3.63	1.51	4.42	1.75
Graduate studies	1.92	1.53	4.41	1.42	4.16	1.38	2.76	1.58	3.30	1.48	4.46	1.23
	F=1.17	P=0.31	F=1.32	P=0.26	F=2.15	P=0.11	F=4.95	P=0.008	F=0.73	P=0.47	F=1.30	P=0.27
Training in Medication safety												
Yes	2.25	1.64	4.17	1.45	3.85	1.51	2.84	1.58	3.57	1.52	4.30	1.56
No	2.28	1.54	3.96	1.48	3.68	1.49	3.17	1.63	3.57	1.51	4.34	1.80

	F=0.015	P=0.90	F=1.23	P=0.26	F=0.76	P=0.38	F=2.72	P=0.10	F=0.000	P=0.999	F=0.031	P=0.86
Policies & procedure implementation in the hospital												
yes	2.16	1.56	4.11	1.44	3.80	1.49	3.0	1.61	3.59	1..48	4.32	1.67
No	2.71	1.64	3.84	1.55	3.57	1.56	3.08	1.65	3.49	1.66	4.31	1.78
	F=4.89	P=0.028	F=1.40	P=0.237	F=0.932	P=0.335	F=0.113	P=0.73	F=0.18	P=0.66	F=0.003	P=0.95
Department												
ICU	3.04	1.74	3.78	1.56	3.52	1.64	3.0	1.73	3.83	1.43	3.83	2.05
CCU	2.16	1.46	3.89	1.57	3.95	1.45	2.68	1.69	3.45	1.32	4.87	1.33
ICU-Neonate	2.13	1.56	4.32	1.68	3.81	1.57	2.90	1.49	3.55	1.63	4.29	1.29
ICU-pediatric	1.24	0.56	5.0	1.00	4.59	1.06	2.94	1.24	3.35	1.53	3.88	1.61
Pediatric	2.0	1.54	4.73	1.24	3.95	1.13	3.05	1.36	2.82	1.36	4.45	1.89
Internal medicine	2.45	1.50	3.80	1.54	4.30	1.75	2.40	1.50	3.75	1.61	4.30	1.38
surgical	2.50	1.61	3.70	1.44	3.37	1.65	3.50	1.77	3.57	1.50	4.37	1.79
OB&Gyn.	2.33	1.63	4.09	1.31	3.67	1.49	2.96	1.60	3.61	1.63	4.28	1.79
Orthopedic	2.06	1.95	3.78	1.30	3.17	0.98	3.50	1.68	4.44	1.29	4.06	1.95
	F=1.96	P=0.051	F=2.32	P=0.02	F=1.97	P=0.51	F=1.32	P=0.23	F=1.65	P=0.11	F=0.97	P=0.45

Annex 8: Frequency of committed and reported medication errors with hospital and participants' characteristics

	Frequency of Committing MEs						Frequency of Reporting MEs					
	Zero ME committed		1-3 MEs committed		More than 3 MEs committed		Zero ME reported		1-3 MEs reported		More than 3 MEs reported	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Hospital												
PMC	36	46.2	49	41.5	22	34.9	74	56.5	28	26.9	7	26.9
Al-Makassed	21	26.9	42	35.6	37	58.7	29	22.1	53	51.0	18	69.2
Arab Specialty	21	26.9	27	22.9	4	6.3	28	21.4	23	22.1	1	3.8
	χ^2= 18.90 P=0.001						χ^2= 37.19 P<0.001					
Gender												
Male	27	34.6	50	42.4	27	42.9	42	32.1	55	52.9	8	30.8
Female	51	65.4	68	57.6	36	57.1	89	67.9	49	47.1	18	69.2
	χ^2= 1.42 P= 0.489						χ^2= 11.53 P=0.003					
Age												
< 30 years	21	26.9	32	27.1	17	27	46	35.1	22	21.2	3	11.5
30-40 years	49	62.8	68	57.6	34	54	74	56.5	60	57.7	18	69.2
>40 years	8	10.3	18	15.3	12	19	11	8.4	22	21.2	5	19.2
	χ^2= 2.37 P= 0.668						χ^2= 14.28 P=0.006					
Experience in profession												
< 5 years	34	43.6	46	39	109	42.1	59	45.0	42	40.4	9	34.6
5-10 years	25	32.1	45	38.1	89	34.4	43	32.8	37	35.6	9	34.6
>10 years	19	24.4	27	22.9	61	23.6	29	22.1	25	24.0	8	30.6
	χ^2= 1.52 P= 0.822						χ^2= 1.50 P=0.826					
Education												
diploma	34	43.6	40	33.9	5	7.9	46	35.1	30	28.8	3	11.5
BA	38	48.7	64	54.2	43	68.3	68	51.9	63	60.6	14	53.8

Postgraduate	6	7.7	14	11.9	15	23.8	17	13.0	11	10.6	9	24.6
	χ^2= 24.97 P<0.001						χ^2= 13.64 P=0.009					
shifts												
Morning	22	28.2	27	22.9	19	30.2	31	23.7	29	27.9	9	34.6
Night	5	6.4	6	5.1	3	4.8	5	3.8	6	5.8	3	11.5
Rotate	51	65.4	85	72	41	65.1	95	72.5	69	66.3	14	53.8
	χ^2= 1.64 P= 0.802						χ^2= 4.78 P=0.310					
Training in Medication safety												
Yes	39	50	60	50.8	26	41.3	62	47.3	52	50.0	13	50.0
No	39	50	58	49.2	37	58.7	69	52.7	52	50.0	13	50.0
	χ^2= 1.64 P= 0.44						χ^2= 0.186 P=0.911					
Training in Patient safety												
Yes	47	60.3	80	67.8	38	60.3	82	62.6	66	63.5	19	73.1
No	31	39.7	38	32.2	25	39.7	49	37.4	38	36.5	7	26.9
	χ^2= 1.56 P= 0.457						χ^2= 1.055 P=0.590					
Policies & procedure implementation												
Yes	66	84.6	93	78.8	52	82.5	109	83.2	80	76.9	23	88.5
No	12	15.4	25	21.2	11	17.5	22	16.8	24	23.1	3	11.5
	χ^2= 1.11 P= 0.574						χ^2= 2.492 P= 0.288					
Department												
ICU	7	9.0	10	8.5	6	9.5	12	9.2	10	9.6	1	3.8
CCU	12	15.4	19	16.1	7	11.1	20	15.3	14	13.5	4	15.4
ICU-Neonate	6	7.7	15	12.7	10	15.9	11	8.4	16	15.4	4	15.4
ICU-pediatric	2	2.6	11	9.3	4	6.3	3	2.3	10	9.6	4	15.4
Pediatric	3	3.8	7	5.9	11	17.5	10	7.6	7	6.7	5	19.2
Internal medicine	5	6.4	11	9.3	4	6.3	7	5.3	13	12.5	0	0
surgical	19	24.4	16	13.6	11	17.5	30	22.9	12	11.5	4	15.4
OB&Gyn.	19	24.4	23	19.5	3	4.8	31	23.7	12	11.5	3	11.5
Orthopedic	5	6.4	6	5.1	7	11.1	7	5.3	10	9.6	1	3.8
	χ^2= 29.6 P= 0.02						χ^2= 33.74 P= 0.006					