Cape Peninsula
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Trends and Reporting of Medication Administration Errors among Nursing Students at a Higher Education Institution in the Western Cape

by

Yousef Ahmed Abu-Saksaka

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Supervisor: Dr Hilda Vember

Co-supervisor: Dr RR Marie Modeste

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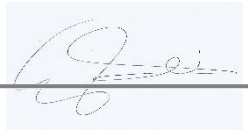
DECLARATION

I, Yousef Ahmed M Abu-saksaka, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



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ABSTRACT

One of the most important issues in the provision of healthcare services which threaten the patient's safety, is medication administration errors. These could compromise patient safety and may lead to patient disability or even death, besides the financial cost of these errors. Nurses are responsible for administering medication to numerous patients. They thus are the last defence line against medication administration errors. All student nurses are trained very early in their courses on how to administer medication and all the complications and implications that accompany this important procedure. Although lecturers spend time and effort in teaching nursing students about protocols for safe medication administration, nurses still commit medication administration errors.

The aim of the study was to determine awareness and perception of the occurrence and reporting of medication administration errors (MAEs) among nursing students. A descriptive quantitative design was employed. A questionnaire was used to collect data. Responses were collected from 291 nursing students at a higher education institution in the Western Cape, South Africa. Nonprobability proportional quota sampling was used in this study for data collection. Data was analysed with IBM SPSS® software. Data was presented in graphs, percentages, means, and standard deviation, while inferential statistics were conducted.

The findings of the study reveal that 85.2% of the respondents were aware of MAE occurrence, but 40.1% were unaware of reporting of these errors. The top and most significant subscale for MAE occurrence was the physician communication subscale, while the top and only significant barrier to reporting these errors was the fear subscale.

In conclusion, most of the respondents were aware of MAE occurrence, while more than a third were unaware of the reporting of these errors. The study recommended building non-punitive blame-free reporting systems to emphasise the importance of reporting errors.

KEYWORDS: *medication errors, medication administration errors, occurrence and reporting of medication administration errors*

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DEDICATION

I would like to dedicate this work to my late mother, Salma Mohammad Yousef who was my source of inspiration. You will always live in my heart. May God (ALLAH) bless you.

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ABBREVIATIONS AND ACRONYMS

ACE	Angiotensin-Converting Enzyme
ADEs	Adverse Drug Events
CPUT	Cape Peninsula University of Technology
DPSI	Disclosure of Patient Safety Incidents
EN	Enrolled Nurse
HCW	Healthcare Worker
HEI	Higher Education Institution
HIT	Healthcare Information Technology
HoD	Head of Department
MAE	Medication Administration Error
MAR	Medication Administration Record
ME	Medication Error
MERSs	Medication Errors Reporting Systems
MRC	Medical Research Council
NCC MERP	National Coordinating Council for Medication Error Reporting and Prevention
NEI	Nursing Education Institution
NHS	National Health Service
PICU	Paediatric Intensive Care Unit
RN	Registered Nurse
SANC	South African Nursing Council
SD	Standard Deviation
SPSS	Statistical Package for The Social Sciences
UK	United Kingdom
US	United States
WHO	World Health Organization

DEFINITION OF CONCEPTS

Adverse drug events (ADEs) refer to the undesirable effects of drugs.

Atomism is indicated that the individual represented the main component of the society.

Enrolled nurse (EN) is the person who is registered with the South African Nursing Council (and authorised by) the South African Nursing Act (Act No. 33 of 2005) to practise as an enrolled nurse and who has the right to administer medication under direct supervision of a registered nurse.

Medication administration errors (MAEs) refer to errors that can occur when the nurse administers the prescribed and dispensed medication. For example: writing time, wrong patient, wrong route, medication that can cause adverse events due to interaction or allergy. For this study, MAEs will be used to refer to MEs and MAEs.

Medication administration is the process of giving a drug to a patient by the medication administrator from written or verbal doctors' orders, such as parenteral administration (subcutaneous, intramuscular, intradermal or intravenous routes) or enteral administration (through mouth or rectum).

Medication administrator refers to a person who has the right to administer medication to a patient, and includes registered nurses, enrolled nurses and nursing students.

Medication error (ME) refers to any error that can happen at the prescribing level by the prescribing medical practitioners, or at the dispensing level by the pharmacist, or at the administration level by the nurse administering the medication.

Near-miss errors are also known as potential adverse drug events (potential ADEs) and are defined as events that may lead to adverse drug consequence but fortunately did not occur.

Nursing student refers to the person who is registered with the South African Nursing Council under (and authorised by) the South African Nursing Act (Act No. 33 of 2005) to practise as a student nurse and who has the right to administer medication under direct supervision of a registered nurse.

Patient safety refers to the prevention of errors and adverse effects in patients associated with healthcare.

Registered nurse (RN) is the person who is registered with the South African Nursing Council under (and authorised by) the South African Nursing Act (Act No. 33 of 2005) to practise as a registered nurse and who has the right to administer medication.

Ontological it is referred to the dealing with the nature of being.

CHAPTER ONE

CONTEXUALISATION AND ORIENTATION OF THE STUDY

1.1 Introduction

According to the World Health Organization (WHO), the risk of being harmed during rendering healthcare is much greater than the risk of being harmed by air travel or nuclear plants, which are sources usually perceived as being considerably more dangerous (Iliffe, n.d.). Errors occurring during the delivering of health- care lead to about 7 000 deaths annually in the United States (US) (WHO, 2011:243), while in Great Britain these errors contribute to 712 deaths every year and are indicated as a contributory factor in 1700 to 22 300 deaths per year (Elliott et al., 2018:4). These numbers are an average based on the incidence of medication errors worldwide (WHO, 2011:243; Haw et al., 2014:798). However, it is important to stress that there are differences between developed and developing countries (Iliffe, n.d.).

When patients are admitted to hospital, they expect to receive the correct medication at the right time and under the right conditions (Jones & Treiber, 2010:240; Kim & Bates, 2013:595-596). Patients have an implicit trust in the health institution and believe that their best interests are at the heart of the healthcare providers. Therefore, it is important for health institutions to build this trust between patients and healthcare workers (HCWs) who provide care at the health institution (Wittich et al., 2014:1116). It is thus the duty of healthcare workers to provide correct and truthful reports on their duties, and more specifically, those duties relating to the administration of medication. However, medication administration errors are common and it is the responsibility of health institutions to support their healthcare workers in being truthful at all times by gaining their trust (Wolf & Hughes, 2008:335; Rothstein, 2014:965).

Physicians and nurses always strive to minimise the occurrence of errors, as they have patients' best interests at heart. Most of their time is spent providing the best care to patients in order to improve their health outcomes. Although they are professionals, physicians and nurses are human and the possibility of committing an error always exists. The consequences of committing errors, together with concomitant disciplinary action and dismissal, often causes healthcare workers to avoid reporting these errors (Wolf & Hughes, 2008:341; Weant et al., 2014:47).

Medication administration is an integral part of the nurse's role (Pryce-Miller & Emanuel, 2010:8). It is thus argued that most medication errors (MEs) occur at this stage (Weant et al., 2014:45). These types of errors are known as medication administration errors (MAEs). According to Berdot

et al. (2016:342), MAEs are ranked as the third cause of patient disability or death. Nurses therefore need to develop the requisite skills to improve their competency in administering medication. Prior to entry into practice, nurses should be adequately trained to competently administer medication in order to avoid MAEs, which would reduce potential harm to patients and gain the patient's trust (Pryce-Miller & Emanuel, 2010:8).

While working in a hospital environment, the researcher observed MAEs and how they impacted on the healthcare workers, as well as the patients. This observation stimulated an interest in the study of MAEs. This chapter includes an overview of the research study with a description of the background, statement of the problem, research question, purpose of the study, and conceptual framework, and concludes with the layout of the subsequent chapters. It also summarises the research design, method of data collection, data analysis and ethical considerations, which will be explained in greater detail in Chapter 3.

1.2 Background of the study

1.2.1 Medication administration process

The medication administration process consists of five steps: firstly, ordering the medication; secondly, writing the prescription; thirdly, preparation of the medication by the pharmacy; fourthly, administration of the medication by the healthcare workers; and finally, the documentation of medication. MEs may occur at any time, during one or more of these steps (Gordon, 2014:18). Medication errors (MEs) are classified according to prescription, transcription, dispensing, and administration errors (Radley et al., 2013:471). These errors may occur due to ignorance or unethical behaviour on the part of the healthcare professional (Salami, 2018:281). Similarly, lack of communication, incorrect prescriptions, inadequate labelling and packaging, as well as the method of dispensing the medication, may cause medication administration errors (Salami, 2018:281).

The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP, 2018) cites lack of education, whereas Oshikoya et al. (2013:68) regard inadequate university curricula and training programmes as one of the causes of MAEs. Furthermore, because the opportunities for nursing students to prepare and administer medication are limited, their exposure to medication is also limited, thus increasing the possibility of MAE occurrence. In this regard, Valdez et al. (2013:222) report that although students can administer medication under supervision, constant supervision and control are not always possible or practical.

1.2.2 Medication administration errors (MAEs)

One of the most important issues in the field of health that impact patient safety and health outcomes are MAEs (Lee, 2017:728; Schnock et al., 2017:131). A medication administration error (MAE) is defined as “a deviation from the prescriber’s medication order as written on the patient’s chart, manufacturer’s instructions or relevant institutional policies” (Keers et al., 2013a:1047). This type of error comprises that described by the NCC MERP (2011) as any preventable event that may cause or lead to inappropriate medication use that may have a harmful effect on the patient. An error at the administration phase is very critical because it is directly harmful to the patient and the possibility to correct it is limited (Tabibzadeh & Muralidharan, 2019:208). The MAEs involve omission errors, incorrect administration techniques as well as the administration of incorrect or expired medication (Parand et al., 2016:1). Understanding how and why MAEs occur and constraints to reporting, represent the key to the intervention that minimises MAEs (Keers et al., 2013a:1046).

1.2.3 Causes of MAEs

The medication administration process is linked to many extrinsic and intrinsic factors that may lead to errors. These factors include nursing competence, culture and work environment, the nursing process, prescription factors, administrative factors and patient-related factors (Anthony et al., 2010:21; Kim & Bates, 2013:593; Leufer & Cleary-Holdforth, 2013:216; Speroni et al., 2013:19).

The causes of medication administration errors are classified by Wakefield et al. (2005:475-489) into four main groups. These four groups are MAEs caused by factors related to pharmacies, manufacture, physicians, and nurses. Wakefield et al. (2005:475-489) developed a questionnaire based on the four main groups to investigate nurses’ perceptions regarding MAEs. This questionnaire served as a baseline for further research regarding the causes of MAEs.

1.2.4 Incidence of MAEs

According to Feleke et al. (2015:1), a number of patients die as a result of MAEs. There are about 450 000 medication errors that harm patients in the USA each year (Kliger, 2010:690). The financial cost of these errors was estimated between 3.5 billion and 29 billion dollars annually (Kliger, 2010:690). MAEs occur in hospitals worldwide. However, reporting systems are still unknown in many of these hospitals. From the beginning of 2005 to the end of 2010, a total of 526 186 medication incidents were reported in the UK. MAEs accounted for 50% of these reports followed by prescribing errors at 18% (Cousins et al., 2012:597). However, 51% of the total MAEs

was reported among neonatal intensive care units and paediatric wards in Gauteng, South Africa (Truter et al., 2017:5).

The World Alliance for Patient Safety was launched to activate research progress on patient safety. However, most of the studies on patient safety and adverse events focused on developed countries, with only a few studies documented in developing countries (Carpenter et al., 2010:48). Similarly, Bates (2010:174) reported that research regarding MAEs and patient safety had mostly been done in developed countries, with an incidence rate of 10% in these countries.

1.2.5 Nurses and MAEs

One of the important roles of nurses is medication administration (Pryce-Miller & Emanuel, 2010:8). Forty percent (40%) of nurses' work time is consumed by the administration of medication (Armitage & Knapman, 2003:130; Huynh et al., 2016:2). Nurses are responsible for administering medication to numerous patients daily. Hence, the chances of committing errors during this process are highly probable (Jones & Treiber, 2010:240). Therefore, nurses' knowledge of calculation and effects of, reasons for, and incompatibility of medications is important to patient safety (Simonsen et al., 2014:1). Nurses have to be made aware of MAEs in order to maintain and achieve patient safety at all times (Jones & Treiber, 2010:240). So, the prevention of MAEs and ensuring patient safety are important roles of nurses, as they are the last defence line against errors (Weant et al., 2014:47).

The role of nursing students during their practice time is prescribed by the South African Nursing Council (SANC) (2013) in the Regulations relating to the accreditation of institutions as nursing education institutions (R173). The nursing students are allowed to administer the medication under the supervision of the registered nurse (SANC, 2013b: R173). The SANC policy, in respect of clinical practice, stipulates that students must function as members of the health team with certain responsibilities for patient care from the commencement of their respective training (SANC, 1995:5). This level of function shall be in accordance with the stage and terminal objectives of the programme and needs to fit within the scope of practice as stipulated in Regulation (R2598) relating to the scope of practice of persons who are registered or enrolled under the Nursing Act, 1978 (SANC, 2005: R2598 as amended, 1984).

1.2.6 Lack of reporting MAEs

Most of the research studies in this field are designed to understand the nature of MAEs and the reasons for their occurrence (Rehan & Bhargava, 2015:1). MAEs contribute directly to patient safety and reporting them is crucial to reduce and prevent occurrence (You et al., 2015:276).

Furthermore, reporting MAEs will lead to an improvement in quality care (Blignaut, 2015:234; Hill, 2016:139). Student nurses are fearful of reporting MAEs, as they do not want to be disciplined by the management or administration of the healthcare services and providers (You et al., 2015:280). Accurately reporting MAEs as they occur allows healthcare providers and health institutions to understand how errors occur and how to reduce and prevent them (Weant et al., 2014:48). Nurses' reporting behaviours are influenced by a number of factors. Hewitt et al. (2017:134) argue that nursing reporting behaviours are influenced by the hierarchical cultural type, and as a result are associated with less participation of nurses in quality improvement programmes. Moreover, fear, disagree with what MEs are. Reporting effort, and administrative responses, were mentioned by old and new studies, as reasons that prevent the nurses from reporting their errors (Mayo & Duncan, 2004:209; Wakefield et al., 2005:484; Abou Hashish & El-Bialy, 2013:2163; Al-Youssif et al., 2013:62; Blignaut, 2015:181; Hill, 2016:69).

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1.2.7 Strategies for reduction of MAEs

Nursing students' awareness of MAEs and patient safety is enhanced by early exposure to the complex nature of the medication administration process. This should be taught and practised in the clinical skills laboratory as continuous practice assists nurses to improve patient outcomes (Ofosu & Jarrett, 2015:12). The development of strategies to identify MAEs was recommended by Blignaut (2015:263-264) in order to improve patient safety and reduce their occurrence. Although reporting systems are cited as a viable strategy to reduce MAEs, Shawahna et al. (2016:412) and Schnock et al. (2017:131) reported that MAEs still occur. Therefore, new strategies with better reporting systems for nurses should be developed to ensure patient safety and reduce MAEs (Hammoudi et al., 2017:1038). In terms of training, Härkänen et al. (2017:3490) recommend that healthcare professionals, including students, should be adequately trained in the administration of medication in order to prevent MAEs. Furthermore, quality of nursing care should be maintained at all times (Härkänen et al., 2017:3491). Practical training should be fundamental for nursing students in order to facilitate a deeper understanding of MAEs and their impact on patient safety. Moreover, practical training improves the quality of nursing service and the care rendered by these students (Hammoudi et al., 2017:1038).

Bates (2007:4-5) recommends that nursing students should be trained during their first year on medication administration, the relevant processes and monitoring patients in order to identify any adverse drug effects. Further practical training should include administration of oral and intramuscular medication. Pryce-Miller and Emanuel (2010:8) argue that nursing education

institutions should create a learning environment, where experienced lecturers and professional registered nurses conduct workshops for undergraduate nurses on the occurrence of MAEs. Technological approaches to teaching such as the use of computers in undergraduate nursing programmes and giving support to these students, might reduce MAEs (Pryce-Miller & Emanuel, 2010:8).

1.3 Statement of research problem

MAEs are the most frequent types of errors that cause adverse events and are a major concern for patient safety (Kim & Bates, 2013:590; Speroni et al., 2013:19). MAEs occurred from 9.4% to 80% of the total administered medications (Alsulami et al., 2012:833), whereas Oshikoya et al. (2013:67) and Feleke et al. (2015:1) indicate that more than 50% of MAEs are not reported by nurses. Hence, MAEs have become a significant problem among healthcare services worldwide (Mohmmed & Hassane El-sol, 2017:75).

The consequences of MAEs are numerous, such as prolonged hospital stay and heavy financial implications (McLeod et al., 2014:67; Neville & Gray, 2015). In terms of financial cost, billions of dollars are spent annually owing to MAEs and the human cost is even higher, with a high rate of human morbidity and mortality (Kliger, 2010:690; Walsh et al., 2017:481). The complications of medication administration errors could result in prolonging patients' hospital stay from 4.6 to 10.3 days, as noted in a US study (McLeod et al., 2014:67). The British National Health Service (NHS) paid a total of 1.6 billion pounds in 2014 in legal claims related to these errors. This was an increase of 18% from the previous year. Neville and Gray (2015) reported that hospitals that could not provide proof of reporting systems and reporting of mistakes, might be liable to pay 10 000 pounds per unreported case to the Litigation Authority.

Hence, the lack of the knowledge of MAEs has dire consequences for the patient, nurse, and health institutions. It severely compromises patient safety and may lead to patient disability or even death. It is therefore imperative that nurses receive adequate training to administer medication correctly to patients. Furthermore, proper reporting systems should be developed to prevent MAEs. Although lecturers spend time and effort in teaching students protocols for safe medication administration, students still commit MAEs (Valdez et al., 2013:222). This is because most of them do not understand the nature of these errors. Valdez et al. (2013:222) revealed that 92.5% of students' reports were associated with medication errors and 3% resulted in patient harm. Furthermore, Wolf et al. (2006:39-47) state that most student errors are omission errors, followed by the wrong dose of medication. In the literature, registered nurses are the focus of MAEs. However, nursing students' medication administration errors remain unreported (Valdez et

al., 2013:222). Additionally, there is a need for sufficient knowledge of student nurses' perceptions of the occurrence and reporting of MAEs, as these are occurrences that happen during their clinical learning in healthcare institutions. Therefore, the focus of this study is to investigate the perception of occurrence and the reporting of MAEs among undergraduate nursing students, as well as the students' perceptions to the percentage of reporting of non-IV medication errors during their practice time.

1.4 Research question

The study is guided by one main research question:

What are perceived of the occurrence and reporting of MAEs among undergraduate nursing students at a higher education institution in the Western Cape?

1.5 Aim

The aim of the study was to determine the awareness and perception of the occurrence and reporting of medication administration errors (MAEs) among nursing students at a higher education institution in the Western Cape province (South Africa).

1.6 Objectives

The objectives of this study were to determine:

- awareness of the occurrence and reporting of medication administration errors among undergraduate nursing students at a higher education institution in the Western Cape;
- factors related to medication administration error occurrence indicated by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where undergraduate students are placed;
- barriers to reporting medication administration errors as perceived by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where they are placed; and
- the percentage of reporting the non-IV medication errors perceived by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where undergraduate students were placed.

1.7 Conceptual framework

The relationship between the variables used in this study is described by a conceptual framework. This framework is based on the conceptual underpinnings developed by Wakefield et al. (2005:476). Four main variables were set to determine nursing students' perception of occurrence and reporting of MAEs and are listed overleaf.

Students' awareness of any occurrence and reporting of medication administration errors: This variable was developed by the researcher to determine students' awareness of MAE occurrence during their practice time and its reporting procedure. This level of awareness and knowledge could develop the level of student trust in reporting MAEs, and consequently lead to an improvement in patient safety.

Reasons for occurrence of medication administration errors: This variable determined students' perceptions of the reasons for and causes of MAEs. This variable showed that the reasons for MAE occurrence are not related to nurses only, but may be related to four main reasons: those relating to manufacturing, pharmacy-related reasons, reasons relating to physicians, and finally, reasons related to nurses (Wakefield et al., 2005:484). When students are made aware of other existing reasons for MAEs and understand that they are not solely responsible for their occurrence, they may be encouraged to report MAEs. As a result, an improvement in reporting of MAEs will aid health institutions in understanding the most common causes of MAEs, and subsequently preventing their occurrence and improving patient safety.

Why medication administration errors are not reported: The purpose of this variable was to determine the students' perception of the barriers for reporting MAEs. These barriers were related to fear, the effort involved in reporting the error, and disagreement regarding the definition of MAEs (Wakefield et al., 2005:484). Furthermore, students' perceptions of the causes of MAEs, their awareness of MAE occurrence and the ensuing reporting procedures, impact reporting trends. Moreover, the self-confidence of students is improved by reporting procedures which play an important role in addressing barriers to reporting MAEs.

Percentage of each type of non-IV medication errors reported in the practice unit: This variable detected students' perceptions of the frequency of reporting non-IV medication errors that occurred during respondents' practice time (Wakefield et al., 2005:480). This variable reflects the percentage of reported errors from the total errors that occurred during students' practice time.

1.8 Research methodology

1.8.1 Research philosophy

The study adopted a positivist research philosophy as it is the dominant paradigm in nursing studies (Polit & Beck, 2017:11). The role of the researcher is very limited in the positivism paradigm in respect of an objective interpretation of the research findings (Polit & Beck, 2018:7). Findings from this study were quantifiable and resulted in statistical analysis.

1.8.2 Research strategy

The research strategy guides the study in terms of collecting relevant background information and using appropriate data analysis techniques in order to arrive at a conclusion (Denscombe, 2014:3-4). This study employed a self-administered questionnaire as the primary strategy and a literature review as the supporting one. The questionnaire was used for the collection of statistical information and simultaneously enabled the collection of reliable and valid data collection necessary to achieve the objectives and aim of this study.

1.8.3 Research design

A descriptive quantitative design was used in this study. A descriptive design was selected to describe the variables as the quantitative data of the questionnaire was numerically analysed (Gray et al., 2017:25). A quantitative design is used to measure the variable of interest according to the objectives (Grove et al., 2013:706). The purpose of this design is to describe the variables of the study (Brink et al., 2018:96). Chapter 3 provides an in-depth discussion.

1.8.4 Population

The target population for this study comprised second-, third- and fourth-year undergraduate nursing students registered for the undergraduate nursing degree at a higher education institution (HEI) in the Western Cape province. Approximately 563 students in their second, third and fourth year were registered for the nursing programme at one campus of this HEI. All second-, third- and fourth-year students on the basic nursing programme were approached to participate in this study. The total number of students was 563: second-year students (213), third-year students (180) and final/fourth-year students (170). As the total number of students was not equally distributed across the three years of study, the researcher used the quota sampling method for data collection. (For an in-depth discussion refer to Chapter 3, Section 3.6.2.)

1.8.5 Data collection

According to Brink et al. (2018:44), data-collection tools are designed to meet the purpose of the study. A self-administered questionnaire was used as the primary data-collection tool in this study (refer to Appendix B). The questionnaire was divided into five sections in alphabetical order. Part A and B were developed by the researcher, while part C, D and E had been used in previous studies. Permission was granted from the developer, Dr Bonnie Wakefield, of the Sinclair School of Nursing at the University of Missouri (refer to Appendix C). For an in-depth discussion, see Chapter 3, Section 3.7.2.

1.9 Data analysis

The data was analysed by means of the Statistical Package for the Social Sciences (SPSS) Version 24 (IBM SPSS Inc., 2016). Microsoft Excel was also used to handle the data and graphical presentations with line and bar charts were designed to present the results. The variables were described by mean and standard deviation (SD), maximum, minimum, percentage, one-sample *t*-test and chi-square test, and further details are presented in Chapter 3, Section 3.10.

1.10 Delineation of study

This study was focused on nursing students enrolled in undergraduate nursing programmes at an HEI in the Western Cape Province (South Africa) and focused only on the occurrence and reporting of MAEs as perceived by undergraduate nursing students. Results from this study may differ from studies based on populations with dissimilar demographics. Generalisation of results and findings should be approached with caution.

1.11 Contribution

This research may contribute towards an understanding of the causes of MAE occurrence and its reporting as perceived by nursing students during their practice training.

1.12 Ethical considerations

Ethics: The following ethical principles were applied in this research (South African Medical Research Council, 2018:1-17): Informed Consent, Autonomy, Beneficence and Non-Maleficence, Confidentiality, and Justice. These principles are discussed and elaborated upon in Chapter 3. Ethical clearance was obtained from the Faculty of Health and Wellness Sciences Research Ethics Committee at the Cape Peninsula University of Technology (CPUT) (refer to Appendix D).

The researcher obtained a written signed consent letter from the respondents prior to data collection (Appendix A).

1.13 Chapter overview

This study comprises six chapters.

Chapter 1 provides the introduction, background of the study, problem statement, research question, and aim and objectives of the study.

Chapter 2 provides an extensive literature review based on keywords identified from the title, aims and objectives of the study.

Chapter 3 describes the research methodology used in this study, which includes the research philosophy, research design, research strategy, population of the study and sampling techniques, as well as data collection and data analysis. The measures to ensure validity and reliability are presented in this chapter.

Chapter 4 presents a quantitative analysis of the collected data based on the self-administered questionnaires.

Chapter 5 provides a discussion of the findings of this study compared with previous literature reviewed and concludes with guidelines to address the phenomenon under study.

Chapter 6 describes the conclusions and recommendations emanating from the study. The limitations are also noted.

1.14 Summary

Chapter 1 contextualised the study and provided the reader with the background to MAE, highlighting the causes and incidence of MAE. The chapter also presented the research question, aim and objectives of the study, and problem statement. For the research methodology, a deductive approach within a positivism paradigm was selected. Data was collected using self-administered questionnaires, followed by quantitative descriptive data analysis. The conceptual framework was described, and four main variables were set to establish nursing students' reporting of MAEs. A discussion of ethics was also provided, and the chapter concluded with the delineation, contribution of the research, definition of terms, and chapter overview.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The literature review is the critical phase of the research process and provides a broad review of scholarly published literature on a topic. It contributes to the scope of the study, helps formulate the research question, and recommends the best method of data collection. More importantly, a literature review provides relevant sources drawn from theoretical and scientific knowledge regarding the topic (Grove et al., 2013:40).

The review of literature in this chapter is focused on journal articles, books and internet sources that deal with findings on MAE. Databases such as Google Scholar, PubMed, as well as the CPUT library were utilised to access relevant literature. Keywords used in the search were *medication errors, medication administration errors, occurrence and reporting of medication administration errors*. Both recent and older articles were sourced and incorporated into the literature review to demonstrate the extent of this problem. The Human Error Report was used as the basis for research relating to medication administration incidence and patient safety (Kohn et al., 2000:1-10).

The studies regarding MAE in South Africa were few, especially those relating to students in training and their perceptions of MAE (Blignaut, 2015:2; Hill, 2016:43). The paucity of studies in this field was highlighted by the researcher in this literature review. Hence, the researcher hopes to make a valuable contribution to the topic with this study. The literature review is presented in the following format: the background to MAE, elicited from the latest research regarding this issue, is presented and includes a discussion on MAE occurrence worldwide and nationally. Thereafter, a discussion of the causes and consequences of MAE is presented as well as the barriers preventing healthcare workers from reporting it. The literature review also includes a discussion of reporting of MAE among nurses and interventions to decrease MAE occurrence. The chapter concludes with a summary of the reviewed literature.

2.2 Review of literature

2.2.1 Prevalence of MAE

Medication errors are common and occur at a rate of 0.8 per 100 admissions, or 1.6 per 1000 patient days (Choi et al., 2016:428). In general, medication errors at the administration phase are

highly prevalent in hospitals all over the world with documentation errors reported as the most dominant type. An observation study was conducted in the Felege Hiwot Referral Hospital inpatient department in Nigeria where 82 nurses were observed during medication administration. The researchers observed the administering of 360 medications by those nurses. These administrations had one or more medication errors. Documentation errors accounted for 87.5% of the errors, technique errors for 73.1%, while 53.6% were time-related errors (Feleke et al., 2015:1).

2.2.2 Global occurrence of MAEs

In terms of MAE occurrence on a global rate, an observational study by Berdot et al. (2012:1) reported more than 200 errors per month in Paris (France). The study observed 28 nurses who provided care to 108 patients, where 1501 opportunities for MAE occurrence were reported. However, only 415 errors occurred out of the 1501 opportunities for MAE occurrence. The study also showed that less than half (46.4%) of the MAEs occurred during the morning shift, 40.7% during the evening shift and the rest (12.9%) at the noon shift (Berdot et al., 2012:1). Moreover, an Australian study at the Northern Hospital in Melbourne, reported that 125 patients were affected by MAEs during the study period. The failure to attach patients' ID bands, was the most occurred type of these errors (41%), followed by omission errors (38%) and failure to document the allergy status of the patients, accounted for (12%) (Scott et al., 2014:167).

Wang et al. (2015:393) conducted a study on quality improvement in decreasing MAEs committed by nurses from 2011 to 2014. The study reported a decreased rate of 60.9% (from 143 to 64 incidents), where omission was the top type of MAE during the first half of 2011 to the first half of 2014, with a decrease of 50% (40 cases versus 20 cases). The study revealed that fewer MAEs were committed by experienced registered nurses. However, the number of MAEs in surgical wards was double that in medical wards, whereas the intensive care units displayed higher occurrence rates as opposed to non-intensive care units (Wang et al., 2015:393).

2.2.3 National occurrence of MAE

A study conducted at the Paediatric Intensive Care Unit (PICU) at the Inkosi Albert Luthuli Central Hospital in Durban (South Africa) over a three-month period in 2014, reported that 111 MAEs had occurred (Gokhul et al., 2016:1222). The study was based on a population of 117 children who were admitted to the PICU at the hospital. This means that 94.9% of errors occurred at this unit and that the children were exposed to at least one error during their admission. Unfortunately, only 26.2% of the errors were spontaneously reported, while the remaining 73.8% were only detected on chart review. Furthermore, the majority (76%) of the PICU staff were unable to complete the

medication calculations accurately, indicating a need for further training in this regard (Gokhul et al., 2016:1222).

Blignaut (2015:86) observed 1847 prescribed doses that were administered to 315 patients, of which 296 (94%) patients were exposed to an error. The most frequent types of MAE were those relating to wrong times, followed by omission errors. Lastly, the least frequent MAEs were related to administration of the correct dosage of medication to the incorrect patient. The overall occurrence of MAE during the parenteral administration process was 3% higher than that during the enteral administration process. However, the rate of enteral MAE occurrence was higher than that of parenteral occurrence in the medical units, whereas the overall occurrence in the medical units was higher in the surgical units (Blignaut, 2015:102). Furthermore, in the neonatal intensive care unit and paediatric wards of a tertiary academic hospital in Gauteng (South Africa), 663 MAEs were detected among 227 patients. MAEs represented 51%, whereas 47% were attributed to prescribing errors. The most frequently occurring errors was incorrect dose (34%), while the incorrect time errors represented the less frequent type of error (Truter et al., 2017:5).

2.3 Causes of MAE

In order to improve patient safety, factors contributing to and causing MAE have to be defined and analysed. Disclosure of these factors among healthcare workers is important in improving patient safety (Welzel, 2012:406). Therefore, an understanding of MAEs, how they occur, and when and how they should be reported, are integral parts of healthcare workers' knowledge (You et al., 2015:277).

The top five causes of the occurrence of MEs as ranked by Californian registered nurses in the United States, were those related to the legibility of the script. Registered nurses reported "difficult to read" and "illegible physicians' handwriting" as the main cause of MAEs. Some nurses reported "distraction" and "exhaustion" as a cause, whereas others reported similar drug names as confusing, contributing to miscalculation of dosages (Mayo & Duncan, 2004:209, 212). The perceptions of nurses in respect of the causes of MAEs vary from one individual to the next (Keers et al., 2013a:1045).

MAEs occur especially among nurses when one or more of the five rights of medication administration is neglected or violated (Elliott & Liu, 2010:300). The rights of medication administration are outlined as the correct drug at the exact time with the correct dosage to the correct patient, through the right route for the precise reason with accurate documentation

(Athanasakis, 2015:801). More recently, four more rights have been added as illustrated in Figure 2.1.

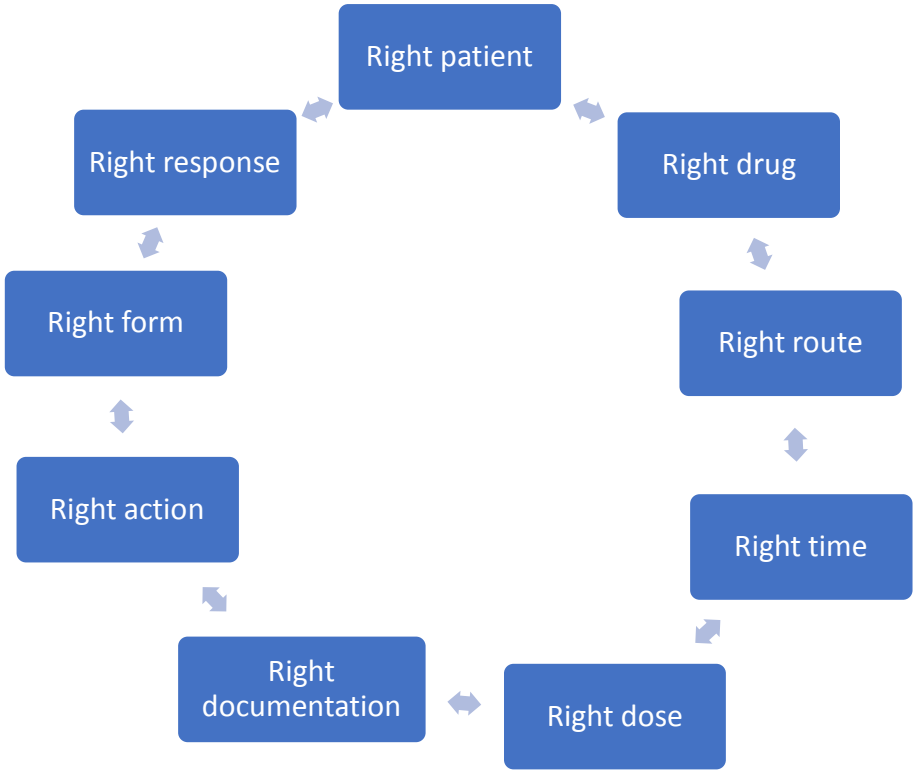


Figure 2.1: Nine rights of medication administration (Elliott & Liu, 2010:300)

Most nurses will be familiar with the five rights of medication administration: the right patient, drug, dose, route, and time, but delivering quality in medication administration is not strictly limited to these five rights. In recent years, two rights were added (right response and documentation), and later, form and action were added (Elliott & Liu, 2010:300). MAEs are usually related to right patient, drug, dose and documentation, can take many forms, and occur at different stages of the medication administration process. Miscommunication among clinicians, poor medication, a disorganised medication trolley, lack of verification, and an illegible or incomplete medication prescription are contributing factors to MAE occurrence as well (Elliott & Liu, 2010:300).

2.3.1 Causes of MAEs globally

According to a study in the southern United States by Hanna (2014:43-45), nurses from three hospitals identified packaging of medication and physician communication-related reasons as the top two categories of MAE occurrence. Consequently, the top five items from the main categories were: a) illegibility of the script, b) unclear handwriting of the physician, c) similar medication

names, d) similar packaging of medication, or e) overall similar appearance of medication. Also, in Sweden, Bergqvist et al. (2012:1) reported on and analysed 30 MAEs committed by registered nurses. Findings from the study indicate a range of factors that contributed to MAE occurrence, such as negligence of the nurse, not being focused on the task, dispersed by patient's needs, administration of additional dose of medication, insufficient knowledge of the administered medication, not reading the documentation thoroughly leading to an oversight of instruction, and non-adherence to correct medication administration procedures.

Similarly, 1305 nursing students at La Salle University in Philadelphia (US) indicated that the first five causes of medication administration errors from 48 mentioned causes, were a) human deficit (51%), b) protocol not followed (31.9%), c) knowledge deficit (26.5%), d) communication deficit (16.7%), and e) no system safeguard (7.9%) (Wolf et al., 2006:42). These findings are supported by Keers et al. (2013a:1048) who conducted a systematic review of 54 quantitative and qualitative hospital-based research studies. These studies were performed in Australia, Canada, Germany, Malaysia, New Zealand, South Africa, the United Kingdom, and the United States. Results from the study indicate that slips and lapses were the most commonly reported unsafe acts, followed by deliberate violations and knowledge-based mistakes. Factors that provoked administration errors include unclear written communication in documentation, problems relating to supply and storage of medication, such as errors at the pharmacy dispensing stage, high workload, stress and exhaustion of staff, and distractions during the administration process.

Following guidelines and policies is key to reducing MAE. A study conducted by Gill et al. (2012:141) explored nurses' adherence to the protocols and procedures during the administration process. Nurses indicated that the medication administration process was complicated, in particular when dealing with paediatric patients. The results showed incompatibility between following the administration policies and protocols with self-reported medication administration practices. The study also explored nurses' perceptions of factors influencing compliance with protocols. Findings showed that familiarity of nurses with patients impacted their ability to follow protocols. In addition, an inability to identify patients with wrist bands, such as patients in burns units, impacted nurses' adherence to protocol and procedures.

Kim et al. (2011:346) conducted a study over two years (2009–2011) in South Korea. The study surveyed 224 nurses to examine their perceptions of MAEs. The study reported that nurses perceived unfamiliarity with drugs; advanced preparation and administration of drugs without re-checking; heavy workload; miscommunication while transmitting verbal orders; and miscommunication with physicians as the most important factors contributing to MAEs. Similarly,

Unver et al. (2012:317) conducted a study in Turkey regarding nurses' perspectives on the occurrence of MAEs. This study investigated 82 experienced nurses and 87 newly graduated nurses in a military education and research hospital. Nurses indicated distraction by other patients, co-workers, or events in the unit as the most important cause of MAEs, followed by nurses' failure to check the patient's name band with the medication administration record (MAR). The contributing factors to MAE occurrence were similar among nurses in the paediatric and adult units.

Stratton et al. (2004:388-389) reported that factors such as interruption during medication administration, unbalanced nurse-to-patient ratios, and administration of medication to multiple patients without double-checking dosages were reported as MAE causes. Similarly, Choo et al. (2013:101) conducted an observational study on 140 registered nurses in two acute facilities in Singapore. Findings of the study highlighted interruption and disturbances during medication administration as the most important factors influencing MAE occurrence. These findings confirm that nurses did not always adhere to safe practice guidelines and policies. Ten guidelines for medication administration were established in this study to explore the compliance of nurses with medication administration protocols. The compliance rate was over 75% out of seven of the ten steps. The majority of nurses (73.6%) checked the patient ID band, 64.1% informed the patient of the medication name and 31% informed the patient of the dosage amount, while only 28.8% of nurses performed a second check of the medication against the prescription chart.

2.3.2 Causes of MAEs nationally

The quality of healthcare institutions in South Africa is affected by the challenges faced by the healthcare system (Coetzee et al., 2013:170). Similar to global reports, causes of MAE have been documented in some institutions at national level. An observational study by Blignaut et al. (2017:3610) researched MAEs and related deviations from safe practice. The study identified a total of 296 MAEs, where the most frequent MAEs were related to wrong time and omissions. In terms of causes, MAEs relating to wrong dose and wrong route were attributed to interruptions and miscalculations. The study also highlighted a need for better training in terms of dosage calculations, as miscalculations were a major cause of MAEs as well (Blignaut et al., 2017:3610).

Truter et al. (2017:6) performed a study in the neonatal intensive care unit and paediatric wards at an academic hospital in Gauteng (South Africa). Results from the study indicated that the main causes of MAEs mostly related to miscalculation (26%), failure to monitor (15%) and lack of adherence to procedures (15%). Anti-infectives (43%) and analgesics (25%) had the most errors. The main causes of MAEs in the medical and surgical units of the Gauteng hospital were workload,

stock distribution problems, and illegible prescriptions (Blignaut, 2015:86). Additionally, a study on MAEs in a neonatal intensive care unit at Groote Schuur Hospital in Cape Town (South Africa) regarding incorrect syringe selection disclosed that the selection of an inappropriate syringe size leads to the administration of the incorrect dosage to the patient. This is especially the case when the medication is delivered via electronic syringe devices. This type of MAE can be minimised through the correct selection of syringe size and reduction of syringe stock options during training. Staff and nurses should be made aware of the potential hazards of incorrect syringe size selection (Tooke & Howell, 2014:470-471).

A study by Coetzee et al. (2013:171) reported that the first cause that negatively affected patient safety was shortage of nurses. However, 44.9% of nurses reported a lack of confidence in managing and solving patients' problems. McEwan (2014:39) also reported that more than half (50%) of countries do not adhere to patient safety policies and procedures. Coetzee et al. (2013:171), also reported that less than 40% of patients take their medication according to the safe clinical guidelines in developed countries. Furthermore, Hill (2016:61-64) conducted a quantitative study among 329 nurses in three private hospitals in the Western Cape province (South Africa). Findings from the study revealed that pharmacy processes (75.68%), workload (74.46%), legibility of prescriptions (71.2%), work pressure (69.60%), distraction during the administration process (67.71%), and exhaustion of nurses (67.47%) were reported as the major causes of MAEs.

2.3.3 Measures to reduce MAE occurrence

Many factors could reduce MAEs and improve patient safety. These factors include confirming patient identity, confirming verbal orders, reducing medicine stock in the unit, and improving medication packaging and labelling, as well as reducing look-alike/sound-alike medication, identifying the causes of errors, and removing the barriers to reporting these errors (Bates, 2007:3; Wakefield & Wakefield, 2009:463; Keers et al., 2013b:237; Al-Youssif et al., 2013:65).

2.4 Consequences of MAEs

Consequences faced by nurses after medication administration errors can include loss of patient trust, civil actions, criminal charges, and medical board disciplinary action (Wittich et al., 2014:1116). In America, over 1.5 million citizens sustained injuries due to MAEs. The financial cost of MEs exceeded 3.5 billion dollars globally. Most of the errors were related to administration errors, which accounted for over a quarter (26%–32%) of the total medication errors (Anderson &

Townsend, 2010:23-27). These errors are completely preventable with the implementation of simple guidelines.

A study by Nanji et al. (2016:25-34) on perioperative medication errors and adverse drug events (ADEs) observed a total of 3 671 medication administrations of which 193 involved MEs and/or ADEs. The majority (79.3%) of errors were preventable, while (20.7%) were non-preventable. Although over a fifth (20.9%) of errors had little potential for harm, a third of errors (33.3%) led to an observed ADE, whereas less than half of errors (45.8%) had potential for patient harm. In terms of the 193 errors, 64.7% were serious, 33.3% were significant, and 2.0% were life-threatening (Nanji et al., 2016:25-34).

The consequences of MAEs do not only incur financial costs, but directly impact patients' safety. Furthermore, the psychological and emotional impacts are broad and affect the practice, performance, confidence and personal status of nurses and HCWs (Seys et al., 2013:136-147; Blignaut, 2015:11; Nanji et al., 2016:34). Therefore, a blame-free reporting system that encourages nurses and HCWs to report their errors should be encouraged in healthcare institutions (Abou Hashish & El-Bialy, 2013:2160; Hanna, 2014:21; Rehan & Bhargava, 2015:2; Mohammad et al., 2016:8; Holmström, 2017:33).

2.5 Reporting of MAEs

The South African Nursing Council (SANC) Regulation relating to the keeping, supply, administering or prescribing of medicines by registered nurses (R2418) Section 3 (1984) states that a nurse who administer the medication is responsible for the proper and accurate recording of the medication in the patient record chart: name, strength, dosage, date and time of medicine administration (SANC, 1984: R2418). SANC Regulation related to setting out the acts or omissions in respect of which the Council may take disciplinary steps (R767) states that failure to administer the correct medication, follow correct procedure or provide appropriate care to the patient, may result in disciplinary action (SANC, 2014: R767).

A study conducted by Blignaut (2015:86) regarding medication administration safety in medical and surgical units in Gauteng (South Africa), found that MAEs were not always reported and the main cause of non-reporting was fear of dismissal or disciplinary action. Gokhul et al. (2016:1222) conducted a prospective study at the PICU of the Inkosi Albert Luthuli Central Hospital in Durban (South Africa) and confirmed that only 2.7% of MEs were reported from the adverse events that occurred, while more than two-thirds (73.8%) of errors were detected by chart review.

The study of Jones and Treiber (2010:243) describes nurses' perceptions of how and why medication errors occur and their personal experiences of medication errors. The study confirmed that 78% (158 out of 202) of nurses admitted making medication errors and provided details of these errors. The majority (94%) of nurses believed that all errors should be reported (even if not harmful to the patient), whereas 77% reported an error to the patient or the patient's family (Jones & Treiber, 2010:243). Mayo and Duncan (2004:209) revealed that nurses shared different perceptions of reporting of medication errors. Only 45.6% of the 983 nurses in the study believed that all drug errors are reported, and reasons for not reporting include fear of managers and peer reactions.

2.5.1 Frequency reporting of medication administration errors globally

The reporting of the failure represented an opportunity to learn from it (WHO, 2014:7). The causes of MAEs have common roots and should be corrected. Consequently, the occurrence of these errors referred to weaknesses in the healthcare system (Iliffe, n.d.). The World Alliance for Patient Safety in 2005 set guidelines for the learning and reporting system in respect of adverse drug events to enhance the use of this system worldwide to improve healthcare services and patient safety (WHO, 2005:21). In the South African context, the South African Nursing Council (2013) reported malpractice of 629 professional nurses from 2003 to 2008. Of these reported misconduct cases, 105 of them were related to medication administration (SANC, 2013a:3).

In terms of the most frequently reported MAEs, non-IV medication errors were ranked as highest by a group of nurses in California hospitals (USA) (Hanna, 2014:47). In contrast, nurses in Saudi Arabia shared a different view and ranked IV medication errors as the most frequently reported type (Al-Youssif et al., 2013:62). The studies also reported different rankings for the subtypes of non-IV medication errors.

Hanna (2014:47) ranked the wrong dose, wrong drug and the wrong patient as the most frequently subtype-reported MAEs. Al-Youssif et al. (2013:63) ranked the most frequently reported non-IV medication as subtype, such as wrong time of administration, wrong dose and omission of the medication in a study performed at Saudi Arabian hospitals. Owing to the frequent occurrence of MAEs, health services use them as an indication of patient safety, as patients are always at potential risk of MAEs (Yung et al., 2016:580).

Medication administration errors are further classified according to the route of administration, such as IV and non-IV medication errors. Non-IV medication errors are classified into nine subtypes which are wrong dose, wrong drug, wrong patient, wrong route, wrong time of

administration, medication that was omitted, administration of a drug to a client with a known allergy, medication that was not ordered, or medication administered after discontinued use (Schnock et al., 2017:131). IV medication errors have the same subtypes as non-IV medication errors: wrong fluid used, fluid administered at the incorrect rate, and wrong method of administration (Härkänen et al., 2017:3486).

2.5.2 Frequency reporting of medication errors nationally

Studies that determine medication errors, MAE occurrence, and barriers to reporting these errors have been conducted among nurses and nursing students in South Africa (Blignaut et al., 2014; Du Preez, 2016; Gokhul et al., 2016; Hill, 2016; Truter et al., 2017).

Truter et al. (2017:5) reported a total of 663 medication errors in 227 patients over a study period of 16 weeks. Findings indicated that 78% (178 out of 227) of patients had experienced one or more error(s). The majority of errors were attributed to administration errors (51%), followed by prescription errors (47%). In terms of frequency, wrong dosage accounted for 34% of errors, followed by omission of medication (18.5%) and medication given at the wrong time (12%). Over two-thirds (67%) of patients were not exposed to any potential harm by the MAE, whereas the remaining third (33%) were exposed to some level of harm (Truter et al., 2017:5-10).

2.5.3 Barriers to reporting of MAEs

Reporting MAEs helps to identify nursing trends and behaviours and highlights problem areas at hospitals. Proper reporting also encourages prevention of future errors and improves the quality of healthcare and hospital services (Choo et al., 2013:1; Kim & Bates, 2013:590; Hanna, 2014:66; Feleke et al., 2015:1; Bifftu et al., 2016:1; Lee, 2017:728). Reporting errors has to be encouraged among nursing staff as a lack of reporting compromises the health and safety of patients. Barriers to reporting MAEs should be explored from nurses' perspectives in order to prevent their repeating this behaviour.

Mohammad et al. (2016:2) conducted a study on the barriers to reporting MAEs among nurses in an accredited hospital in Saudi Arabia. Some of the barriers included an inability to identify and define an MAE, as well as administrative responses to MAEs. Other barriers noted were fear of dismissal and disciplinary action, the most prominent barriers to reporting. Some nurses also viewed projecting a positive image of themselves to co-workers to be a reason hindering them from reporting MAEs (Mohammad et al., 2016:2). Nurses want to maintain this positive image of themselves, and fear that reporting MAEs will result in lowering their esteem among their peers and managers (Hammoudi et al., 2017:1038).

2.5.3.1 Factors that affect reporting behaviour

Studies have confirmed that the biggest barrier to reporting medication administration errors is fear (Mohammad et al., 2016:1-13; Berdot et al., 2016:342-350; You et al., 2015:276; Härkänen et al., 2017:3486-3499; Latimer et al., 2017:7-9; Schnock et al., 2017:131-140). Some of the factors that affect nurses' reporting trends are voluntary and anonymous reporting with concerns about problem solving, rather than the blame-free approach (Wakefield et al., 2005:483; Hanna, 2014:21; Rehan & Bhargava, 2015:2; Holmström, 2017:33). Moreover, Gordon (2014:20) contends the strongest barriers to reporting are management's response (34.8%) and fear of co-workers' reactions (32.6%). However, 21.7% of respondents did not report their errors as they were not serious enough to report (Gordon, 2014:20).

Hanna (2014:43-45) noted that fear and administrative barriers were listed as the top two barriers preventing nurses from reporting MAEs at three hospitals in the southern United States. The top five items following the main barrier categories were: no positive feedback from administration, fear of blame, patients' negative attitudes towards nurses, fear of adverse consequences, and nurses being recognised as incompetent (Hanna, 2014:64). However, a study at a psychiatric hospital of King's College, London, disclosed that more than half the nurses (52%) do not report an MAE committed by a colleague. Nurses would rather accept a colleague's excuse as the first reason for not reporting an MAE (Haw et al., 2014:800).

Health Quality Ontario (2017:1) noted common barriers reported in the literature by healthcare professionals. These included fear of blame, legal action, lack of knowledge about error reporting systems, lack of knowledge about what constitutes an error, nurses' perceptions that reporting does not improve patient safety, lack of organisational support, and inadequate feedback from administration. Reporting of MAEs among South Korean nurses was very low. It ranged from 6.3% to 29.9% at ten hospitals in South Korea. Underreporting of these errors was due to fear of negative consequences. Moreover, most of the nurses reported their errors to the physician rather than completing an incident report (Lee, 2017:728). The same findings were reported in Ethiopia, where less than one-third (only 29.1%) of the nurses at the University of Gondar Referral Hospital in Ethiopia reported their MAEs. The factors for refusal of error reporting were educational status, disagreement with definition, administrative reasons and fear (Bifftu et al., 2016:5).

According to a study conducted in Iran, fear and the reporting process were two important reporting barriers (Mansouri et al., 2014:3). Nurses felt that the sense of being reprimanded and ignoring to report respectively were the most frequent factors. The study also reported that anti-infectives were the most frequent drugs involved in MAEs (Mansouri et al., 2014:3). Similarly, a

study by Haw et al. (2014:797) revealed common themes for not reporting an error: knowledge, fear and burden of work. The study confirmed that nurses are not yet fully convinced of the need to report MAEs and recommended increasing knowledge of MAEs and reducing burden of work to encourage reporting.

A study by Ock et al. (2017:68) reported on the obstacles to disclosure of patient safety incidents (DPSI) and concluded that fear of medical lawsuits and punishment, fear of a damaged professional reputation among colleagues and patients, diminished patient trust, the complexity of the situation, and the absence of a patient safety culture were major barriers to reporting MAEs. A further indicated that nurses do not report medical errors that they experience or witness (Soydemir et al., 2017:1348). Findings from the study indicated four main barriers to reporting: fear, the attitude of administration, barriers related to the system, and nurses' perceptions of what constitutes an error (Soydemir et al., 2017:1348).

A study at King Fahd Medical City in Riyadh, Saudi Arabia conducted among 300 nurses revealed that the barriers for reporting nurses' MAEs are administrative barriers, followed by fear. However, the study found no significant relation between demographic factors (e.g. age, gender and work experience) and the overall barriers in reporting MAEs (Almutary & Lewis, 2012:119-123). Nurses at a large governmental hospital in Saudi Arabia (307) participated in a study related to barriers in reporting MAEs. They stated fear of blame and a focus on individuals rather than on the system as primary factors preventing them from reporting their errors. Over half of nurses (58.96%) reported errors that carried potential harmful consequences for the patient (Mohammad et al., 2016:6-7).

The nurses at King Khalid Public Government Hospital (Kingdom of Saudi Arabia) stated that the first subscale of reasons for MAE occurrence was medication packaging. The major reasons for not reporting MAEs were fear and administrative reactions to MAEs. Fear included fear of the patient's or family's negative attitudes towards the nurse and fear of adverse consequences for the patient's health (Al-Youssif et al., 2013:56). Administrative barriers included inappropriate responses by the administration, no positive feedback, and focus on the individual, rather than on examining the reporting system. The nurses contended that medications with similar names, similar appearance, and similar medication packages contributed to MAEs. Secondary causes of MAEs were those related to system issues such as the use of abbreviations. Factors relating to shifts (nurses moving during working hours) were also highlighted as causes of MAEs (Al-Youssif et al., 2013:66-67).

Important barriers militating against students' reporting MAEs were administrative barriers and fear of managers (Koohestani & Baghcheghi, 2009:66). One-third of nursing students (9 out of 28) at the University of Queensland (Australia) indicated that they did not report errors when the error did not cause potential harm to the patient (Reid-Searl et al., 2010:228).

2.5.4 Medication errors reporting systems (MERSs)

Medication errors reporting systems (MERSs) have been developed to manage safety risks in medication units (Wakefield et al., 2000:16; Holmström, et al., 2012:165; Holmström, 2017:1). The aim of MERSs is to assist with interventions to improve healthcare through analysis of factors contributing to MAEs (WHO, 2005). Although MERSs vary across countries and within different healthcare settings, similar difficulties and challenges are faced by HCWs and nurses who report their errors (McLeod et al., 2014:1).

These difficulties and challenges range from lack of time to report an error, lack of education regarding the medication reporting procedure, to lack of willingness to report an error (Ashcroft et al., 2006:48; Holmström et al., 2012:165). Implementation of MERSs thus should be based on information from various countries and healthcare settings (National Patient Safety Agency, 2018).

Common facilitators to improve reporting of MAEs include a non-accusatory work environment, changing perceptions on incident reporting in improving safety, clarification of reporting routes, how the system uses reports, enhanced and positive feedback, role models (such as managers) using and promoting reporting, legislated protection of those who report, provision of an option to report anonymously, provision of education and further training opportunities, and clear guidelines on what to report (Health Quality Ontario, 2017:1).

A computer program for medication safety, Med Safe Tools, was designed by the Canadian Institute for Safe Medication Practices to report MAEs. The program relies heavily on voluntary reporting procedures and was used in the Al-Ain Hospital in the United Arab Emirates. The study investigated 370 nursing staff that completed a pre- and post-self-reporting questionnaire. Training, education and in-service materials were offered to all nurses. Simultaneously, the program tracked 185 nurses who still reported errors using the paper incident reporting procedure. The results of this study showed a significant difference between the medication errors reported using Med Safe Tools (98) and those using paper incident reporting procedures (11). Med Safe Tools reported a total of 98 errors, whereas only 11 MAEs were reported using the paper incident reporting procedure (Elnour et al., 2007:177).

The severity of medication errors was categorised (A-I) by the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP), where (A) represented the near-miss errors, while (I) represented errors that could lead to death (NCC MERP, 2018). However, a standardised database for the identification and quantification of medication errors in South African hospitals still needs to be established and medication error reporting systems need to be formalised and standardised (Mehta et al., 2014:104; Truter et al., 2017:5).

2.6 Interventions to reduce the MAEs

Many interventions have been suggested and developed to reduce MAEs in the healthcare field. Most interventions have developed around the reasons for MAEs, which may be related to the individual clinician, HCW or nurse, the workplace environment or medication administration system. Therefore, multi-factorial intervention approaches have to be developed to address various related factors (Tzeng et al., 2013:13; Berdot et al., 2016:342; Flynn et al., 2016:19; Nanji et al., 2016:25-34).

2.6.1 Technology–based interventions

Many MAEs occur as a result of human error in the administration process and include the prescribing, transcribing, prescription auditing, preparing, dispensing, administration, and monitoring areas. The introduction of technology-based interventions may reduce the occurrence of MAEs by removing the possibility of human error. A systematic review examined ten electronic databases related to MAE reduction interventions and revealed that automatic dispensing of drugs, computerisation of the physician order, use of the barcode technique for medication administration, and electronic administration techniques were the most effective interventions to reduce MAEs (Keers et al., 2014:317-318). Similarly, automated drug dispensing and computerised physician order entry were also reported as useful technology interventions to reduce MAEs (Flynn et al., 2016:19). Other technology-based interventions include electronic medication tracing, online query systems to identify capsules or tablets, web-based software for prescription, and mode of unit dose labelling (Wang et al., 2015:395-397). The use of checklists to continuously measure patient safety represents the second and third audit keys respectively. These keys were used by Blignaut (2015:235) in public hospitals in Gauteng as two interventions to reduce MAEs and improve overall patient safety.

Blignaut (2015:235) suggested an IT intervention based on barcode technology and fingerprint detection for quick and efficient reporting. Furthermore, it was suggested that this computerised system should be accessible to the physician, nurses and pharmacists, with mandatory fields to

avoid prescription, medication administration and dispending errors. However, a systematic review of 16 studies by Lapkin et al. (2016:845) reported that successful interventions have to deploy both technology-based interventions with training, education and risk management practices in order to effectively reduce MAEs.

2.6.2 Nursing education/training

Nurses, physicians, pharmacists and other HCWs play a role in the medication administration process (Haw et al., 2014:797; Keers et al., 2014:325; Simonsen et al., 2014:1; Parand et al., 2016:2; Härkänen et al., 2017:3486). Another study conducted by Haw et al. (2014:799) revealed that nurses may need further in-house training to reduce MAE occurrence. Wulff et al. (2011:2080) conducted a systematic review of twelve studies regarding interventions for MAE reduction and proposed better training programmes for nurses on techniques in medication administration processes. One study highlighted the use of simulation and clinical pharmacist-led training to reduce MAE occurrence (Keers et al., 2014:317).

2.6.3 Work environment and ward system changes

As previously mentioned, some MAEs are caused by heavy workloads of nurses. Working longer shifts leads to exhaustion and burnout, with associated errors. Furthermore, heavy workloads have been related to interruptions during medication administration processes. Nurses and HCWs are often overburdened with too many patients to take care of and are thus prone to interruptions (Fasolino & Snyder, 2012:E14-E15; Feleke et al., 2015:1). These studies recommend decreased lengths of shifts and an increase in staff per shift. Raban and Westbrook (2014:414) noted that shorter shifts increase nurses' focus and minimise interruptions during the medication administration process.

2.6.4 Pharmaceutical factors

The pharmacist present in the ward could prevent about 58% of the occurrence of medication errors (Simpson et al., 2004:F481). In Nigeria, 15.2% of pharmacists were involved in medication errors, and they ranked the wrong labelling of patients' names as the most common type of error (Ojerinde & Adejumo, 2014:25). The appointment of a clinical pharmacist to monitor treatment procedures and patient safety has been established in some countries, whereas the communication with the pharmacist reduce a further MAE occurrence (Simpson et al., 2004:F480; Wong et al., 2009:161; Khalili et al., 2011:281).

Alotaibi and Federico (2017:1173) recommended the use of healthcare information technology (HIT) in healthcare services as key to reducing MAE and improving patient safety. Other interventions include continual and ongoing staff training; improvement of mathematical skills; further training in medication administration and use; redesign of medication preparation areas; reduction of medication storage in units; outsourcing supply of high risk products; improvement of medication labelling; better accessibility to pharmacy services; and use of information technology in healthcare services for better medication administration (Keers et al., 2014:318; Schnock et al., 2017:131).

2.7 Summary

There are still many research gaps which need to be explored by further studies. MAEs pose a threat to the health and safety of patients, and despite being preventable, still occur daily in healthcare facilities nationally and globally. Although several reporting systems have been implemented in healthcare facilities and hospitals, the actual number of MAEs is still not reported and is not documented.

Based on the review of literature, it appears that the major reason for omission of reporting is fear of dismissal and disciplinary action from administrative authorities. Some nurses feel that reporting MAEs compromises their professional reputation, whereas others do not report MAEs because of potential harm to the patient. The literature review has also highlighted systematic weaknesses of current reporting systems. Nurses often feel that reporting procedures are cumbersome and therefore omit reporting MAEs when they occur. In terms of interventions to decrease and prevent MAE occurrence, studies suggest that a blame-free system of reporting should be encouraged in addition to an easier computerised system of reporting. The next chapter (Chapter 3) provides the research methodology for the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

According to Brink et al. (2018:187), research methodology shows the reader the process that the researcher followed to answer the research question, or to solve the research problem. This chapter will discuss the research methodology that was utilised to determine the perceive occurrence and reporting of medication administration errors among nursing students. In this study, a quantitative descriptive research design was applied to achieve the following stated objectives:

- Determine awareness of the occurrence and reporting of medication administration errors among undergraduate nursing students at a higher education institution in the Western Cape.
- Determine factors related to medication administration error occurrence indicated by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where undergraduate students were placed.
- Determine barriers to reporting medication administration errors as perceived by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where they were placed.
- Determine the percentage of reporting the non-IV medication errors perceived by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where undergraduate students were placed.

Research methodology includes the design, setting, sample, methodological limitations, and data collection and analysis techniques in a study (Brink et al., 2018:187). The purpose of this chapter is to discuss the research methodology used in this study. The chapter is organised under major headings: research paradigm; design; population and sampling; methods of data collection; presentation of results; validity and reliability; and ethical considerations applied in this study.

3.2 Research setting

The study was performed at a higher education institution (HEI) in the Western Cape province (South Africa). This institution offered a range of undergraduate nursing programmes (with general nursing, midwifery, psychiatry and community nursing) which were included in this study. The nursing department has three sites where the basic undergraduate training programme is offered.

The one campus included in the study for data collection has the largest number of undergraduate students compared with the other two sites, which are situated in two rural areas.

3.3 Research paradigm

Research paradigms deal with the source, nature and development of knowledge (Polit & Beck, 2018:411). Essentially, the paradigm is the worldview. The nursing inquiry utilises the positivist and constructivist paradigms (Polit & Beck, 2017:11).

3.3.1 Positivism

Positivism is the dominant paradigm in nursing research (Harvey & Land, 2016:49). Positivism has influenced many health and social science researchers (Brink et al., 2018:96). It is a philosophy that is in accordance with the empiricist view that knowledge stems from human experience. It has an atomistic, ontological view of the world as comprising discrete, observable elements and events that interact in an observable, determined and regular manner (Polit & Beck, 2018:6-7). The positivist philosophy advocates that factual and valid knowledge is obtained through measurement and observation (Gorski, 2018:24).

In the positivist paradigm, the role of the researcher is very limited and is confined to an objective interpretation of the research findings and data collection. Findings are normally quantifiable and observable, and thus quantifiable observations will result in statistical analysis (Holloway & Galvin, 2017:22-23). The researcher is thus separate from and independent of the study. Positivism has a highly structured research design that enforces pre-set boundaries and limits to the research. Hence, it is not very useful when attempting to explain the “why” behind a particular phenomenon but it is the better approach to describe the causes of human behaviour (McCann, 2017:43-53). The second disadvantage of positivism is that it assumes the objectivity of the researcher. However, a positivist-based study cannot assume to be totally objective, as the values and interests of the researcher will ultimately impact the approach to the study, such as choice of questions (Ritchie et al., 2014:111). Lastly, positivism also relies heavily on the fact that experience is a valid source of knowledge and does not take into consideration additional influential components such as time, cause and space (Ritchie et al., 2014:111). The positivist paradigm was applied in this study. It relies on explanations that indicate causality between variables and fits a quantitative research approach.

3.4 Quantitative research approach

A quantitative approach was used in this study. The quantitative approach is used to describe and test relationships to identify the nature of the cause and effect impact among the study variables (Grove & Cipher, 2017:13). This approach allowed the researcher to describe the variables with regard to the students' awareness of the occurrence and their reporting of MAEs, as well as the reasons for these errors, the barriers to reporting them, and the frequency of reporting these errors. The advantage of a quantitative approach is the ability to and possibility of quantitatively measuring concepts, explaining causal relationships between variables and concepts, and generalising research findings to a certain extent (Gray et al., 2017:27).

3.5 Research design

3.5.1 Descriptive research

Descriptive design is not strictly qualified as either a quantitative or qualitative research methodology, but instead it employs elements of both and often within the same study (Brink et al., 2018:96). The present study adopted a descriptive research design which involves gathering data describing events, and then organising, tabulating, depicting and describing the data collection within a quantitative research approach (Polit & Beck, 2017:206). The researcher sets out to determine, describe or identify what is, while analytical research attempts to establish why it is that way or how it came to be. Descriptive research is aimed at casting light on current issues or problems through a process of data collection that enables researchers to describe the situation more completely – in this case the occurrence and reporting of MAEs as perceived by nursing students at a higher education institution in the Western Cape.

3.6 Population and sampling

3.6.1 Population

A population is a set of entities in which all the measurements of interest to the practitioner or researcher are presented (Gray et al., 2017:53). The target population for this study comprised second-, third- and fourth-year undergraduate nursing students registered for the undergraduate nursing degree at an HEI in the Western Cape. Approximately 563 students from second to fourth year were registered for this course at the HEI. All students enrolled for this study programme had been approached to participate in this study.

The total population of the study was 563. The quota sampling was applied to select the participants. More than half (53.28% *n*=300) agreed to participate in the study by signing the consent form (Appendix A). Nine (9) of the returned questionnaires were excluded as they were incomplete. However, the sample size was achieved. The total per year levels were: 213 second-year students (37.8%), 180 third-year students (32%) and 170 final-year students (30.2%). As the total number of students was not equally distributed across the three years of study, the researcher used the quota sampling method.

3.6.2 Sampling

Sampling refers to the process of selecting a representation of a population to collect data (Polit & Beck, 2018:417). Sampling methods are classified into probability sampling and non-probability sampling. Probability sampling refers to the selection of a list containing the names of everyone in the population that the researcher is interested in (Brink et al., 2018:119). Non-probability sampling is used mainly when the researchers find it unfavourable to use the random selection to the sample size, owing to a lack of probability sample lists (Denscombe, 2014:33). A non-probability sampling technique was employed by the researcher in this study.

3.6.2.1 Non-probability sampling techniques

Non-probability sampling techniques include convenience sampling, quota sampling, purposive sampling, network sampling, and theoretical sampling (Grove & Cipher, 2017:15). The implication of using non-probability sampling is the limitation of the generalisability of the study. However, it allows the researcher to target people with the required information and collect relevant data (Denscombe, 2014:49-51). Convenience and quota sampling are usually used with quantitative research (Gray et al., 2017:342). Convenience sampling (accidental sampling) is commonly used in healthcare studies and might include patients who attend a clinic on specific days, who attend support groups, are hospitalised patients, or comprise a classroom of students. Convenience samples are accessible, save time and effort, and are inexpensive, but with this technique the opportunity to control bias is limited (Garcia-Alexander et al., 2017:25; Polit & Beck, 2018:417). Quota sampling uses the convenience sampling technique with features to include the subject types that are likely to be underrepresented in the convenience sample. The use of quota sampling is to replicate the proportions of subgroups present in the population (Grove & Cipher, 2017:15).

Proportional quota sampling was used in this study. The purpose of quota sampling is to draw a sample that has the same proportions or characteristics as the whole population (Grove & Cipher, 2017:15). Quota sampling allows the researcher to control the number of sample subjects with

desired characteristics (Denscombe, 2014:40). A proportional quota sample allows the researcher to obtain information on the composition of the population (Garcia-Alexander et al., 2017:39). Quota sampling uses a convenience sampling technique to ensure the inclusion of subject types or strata in a population. It offers improvement over convenience sampling and tends to decrease potential biases(Polit & Beck, 2017:253-254).

With this sampling method, the researcher divided the population group into three subgroups (strata) depending on the year of study (second-year, third-year and fourth-year nursing students) (refer to Section 1.8.4). Quota sampling with convenience technique was then used to collect the data to achieve the desired number of the sample size.

3.6.2.2 Inclusion and exclusion criteria

The inclusion criteria for respondents were limited to nursing students in the second, third and fourth years of an undergraduate nursing degree who were enrolled at an HEI in the undergraduate nursing programme. Secondly, only students who were 18 years and older were included in the study. Students who met these inclusion criteria were eligible for selection and participation in the study.

The students selected to participate in this study did their practical training at various health institutions in the Western Cape province. Furthermore, the nursing students at the selected HEI represented one of the highest numbers of nursing students among the Western Cape nursing institutions in South Africa. Hence the researcher opted to determine the perceived occurrence and reporting of MAEs of this group of students.

The exclusion criteria were all first-year nursing students, as they had not yet been exposed to a practice programme where medication was administered. Secondly, all students enrolled in other nursing programmes such as general nursing, midwifery, psychiatry and community nursing at the HEI, were not considered to participate in this study.

3.6.2.3 Sample size

The sample size calculated as the target population of this study was 563 nursing students at the time of data collection. Confidence intervals and confidence levels were established once the total population was known. Thus, the existing sample is reflected in the population. The Sample Size Calculator (2016) was used by the researcher to calculate the sample size. The researcher used a confidence level of 95%, which represents how sure one can be that one's results are a true reflection of the population. The confidence interval of 4 was calculated using the sample size

calculator from the Survey System website, which represents the range of the true value for the population (Sample Size Calculator, 2016). Based on that, the sample size was estimated as 291, comprising second-, third- and fourth-year undergraduate nursing students. The formula below was used to calculate the sample size manually:

Z (standard normal deviation) =1.96
P (proportion) = 0.5
e (error margin or confidence interval) = 0.04
N (population) = 563

$$\frac{\frac{z^2 \times p(1-p)}{e^2}}{1+(\frac{z^2 \times p(1-p)}{e^2 N})} = \frac{\frac{(1.96)^2 \times 0.5(1-0.5)}{(0.04)^2}}{1+(\frac{(1.96)^2 \times 0.5(1-0.5)}{(0.04)^2 \times 563})} = \frac{600.25}{2.066} = 290.53 \cong 291$$

3.6.3 Recruitment process of respondents

The recruitment process was conducted by the researcher and the supervisor involved in this study. Two meetings were conducted with the head of department (HoD) on the one campus during February 2017. The aim of the meeting with the HoD was to request permission to conduct the research and to discuss strategies for the recruitment procedure of the respondents. During the meetings, the intention of the research project was also clarified. Thereafter, the HoD informed relevant members of staff about the research project.

After ethical clearance was obtained from the Faculty of Health and Wellness Sciences Research Ethics Committee at CPUT (Appendix D), the researcher and the supervisor conducted meetings with the various programme coordinators from the second-, third- and fourth-year nursing programmes. During these meetings, logistics relating to time, dates and availability of the selected students for data collection were established. The recruitment of the respondents was achieved within two days. The third- and fourth-year students were recruited on the first day and second-year students on the second day, and the quota proportions were maintained.

Table 3.1: Sample size realization

Year of the study	Recruited	Accepted	Questions returned	Question incomplete	Final sample size	Male	Female	Not indicate the gender
Total	300	300	300	9	291 (100%)	54	236	1
Second year	113	113	113	3	110 (37.8%)	29	81	0
Third year	97	97	97	4	93 (32%)	13	80	0

Year of the study	Recruited	Accepted	Questions returned	Question incomplete	Final sample size	Male	Female	Not indicate the gender
Fourth year	90	90	90	2	88 (30.2%)	12	75	1

3.7 Data collection

3.7.1 Data-collection procedure

The data collection is the critical process in the research study where the researcher gathers information to answer the research question (Brink et al., 2018:33). A research strategy refers to the method that guides the researcher to investigate the research. It is a general design that aids the researcher in addressing and answering the research questions in a methodical way and stipulates why a certain research strategy has been selected. The research strategy guides the study in terms of collecting relevant background information and using appropriate data-analysis techniques in order to arrive at a conclusion (Denscombe, 2014:3-4). The present study used a self-administered questionnaire for the data collection and simultaneously enabled the collection of reliable and valid data necessary to achieve the objectives and aim of this study.

Maintaining the quota distribution, the students were invited to participate, and 300 consent forms were distributed. The researcher and his supervisor met with all the students, and the lecturer in each class introduced the researcher to the prospective respondents. Three hundred (300) consent forms were signed and 300 questionnaires distributed to the respondents.

Before commencement of data collection, the purpose and aims of the study were explained to the respondents. A written information sheet was also given to all respondents and attached to the consent form (refer to Appendix A). The researcher explained the nature of the research and provided respondents with an opportunity to ask questions before they consented to participate in the study. The respondents were made aware that they had the right to withdraw from the study, even after they had provided informed consent, without being victimised or with any negative consequences. Ample time was given to respondents to complete the questionnaire. The researcher administered the questionnaire.

The questionnaires were collected after completion and coded anonymously by the researcher as second year (2.000), third year (3.000) and fourth year (4.000). After extraction of the data, the completed questionnaires were stored safely in a locked safe in the nursing department at the HEI where the researcher is a registered student. Thereafter, data was numerically analysed using the Statistical Package for Social Sciences (SPSS Version 24).

3.7.2 Data collection instrument: Self-administered questionnaire

According to Brink et al. (2018:44), data-collection tools are designed to meet the purpose of a study in order to achieve the aim of the study. The data-collection tools should measure the variables under the same condition (Gray et al., 2017:422). A self-administered questionnaire was used as a data-collection tool in this study (refer to Appendix B).

The data-collection instrument in the present study consisted of a self-administered questionnaire. The self-administered questionnaire is a research instrument consisting of a series of questions with the purpose of gathering data or information from respondents. The questions were classified into open-ended and closed-ended questions (Creswell & Creswell, 2018:14). An open-ended question allows respondents to answer the question freely, whereas a closed-ended question provides a list of options from which to choose. The response options are mutually exclusive and may be dichotomous (two options), nominal-polytomous (more than two unordered options), ordinal-polytomous (more than two ordered options) and bounded continuous, where the respondent is presented with a continuous scale (Polit & Beck, 2017:271-272).

The advantages of using a questionnaire are that it is much easier in terms of reaching a wider population, it is cost effective, and relatively easy to complete. Furthermore, a standard questionnaire provides answers that are quantifiable and measurable, and therefore much easier to analyse. However, because the answers are quantifiable, questionnaires do not provide further insight into the subject under study. This is more so when there is little or no previous information on a particular topic. Also, because the responses of the questionnaire are limited, respondents are permitted to select from those options only. If the right response is not among the choice of answers, then the researcher might gain little or no information. Lastly, respondents sometimes misunderstand or misinterpret questions if they are not clearly constructed and explained before data collection (Brink et al., 2018:139).

3.7.3 Questionnaire construct

The questionnaire for this study was divided into five sections in alphabetical order. Part A and B were developed by the researcher. Part C, D and E had been used in previous studies and developed by Dr Bonnie Wakefield of the Sinclair School of Nursing at the University of Missouri. Permission to use the questionnaire was obtained from the developer (see Appendix C).

Part A collected respondents' demographic characteristics and comprised Items 1, 2, 3 and 4.

Part B outlined respondents' awareness of the occurrence and reporting of MAEs and comprised Items 5 and 6.

Part C outlined the causes of MAEs and comprised 20 items on MAE-related causes with a six-point Likert scale (1=strongly disagree to 6=strongly agree). This part of the questionnaire was further classified into four subscales: physician communication-related causes (6 items: Questions 10, 11, 12, 13, 14 & 18); medication package-related causes (3 items: Questions 7, 8 & 9); pharmacy process-related causes (3 items: Questions 15, 16 & 17) and nursing staff-related causes (8 items: Questions 19, 20, 21, 22, 23, 24, 25 & 26).

Part D comprised 11 items with a six-point Likert scale (1=strongly disagree to 6=strongly agree) and outlined nursing students' perceptions of barriers to reporting MAEs. This part of the questionnaire was further categorised into four subscales: disagreement with definition (4 items: Questions 27, 28, 31 & 32), reporting effort (2 items: Questions 29 & 30) and fear (5 items: Questions 33, 34, 35, 36 & 37).

Part E comprised 9 items with a 10-point Likert scale (1=0–20% while 10=100%). This part outlined respondents' predictions about the percentage of non-intravenous MAE reporting in the units at the health service where the students are in practice.

3.8 Pilot study

Holloway and Galvin (2017:346) define the pilot study as a small version of the proposed research study, where the researcher can use 10 to 20 respondents to test the ability of the instrument to measure the variables it is supposed to do (Grove et al., 2013:343). In this study, 15 respondents were used for the pilot study, which was sufficient to estimate the variances in the instrument.

A pilot study was employed in this study and conducted at one campus of the HEI in the Western Cape of South Africa. The pilot study was used to test the various components of the questionnaire, as well as the planned research methodology and its suitability to the respondents (Gray et al., 2017:54). The pre-testing questionnaire was conducted on one day during the data-collection period. Respondents in the pilot study included second-, third- and fourth-year nursing students who met the inclusion criteria for the study.

Consent forms were distributed to the respondents prior to the questionnaire sheets. The consent forms consisted of an information sheet (refer to Appendix A) with information about the study. Agreement to participate in the pilot study was obtained using the consent form (refer to Appendix A). The researcher explained to the respondents the purpose of the study and the contents of the

informed consent. The researcher informed the respondents that they were free to participate in the study or to withdraw at any time even after completion of the consent form. A total of 15 questionnaires were distributed. All the distributed questionnaires were returned. The respondents indicated that the questionnaire was clear, easy to read and easily understood. The questionnaires took approximately 10–15 minutes to complete. The results of the pilot study indicated that no corrections or adjustments to the existing instrument were necessary.

3.9 Data analysis

The purpose of data analysis is to construct meaning from the data. This is achieved by coding, summarising and using appropriate data-analysis tools to derive meaning from the data (Polit & Beck, 2017:426). It involves the conversion of collected data into a form useful for deriving meaningful results and includes conclusions, tables and graphs (Gray et al., 2017:56).

The first objective of the study outlines the students' awareness of MAE occurrence and of reporting it. This objective consisted of two closed-ended questions. The second objective was related to the causes of the MAE occurrence and consisted of 20 items with a six-point Likert scale (1=strongly disagree to 6=strongly agree), which classified to four main subscales (Wakefield et al., 2005:484). The three points of disagreement on the Likert scale were estimated together and the three points of agreement were estimated together in order to determine the respondents' agreement with each item and each subscale. The third objective was related to the barrier to reporting MAEs and consisted of 11 items with a six-point Likert scale (1=strongly disagree to 6=strongly agree), which classified to three main subscales (Wakefield et al., 2005:484). Also, the disagreement points were estimated together as well as the agreement points to determine the respondents' agreement with each barrier and each subscale. The last objective was to determine the reporting frequency of the medication errors with a 10-point Likert scale (1=0–20% while 10=100%). These points were estimated to determine the percentage of reporting of each type of medication error.

The collected data was coded and tabulated. The Statistical Package for Social Sciences (SPSS Version 24) was used to analyse the data (IBM SPSS Inc., 2016). Microsoft Excel was utilised for graphical presentation such as line and bar charts. The analysis was performed under the supervision, and with consultation and support from the statistician at the HEI where the research was done. In this study, descriptive and inferential statistics were conducted to analyse the collected data.

3.9.1 Descriptive statistics

Descriptive statistics are used to describe the basic features of the data in a study (Ross & Willson, 2018:9). Descriptive statistics provide simple summaries about the sample and the measures. Descriptive statistics form the basis of virtually every quantitative analysis of data and differ from inferential statistics (Brink et al., 2018:166). The variables were described in tables and figures by the mean, standard deviation (SD), maximum, minimum, and percentage.

3.9.2 Inferential statistics

Inferential statistics apply the sample statistics to the data to make inferences regarding the study population (Polit & Beck, 2018:406). The chi-square test is the test that determines whether the examined variables have a significant difference or are independent (Grove & Cipher, 2017:191). The chi-square test was applied to check whether there was any relation between the year of the study and the respondents' awareness of MAE occurrence and its reporting during their practice time.

A one-sample *t*-test compares the mean of the sample to a pre-specified value to detect whether this mean is significantly different from that value (Ross & Willson, 2018:9). The one-sample *t*-test was used in the current study to determine whether the main subscales as well as the items of the causes' occurrence and the barriers to report the MAEs deviated from the neutral mean (3.5) of the six-point Likert scale. So, the items as well as the subscales, that have a mean value above 3.5, are considered as significant causes to MAEs or barriers to report it.

3.10 Academic rigour

3.10.1 Validity

According to Polit and Beck (2018:421), the validity of the data-collection instrument refers to the ability of the questionnaire to measure what it is supposed to measure and give clarification of how it is applied. Gray et al. (2017:695) contend that the validity of an instrument determines the extent to which it reflects the abstract construction being examined. The instrument validity should be established before the data collection (Brink et al., 2018:152). The questionnaire used in the present study was validated through previous studies which used this questionnaire as a whole or in part (Wakefield et al., 2005; Koohestani & Baghcheghi, 2009; Al-Youssif et al., 2013; Aboshaiqah, 2014; Hanna, 2014; Blignaut, 2015; Bifftu et al., 2016). However, a pilot study was conducted to establish the face and content validity by presenting the questionnaire to 15 students prior to data collection.

3.10.1.1 Face validity

The superficial appearance of the instrument and its ability to measure the phenomenon is known as face validity (Polit & Beck, 2018:403). The face validity is useful to determine the readability and clarity of the instrument content (Brink et al., 2018:152).

The data-collection tool for the present study was based on the objectives and purpose of the study. An extensive literature review was also completed in this field. Furthermore, the questionnaire for this study was based on a questionnaire developed by Dr Wakefield, which sought to determine nurses' perceptions of MAE. This instrument has been used in many previous studies and has been adapted with modifications for the nursing students. The questionnaire was reviewed by the supervisor and co-supervisor of the researcher as well by as a registered nurse (RN) to confirm the validity. Moreover, the researcher conducted a pilot study to test the suitability of the instrument for the respondents and test the time frame required to complete the questionnaire.

3.10.1.2 Content validity

Content validity is defined as the establishment of the instrument's ability to measure all known variables relevant to the construct being measured (Grove & Cipher, 2017:47). The absence of one or more components will impact the ability of the instrument to measure effectively what it set out to measure (Brink et al., 2018:152). The content validity in the present study was enhanced by the conceptual framework, which comprised the same headings as those used in the questionnaire of this study. These factors are also connected to the objectives, and the framework applied in this study as is shown in Table 3.2.

Table 3.2: Content validity of the instrument

Objectives	Conceptual Framework	Items number in questionnaire
Determine awareness of the occurrence and reporting of medication administration errors.	Students' awareness of any occurrence and reporting of medication administration errors.	5 and 6
Determine factors related to medication administration error occurrence.	Reasons for occurrence of medication administration errors.	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 and 26
Determine barriers to reporting medication administration errors.	Why medication administration errors are not reported.	27, 28, 29, 30, 31, 32, 33, 34, 35, 36, and 37
Determine the percentage of reporting the non-IV medication errors.	Percentage of each type of error reported in the unit where the students are placed.	38, 39, 40, 41, 42, 43, 44, 45 and 46

3.10.2 Reliability

The reliability of a measure denotes the consistency of measures obtained in the use of a particular instrument and indicates the extent of random error in the method of measurement (Grove et al., 2013:707). That means, when the same variable is measured under the same conditions by using the data-collection tools (questionnaire), the result will show equal measurements (Brink et al, 2018:155-156). The perceived of occurrence and reporting of MAEs among nursing students were tested via the questionnaire. This approach was able to determine what effect the students' lack of knowledge might have on MAE occurrence.

The reliability of the data-collection instrument (the questionnaire, as a whole or in part) had been tested previously by many studies and the results were significant (Wakefield et al., 2005; Koohestani & Baghcheghi, 2009; Al-Youssif et al., 2013; Aboshaiqah, 2014; Hanna, 2014; Blignaut, 2015; Bifftu et al., 2016). In addition, a pilot study was performed among 15 nursing students to confirm and test the clarity and conciseness of the questionnaire.

Cronbach's alpha coefficient tests were done for elements of the questionnaire (Parts B, C, D and E) to test the instrument's reliability. Gray et al. (2017:374) note that Cronbach's alpha results less than 0.6 are considered low, and indicate limited instrument reliability or consistency in measurement with high random error, whereas Taber (2018:1282) contends that a Cronbach's alpha of 0.7 or above is acceptable. Consequently, the Cronbach's alpha coefficient test results of the pilot study used in this study were sufficiently reliable, as shown in Table 3.3.

Table 3.3: Cronbach's alpha coefficient tests results of pilot study

Groups	Cronbach's Alpha
Awareness of occurrence and reporting of MAEs	**0.76**
Why MAEs occur?	**0.89**
Medication packaging	0.84
Physician communication	0.85
Pharmacy related	0.89
Nurse related	0.81
Why MAEs are not reported?	**0.93**
Disagreement over definition	0.77
Fear	0.90

Groups	Cronbach's Alpha
Reporting effort	0.73
Percentage of each type of error reported in the unit where students are placed	**0.91**

3.11 Ethical considerations

Polit and Beck (2017:138) notes that the maintenance and preservation of respondents' rights and welfare are integral to conducting research. These should take precedence over the needs of the researcher. Ethical considerations focused on the protection of the human rights of the individuals who participated in the research study (Pera et al., 2011:331). All ethical principles were adhered to during the research process of the current study.

All respondents gave written signed consent prior to the completion of the questionnaires. All questions were answered anonymously and coded for statistical purposes. However, the consent forms signed by the respondents will be kept confidentially for a period of five years in a locked safe in the Department of Nursing at CPUT, after which they will be destroyed. On completion of the research (graduation) and publication in a journal, an electronic copy and a hard copy of the thesis will be provided to the library of the institution and will be accessible to students and staff.

3.11.1 Ethics approval

Permission for this study was obtained and renewed annually from the Research Ethics Committee of the Faculty of Health and Wellness Sciences at the Cape Peninsula University of Technology (CPUT) (reference number: CPUT/HW-REC 2016/H23) (refer to Appendix D). A supporting letter was obtained from the campus head where the undergraduate programme is offered at this HEI (refer to Appendix E). A supporting letter from the student counselling services on campus (refer to Appendix E) was also received, should any respondents react negatively to any of the questions. In the event of this, students would be referred to student counselling. However, during data collection, no student reacted negatively, and no referral was required at any stage.

3.11.2 Informed consent

An informed consent form was given to the respondents prior to the data-collection process and administration of the questionnaires. The informed consent comprised two parts. Part 1 was the information sheet, which included purpose, benefits and risks of the study and the contact details of the researcher and relevant contact persons. Part 2 comprised the consent form to be signed

by the respondents after perusal of the information sheet. The respondents gave their written permission prior to the completion of the questionnaire (refer to Appendix A for consent and information sheet). The informed consent was explained in detail by the researcher to all the respondents. The respondents were informed of their right to withdraw from the study at any time, even after the provision of informed consent, without any negative consequences (World Medical Association, 2013). The researcher did not encounter any difficulties and was available to provide clarity in respect of any questions that the respondents might have had.

3.11.3 Ethical principles

According to Pera et al. (2011:331), the fundamental ethical principles which should be adhered to during research are autonomy, justice, and beneficence.

3.11.3.1 Autonomy

Autonomy means “respect for persons” (Brink et al, 2018:29). Autonomy is an ethical principle promoted by the Medical Research Council (MRC) of South Africa (South African Medical Research Council, 2018:8). Within the research context, research is required to adhere to the principle of autonomy, which involves three precepts. These rights include the right to self-determination, which means the participant has the right to decide whether to participate in the study without any victimisation or prejudicial treatment, as well as the right to refuse to give any information and to ask for clarification (Holloway & Galvin, 2017:53).

The researcher had explained to the respondents the purpose of the study as well as the benefits and risks of the study. This was also included in the information sheet attached to the consent form. Furthermore, the researcher informed the respondents their participation in the study was voluntary and they could withdraw from the study even after having given their consent. Moreover, the researcher and his supervisor were available to clarify any questions from the respondents.

Each respondent gave written permission, without coercion, by signing a consent form prior to the completion of the questionnaire. The informed consent was signed by the students to fulfil the requirements of the code of ethics for human participants and it gave the respondents the right to withdraw from the study at any time without any repercussions (refer to Appendix A for consent and information sheet).

3.11.3.2 Beneficence and non-maleficence

The beneficence and non-maleficence principles, stated concisely, are doing good without inflicting harm to persons (Holloway & Galvin, 2017:53). No harm to any participant was envisaged in this study. Moreover, there were no reports of harm, discomfort or anxiety from the respondents. The benefits of this research were explained to the respondents (refer to Appendix A). In this research study, the questions in the questionnaire were phrased carefully in order to prevent any psychological distress for respondents. Respondents were encouraged to ask for clarification if needed. However, a supporting letter from student counselling, where students could be referred in case of any negative reaction, is attached (refer to Appendix E). The researcher ensured that the time scheduled for respondents to complete questionnaires was scheduled in collaboration with students and their lecturers.

3.11.3.3 Confidentiality

Confidentiality refers to how the researcher manages the personal information furnished by respondents (Wiles, 2013:42). Self-administrated questionnaires enhance respondents' feelings of confidentiality and anonymity (Brink et al., 2018:139). A self-administered questionnaire was used in this study with questions that were read and answered by the respondents without their need to have direct contact with the researcher. To ensure confidentiality in this study, a unique reference number was used for each questionnaire. As no names were used in the questionnaire, the researcher was unable to link the responses to the questions to individual respondents (Polit & Beck, 2018:83). The questionnaire was completed anonymously (refer to Appendix B). Respondents were assured by the researcher that in order to avoid confidentiality violation, the information collected would not be made available to any other person without their permission. However, the consent forms signed by the respondents, as well as the data, will be kept confidentially for a period of five years in a locked safe in the Department of Nursing at CPUT, after which it will be destroyed. Only the supervisor, co-supervisor, statistician and researcher will have access to the data.

3.11.3.4 Justice

Justice in research ethics refers to fairness without prejudice in dealing with respondents, and giving them an equal chance to participate in a research study (Butts & Rich, 2016:357). The respondents' right to privacy and fair treatment was observed throughout this study (Tappen, 2016:513). The researcher gave all respondents sufficient time to complete the questionnaire in privacy. A quiet lecture theatre was reserved for respondents to complete the questionnaire. All

respondents' privacy was respected and secured during the research process. Respondents were allowed at any time to withdraw from the study.

3.12 Summary

This chapter provided the research methods for the study. A quantitative descriptive design was used in this study and a questionnaire was employed as the data-collection instrument. A discussion of the sample and population was provided: the population comprised nursing students from the second, third and fourth years of study. The researcher applied a proportional quota sampling technique for the selection of the sample. The data-collection procedures were outlined, followed by the pilot study and its ensuing results. Quantitative data analysis techniques were used in the study, with the use of SPSS (Version 24).

The validity and reliability related to the data instruments were also described. Finally, ethical considerations for the research procedure were considered and adhered to throughout the research process. The next chapter deals with the data analysis and presents the results in tables and charts.

CHAPTER FOUR

FINDINGS OF THE STUDY

4.1 Introduction

This chapter outlines the findings from an analysis of the data collected in this study. The findings are presented in figures and tables. A descriptive statistical data analysis was used in this study which represented the technique to convert the data to numerical form when subjected to statistical analysis (Gray et al., 2017:523).

The aim of the study was to determine the awareness and perception of the occurrence and reporting of medication administration errors (MAEs) among nursing students at a higher education institution in the Western Cape province (South Africa). This was achieved by determining their awareness of the occurrence and reporting of these errors, establishing the factors related to MAE occurrence among them, identifying the barriers to reporting these errors among them, and ascertaining the reporting frequency of non-IV MAEs in the units at the health services where undergraduate students are placed.

In this study, respondents completed questionnaires to provide the required data to achieve the mentioned objectives. This questionnaire consisted of five parts. The first part comprised demographic data. The second part was related to the first objective and consisted of two items to determine respondents' awareness of MAE occurrence and its reporting during their practice time. The third part was related to the second objective to determine the cause of MAE occurrence as perceived by the respondents; this part comprised 20 items related to the causes of MAE occurrence. These items were classified according to four main subscales (physician communication-related, pharmacy-related, nurse-related, and medication package-related subscales) (Wakefield et al., 2005:484). The fourth part was related to the third objective to determine the barriers of reporting the MAEs as perceived by respondents. This part consisted of 11 items related to the barriers to reporting MAEs. These items were classified according to three main subscales (fear, reporting effort, and disagreement with ME definition) (Wakefield et al., 2005:484). Finally, the fifth part was related to the fourth objective to determine the most frequently reported type of non-IV medication errors at the unit where the respondents practise (Wakefield et al., 2005:484).

In order to achieve the objectives of the study, 300 questionnaires were distributed to the respondents in an HEI in the Western Cape, South Africa. All the questionnaires were returned,

but nine questionnaires were excluded by the researcher as they were incomplete. The sample size of the study was 291, and study level proportions were maintained. The questionnaire for this study included five sections and the results are presented as follows: demographic data, students' awareness in respect of MAE occurrence and its reporting, causes of MAEs at the unit where the respondents practise, and reasons for non-reporting at the unit where the respondents practise. Finally, the percentage of each type of non-IV ME that occurred in the units where the respondents practise was reported.

4.2 Section A: Respondents' demographic profile

This section represents the demographic profile of the respondents. The respondents were requested to indicate their age, gender, marital status and year of study. Table 4.1 presents the results of their responses to the demographic section.

In this study, 290 respondents indicated their gender. Most respondents (81.4%, *n*=236) were female. The majority (97.9%, *n*=285) responded to the age item. The mean of the respondents' age is 23.49, with a minimum age of 19 years and maximum age of 43 years. Most respondents were 25 years or younger (81.8%, *n*=233, followed by respondents aged between 26 and 31 years (10.9%, *n*=31). Thirteen respondents (4.5%, *n*=13) belonged to the 32–37 age group and six (2.8%, *n*=8) were 38 years or older.

Regarding respondents' marital status and the year of study, all respondents provided responses to these items. Most respondents (88.7%, *n*=258) reported a single status. Only 25 respondents (8.6%, *n*=25) reported being married. Respondents indicating divorced status were the smallest group in this study. The distribution of the respondents over the three years of study was similar, with 110 (37.8%) in second year, 93 (32.0%) in third year and 88 (30.2%) in fourth year. In terms of gender distribution, female students represented the majority in each year level of study. The distribution of gender was similar among the years of study (see Chapter 3, Table 3.6.1). Table 4.1 below provides further details.

Table 4.1: Demographic data of respondents

Variable	Total (*N*)	Category	*n* (%)
Gender	290	Male	54 (18.6%)
		Female	236 (81.4%)
Age	285	≤ 25	233 (81.8%)
		26 – 31	31 (10.9%)
		32 – 37	13 (4.5%)
		≥ 38	8 (2.8%)
Year of study	291	Second	110 (37.8%)
		Third	93 (32.0%)
		Fourth	88 (30.2%)
Marital status	291	Single	258 (88.7%)
		Married	25 (8.6%)
		Divorce	3 (1.0 %)
		Other	5 (1.7%)

4.3 Respondents' awareness of MAE occurrence

This section discusses respondents' awareness of any MAEs that occurred during their practice time. Two closed-ended questions were used to determine the awareness of the respondents in respect of the occurrence of MAEs and are related to the first objective of the study, which was to determine respondents' awareness of MAE occurrence during their practice time.

4.3.1 Respondents' awareness of MAE occurrence among the total students

Table 4.2 shows respondents' awareness of the occurrence of MAEs. The respondents were asked to indicate if they were aware of the occurrence of any MAEs during their practice time.

The majority of students (*n*=290) responded to this question. Most respondents (85.2%, *n*=247) indicated that they were aware of MAE occurrences, while a lower percentage (14.8%, *n*=43) indicated that they were not aware of any MAE occurrences.

Table 4.2: Respondents' awareness of MAE occurrence

Are you aware of any MAE occurrence?	Frequency (*N*=290)	Percentage
Yes	247	85.2%
No	43	14.8%
Total	290	100%

4.3.2 Respondents' awareness of MAE occurrence across each year of study

As presented in Table 4.3, respondents' awareness of MAE occurrence in each year of study is highlighted. These respondents were probed about their awareness of MAE occurrence during their practice time. The majority (*n*=290) responded to the question, except for one (1) who did not answer this question.

There was a similar proportion of respondents aware of MAE occurrence during their clinical placements in the three years of study. The highest percentage of the awareness of the occurrence of MAEs among the respondents was noted among the fourth-year respondents (89.8%, *n*=79), followed by second-year respondents (85.3%, *n*=93). These students were aware of MAE occurrences in the health services where they were placed. However, about a fifth (19.4%) of the third-year respondents were not aware of any MAE occurrences in the health services where they were placed for their experiential learning.

Table 4.3: Respondents' awareness of MAE occurrence across years of study

		Are you aware of any medication administration errors in the health services where you are placed?		
		No	**Yes**	**Total**
Year of study	Second year	16 (14.7%)	93 (85.3%)	109
	Third year	18 (19.4%)	75 (80.6%)	93
	Fourth year	9 (10.2%)	79 (89.8%)	88
Total		43 (14.8%)	247 (85.2%)	290

4.3.3 The relationship between the awareness of the respondents to MAE occurrence and year of study

Table 4.4 shows the result of the chi-square test to determine if there was a significant difference between the respondents' year of study and their awareness of MAE occurrence during their practice time.

The *p*-value of the chi-square test was 0.225, which is higher than 0.05, indicating that there is no significant difference between the respondents' year of study and their awareness of MAE occurrence. In other words, the respondents' awareness of MAE occurrence is independent of the year of study.

Table 4.4: Results of chi-square tests for respondents' awareness of MAE occurrence across years of study

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.986[a]	2	0.225
Likelihood Ratio	3.027	2	0.220
Linear-by-Linear Association	0.610	1	0.435
N of Valid Cases	290		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.05.

4.4 Causes of MAE occurrence

This section presents the factors that may lead to MAE occurrence. Twenty (20) items were introduced to the respondents to indicate their agreement on the causes of MAE occurrence. A six-point Likert scale was applied to each item in order to determine respondents' agreement. Furthermore, these items were classified under four main subscales according to the classification of Wakefield et al. (2005) to determine the subscales that play an important role in MAE occurrence. The subscales are physician communication-related causes (6 items: Questions 10, 11, 12, 13, 14 & 18); medication package-related causes (3 items: Questions 7, 8 & 9); pharmacy process-related causes (3 items: Questions 15, 16 & 17) and nursing staff-related causes (8 items: Questions 19, 20, 21, 22, 23, 24, 25 & 26).

This section highlights the causes of MAEs according to the perceptions of the respondents and is guided by the second objective of the study.

4.4.1 Respondents' perceptions of the causes of MAE occurrence subscales

Figure 4.1 shows the respondents' perceptions of the causes of MAE occurrence. The causes of MAE occurrence in this study were classified according to four main subscales. The percentage was calculated to determine respondents' agreement with the four subscales of the causes of MAE occurrence.

The physician communication subscale was ranked at the top subscale and was agreed on by over two-thirds of respondents (69.3%). Moreover, the medication package and nurse-related subscales were at the same level of agreement as indicated by 60% of respondents. Finally, the majority of respondents (91.4%) disagreed that pharmacy-related reasons were causes of MAEs.

Figure 4.1 shows that medication packaging, physician communication and nurse-related factors play major roles in the occurrence of MAEs. More details are shown in Figure 4.1.

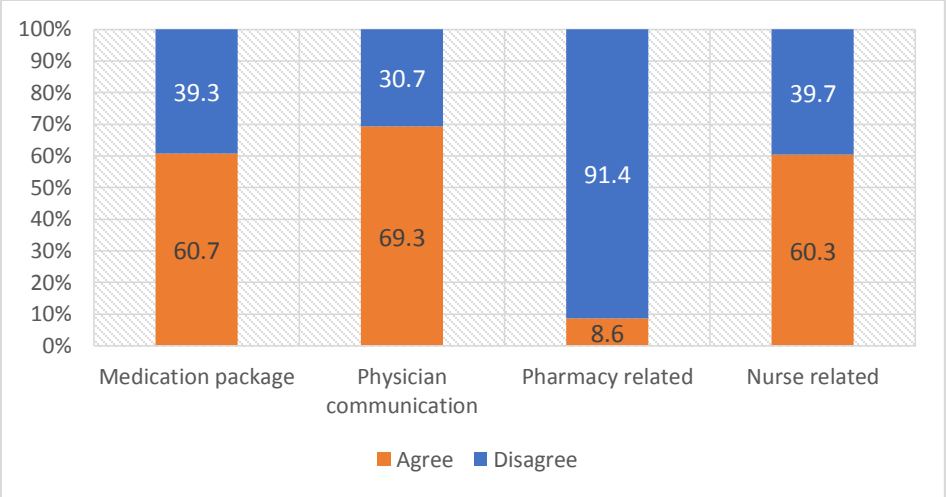


Figure 4.1: Respondents' perceptions of causes of MAEs occurrence subscales

4.4.2 Respondents' agreement with the subscales of causes of MAE occurrence

Figure 4.2 shows the degree of respondents' agreement with the four causes of MAE subscales. A six-point Likert scale was applied to each item of the four subscales in order to determine respondents' agreement. Option 1 represented "strongly disagree" while 6 represented "strongly agree". The neutral mean of the six-point Likert scale was 3.5.

Results in Figure 4.2 indicate respondents' agreement with the three of the four subscales as causes of MAE occurrence. The top subscale was the physician communication-related subscale with a mean of 4.22±0.99 and represented the slight agreement of respondents with this subscale. The nursing staffing-related subscale represented slight agreement with a mean of 3.86±0.94, and the last subscale was the medication package-related causes with a mean of 3.75±1.33 that represented the slight agreement of the respondents. The fourth subscale, the pharmacy process-related subscale, was moderately disagreed with as a cause of MAE occurrence by the respondents with a mean of 1.76±1.04.

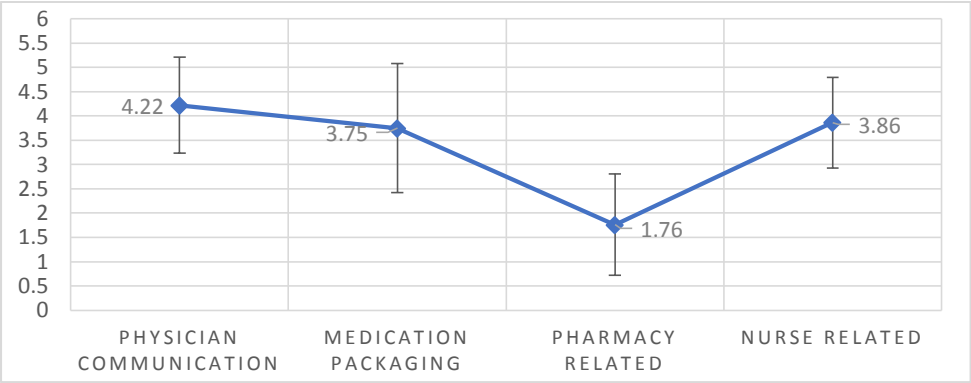


Figure 4.2: Average of respondents' agreement with the subscales of causes of MAE occurrence

4.4.3 Respondents' perceptions of the subscales of causes of MAE occurrence across each year of study

Figure 4.3 presents the percentage of respondents' agreement with the main subscales of MAE causes among each year of study. Four main subscales for the causes of MAE occurrence were mentioned in this study. The percentage of respondents who agreed with these subscales was estimated and represented in Figure 4.3. The respondents' agreement with the subscales of MAE occurrence was identical among each year of study, where respondents agreed with three (medication package, physician communication, and nurse-related causes) of the four subscales. The physician communication-related subscale was the most agreed upon subscale as perceived by most respondents across the years of study. Moreover, respondents in each year of study disagreed with the pharmacy-related subscale as a cause of MAE occurrence. Results show that pharmacy-related factors are not one of the major causes of MAE as perceived by the respondents.

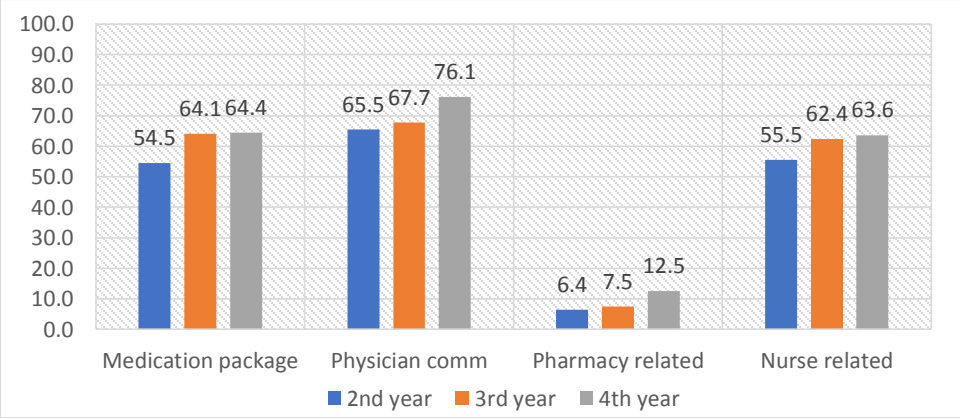
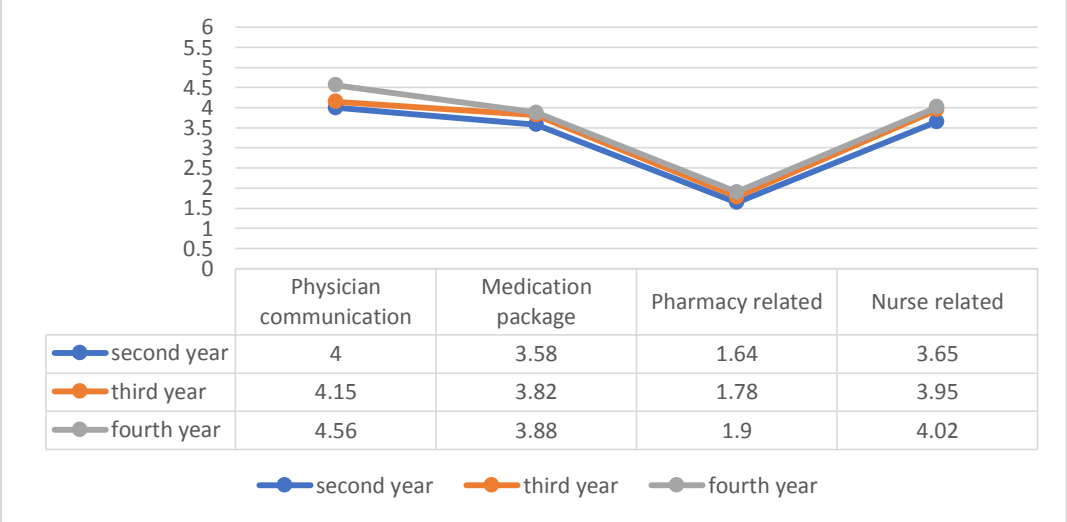


Figure 4.3: Respondents' perceptions of causes of MAE occurrence subscales across each year of study

4.4.4 The respondents' agreement with subscale causes of MAE occurrence across each year of study

Figure 4.4 shows the degree of agreement of respondents with each subscale for causes of MAE occurrence among each year of study. A six-point Likert scale was used. A six-point Likert scale was applied with a neutral level of 3.5. The second year of study is represented by a blue colour, the third year of study is represented by an orange colour, while the fourth year of study is represented by a grey colour.

As noted in Figure 4.4, the respondents among each year of study agreed with all subscales except for the pharmacy-related subscale. Moreover, the agreement of the fourth-year respondents to each subscale was higher than that of the other years of study. Consequently, the agreement of third-year respondents with each subscale was higher than that of the second-year respondents. More details are shown in Appendix L.



	Physician communication	Medication package	Pharmacy related	Nurse related
second year	4	3.58	1.64	3.65
third year	4.15	3.82	1.78	3.95
fourth year	4.56	3.88	1.9	4.02

Figure 4.4: Average of respondents' agreement with the subscales of causes of MAE occurrence across each year of study

4.4.5 Respondents' perceptions of the individual items related to causes of MAE occurrence

Table 4.5 shows respondents' perceptions of items related to MAE occurrence. Twenty items with a six-point Likert-scale were presented to respondents. The items were classified under subscales: physician communication-related causes (6 items); medication package-related causes (3 items); pharmacy process- related causes (3 items); and nursing staff-related causes (8 items).

Likert scales were used in this study to rate MAE occurrence. The percentage of each point of the six-point Likert scale was calculated. Accordingly, the total percentage for the three "disagree" points and the other three "agree" points was estimated to determine respondents' agreement with these causes among each year of study.

Half the respondents (50%) agreed with 13 of the 20 items as causes of MAE. The first important cause was the use of abbreviations in the written order of the physicians. The majority of respondents (*n*=237, 81.4%) agreed with this as a main cause of MAE. Moreover, 155 (53.3%) of the respondents strongly agreed with the use of abbreviations as a cause of MAE occurrence. The second item was the unclear physician orders, as indicated by 234 (80.4%) of the respondents, with "strongly agree" by 120 (41.2%). These top two items were followed by the physician communication-related subscale. On the other hand, all the items of the pharmacy-related subscale were at the top of respondents' disagreement. The most disagreed on item was incorrect medication preparation by the pharmacy as perceived by 270 (92.8%) of the respondents. Moreover, more than half (*n*=174, 59.8%) of the respondents strongly disagreed with this item as a cause of MAE occurrence. More details are shown in Table 4.5 and Appendix F.

Table 4.5: Respondents' perceptions of the items of MAE occurrence

Item No.	Causes of MAE occurrence	Total disagree		Total agree	
		n	%	*n*	%
7	The names of many medications are similar	129	44.5%	161	55.5%
8	Different medications look alike	95	32.7%	196	67.3%
9	The packaging of many medications is similar	118	40.8%	171	59.2%
10	Physicians' medication orders are not legible	70	24.2%	219	75.8%
11	Physicians' medication orders are not clear	57	19.6%	234	80.4%
12	Physicians change orders frequently	108	37.2%	182	62.8%
13	Abbreviations are used instead of writing the orders out completely	54	18.6%	237	81.4%
14	Verbal orders are used instead of written orders	175	60.3%	115	39.7%
15	Pharmacy delivers incorrect doses to this unit	257	88.6%	33	11.4%
16	Pharmacy does not prepare the medication correctly	270	92.8%	21	7.2%
17	Pharmacy does not label the medication correctly	268	92.4%	22	7.6%
18	Poor communication between nurses and physicians	71	24.4%	220	75.6%
19	Many patients are on the same or similar medications	60	20.6%	231	79.4%
20	On this unit, there is no easy way to look up information on medications	150	51.6%	141	48.4%

Item No.	Causes of MAE occurrence	Total disagree		Total agree	
		n	%	*n*	%
21	Nurses get pulled between teams and from other units	117	40.5%	172	59.5%
22	Nurses or nursing students do not adhere to the approved medication administration procedure	172	59.3%	118	40.7%
23	Nurses or nursing students are interrupted while administering medications to perform other duties	61	21.0%	230	79.0%
24	Unit staffing levels are inadequate	92	31.7%	198	68.3%
25	All medications for one cohort of patients cannot be passed within an accepted time frame	106	36.5%	184	63.5%
26	Nurse or nursing student is unaware of a known allergy	162	55.7%	129	44.3%
➞ Medication package ➞ Physician communication ➞ Pharmacy related ➞ Nurse related					

4.4.6 Respondents' perceptions of individual items related to causes of MAE occurrence across each year of study

Table 4.6 presents respondents' perceptions of the items relating to the causes of MAE occurrence among each year of study. The percentile of each point of the six-point Likert scale was calculated. The total percentage then was applied to the "disagree" group (strongly, moderately and slightly) and "agree" group (strongly, moderately and slightly) of each item to determine the total agreement of respondents with these causes.

Firstly, most second-year respondents (80%, *n*=88) perceived that the main cause of MAE occurrence was Item 19 (many patients are on the same or similar medications). Conversely, the majority of second-year students (95.4%, *n*=105) disagreed with Item 17 (pharmacy does not label the medication correctly) as a cause of MAE occurrence.

Most third-year respondents (80.7%, *n*=75) indicated four items as the primary cause of MAE occurrence. These items were unclear medication orders (Item 11), use of abbreviations (Item 13), many patients on similar medication (Item 19), and interruption while administering the medication (Item 23). On the other hand, the two most disagreed upon items as causes of MAE occurrence were Items 15 and 16. The majority of the third-year respondents (93.5%, *n*=87) disagreed with Item 15 (pharmacy delivers incorrect doses to this unit) and Item 16 (pharmacy does not prepare the medication correctly).

Finally, most fourth-year respondents (89.8%, *n*=89) perceived that the main cause of MAE occurrence was Item 11 (unclear medication orders). The top disagreed upon item was Item 17 (incorrect labelling of medication by the pharmacy) as indicated by (90.9%, *n*=90) of fourth-year respondents. More details are presented in Table 4.6 and in Appendix G.

Table 4.6: Causes of MAE occurrence among each year of study

Item No.	Cause	2nd		3rd		4th	
		Disagree	Agree	Disagree	Agree	Disagree	Agree
7	The names of many medications are similar	58 (52.7%)	52 (47.3%)	39 (42.4%)	53 (57.6%)	32 (36.4%)	56 (63.6%)
8	Different medications look alike	43 (39.1%)	67 (60.9%)	26 (28.0%)	67 (72.0%)	26 (29.5%)	62 (70.5%)
9	The packaging of many medications is similar	48 (43.6%)	62 (56.4%)	34 (37.0%)	58 (63.0%)	36 (41.4%)	51 (58.6%)
10	Physicians' medication orders are not legible	36 (33.0%)	73 (67.0%)	20 (21.7%)	72 (78.3%)	14 (15.9%)	74 (84.1%)
11	Physicians' medication orders are not clear	30 (27.3%)	80 (72.7%)	18 (19.3%)	75 (80.7%)	9 (10.2%)	79 (89.8%)
12	Physicians change orders frequently	45 (41.3%)	64 (58.7%)	36 (38.7%)	57 (61.3%)	27 (30.7%)	61 (69.3%)
13	Abbreviations are used instead of writing the orders out completely	24 (21.8%)	86 (78.2%)	18 (19.3%)	75 (80.7%)	12 (13.6%)	76 (86.4%)
14	Verbal orders are used instead of written orders	61 (56.0%)	48 (44.0%)	64 (68.8%)	29 (31.2%)	50 (56.8%)	38 (43.2%)
15	Pharmacy delivers incorrect doses to this unit	98 (89.9%)	11 (10.1%)	87 (93.5%)	6 (6.5%)	72 (81.8%)	16 (18.2%)
16	Pharmacy does not prepare the medication correctly	104 (94.6%)	6 (5.4%)	87 (93.5%)	6 (6.5%)	79 (89.8%)	9 (10.2%)
17	Pharmacy does not label the medication correctly	105 (95.4%)	5 (4.6%)	84 (91.3%)	8 (8.7%)	80 (90.9%)	8 (9.1%)
18	Poor communication between nurses and physicians	32 (29.1%)	78 (70.9%)	24 (25.8%)	69 (74.2%)	15 (17.1%)	73 (82.9%)
19	Many patients are on the same or similar medications	22 (20.0%)	88 (80.0%)	18 (19.3%)	75 (80.7%)	20 (22.7%)	68 (77.3%)
20	On this unit, there is no easy way to look up information on medications	71 (64.5%)	39 (35.5%)	44 (47.3%)	49 (52.7%)	35 (39.8%)	53 (60.2%)
21	Nurses get pulled between teams and from other units	41 (37.6%)	68 (62.4%)	41 (44.1%)	52 (55.9%)	35 (40.3%)	52 (59.7%)

Item No.	Cause	2nd		3rd		4th	
		Disagree	Agree	Disagree	Agree	Disagree	Agree
22	Nurses or the nursing students do not adhere to the approved medication administration procedure	69 (63.3%)	40 (36.7%)	52 (55.9%)	41 (44.1%)	51 (57.9%)	37 (42.1%)
23	Nurses or the nursing students are interrupted while administering medications to perform other duties	29 (26.4%)	81 (73.6%)	18 (19.3%)	75 (80.7%)	14 (15.9%)	74 (84.1%)
24	Unit staffing levels are inadequate	43 (39.1%)	67 (60.9%)	26 (28.3%)	66 (71.7%)	23 (26.1%)	65 (73.9%)
25	All medications for one cohort of patients cannot be passed within an accepted time frame	50 (45.9%)	59 (54.1%)	30 (32.3%)	63 (67.7%)	26 (29.6%)	62 (70.4%)
26	Nurse or the nursing student is unaware of a known allergy	66 (60.0%)	44 (40.0%)	47 (50.5%)	46 (49.5%)	49 (55.7%)	39 (44.3%)
➞ Medication package ➞ Physician communication ➞ Pharmacy related ➞ Nurse related							

4.4.7 Significant subscales of causes of MAE occurrence

Table 4.7 presents the results of one sample *t*-test to the four main subscales of MAE occurrence. All the subscales were significantly different from the neutral level of six-point Likert scales (3.5). The observed point was the pharmacy process-related subscale which was significantly lower than the neutral level. This is an indication that this subscale is not a significant cause of MAE occurrence among respondents. The other three subscales were significantly higher than the neutral level of the six-point Likert scale to reflect a significant cause of MAE occurrence.

Table 4.7: Significant subscales of MAE occurrence

One-Sample Test						
	Test Value = 3.5					
					95% Confidence Interval of the Difference	
Subscale	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Physician communication	12.459	290	<0.001	0.72125	0.6073	0.8352
Medication packaging	3.193	290	0.002	0.24914	0.0956	0.4027
Pharmacy related	-28.445	290	<0.001	-1.73654	-1.8567	-1.6164
Nurse related	6.537	290	<0.001	0.35880	0.2508	0.4668

4.4.8 Significant different items of causes of MAE occurrence

Table 4.8 presents the results of the one-sample *t*-test for items significantly different from the neutral mean of the six-point Likert scale (3.5). These items had a mean higher than the neutral mean (3.5) to represent significant causes of MAE occurrence.

The mean of 12 causes of the 20 mentioned causes of MAE occurrence was significantly higher than the neutral mean of the six-point Likert scale (3.5). The mean of these causes ranged between 3.76 (+1.657) and 4.85 (+1.554). The top three significant causes with the highest mean were the use of abbreviations (4.85±1.554), unclear physician orders (4.67±1.514), and illegible physician orders (4.65±1.619). Similar packaging of many medications ranked at the bottom of the significant causes with a mean of (3.76±1.657). For more detail, see Table 4.8 and Appendix H.

Table 4.8: The significant causes of MAEs occurrence

Number	One sample *t*-test Item	Test value = 3.5					
		Mean	Standard deviation	Standard error of mean	*t*	df	Sig. (2-tailed)
13	Abbreviations are used instead of writing the orders out completely	4.85	1.554	0.091	14.840	290	<0.001
11	Physicians' medication orders are not clear	4.67	1.514	0.089	13.151	289	<0.001
10	Physicians' medication orders are not legible	4.65	1.650	0.097	11.819	288	<0.001
23	Nurses or nursing students are interrupted while administering medications to perform other duties	4.63	1.619	0.095	11.896	290	<0.001
19	Many patients are on the same or similar medications	4.51	1.446	0.085	11.936	290	<0.001
18	Poor communication between nurses and physicians or between nursing student and supervisor	4.32	1.464	0.086	9.589	290	<0.001
24	Unit staffing levels are inadequate	4.24	1.600	0.094	7.929	289	<0.001
25	All medications for one cohort of patients cannot be passed within an accepted time frame	3.99	1.651	0.097	5.014	289	<0.001
8	Different medications look alike	3.99	1.667	0.098	4.976	290	<0.001
12	Physicians change orders frequently	3.88	1.448	0.085	4.501	289	<0.001
21	Nurses or nursing students get pulled between teams and from other units	3.84	1.688	0.099	3.432	288	0.001

Number	One sample *t*-test Item	Test value = 3.5					
		Mean	Standard deviation	Standard error of mean	*t*	df	Sig. (2-tailed)
9	Packaging of many medications is similar	3.76	1.657	0.097	2.644	288	0.009

➞Medication package ➞ Physician communication ➞ Nurse related

4.5 Respondents awareness of MAE reporting

In this study, over 85% of respondents indicated an awareness of MAE occurrence, and physician communication-related factors were indicated as contributing most to MAEs, with the pharmacy process having a significantly lower contribution. Occurrence requires reporting, and this section presents MAE reporting aspects investigated in this study and is aligned with the first objective of the study.

4.5.1 Awareness of respondents to reporting of MAEs

Table 4.9 presents respondents' awareness of reporting MAEs. Respondents were asked to indicate if they were aware of MAEs being reported. The majority (97.6%, *n*=284) of 291 of students responded to this closed-ended item. More than half (59.9%, *n*=170) indicated that MAEs they were aware of were reported. The remainder (40.1%) indicated that they were not reported.

Table 4.9: Awareness of MAE reporting

Are medication administration errors reported?	Frequency (*n*=284)	Percentage
Yes	170	59.9%
No	114	40.1%
Total	284	100%

4.5.2 Awareness of respondents of reporting MAEs across each year of study

Table 4.10 shows the awareness of reporting of MAEs that occurred during students' experiential learning. The table shows a shift in respondents' awareness of reporting MAEs as they progressed to further years of study. More than half (55.1%, *n*=60) of the second-year respondents indicated they were aware of the reporting of MAEs occurring during their practice time, while more than

two-thirds (69.8%) of the fourth-year respondents were aware of the reporting of MAEs during their practice time.

Table 4.10: Awareness of reporting of MAEs across each year of study

		Are the medication administration errors reported?		
		No	Yes	Total
Year of study	Second year	49 (44.9%)	60 (55.1%)	109
	Third year	39 (43.8%)	50 (56.2%)	89
	Fourth year	26 (30.2%)	60 (69.8%)	86
Total		114 (40.1%)	170 (59.9%)	284

4.5.3 The relation between awareness of the reporting of MAEs and the year of study

Table 4.11 presents the results of the chi-square test in order to determine an association between respondents' year of study and their awareness of the reporting of MAEs occurring during their practice time.

The *p*-value of the chi-square test was 0.079, which is higher than 0.05, indicating that there is no significant difference between respondents' awareness of the reporting of MAEs that occurred during their practice time and their level of study. In other words, the awareness of respondents in reporting MAEs is not dependent on their level of study.

Table 4.11: Association between the respondents' year of study and their awareness of reporting MAEs

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.066[a]	2	0.079
Likelihood Ratio	5.176	2	0.075
Linear-by-Linear Association	4.070	1	0.044
N of Valid Cases	284		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 34.52.

4.6 Respondents' perceived barriers to reporting MAEs

In this study, up to 40% of respondents indicated that the MAEs they were aware of, were not reported. This section discusses the perceived barriers to reporting MAEs and is aligned with the third objective of the study, which is to determine the factors related to hindering the reporting of MAEs as perceived by undergraduate nursing students at a higher education institution in the Western Cape. Respondents were presented with 11 items that outlined perceptions of barriers to reporting MAEs. These were classified according to three main subscales. The three subscales were disagreement with definition (4 items: Questions 27, 28, 31 & 32), reporting effort (2 items: Questions 29 & 30) and fear (5 items: Questions 33, 34, 35, 36 & 37). The six-point Likert scale was applied to each barrier to determine respondents' perceptions of barriers to reporting MAEs.

4.6.1 Respondents' perceptions of main subscales of barriers to reporting MAEs

Figure 4.5 shows respondents' perceptions of the main subscales of the barriers to reporting MAEs. This is determined by the application of the percentage to each subscale. The strongest barrier was fear, as was indicated by the majority of respondents (82.8%), followed by the reporting effort subscale as indicated by more than half of the respondents (54.0%). The subscale relating to disagreement with the definition of MEs as a barrier to reporting MAEs was disagreed by more than half (53.6%) of the respondents. More details regarding respondents' agreement and disagreement with each subscale are indicated in Figure 4.5.

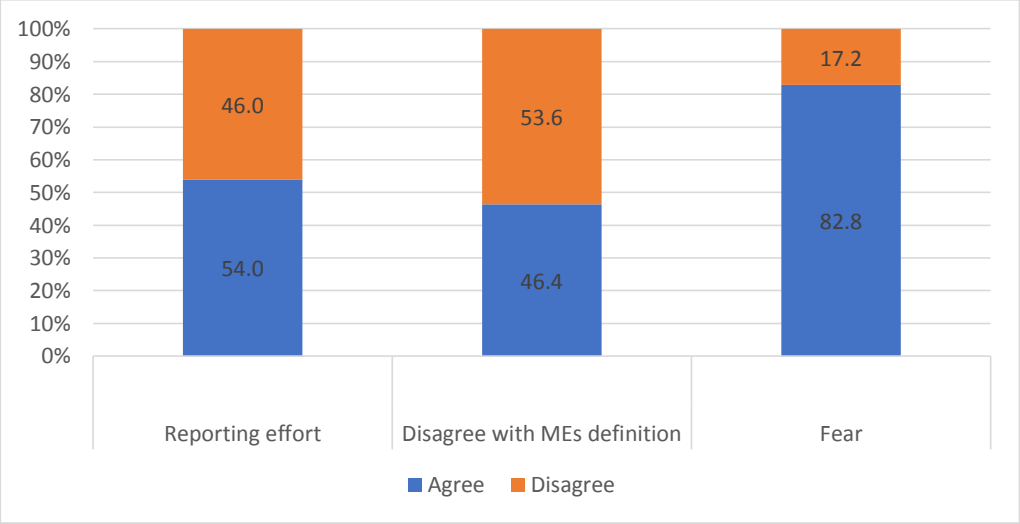


Figure 4.5: Respondents' perceptions of barriers to reporting MAE subscales

4.6.2 Respondents' agreement with the subscales of barriers to reporting MAEs

Figure 4.6 shows the degree of respondents' agreement with the subscales of barriers to reporting MAEs. The mean of the six-point Likert scale was used to determine the degree of agreement. Number 1 of the Likert scale represented "strongly disagree", while 6 represented "strongly agree", with the numbers in between representing other degrees of agreement. The neutral level of agreement was 3.5.

The respondents agreed to two of the three subscales of barriers to reporting MAEs. The top subscale was indicated as fear. The mean of this subscale was 4.82 (±1.21), representing moderate agreement of respondents to fear as a main barrier to reporting MAEs. The second subscale was the reporting effort with a mean of 3.58 (±1.60), representing slight agreement of respondents to fear as a barrier. Lastly, respondents indicated slight disagreement with the definition of MEs subscale with a mean of 3.22 (±1.19) (Figure 4.6).

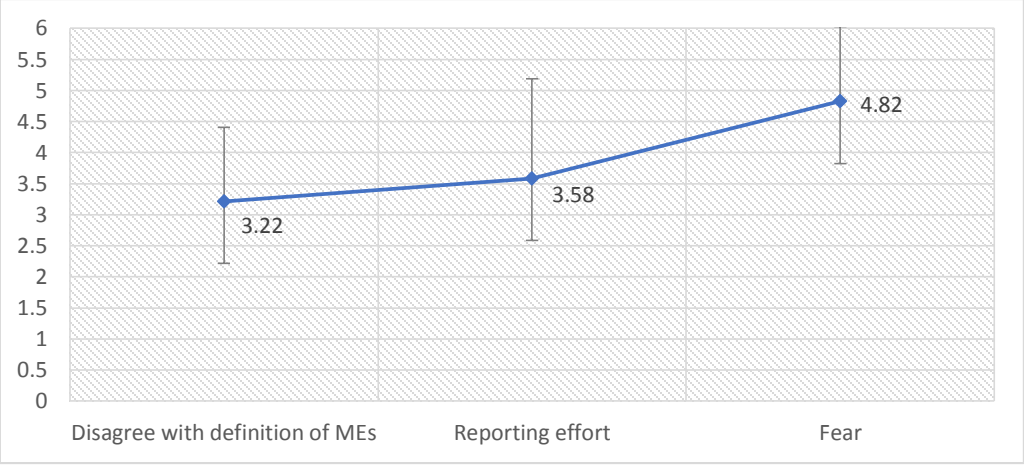


Figure 4.6: Average of respondents' agreement with the subscales of barriers to reporting MAEs

4.6.3 Respondents' perceptions of the subscales of barriers to reporting MAEs across each year of study

As is shown in Figure 4.7, there are three main barriers to reporting MAEs. Figure 4.7 further classifies these three subscales of barriers to reporting MAEs into each year of study. Results show that respondents' agreement with these subscales varied among each year of study. The percentage of respondents who agreed with these subscales was estimated among each year of study to determine their agreement with each subscale of the barriers to reporting MAEs.

As is indicated in Figure 4.7, the fear subscale was reported as the most predominant barrier to reporting MAEs across all years, with the highest percentage attributed to third-year respondents (88.2%) followed by fourth-year respondents (83.0%). The effort in reporting MAEs subscale was considered the second most predominant barrier as indicated by the third- and fourth-year respondents.

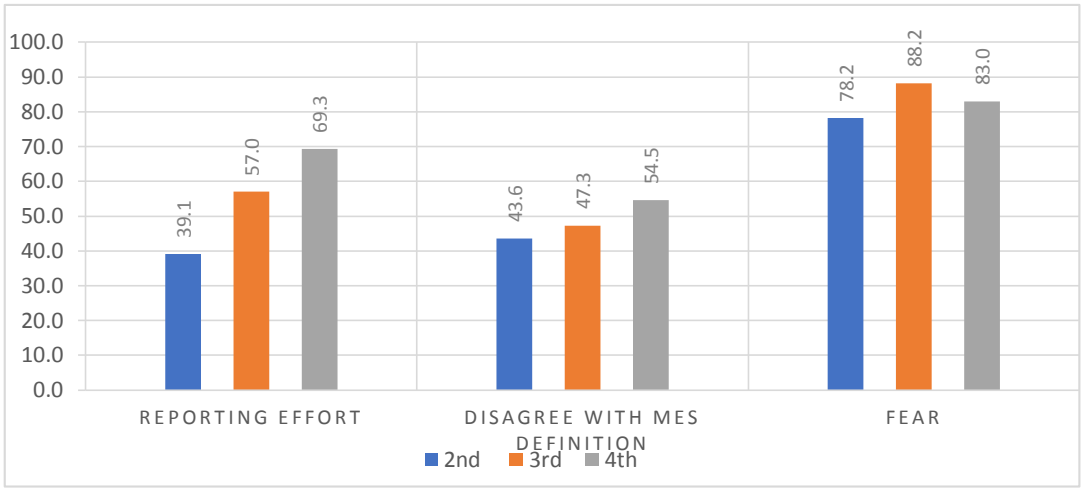
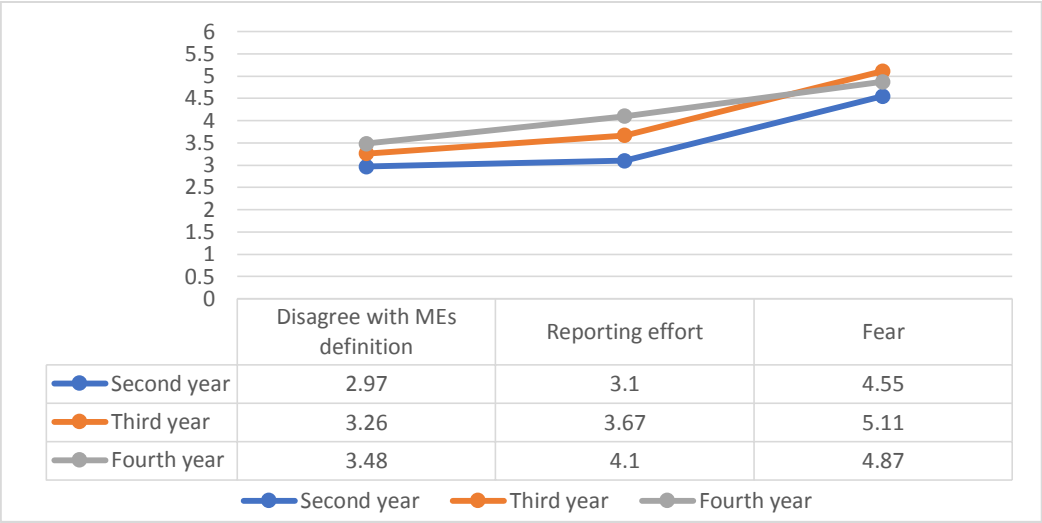


Figure 4.7: Respondents' perceptions of barriers to reporting MAEs subscales across each year of study

4.6.4 Respondents' agreement with the subscales of barriers to reporting MAEs across each year of study

Figure 4.8 presents the agreement of respondents with the subscales relating to barriers to reporting of MAEs among each year of study. The mean of the Likert scale used was calculated. A six-point Likert scale was applied to each item of these subscales, ranging from "strongly disagree" to "strongly agree", where 3.5 represented the neutral level of the six-point Likert scale.

Results in Figure 4.8 show that the third- and fourth-year respondents slightly agreed with the reporting effort subscale as a barrier to reporting MAEs, while second-year respondents indicated slight disagreement. The fear subscale was the most prominent barrier, with moderate agreement indicated across all years of study. Only the fourth-year respondents indicated slight agreement with the subscale related to disagreement with the definition of MEs. Further details are seen in Appendix M.



	Disagree with MEs definition	Reporting effort	Fear
Second year	2.97	3.1	4.55
Third year	3.26	3.67	5.11
Fourth year	3.48	4.1	4.87

Figure 4.8: Average of respondents' agreement with the subscales of barriers to reporting MAEs across each year of study

4.6.5 Respondents' perceptions of the individual items related to barriers to reporting MAEs

Table 4.12 presents respondents' agreement with the barriers to reporting MAEs. Eleven (11) items were used as barriers of reporting MAEs. These reasons were classified into three main subscales (fear, disagreement with definition, and reporting effort). The agreement with these reasons was determined by the use of a six-point Likert scale, where 6 represents "strongly agree" and 1 represents "strongly disagree". These Likert scales were analysed by descriptive statistics using the percentage to indicate respondents' agreement with each item. Furthermore, the percentage of total agreement and total disagreement points were estimated to determine respondents' agreement with each item, as shown in Table 4.12.

Based on the subscale classification, the first subscale was fear, with 5 items. All fear items were agreed with by respondents as barriers to reporting MAEs. The highest percentage was attributed to Item 37. Nurses or nursing students could be blamed if something happened to the patient as a result of the medication error as perceived by most respondents (*n*=251, 86.2%), followed by Item 36 (nurses or nursing students fear adverse consequences from reporting MAEs) as perceived by 85.2% (*n*=248).

The second subscale was nurses' agreement with the definition of medication errors which consisted of four items. The most agreed upon item was Item 32 (nurses or nursing students may not think the error is important enough to be reported) as perceived by more than half of

respondents (59.4%, *n*=173) and Item 31 (medication error is not clearly defined) as reported by 150 (51.7%) of the respondents.

The last subscale was reporting effort, which consisted of two items. More than half of respondents (58.4%, *n*=170) agreed that Item 29 (filling out an incident report for a medication error takes too much time) was a barrier to reporting MAEs.

Conversely, Item 27 (nurses do not agree with hospital's definition of a medication error) was ranked highest in terms of the most disagreed on as a barrier to reporting MAEs as was perceived by 210 (72.7%) of the respondents. Table 4.12 below provides further details as well as Appendix I.

Table 4.12: Barriers to reporting MAEs among the total of respondents

Item No.	Barriers to reporting MAEs	Total disagree		Total agree	
		n	%	*n*	%
27	Nurses do not agree with hospital's definition of a medication error	210	72.7%	79	27.3%
28	Nurses or nursing students do not recognise an error has occurred	155	53.3%	136	46.7%
29	Filling out an incident report for a medication error takes too much time	121	41.6%	170	58.4%
30	Contacting the physician about a medication error takes too much time	147	50.7%	143	49.3%
31	Medication error is not clearly defined	140	48.3%	150	51.7%
32	Nurses or nursing students may not think the error is important enough to be reported	118	40.6%	173	59.4%
33	Nurses or nursing students believe that other nurses will think they are incompetent if they make medication errors	53	18.3%	236	81.7%
34	The patient or family might develop a negative attitude towards the nurses or nursing student or may sue the them if a medication error is reported	52	17.9%	238	82.1%
35	Nurses or nursing students are afraid the physician will reprimand them for the medication error	59	20.3%	231	79.7%
36	Nurses or nursing students fear adverse consequences from reporting medication errors	43	14.8%	248	85.2%
37	Nurses or nursing students could be blamed if something happens to the patient as a result of the medication error	40	13.8%	251	86.2%

➞ Disagree with ME definition ➞ Reporting effort ➞ Fear

4.6.6 Respondents' perceptions of individual items related to barriers to reporting MAEs across each year of study

Table 4.13 presents the descriptive statistical analysis of the barriers to reporting MAEs as perceived by the respondents across each year of study. These reasons were organised according to a six-point Likert scale (1 = strongly disagree to 6 = strongly agree). The percentage of each point was estimated and the total percentage of "agree" and "disagree" points was calculated.

The majority of second-year respondents (82.7%, *n*=91) perceived that the strongest barrier to reporting MAEs was Item 36 (fear of adverse consequences). The third-year respondents perceived two reasons as top barriers to reporting of MAEs. The first barrier was Item 33 (fear of being labelled incompetent) and was indicated by 85 (91.4%) of the third-year respondents. The second barrier was Item 36 (fear of adverse consequences) as reported by 85 (91.4%) of third-year respondents. Finally, most of the fourth-year respondents (92%, *n*=81) reported Item 37 (fear of blame) as the top barrier to reporting MAEs.

However, Item 27 (nurses do not agree with hospital's definition of a medication error) was ranked the highest in terms of disagreement among all years of study. Here 83 (76.1%) of second-year respondents, 71 (77.2%) of third-year respondents, and 56 (63.7%) of fourth-year respondents disagreed with this as a barrier to reporting MAEs. More details are depicted in Table 4.13 and Appendix J.

Table 4.13: Barriers to reporting MAEs across the years of study

Item No.	Barriers to reporting MAEs	2nd year		3rd year		4th year	
		Disagree	Agree	Disagree	Agree	Disagree	Agree
27	Nurses do not agree with hospital's definition of a medication error	83 (76.1%)	26 (23.9%)	71 (77.2%)	21 (22.8%)	56 (63.7%)	32 (36.3%)
28	Nurses or nursing students do not recognise an error occurred	71 (64.6%)	39 (35.4%)	38 (45.8%)	45 (54.2%)	36 (40.9%)	52 (59.1%)
29	Filling out an incident report for a medication error takes too much time	63 (57.3%)	47 (42.7%)	37 (39.8%)	56 (60.2%)	21 (23.9%)	67 (76.1%)
30	Contacting the physician about a medication error takes too much time	71 (64.6%)	39 (35.4%)	43 (46.2%)	50 (53.8%)	33 (37.9%)	54 (62.1%)
31	Medication error is not clearly defined	58 (53.2%)	51 (46.8%)	46 (49.5%)	47 (50.5%)	36 (40.9%)	52 (59.1%)
32	Nurses or nursing students may not think the error is important enough to be reported	52 (47.3%)	58 (52.7%)	34 (36.6%)	59 (63.4%)	32 (36.4%)	56 (63.6%)

Item No.	Barriers to reporting MAEs	2nd year		3rd year		4th year	
		Disagree	Agree	Disagree	Agree	Disagree	Agree
33	Nurses or nursing students believe that other nurses will think they are incompetent if they make medication errors	27 (24.8%)	82 (75.2%)	8 (8.6%)	85 (91.4%)	18 (20.9%)	68 (79.1%)
34	The patient or family might develop a negative attitude towards the nurses or nursing student or may sue the then if a medication error is reported	25 (22.7%)	85 (77.3%)	14 (15.1%)	79 (84.9%)	13 (14.9%)	74 (85.1%)
35	Nurses or nursing students are afraid the physician will reprimand them for the medication error	28 (25.4%)	82 (74.6%)	13 (14.0%)	80 (86.0%)	18 (20.7%)	69 (79.3%)
36	Nurses or nursing students fear adverse consequences from reporting medication errors	19 (17.3%)	91 (82.7%)	8 (8.6%)	85 (91.4%)	16 (18.9%)	72 (81.1%)
37	Nurses or nursing students could be blamed if something happens to the patient as a result of the medication error	23 (20.9%)	87 (79.1%)	10 (10.8%)	83 (89.2%)	7 (8.0%)	81 (92.0%)
➞ Disagree with ME definition ➞ Reporting effort ➞ Fear							

4.6.7 The significant subscales of the barriers to reporting MAEs

Table 4.14 shows the significant difference of the three main subscales relating to the barriers to reporting MAEs from the neutral level of the six-point Likert scale (3.5) as a result of applying the one-sample *t*-test.

Results in Table 4.14 show that the fear subscale was significantly higher than the neutral level of the six-point Likert scale, reflecting that this subscale is the only barrier of significance in reporting MAEs as perceived by respondents. On the other hand, disagreement with the definition subscale was lower than the neutral level. The reporting effort had no significant difference from the neutral level.

Table 4.14: Significant subscales of barriers to reporting MAEs

One-Sample Test						
	Test Value = 3.5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Disagree with definition	-4.065	290	0.000	-0.28322	-.4204	-0.1461
Reporting effort	0.898	290	0.370	0.08419	-.1003	0.2686
Fear	18.665	290	0.000	1.32234	1.1829	1.4618

4.6.8 The significant different items of barriers to reporting MAEs

Table 4.15 presents the results of barriers to reporting MAEs that are significantly different from the neutral level of the six-point Likert scale (3.5) with a mean higher than this neutral level as a result of applying the one-sample *t*-test to the barriers to reporting MAEs.

Seven of eleven mentioned barriers to reporting MAEs were significantly higher than the neutral level. This reflected that these reasons were representative of the significant barrier that prevented nurses from reporting their MAEs as perceived by respondents. The observed note was that five of these seven barriers were categorised under the fear subscale, while other barriers (filling out an incident report for MEs takes too much time, and nurses or nursing students may not think the error is important enough to be reported) ranked as the sixth and the seventh barriers and were categorised under the reporting effort, and disagree with ME definition subscales. For further details see Appendix K.

Table 4.15: Significant barriers to reporting MAEs

Item No.	Barrier to reporting MAEs	Mean	STD	SD error of mean	*T*	df	Sig. (2-tailed)
37	Nurses or nursing students could be blamed if something happens to the patient as a result of the medication error	5.09	1.503	0.088	18.003	290	< 0.001
36	Nurses or nursing students fear adverse consequences from reporting medication errors	4.86	1.479	0.087	15.641	290	< 0.001
34	The patient or family might develop a negative attitude towards the nurses or nursing or may sue the them if a medication error is reported	4.80	1.575	0.092	14.018	289	< 0.001
33	Nurses or nursing students believe that other nurses will think they are incompetent if they make medication errors	4.76	1.646	0.097	13.024	288	< 0.001
35	Nurses or nursing students are afraid the physician will reprimand them for the medication error	4.63	1.495	0.088	12.846	289	< 0.001
29	Filling out an incident report for a medication error takes too much time	3.79	1.808	0.106	2.739	290	0.007
32	Nurses or nursing students may not think the error is important enough to be reported	3.74	1.911	0.112	2.102	290	0.036

➞ Disagree with ME definition **➞ Reporting effort** **➞ Fear**

4.7 Percentage of non-IV medication errors

In this section respondents were asked to determine the percentage of each type of non-IV medication error reported in the units where they were practising. The percentages were represented by ten points. Number 1 represented the percentage between 0% and 20%, number 2 represented the percentage between 21% and 30%, up to number 10 which represented the percentage 100%. Thereafter, respondents' answers were analysed by determining the percentage of reporting for each item. The total percentage of reporting for all non-IV medication errors was then determined. Moreover, the mean and standard deviations were determined. This section highlights the frequency of reporting MEs according to the perceptions of the respondents and is guided by the fourth objective of the study.

Table 4.16 shows the percentage of reporting non-IV medication errors as perceived by respondents. Also, the mean with standard deviation was presented to determine where the percentage is located on the ten points.

The total percentage of reporting non-IV medication errors was 40.3%. However, the wrong time of administration (46.6%) was the most frequently reported type of non-IV medication error as perceived by respondents, followed by omitted medication errors (45.7%) and finally, wrong dose errors (42.8%). The wrong route (31.2%) was the least frequently reported error.

Table 4.16: Percentage of reporting non-IV medication errors

Type of Non-IV medication error	*N*	Mean (±STD)
Wrong time of administration	46.6 %	4.32 (±2.99)
Medication is omitted	45.7 %	4.24 (±2.97)
Wrong dose	42.8 %	3.96 (±2.88)
Medication administered after the order to discontinue has been written	42.5 %	3.92 (±2.87)
Wrong drug	39.9 %	3.72 (±2.97)
Wrong patient	38.5 %	3.57 (±2.93)
Medication is given, but has not been ordered by the physician	38.5 %	3.57 (±2.88)
Given to patient with a known allergy	37.1 %	3.47 (±3.07)
Wrong route of administration	31.2 %	2.88 (±2.46)
Overall Non-IV medication error	40.3 %	3.74 (±1.93)

4.8 Summary

A total of 291 second-, third- and fourth-year nursing students enrolled for the basic undergraduate nursing programme were the respondents in this study. Most were female and under the age of 26. Respondents were asked to rate their knowledge regarding the objectives of this study, as mentioned previously.

Data was collected on respondents' perceptions of the causes of MAE occurrence, the barriers to reporting MAEs and their awareness of MAE occurrence during their practice time. Data was also collected on their awareness of whether these errors were reported and their perceptions of the percentage of non-IV medication errors reported in the units where they were engaged in experiential learning.

Data was analysed using SPSS Version 24, and the findings were presented in tables and figures. A further discussion of these results follows in Chapter 5.

Of the respondents, 85.2% were aware of MAE occurrence during their practice time. However, 40.1% were unaware of its reporting. The first cause subscale for MAE occurrence was the physician communication-related subscale, while the top item cause was the use of abbreviations.

The fear subscale was the primary barrier in respect of reporting MAEs, while the fear of blame was the top barrier. Moreover, "wrong time" errors were the most frequently reported errors in the units as indicated by respondents.

CHAPTER FIVE

DISCUSSION OF THE RESULTS

5.1 Introduction

The findings of this research study are interpreted and discussed in this chapter. The discussion focuses on the objectives of the study: awareness of MAE occurrence and its reporting; perceived causes of MAE occurrence; perceived barriers to reporting errors; and percentage of reporting MEs occurring during students' practice time.

Two closed-ended questions were used to determine awareness of MAE occurrence and reporting. Four main subscales (physician communication- related, pharmacy-related, nurse-related, and medication package-related subscales) divided to 20 items on a six-point Likert scale were used to determine the causes of MAE occurrence (Wakefield et al., 2005:484). Three main subscales (fear, reporting effort, and disagreement with ME definition), divided into 11 items on a six-point Likert scale, were used to determine the barriers to reporting MAEs (Wakefield et al., 2005:484). The types of non-IV medication errors were noted on a 10 point-Likert scale to determine how the students perceived the frequency of reporting these errors in the units where they were completing their clinical placement (Wakefield et al., 2005:484). The findings are compared with national and international studies on nursing students as well as registered nurses. The discussion is linked to each objective of this study.

5.2 Students' awareness of MAE occurrence and reporting thereof

Based on 99.7% (*N*=290) of respondents, 85.2% were aware of MAE occurrence during their practice. This percentage has varied worldwide between 46% and 66%. In the emergency department of the Imam Khomeini Hospital in Iran, 46.8% of the nurses had committed medication errors (Ehsani et al., 2013:1). Another study conducted at the same hospital by Cheragi et al. (2013:229) indicated that 64.5% of the nurses had made medication errors. Moreover, Feleke et al. (2015:1) indicated that MAEs occurred in 56.4% of administered medication among nurses in Ethiopia. According to Ojerinde and Adejumo (2014:22), 66% of nurses in Nigeria were involved in medication error occurrence. These errors occurred because of a shortage of nurses (Ehsani et al., 2013:1); insufficient pharmacological information (Cheragi et al., 2013:228; Ehsani et al., 2013:1; Ojerinde & Adejumo, 2014:22); nurses' interruption during medication administration (Wakefield et al., 2005:484; Hanna, 2014:41; Feleke et al., 2015:1); physician communication-related causes (Wakefield et al., 2005:484; Aboshaiqah, 2014:63; Hanna, 2014:41); nurse-related

causes (Wakefield et al., 2005:484; Al-Youssif et al., 2013:61; Blignaut, 2015:162); pharmacy-related causes (Wakefield et al., 2005:484; Ehsani et al., 2013:1), and medication package-related causes (Wakefield et al., 2005:484; Al-Youssif et al., 2013:61; Hanna, 2014:41). An exploration of the reasons for MAE among nurses and addressing these will mitigate the occurrence of recent errors and improve the healthcare service. These causes are discussed in greater detail in this chapter.

With regard to respondents' awareness of reporting MAEs (97.6%; *N*=284), 59.9% indicated that these errors were reported, while more than one-third (40.1%) were unaware of reporting. These findings are supported by Koohestani and Baghcheghi (2009:66) who indicated that 80.12% of nursing students' errors were reported. Moreover, inconsistencies in the reporting of MAEs have been noted in other studies. For example, other international studies noted that nurses reported 15% to 53% of their errors (Cheragi et al., 2013:229; Oshikoya et al., 2013:67; Bifftu et al., 2016:1; Mohammad et al., 2016:1). These errors were reported to the instructors (Koohestani & Baghcheghi, 2009:66), the head nurse or supervisor (Mohammad et al., 2016:1); nurse managers (Holmström, 2017:122); and the nurses' office (Ehsani et al., 2013:1). The participation of healthcare workers in developing a reporting system could play an important role in enhancing patient safety, especially nurses, as they are always in direct contact with patients. Therefore, barriers to reporting errors should be explored, and nurses should be prompt in reporting errors as they too have a responsibility to ensure quality of life for all patients and that patients recover.

5.3 Reasons why MAEs occur

With regard to the reasons for MAE occurrence, this study included 20 items as possible reasons for MAEs. These items were classified into four main subscales (physician communication-related, nurse-related, pharmacy-related, and manufacturer-related subscales) (Wakefield et al., 2005:484).

5.3.1 MAE occurrence subscales

Physician communication-related, nurse-related, pharmacy-related, and manufacturer-related subscales were used in this study to determine the main causes of MAE occurrence as perceived by nursing students. Respondents mentioned the subscales of MAE occurrence leading to their errors as follows:

5.3.1.1 Physician communication

Physician communication represented the main subscale of the causes of MAE occurrence in the current study as perceived by 69.3% of the respondents with a mean of 4.22±0.99 on a six-point Likert scale, indicating that the respondents slightly agreed with this subscale as a cause of MAE occurrence. Moreover, the result of the one-sample *t*-test reflected the fact that this subscale was a significant cause of MAEs as perceived by the respondents. This finding was supported by Aboshaiqah (2014:63), who reported the physician communication subscale as the main cause of MAE occurrence. Moreover, the physician communication subscale was reported by other studies as the second cause (Hanna, 2014:41), or the fourth cause (Al-Youssif et al., 2013:61) of MAE occurrence. Furthermore, other studies noted some cases related to physician communication as a reason for MAE occurrence. Dumo (2012:121) reported that the physician does not spend enough time in discussing care options. Blignaut (2015:162-182) noted communication lapses between nurses and physicians as a cause of MAE occurrence among the respondents in medical and surgical units in the Gauteng province in South Africa. Likewise, there are other South African studies that note the lack of communication between nurses and physicians as an important cause of MAE occurrence (Du Preez, 2016:87; Hill, 2016:81-92; Truter et al., 2017:9).

Nurse–physician communication represented the baseline for patient safety. The physician has to write and give instructions for the prescription of medication. The nurse has to interpret these orders. Hence, communication between physician and nurse is of utmost importance, as it could have detrimental effects on the safety of the patient. An overall improvement in communication skills among staff, as well as interdisciplinary communication, plays an important role in decreasing MAEs and increasing error reporting (Cronje, 2012:33; Holmström, 2017:96; Mohmmed & Hassane El-sol, 2017:83).

5.3.1.2 Medication package

Approximately 60.7% of the respondents in the current study mentioned the medication package subscale as a cause of MAE occurrence, with a mean of 3.75±1.33, indicating that the respondents slightly agreed with this subscale as a cause of MAE occurrence. The result of the one-sample *t*-test reflected the fact that this subscale was a significant cause of MAE as perceived by respondents. This finding concurs with that of Aboshaiqah (2014:66), who reported that nurses in Saudi Arabia slightly agreed with this subscale as a cause of MAE occurrence. However, Hanna (2014:41) and Al-Youssif et al. (2013:61) reported this subscale as the main cause of MAE occurrence in their studies. Moreover, further studies note some reasons related to medication package as a cause of MAE occurrence (Mayo & Duncan, 2004:212; Blignaut, 2015:162).

The medication package subscale includes different medications looking similar, names of many medications sounding similar, and packaging of many medications being similar. Choosing or administering incorrect medication, will harm the patient directly and could lead to disability or death. It is important that all medication should be clearly designed and marked in order to distinguish between the various medication packages. Applying the barcode technique to mark all medication differently could play an important role in facilitating the selection and administration of the correct medicine (Keers et al., 2013b:253; Blignaut, 2015:251; Lapkin et al., 2016:852; Alotaibi & Federico, 2017:1177). Furthermore, the nurse should take the medication package to the patient's bedside and open it just before administering the medication (Al-Youssif et al., 2013:65).

5.3.1.3 Nurse-related subscale

The respondents (60.3%) in this study, cited this subscale as a cause of MAE occurrence with a mean of 3.86±0.94, indicating slight agreement of the respondents with this subscale as a cause of MAE occurrence. Moreover, the result of the one-sample *t*-test confirmed that this subscale was a significant cause of MAEs as perceived by the respondents. This finding is supported by Aboshaiqah (2014:66), who indicated that nurses in Saudi Arabia slightly agreed with the nurse-related subscale as a cause of MAE occurrence. Other studies reported the nurse- related subscale as the fourth (Al-Youssif et al., 2013:61) or last (Hanna, 2014:41) reason for MAE occurrence. Furthermore, Hanna (2014:41) indicated that respondents slightly disagreed with the nurse-related subscale as a cause of MAE occurrence. Moreover, many other South African and international studies mention reasons related to the nurse subscale for MAE occurrence. In South Africa, these include patient–nurse ratio, work overload, inadequate staffing levels, and nurses being interrupted while administering medication. These were noted as contributing factors by professional nurses and medication administrators (Blignaut, 2015:162; Du Preez, 2016:46-57; Hill, 2016:71-75). Similarly, workload, interruptions during medication administration, exhaustion, and patient–nurse ratios have been listed by other international studies as causes of MAE occurrence (Mayo & Duncan, 2004:212; Stratton et al., 2004:389; Keers et al., 2013a:1045; Keers et al., 2014:320).

Eight individual items followed the nurse-related subscale as causes of MAE occurrence. Many patients are on the same or similar medication, and nurses are interrupted while administering medication, were the top individual items of the nurse-related subscale as the cause of MAE occurrence as perceived by respondents in the current study. These causes could lead to stress and affect nurses' focus during the medication administration process. They also could affect

nurses' concentration and result in the failure of the medication administration technique. These issues could be minimised by increasing staffing levels and providing a safe medication preparation area with a "**No-Talk**" sign (Feleke et al., 2015:1; Mohmmed & Hassane El-sol, 2017:84). A continuous educational development programme should be provided for nurses to raise their awareness of the effects of interruption during medication administration on patient safety (Feil, 2013:6-8).

5.3.1.4 Pharmacy-related subscale

Most of the respondents (91.4%) in this study disagreed with the pharmacy-related subscale as a cause of MAE occurrence. A mean of 1.76±1.04 indicated that the respondents moderately disagreed with this subscale as a cause of MAE occurrence. Furthermore, the result of the one-sample *t*-test confirmed that this subscale was not a significant cause of MAEs, as perceived by respondents. This finding was supported by Al-Youssif et al. (2013:57) and Aboshaiqah (2014:66), who noted this subscale as the least cause of MAE occurrence. Moreover, Aboshaiqah (2014:66) and Hanna (2014:41) indicated that nurses slightly disagreed with this subscale as a cause of MAE occurrence. Likewise, Hill (2016:70) reported that 58.05% of South African nurses indicated that MAEs rarely occurred owing to incorrect dispensing of medication by the pharmacy. Stratton et al. (2004:389) confirmed that only 25% of paediatric nurses in the USA reported medication errors due to pharmacy-related reasons. Regular courses for nurses, physicians and pharmacists with regard to medication management and calculation play an important role in mitigating MAE occurrence and enhancing patient safety (Feleke et al., 2015:7; Du Preez, 2016:99; Gokhul et al., 2016:1223).

5.3.2 Individual items as causes of MAE occurrence

In this study, there were six (6) individual items reported as causes of MAE occurrence with percentages of 75% or more; these were presented as the leading reasons for MAE. Four of the individual items were part of the physician communication subscale, and included the use of abbreviations, unclear and illegible orders, as well as poor communication between nurses and physicians. The other two individual items were part of the nurse-related subscale, and included interruption while administering medication, and having many patients on similar medication.

5.3.2.1 Abbreviations are used instead of writing the order out completely

The use of abbreviations was perceived as the main reason contributing to the occurrence of MAEs as indicated by 81.4% of the respondents. Moreover, this reason was the first significant cause of MAE occurrence in the current study. This finding was supported by Blignaut (2015:161),

who reported that 83.2% of South Africa medication administrators mentioned this as a risk for MAE occurrence. Furthermore, 35.7% indicated it as a significant risk for MAE occurrence. Al-Youssif et al. (2013:66) note the use of abbreviations as the second reason for MAE occurrence as indicated by nurses in Saudi Arabia. Moreover, many international studies confirm the use of abbreviations as important causes of MAE occurrence (Cheragi et al., 2013:230; Ehsani et al., 2013:3; Valdez et al., 2013:225; Aboshaiqah, 2014:65; Hanna, 2014:41). When abbreviations are used, it is easy to misinterpret what is written, and that could lead to an MAE. This information is useful to healthcare institutions in avoiding the use of abbreviations and encouraging physicians to write orders clearly and legibly (Al-Youssif et al., 2013:66; Du Preez, 2016:98).

5.3.2.2 Physician medication orders are not clear

This reason was the second cause of MAE occurrence as perceived by 80.4% of respondents. Furthermore, the result of the one-sample *t*-test showed that unclear physician orders were the second significant cause of MAE occurrence. Similarly, Hanna (2014:41) mentioned unclear physician orders as the second cause of MAE occurrence as indicated by nurses in the USA. However, according to Aboshaiqah (2014:65), only 25% of nurses in Saudi Arabia mentioned it as a cause of MAE occurrence. Moreover, that physician orders are unclear, was reported by other studies as a cause of MAE occurrence (Mayo & Duncan, 2004:212; Al-Youssif et al., 2013:66; Blignaut, 2015:53). When an order is not clear, it could lead to misinterpretation which could compromise patient safety. This information could facilitate the development of new techniques such as electronic orders and the use of barcodes for prescribing orders to avoid or mitigate the occurrence of MAEs (Blignaut, 2015:251; Lapkin et al., 2016:852; Alotaibi & Federico, 2017:1177).

5.3.2.3 Many patients are on similar medication

This reason was indicated as the third reason for MAE occurrence by 79.4% of respondents. It was one of the significant causes of MAE occurrence in this study. In another study done by Aboshaiqah (2014:65), using the same data-collection instrument as used in this study, “many patients are on similar medication” was identified as one of the noteworthy causes of MAEs, with 57.3% of nurses reporting this. Al-Youssif et al. (2013:42) and Hanna (2014:60) concur that “many patients are on similar medication” is an important cause of MAE occurrence. This similarity in medication, coupled with a heavy workload, creates opportunities for MAEs to occur.

5.3.2.4 Nurses are interrupted while administering medication

The aspect, nurses being interrupted while administering medication, was indicated as the fourth reason for MAE occurrence by 79% of respondents. It was also regarded as the fourth most significant cause of MAE occurrence as perceived by respondents. This has been mentioned by many previous studies as a cause of MAE occurrence (Anderson & Townsend, 2010:25; Armitage et al., 2010:1189; Kim et al., 2011:346; Unver et al., 2012:322; Choo et al., 2013:105; Donaldson et al., 2014:63; Gunningberg et al., 2014:413; Du Preez, 2016:43).

Hill (2016:13) and Westbrook et al. (2010:683) concur, indicating that 63% to 65% of medication administrators and nurses mentioned interruption during medication administration as the key factor for MAE occurrence. Moreover, Blignaut (2015:116) reported that 109 (35%) of 315 medications administered to patients in South African hospitals, were interrupted. Furthermore, Westbrook et al. (2010:683) reported that 53.1% of the nurses' time was interrupted. Westbrook et al. (2010:683) indicated that interruption during medication administration increased the percentage of errors to 12.1%. Furthermore, Hanna (2014:41), having used the same instruments, reported interruption during medication administration as the primary cause of MAE occurrence. Aboshaiqah (2014:65), using the same instruments, found that 39.2% of nurses in Saudi Arabia indicated interruption during medication administration as a reason for MAE occurrence. As indicated by previous studies, interruption while administering medication was perceived as an important cause of MAE occurrence by the respondents in the current study. Interrupting or distracting the nurse while performing the duty increases the likelihood of medication errors. So, a no-interruption zone with a "**No-Talk**" sign should be provided for the medication administration process to minimise distraction during the process and maintain patient safety (Feleke et al., 2015:7; Mohmmed & Hassane El-sol, 2017:84).

5.3.2.5 Physician medication orders are not legible

Respondents perceived illegible physician medication orders as a cause of MAE occurrence. This was indicated by 75.8% of respondents. Moreover, it represented the third most significant cause of MAE occurrence in this study. This finding was supported by other studies conducted in South Africa by Blignaut (2015:161) Hill (2016:81), who reported that between 71% and 87% of South African medication administrators mentioned illegible physician orders as significant risks for MAE occurrence. Also, Mayo and Duncan (2004:209) noted physician order legibility as a third cause of MAE occurrence, while Al-Youssif et al. (2013:60) reported illegible physicians' medication orders as the fourth reason for MAE occurrence as indicated by Saudi Arabian nurses. The same data-collecting instrument was used in this study in Saudi Arabia. Furthermore, a qualitative study

conducted in Turkey by Günes et al. (2014:295), mentioned prescription illegibility as a contributing factor to MAE incidences. Moreover, other international studies mentioned illegible prescriptions as a contributing cause (Wolf et al., 2006:42; Manias et al., 2012:411; Unver et al., 2012:322). The prescription represented the key communication between the nurse and physician to interpret ordering of medication. If the prescription is illegible, it could lead to the nurse's missing important information in the order. This could directly affect or compromise patient safety. So, the order must be confirmed, and the prescription clarified. An electronic prescription with a barcode will play an important role in avoiding illegibility of prescriptions and making them clearer (Blignaut, 2015:251; Alotaibi & Federico, 2017:1174; Hammoudi et al., 2017:1045; Elliott et al., 2018:153).

5.3.2.6 Poor communication between physicians and nurses

Poor communication between physicians and nurses was perceived by 75.6% of respondents in the current study as a cause of MAE occurrence. This was regarded as a significant cause of MAE occurrence in this study. This finding is supported by national and international studies indicating that 65% to 74% of nurses reported poor communication and communication lapses between physician and nurse as risks for MAE occurrence (Aboshaiqah, 2014:65; Blignaut, 2015:161). Poor communication leads to problems, misunderstandings and errors which have a direct effect on healthcare services as well as on patient safety, as reported by several previous international studies (Dumo, 2012:123; Al-Youssif et al., 2013:60; Hanna, 2014:42). Communication between physicians and nurses is essential to the medication administration process and important in limiting MAEs. Thus, meetings to enhance collaboration between nurses and physicians should be conducted regularly to improve the healthcare service and ensure the safety of the patient (Blignaut et al., 2017:3621; Mohmmed & Hassane El-sol, 2017:83).

5.4 Barriers to reporting errors

Failure to report MAEs can have serious health consequences, as opportunities to remedy the situation are lost. Furthermore, should a patient experience any adverse event as the result of an MAE, if the MAE is not reported, other healthcare providers will not be able to identify the problem easily, hence delaying intervention that could be lifesaving.

The section examining barriers to reporting MAEs comprised 11 reasons classified into three main subscales (fear, reporting effort, and disagree with definition). It was used to determine respondents' agreement with the perceived barriers that prevent nurses from reporting their MAEs, with a six-point Likert-type scale (1 strongly disagree, to 6 strongly agree) (Wakefield et al., 2005:484).

5.4.1 Barriers to reporting the MAEs subscale

Fear, reporting effort, and disagree with MEs definition, were the subscales used in the current study to determine the main barriers to reporting the MAEs as perceived by the respondents. The respondents noted the subscale barriers that prevent nurses from reporting their errors as follows:

5.4.1.1 Fear

The fear subscale was the top barrier to reporting nurses' MAEs as perceived by 82.8% of the respondents. The mean of the fear subscale in this study was 4.82 (±1.21) of the six-point Likert-type scale, indicating that the respondents moderately agreed with this subscale. Al-Youssif et al. (2013:62), Hanna (2014:22) and Blignaut (2015:182) concur with the finding of this study that fear was the main barrier to reporting MAEs among nurses in Saudi Arabia, the United States, and South Africa. Moreover, the fear subscale was only significant barrier to reporting MAEs as indicated by the respondents in the current study. According to Mohammad et al. (2016:6), the fear subscale was significantly lower than the neutral level of the six-point Likert scale (3.5), to reflect the fact that this subscale was not a significant barrier to reporting MAEs among nurses in Saudi Arabia.

This finding concurs with results of other studies. Perceived barriers to reporting MAEs were fear of peer reaction and fear of the manager (Mayo & Duncan, 2004:209), as well as fear of the manager's response and co-workers' reactions (Gordon, 2014:20).

In the current study, the fear subscale was the top and only significant barrier to reporting errors as perceived by respondents. Moreover, five of the individual items related to this subscale were at the top of the individual barriers to reporting MAEs. These items are fear of blame, fear of adverse consequences, fear of developing a negative attitude towards the nurses by the patient or family, fear of thinking that they are incompetent, and fear of physician's reprimand. Therefore, voluntary blame-free reporting systems should be established to reduce fear of reprisal among healthcare workers (Almutary & Lewis, 2012:119; Abou Hashish & El-Bialy, 2013:2167; Hanna, 2014:62; Mohammad et al., 2016:8).

5.4.1.2 Reporting effort

More than half of the respondents (54%) in the current study mentioned the reporting effort subscale as a barrier that prevented nurses from reporting their errors. The mean of this subscale in the current study was 3.58 (±1.60) of the six- point Likert scale. This is an indication that the respondents slightly agreed with this subscale. Hanna (2014:44) and Blignaut (2015:182)

indicated that respondents in the United States and South Africa slightly disagreed with the reporting effort as a barrier. However, the results of the one-sample *t*-test in this study have shown that the reporting effort is not a significant barrier in the current study. The reporting effort perceived as a barrier to reporting MAEs could be related to heavy workloads and nurses' exhaustion during their working hours. These reasons could be due to medication not being administered during the accepted time frame and inadequate levels of staff on duty during a particular shift. This barrier could be managed by developing an electronic reporting system as well as to ensure sufficient qualified staff per shift in order to reduce exhaustion during nurses' long working hours (Alotaibi & Federico, 2017:1177; Hammoudi et al., 2017:1045).

5.4.1.3 Disagreement with MEs definition

Less than the half of the respondents (46.4%) in the current study perceived disagreement with ME definition to be a barrier to reporting MAEs, with a reported mean of 3.22 (±1.19). This subscale was mentioned by Blignaut (2015:182) as the last barrier to reporting MAEs among respondents in medical and surgical units in the Gauteng province in South Africa. It is reported as the last barrier by other international studies also (Al-Youssif et al., 2013:62; Hanna, 2014:44). On the other hand, this subscale was reported as the first barrier perceived by nurses in Saudi Arabia (Abou Hashish & El-Bialy, 2013:2161). Moreover, this subscale was lower than the neutral level six-point Likert scale (3.5) in the current study. Hence, it reflected the fact that this subscale was not a significant barrier to reporting MAEs. Mohammad et al. (2016:6) support this finding by indicating that disagreeing with the ME definition was not a significant barrier to reporting MAEs among nurses in Saudi Arabia. The nurses' disagreement with the definition could be interpreted as confusion with medication errors and fear of questioning, as the fear subscale and its related items were ranked highly by respondents. Abou Hashish & El-Bialy (2013:2165) reported the same finding among nurses in Saudi Arabia.

5.4.2 Individual items as barriers to reporting MAEs

In this study, there were five (5) individual items reported as barriers to reporting MAEs, with percentages of 75% or higher. All the individual barriers were part of the fear subscale, and included fear of blame, fear of adverse consequences, as well as fear of a negative attitude towards the nurses, being viewed as incompetent, and lastly fear of the physician's reprimanding nurses for medication errors.

5.4.2.1 Fear of blame

The first barrier to reporting MAEs as perceived by respondents in the current study, was the fear of blame if something happened to the patients as indicated by 86.2% of the respondents. A similar finding was reported by Chiang and Pepper (2006:395), Toruner and Uysal (2012:32), and Holmström, (2017:3), who reported this reason as the main barrier to reporting MAEs among nurses. Blignaut (2015:166) also indicated that 74.4% of South African medication administrators mentioned the fear of blame as the top reason for not reporting their errors. Hanna (2014:44) reported the fear of blame as the second barrier to reporting MAEs among nurses in the USA.

Moreover, fear of blame was the most significant barrier to reporting MAEs in this study. Mohammad et al. (2016:6) support this finding by indicating that fear of blame was the top significant barrier to reporting MAEs among nurses in Saudi Arabia. Furthermore, the fear of blame was an important barrier as mentioned by many other international studies (Stratton et al., 2004:388; Almutary & Lewis, 2012:119; Abou Hashish & El-Bialy, 2013:2160; Al-Youssif et al., 2013:66; Mohammad et al., 2016:7).

The fear of blame was the top barrier to reporting MAEs as perceived by respondents in the current study. This barrier was indicated by many previous researchers as noted in the literature review. Therefore, blame-free reporting systems should be developed in all healthcare organisations to encourage nurses, as well as other healthcare workers, to report their errors in order to learn from these errors and continue to strive to enhance patient safety (Abou Hashish & El-Bialy, 2013:2160; Hanna, 2014:61; Holmström, 2017).

5.4.2.2 Fear of adverse consequences

In the current study, findings revealed fear of adverse consequences from reporting medication administration errors as the second reason for barriers militating against nurses' reporting their MAEs as perceived by 85.2% of the respondents in this study. It was the second significant barrier in the current study. Chiang and Pepper (2006:395) also note fear of adverse consequences as a second barrier to reporting MAEs among Taiwanese nurses, while nurses in the USA ranked it fourth (Hanna, 2014:44).

According to Blignaut (2015:166), 43.8% of South African medication administrators agreed with the fear of adverse consequences as a barrier to reporting MAEs, but 37% strongly disagreed. However, the fear of adverse consequences has been reported in previous studies that used the same instrument (Stratton et al., 2004:388; Al-Youssif et al., 2013:66; Mohammad et al., 2016:7).

The fear of adverse consequences as a barrier to reporting MAEs supports findings from the literature for the requirement for developing a safe work climate with systemic changes to the reporting system to make it free from reprisal. An education programme needs to be established to encourage nurses and healthcare workers to report their errors to ensure patient safety (Abou Hashish & El-Bialy, 2013:2160; Al-Youssif et al., 2013:68; Holmström, 2017:91).

5.4.2.3 Attitudes towards nurses

In this study, 82.1% of respondents regarded the patient or family developing a negative attitude towards nurses as the third barrier to reporting MAEs. Blignaut (2015:166) indicated that 61.4% of South African nurses noted this as a barrier to reporting MAEs. Moreover, 41.1% strongly concurred. This barrier was the third most significant in the current study also. Mohammad et al. (2016:7) reported this barrier as the fourth most significant among nurses in Saudi Arabia.

Other studies that used the same instrument supported the findings of the current study by reporting patients' negative attitudes towards nurses as the third barrier to not reporting MAEs among nurses (Chiang & Pepper, 2006:395; Hanna, 2014:44). This was further reported in several international research studies (Stratton et al., 2004:388; Al-Youssif et al., 2013:66; Mohammad et al., 2016:7).

Nurses' fears in this respect indicate they wish to maintain their positive attitudes and reputations. They were also fearful of being sued for malpractice by family members or patients. An anonymous reporting system thus could play an important role in encouraging nurses to report their errors to improve patient safety and mitigate various other repercussions as noted above (Al-Youssif et al., 2013:66; Blignaut, 2015:264).

5.4.2.4 Being viewed as incompetent

Of the respondents in the current study, 81.7% indicated that MAEs were not reported as nurses might be viewed as incompetent should they make medication administration errors. It was also the fourth most significant barrier in respect of MAE reporting. According to Blignaut (2015:166), only 41% of South African medication administrators agreed with this being a barrier, while 37.8% of nurses strongly agreed with this being a barrier. Qualified nurses also reported other nurses' opinions as a potential barrier (Stratton et al., 2004:388; Chiang & Pepper, 2006:395; Al-Youssif et al., 2013:66; Hanna, 2014:42; Mohammad et al., 2016:7).

Nurses' fears of being viewed as incompetent could be related to their thinking that MEs could be used to measure their competence and that they could be dismissed. An anonymous reporting

system therefore could help nurses to report their errors without the fear of being regarded incompetent (Al-Youssif et al., 2013:66; Blignaut, 2015:264).

5.4.2.5 Physician's reprimand

Nurses are afraid that physicians will reprimand them for medication errors. In this study, 79.7% of the respondents perceived the physician's reprimand as a barrier to reporting MAEs. This fear was the fifth significant barrier to reporting MAEs in the current study. This finding is supported by Hanna, 2014:44), who reported the same finding among nurses in the USA. Furthermore, Blignaut (2015:166) indicated that only 36.9% of South African medication administrators were fearful of being reprimanded.

Mayo and Duncan (2004:209) also reported fear of managers' and peers' reactions as an important barrier in this regard. Nurses' fears of physician chastisement were indicated as a barrier in the findings of other international studies (Stratton et al., 2004:388; Chiang & Pepper, 2006:395; Al-Youssif et al., 2013:66; Mohammad et al., 2016:7).

Nurses' fears of being rebuked explain their desire to maintain a positive attitude and working relationship with physicians as they are afraid of disciplinary procedures and possible dismissal. Therefore, this result supports findings in the literature in respect of the need to establish a voluntary, anonymous, and blame-free reporting system (Blignaut, 2015:264; Holmström, 2017:134). This type of reporting system was indicated by the World Health Organization (WHO) as imperative in developing a reporting culture among nurses that will encourage healthcare workers to report their errors without fear of reprisal (WHO, 2011:156).

5.5 Percentage of each type of error reported in units where students are placed

In the current study, nine types of non-IV medication errors were noted. The first three most reported types as ranked according to their percentages were wrong time of administration (46.5%), omission errors (45.7%), and wrong dose errors (42.8%) as perceived by respondents. This corresponds with the study conducted in South Africa by Blignaut et al. (2017:3616), noting wrong time of administration, omission errors, and wrong dose as the first three reported errors.

5.5.1 Wrong time of administration

The wrong time of administration of medication was the most reported type of error in the units of practice (46.6%) as reported by respondents. This finding is supported by other studies indicating

27% to 53% of wrong-time errors were reported (Al-Youssif et al., 2013:64; Feleke et al., 2015:5; Bifftu et al., 2016:4; Blignaut et al., 2017:3616).

Berdot et al. (2012:1) contend that wrong-time errors are the main reported type of medication error. It was also the first reported type of error by Blignaut et al. (2017:3616). These authors' findings concur with those of this study. Al-Youssif et al. (2013:63) reported the wrong time of administration as the main reported type of non-IV medication errors as perceived by Saudi Arabian nurses. However, nurses at the University of Gondar Teaching and Referral Hospital in Ethiopia ranked these errors as the second most prevalent of non-IV medication reported errors (Bifftu et al., 2016:4), while nurses in the USA perceived it as the fourth (Hanna, 2014:47).

The wrong time of administration was perceived by respondents as the top reported error. This could be related to work overload as indicated in the causes of MAEs (inadequate staffing levels, and all medication cannot be passed within an accepted time frame), both which affect nurses' ability to perform their duties within the specified time. As indicated in the literature, adequate staff with the requisite qualifications should be provided in all departments to decrease the workload in order to perform their duties at the scheduled time and to minimise the possibility of errors (Aboshaiqah, 2014:67; Du Preez, 2016:101).

5.5.2 Omission errors

The second ranked type of reported medication errors as perceived by respondents was omission errors, with a percentage of 45.7%. This percentage is supported by other studies indicating 22% to 41% of reported omission errors (Al-Youssif et al., 2013:64; Bifftu et al., 2016:4; Blignaut et al., 2017:3616). This finding concurs with the findings of Blignaut et al. (2017:3616). Moreover, omission errors were noted by Al-Youssif et al. (2013:63), using the same instrument, as the third reported type of error. However, Hanna (2014:47) used the same instrument and ranked it as the fifth reported type of non-IV medication error, while Bifftu et al. (2016:4) ranked it as the sixth reported type among nurses in Ethiopia. Omission errors could be related to poor communication between nurse and physician. They could also be related to uncontrolled stock in the units. Therefore, improving communication between nurse and physician is important in decreasing these types of errors. Communication between nurse and pharmacist is also important, as the control of medication stock in the unit will assist in limiting these types of errors (Al-Youssif et al., 2013:68; Blignaut, 2015:263; Blignaut et al., 2017:3610).

5.5.3 Wrong dose

Wrong dose errors were the third ranked type of reported errors in the current study with 42.8% frequently reported by respondents. This percentage varied among other studies between 12% and 24% (Al-Youssif et al., 2013:64; Feleke et al., 2015:5; Bifftu et al., 2016:4; Blignaut et al., 2017:3616).

Wrong dose was reported by other studies as the most frequently reported error (Hanna, 2014:47; Truter et al., 2017:5), while it was mentioned by Al-Youssif et al. (2013:63) as the second frequently reported error. However, Bifftu et al. (2016:4) indicated that nurses in Ethiopia ranked wrong dose errors as the fourth reported type. Moreover, many factors influencing MAE occurrence noted in this study could be related to wrong dose errors. These factors are workload factors, prescription- related factors and nurses interrupted while administering medication. Another factor is that the nurses get pulled between teams and from other units, leaving their teams/units with a shortage of staff. Furthermore, the incompetence of nurses or physicians in calculating dosages might be an important reason for these errors. To combat these factors, training sessions on dose calculation will enhance the calculation competence of nurses. Interruptions during medication administration should be controlled, and staff levels should be adequate during medication administration duties. This could limit these types of errors and improve patient safety (Du Preez, 2016:99; Hill, 2016:131; Blignaut et al., 2017:3610).

5.6 Summary

In this chapter, the results of the current study were compared with the results of other national and international studies. Two items to determine the respondents' awareness of the occurrence and reporting of MAEs that occurred during their practice time were discussed in this chapter. Over 85% of the respondents indicated that they were aware of MAEs during their practice time, while over 40% indicated that they were unaware of such errors and consequently did not report them. Furthermore, the main subscales for the causes of MAE occurrence and the barriers to reporting these errors were discussed. The physician communication- related subscale was at the top of MAE occurrence subscales. The fear subscale was also the main obstacle to reporting MAEs. Moreover, items indicated by 75% or more of the respondents as causes of MAE occurrence or as barriers to reporting it, were discussed. The use of abbreviations was the first item leading to MAE occurrence, while the fear of blame was the first barrier item to reporting MAEs. Furthermore, the top three frequently reported non-IV MEs were also discussed, while the wrong-time errors were the most frequently reported type of non-IV MEs at the units where the respondents practised as part of their training.

The next chapter provides the conclusions of this study relating to perceptions of MAE occurrence among student nurses. The recommendations and limitations of this study are discussed in the final chapter, Chapter 6.

CHAPTER SIX

CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1 Introduction

The focus of Chapter 6 is to provide conclusions derived from the research findings, to describe recommendations in line with the purpose of the study, and to mention the limitations of the study. The study was conducted founded on a framework based on the conceptual underpinnings developed by Wakefield et al. (2005:476). Four main variables were set to determine nursing students' perception with regard to the occurrence and reporting of MAEs. The aim of the study was to determine the awareness and perception with regard to the occurrence and reporting of medication administration errors (MAEs) among nursing students at a higher education institution in the Western Cape province (South Africa). The conclusions and recommendations are discussed according to the objectives of the study. The first objective was to determine awareness of the occurrence and reporting of medication administration errors among undergraduate nursing students at a higher education institution in the Western Cape. The second was to determine factors related to medication administration error occurrence indicated by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where undergraduate students are placed. The third objective was to determine barriers to reporting medication administration errors as perceived by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where they are placed. The final objective was to determine the percentage of reporting the non-IV medication errors perceived by undergraduate nursing students at a higher education institution in the Western Cape in the units at the health services where undergraduate students are placed.

6.2 Conclusions

6.2.1 Demographics

The respondents in this study were undergraduate nursing students from second to fourth year of study at an HEI. Most of the respondents were female. The majority were 25 years old or younger, and most were single. The respondents provided information on their awareness of MAEs in the clinical settings where they were placed as student nurses and on their perceptions of causes of MAE occurrence, and barriers to reporting of MAE, as well as the reported frequency of non-IV medication errors.

6.2.2 Objective One: Awareness of MAE occurrence and its reporting

More than 85% of the respondents in the current study were aware of MAE occurrence. This percentage was similar across each year of study. Of the second-year respondents, 85.3% were aware of MAE occurrence during their practice time. This percentage slightly decreased (80.6%) among the third-year respondents, while the percentage slightly increased (89.8%) across the fourth-year respondents. The chi square test between awareness of MAE occurrence and year of study showed no significant difference.

Respondents were questioned about reporting of MAEs. The majority (59.9%) of respondents indicated that errors were reported. This number varied across each year of study. Whereas 55.1% of second-year respondents indicated that errors were reported, this percentage slightly increased (56.2%) across third-year respondents. Furthermore, this percentage increased significantly (69.8%) across fourth-year level respondents. The result of the chi square test showed no significant difference across years of study in reporting MAEs.

6.2.3 Objective Two: Causes of MAE occurrence

Four main subscales, which included 20 items, were used in the current study as reasons for MAE occurrence (physician communication-related, medication package-related, nurse-related, and pharmacy-related subscales) (Wakefield et al., 2005:484). Respondents' agreement with these reasons were as follows:

Firstly, all respondents agreed to three out of four mentioned subscales as causes of MAEs in the current study. The physician communication-related subscale was at the top of these subscales, followed by the medication package-related subscale and nurse- related subscale. On the other hand, most of the respondents did not agree with the pharmacy-related subscale as a cause of MAEs. Moreover, the result of one sample *t*-test reflected this fact. The first three subscales (physician communication-related, medication package-related, and nurse-related subscales) were significantly higher than the neutral level (3.5) of the six-point Likert scale which consequently reflected the fact that they are significant causes of MAE occurrence. The pharmacy-related subscale was lower than the neutral level (3.5), which reflected that this subscale was not a significant cause of MAE occurrence in the current study.

The top three reasons as indicated by the respondents in the current study were: the use of abbreviations instead of complete written orders, unclear physicians' medication orders, and many patients on the same or similar medications. Moreover, the use of abbreviations and unclear physician orders were at the top of the significant causes of MAE occurrence, while similar or the

same medication for many patients was the fifth significant cause of MAE occurrence. On the other hand, two items had the lowest percentage: pharmacy does not prepare the medication correctly, and pharmacy does not label the medication correctly. This highlights that respondents perceived that pharmacy processes that are part of medication administration were quite effective and did not contribute to many of the MAEs in the clinical settings where they spent time as part of their clinical learning.

Secondly, across the second-year respondents, the physician communication- related subscale was at the top of the subscales of MAE occurrence as indicated by more than two-thirds of the second-year respondents. The pharmacy-related subscale, however, had the lowest agreement among the second-year respondents.

The top items of MAE occurrence across the second-year respondents were as follows: many patients are on the same or similar medications, the use of abbreviations instead of writing the order completely, and nursing students are interrupted while administering medications. On the other hand, the pharmacy did not label each medication item correctly had the lowest percentage as a cause of MAE occurrence as perceived by the second-year respondents.

Thirdly, across the third-year respondents, more than two-thirds of the third-year students mentioned the physician communication-related subscale as the main cause of MAE occurrence, while the pharmacy-related subscale received the lowest percentage as a cause of MAE occurrence as perceived by the third-year respondents.

Four items were at the top of the MAE occurrence as perceived by the third-year respondents, with the same percentage (80.7%). These items were: the use of abbreviations instead of writing the order completely, physicians' medication orders are not clear, nursing students are interrupted while administering medications, and many patients are on the same or similar medications. On the other hand, the following two items received the lowest percentage as indicated by the third-year respondents as causes of MAEs. These items were pharmacy delivers incorrect doses to the unit, and pharmacy does not prepare the medication correctly.

Finally, across the fourth-year respondents, the physician communication-related subscale was the first cause of MAE occurrence as indicated by more than three- quarters of the fourth-year respondents. The pharmacy-related subscale received the lowest percentage from the fourth-year respondents as a reason for MAE occurrence.

The top items for MAE occurrence as perceived by the fourth years were physicians' medication orders are not clear, the use of abbreviations instead of writing the orders completely, physicians'

medication orders are not legible, and nurses or nursing students are interrupted while administering medications. On the other hand, the pharmacy does not label the medication correctly had the lowest percentage as a cause of MAE occurrence as indicated by the fourth-year respondents.

6.2.4 Objective Three: Barriers to reporting MAEs

Three main subscales (fear, reporting effort, and disagreement with ME definition) of the barriers to reporting the MAEs that included eleven items, were used in the current study to determine the barriers to reporting MAEs as perceived by the nursing students (Wakefield et al., 2005:484).

Firstly, across the total respondents, the fear subscale was at the top of these subscales as indicated by 82.8% of the students. The result of the one sample *t*-test showed that only the fear subscale was higher than the neutral level of the six-point Likert scale (3.5). This reflected the fact that this subscale is the only one that presents a significant barrier to reporting MAEs among the respondents.

The top three barriers as indicated by the respondents in this study were as follows: the nurses could be blamed if something happens to the patient, they fear adverse consequences, and the patient or family might develop negative attitudes towards the nursing students. Furthermore, these items were consequently at the top of the significant barriers to reporting MAEs. However, nurses do not agree with the hospital's definition of a medication error had the lowest percentage as perceived by the respondents as a barrier to reporting MAEs.

Secondly, across the second-year respondents, the first subscale was the fear subscale as indicated by more than three-quarters of the second-year respondents. The reporting effort subscale had a lower percentage as a barrier to reporting MAEs as perceived by the second-year respondents.

The top three items that presented the barriers to reporting MAEs across the second-year respondents, were fear of adverse consequences, fear of blame, and the patient or family might develop negative attitudes towards the nurses or nursing students. Nurses do not agree with the hospital's definition of a medication error had the lowest percentage as indicated by the second-year respondents as a barrier to reporting MAEs.

Thirdly, across the third-year respondents, the first subscale barrier was the fear subscale as indicated by more than 88% of the third-year respondents. Fewer than half of the third-year

respondents agreed with the subscale of the “disagree with the definition” as a barrier to reporting MAEs.

The top items of the barriers to reporting MAEs across the third-year students were: the patient or family might develop negative attitudes towards the nurses or nursing students, and the nurses or nursing students believe that other nurses will think they are incompetent if they make medication errors. These shared the first position with a percentage of 91.4%, followed by fear of blame, then nurses or nursing students are afraid the physician will reprimand them for medication errors. On the other hand, nurses do not agree with the hospital's definition of a medication error had the lowest percentage across the third-year respondents as a barrier to reporting MAEs.

Finally, across the fourth-year respondents: as for the previous two years, the fear subscale was the first barrier to reporting MAEs across the fourth-year respondents. Disagreement with the definition was indicated by half of the fourth-year respondents.

The top items regarded as barriers to reporting MAEs across the fourth-year respondents were the fear of blame, the patient or family might develop negative attitudes towards the nursing students, and the nursing students fear adverse consequences from reporting medication errors. On the other hand, as indicated by the previous two levels, nurses do not agree with the hospital's definition of a medication error was not indicated as a barrier to reporting MAEs as perceived by the fourth-year respondents.

6.2.5 Objective Four: Frequency of non-IV medication errors at the units where respondents are placed

Nine types of non-IV medication errors were mentioned in the current study to determine the frequency of their reporting at the units where the respondents were enrolled for experiential learning (Wakefield et al., 2005:480). The overall reporting percentage of non-IV medication errors in the current study was 40.3% as indicated by the respondents. The top three frequently reported non-IV medication errors were wrong time of administration (46.6%), followed by omitted medication (45.7%) and finally wrong dose (42.8%). The less frequently reported type was the wrong route (31.2%).

6.3 Recommendations

Recommendations are the critical suggestions for further studies and interventions based on the study findings (Gray et al., 2017:690). The following recommendations emanate from the study findings:

6.3.1 For practice

- The physician communication-related subscale and its items were main reasons for MAE occurrence as perceived by the respondents in the current study. Therefore, interpersonal skills and communication among nurses and physicians should be enhanced in order to discuss the reasons for MAEs openly. This would allow nurses more freedom and confidence to report such errors (Dumo, 2012:123; Aboshaiqah, 2014:67). This has further potential to eliminate the other causes, for example, nurses would then find it easier to communicate with physicians for clarity when orders are illegible, unclear or abbreviated.
- In addition, unclear and illegible physician orders were significant causes of MAE occurrence. Therefore, physicians should review their orders to eliminate such MAEs, and hospitals should act against these types of orders (Du Preez, 2016:99; Hill, 2016:138).
- The respondents also listed interruption while administering medication as a contributing factor to MAE occurrence. Therefore, interruption during medication administration should be eliminated, which could be performed by preparing medication at a no-distraction area. Also, coloured aprons should be worn or "**No-Talk**" signs should be used by nurses to alert other staff with regard to medication administration time (Feleke et al., 2015:1; Du Preez, 2016:98; Hill, 2016:132). Furthermore, the shortage of nurses should to be attended to and workloads need to be addressed to ensure that nurses who are busy administering medication are not disturbed, as other nurses will be available to attend to other patients' needs.
- With reference to inadequate staffing levels, the respondents reported these as one of the causes of MAE occurrence. Thus, staff levels should be increased. A nurse educator/supervisor should be available to nursing students during their practice time, so they will not depend on the nurses (Feleke et al., 2015; Blignaut, 2015).
- All medication cannot be passed within an accepted time frame was one of the significant causes of MAE occurrence in the current study. The wrong time of administration represented the most frequently reported errors at the units where the respondents practised. Therefore, nurses as well as nursing students should practise time management in order to administer medication at the fixed timeslot (Blignaut, 2015:263).
- The fear subscale and its related items, especially the fear of blame, were the top barriers to reporting MAEs. Therefore, healthcare institutions, nursing education institutions, and student supervisors should build a supportive, non-punitive blame-free reporting system to emphasise the value of reporting errors (Potylycki et al., 2006:370; WHO, 2011:14; Kiguba, et al., 2015:273; Blignaut, 2015:264).

- MAEs should be reported to a national reporting programme to share the experience among the healthcare workers and improve patient safety (Ojerinde & Adejumo, 2014:25).

- Electronic prescription could be used to supress the physician communication hurdles (Bates, 2010:175).

6.3.2 For nursing education institutions (NEIs)

- Students should be exposed to more simulation practice in this regard in the onsite clinical laboratories at these NEIs under the supervision of well-trained clinical mentors/supervisors (Wolf et al., 2006:49; Vaismoradi et al., 2014:437).
- Outcomes on the administration of medication should be written in a clear and concise manner for all students in their workbooks. No abbreviations should be used (Du Preez, 2016:98).
- Regular training courses and workshops with regard to MAEs should be held regularly for nursing students to improve their administration competence (Wolf et al., 2006:39; Valdez et al., 2013:222; Vaismoradi et al., 2014:437).
- In order to improve nurses' administration competence, regular training courses with regard to dose calculations should be held for nurses as well as for nursing students. This should be ongoing as part of staff development (Du Preez, 2016:99; Hill, 2016:131; Gokhul et al., 2016:1223; Blignaut et al., 2017:3610).
- Students should be allowed to practise under supervision, so the supervisor should be available during practice time as inadequate staff levels were a significant cause of MAEs in the current study (Vaismoradi et al., 2014:438).
- An assessment of the administration of medication should be done at each level to remind students of this very important aspect of their training and profession (Blignaut, 2015:265).
- Case studies should be devised to allow students to explore the seriousness of MAEs and their detrimental effects on patients in their care (Valdez et al., 2013:227).

6.3.3 For further research

- Further research with regard to intervention studies to reduce medication administration errors should be conducted and feedback should be relayed to nursing education and healthcare institutions to minimise student MAEs during their experiential training (Al-Youssif et al., 2013:68; Vaismoradi et al., 2014:438; Du Preez, 2016:100; Hill, 2016:139).
- Owing to the study limitations, further research should be conducted to include other healthcare staff, management, and patients, to investigate their role in MAE occurrence

and the reporting process in order to detect other factors contributing to these types of errors and to reduce them (Ragab Dorgham & Khamis Mohamed, 2012:4879; Du Preez 2016:99).

6.4 Limitations

The limitations of the study present the problems or restrictions of the study that may affect the generalisability of the findings to other similar populations (Gray et al., 2017:682). The noted limitations in this study are as follows:

- The HEI where this study took place, is one of three (3) HEIs that offer undergraduate nursing training in the Western Cape, with four campuses. This study was only conducted on one of its campuses, hence the results are not generalizable. However, the research was conducted at the largest campus with the most students enrolled at that institution. Furthermore, the HEI has a large number of students similar to its counterparts.
- A self-reporting method was used in this study that might introduce some bias. However, the researcher selected the largest of the four campuses that offer the undergraduate nursing programme to solicit a large number of respondents. Moreover, the target sample for the study was achieved. Furthermore, both researcher and supervisor were available during questionnaire distribution to clarify any questions from respondents.
- There may be additional reasons for MAE occurrence and barriers to reporting not noted in the study. However, the researcher used the questionnaire developed by Wakefield et al. (2005). This questionnaire tool has been used by many international and national studies. Moreover, the researcher conducted a pilot study among the nursing students to further validate the tool.
- Owing to the sensitivity of the issues related to MAEs, respondents were asked what they were aware of and their perceptions with regard to MAEs in the clinical settings where they practise as student nurses. Information on their own MAEs was not explored. This thus limits establishing how safe they are with regard to medication administration.

6.5 Summary

The conclusion, recommendations, and limitations of the study were discussed in this chapter. The study's aim and objectives as initially stated were all achieved. The occurrence, reporting and causes of MAEs, as well as barriers to and frequency of reporting, were highlighted among the total respondents, as well as across each year of study.

The researcher hopes that further interventions to combat MAEs will be embarked on to reduce these across all NEIs among nursing students. It is further hoped that these results will be published widely in order to stimulate further research, particularly at all NEIs in the Western Cape. This would allow researchers to investigate the causes of MAEs and prevent barriers that militate against student nurses reporting MAEs freely, without fear of reprisal.

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APPENDICES

Appendix A: Research Information sheet and Informed Consent

Title: Trends and reporting of medication administration errors among nursing students at a higher education institution in the Western Cape

Principal Investigator: Yousef Ahmed M Abu-saksaka

E-mail: 216152232@cput.ac.za

abosiksaka@gmail.com

Address:

7A Mount View

Agulhas

Loevenstein, Bellville 7530

South Africa

Contact Number: +27715682297

Co-investigator/supervisor: Dr Hilda Vember

E-Mail: vemberh@cput.ac.za

Tel: 021 959 6183

Department of Nursing

Faculty of Health and Wellness Sciences

Cape Peninsula University of Technology

Dear Participant

I am a postgraduate student at the Cape Peninsula University of Technology (CPUT). I am writing to invite you to take part in a study to determine the perceived of occurrence and reporting of medication administration errors among nursing students in training at CPUT. Kindly spend a few minutes to read the information given here, which will describe the details of this project. You can ask me any questions about this project that you do not fully understand. It is very important that you are fully satisfied and that you clearly understand what this research involves and how you could be involved. Also, your participation is entirely voluntary, and you are free to decline to participate. There will not be any negative effects should you decline. You are also free to withdraw from the study at any point, even if you do initially agree to take part.

This study has been approved by the Research Ethics Committee of the Faculty of Health and Wellness Sciences at CPUT and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki.

What this research study is about

The aim of the study is to determine the awareness and perception of the occurrence and reporting of medication administration errors (MAEs) among nursing students at a higher education institution in the Western Cape province (South Africa). This will be performed by determining their awareness in respect of the occurrence and reporting of these errors, the factors related to MAE occurrence, the barriers to reporting these errors, and the percentage of reporting the non-IV MAEs in the units at the health services where undergraduate students are placed.

Why you have been invited to participate

The last defence lines against medication administration errors are nurses and nursing students. Medication administration errors affect the patient's safety and may lead to patient disability or death and also increase the cost of the healthcare service. Your participation will assist in assessing the occurrence and reporting of medication administration errors among nursing students, which will help to improve patient safety as well as the healthcare service, and also improve the curricula of higher education institutions (HEIs) with regard to patient safety and prevention of medication administration errors.

What your responsibilities will be

You will be asked to complete a questionnaire which will take no longer than 10 to 15 minutes.

Will you benefit from taking part in this research?

The results of this study could assist health authorities in formulating new guidelines to protect students from making errors in administering medication, improve students' skills in administering medication, while students' concerns regarding medication administration errors would be addressed. More practical measures could also be put in place to assist students to deal with this issue.

Are there any risks involved in my taking part in this research?

No obvious risks are anticipated by your participating in this study. Your name, contact details and identities will be confidential. Some of the questions may cause emotional discomfort to you. However, in case you are emotionally distressed, you will be offered referral to the counselling unit at the University for counselling and support. In Bellville, the counselling unit is located on the ground floor of the library extension building and the contact details are: +27 21 959 6182.

Will you be paid to take part in this study and are there any costs involved?

There is no financial reward in participating in this study and no direct cost to you.

DECLARATION BY PARTICIPANT:

I declare that:

I have read this information and consent form and that it is written in a language in which I am fluent and comfortable with.

I have had a chance to ask questions and all my questions have been sufficiently answered.

I understand that taking part in this study is voluntary and I have not been forced to take part.

I may choose to withdraw from the study at any time and will not be penalised or prejudiced in any way.

I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan as agreed to.

I also consent that my information may be:

- used and kept for future research studies ☐

☐

- used and discarded

Signed at (place) .....…..……...…….. On (date) …..……...…..……. 201…

Signature of participant----------Signature of witness----------

Code number…….

DECLARATION BY THE INVESTIGATOR

I, Yousef Ahmed M Abu-saksaka declare that the information in this document has been explained to

(Name of participant) ……..…

I encouraged her/him to ask questions and provided adequate time to answer them.

I am satisfied that she/he adequately understand all aspects of the research, as discussed above.

Signed at (place) .....…….....….. On (date) ….……..…..…..……. 201..

Signature of investigator ……Signature of witness ……

Appendix B: Questionnaire

This questionnaire was developed by Dr Bonnie Wakefield, and it has been validated through previous studies which used this questionnaire as is or used only a part of it (Wakefield et al., 2005; Koohestani & Baghcheghi, 2009; Al-Youssif et al., 2013; Aboshaiqah, 2014; Hanna, 2014; Blignaut, 2015; Bifftu et al., 2016). Permission was granted from the developer, Dr Bonnie Wakefield, of the Sinclair School of Nursing at the University of Missouri (refer to Appendix C).

The purpose of this questionnaire is to determine the trends and reporting of medication administration errors among nursing students at a higher education institution in the Western Cape (South Africa).

Code number……..

A. Demographic data:

1. Age: ……...
2. Gender: please tick ☑

   ☐ Male ☐ Female

3. Marital status: please tick ☑
   - ☐ Single
   - ☐ Married
   - ☐ Divorced
   - ☐ Other
4. Year of study: please tick ☑
   - ☐ Second year
   - ☐ Third year
   - ☐ Fourth year

B. Occurrence and reporting of medication administration errors:

5. Are you aware of any medication administration errors in the health services where you are placed? Please tick ☑

☐ Yes ☐ No

6. Are the medication administration errors reported? please tick ☑

☐ Yes ☐No

C. Reasons why medication administration errors occur in the unit where students are placed. Please circle the number that best reflects the extent to which you agree that the following reasons contribute to <u>why medication errors occur in your unit.</u>

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
7. The names of many medications are similar.	1	2	3	4	5	6
8. Different medications look alike.	1	2	3	4	5	6
9. The packaging of many medications is similar.	1	2	3	4	5	6
10. Physicians' medication orders are not legible.	1	2	3	4	5	6
11. Physicians' medication orders are not clear.	1	2	3	4	5	6
12. Physicians change orders frequently.	1	2	3	4	5	6
13. Abbreviations are used instead of writing the orders out in full.	1	2	3	4	5	6
14. Verbal orders are used instead of written orders.	1	2	3	4	5	6
15. Pharmacy delivers incorrect doses to this unit.	1	2	3	4	5	6
16. Pharmacy does not prepare the medication correctly.	1	2	3	4	5	6
17. Pharmacy does not label the medication correctly.	1	2	3	4	5	6
18. Poor communication between nurses and physicians or between the nursing student and supervisor.	1	2	3	4	5	6
19. Many patients are on the same or similar medications.	1	2	3	4	5	6
20. In this unit, there is no easy way to look up information on medications.	1	2	3	4	5	6
21. Nurses or nursing students get pulled between teams and from other units.	1	2	3	4	5	6
22. Nurses or nursing students do not adhere to the approved medication administration	1	2	3	4	5	6

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
procedure.						
23. Nurses or nursing students are interrupted while administering medications to perform other duties.	1	2	3	4	5	6
24. Unit staffing levels are inadequate.	1	2	3	4	5	6
25. All medications for one cohort of patients cannot be passed within an acceptable time frame.	1	2	3	4	5	6
26. Nurse or nursing student is unaware of a known allergy.	1	2	3	4	5	6

D. Reasons why medication administration errors are not reported in the unit where students are placed. Please circle the number that best reflects the extent to which you agree that the following reasons contribute to <u>why errors are not reported in your unit</u>.

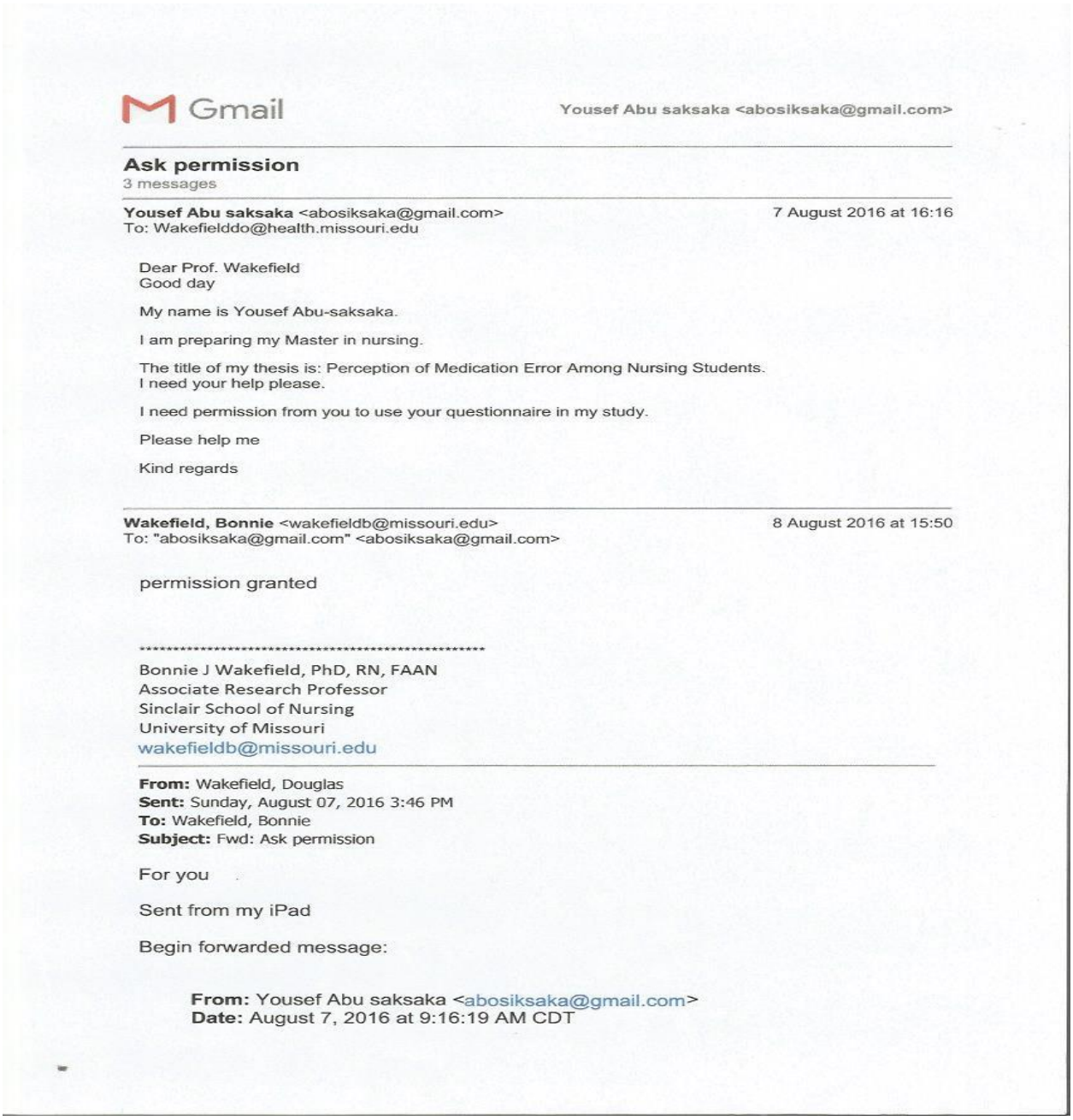
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
27. Nurses do not agree with hospital's definition of a medication error.	1	2	3	4	5	6
28. Nurses or nursing students do not recognise an error occurred.	1	2	3	4	5	6
29. Filling out an incident report for a medication error takes too much time.	1	2	3	4	5	6
30. Contacting the physician about a medication error takes too much time.	1	2	3	4	5	6
31. Medication error is not clearly defined.	1	2	3	4	5	6
32. Nurses or nursing students may not think the error is important enough to be reported.	1	2	3	4	5	6
33. Nurses or nursing students believe that other nurses will think they are incompetent if they make medication errors.	1	2	3	4	5	6
34. The patient or family might develop a negative attitude towards the nurses or nursing student or may sue the them if a medication error is reported.	1	2	3	4	5	6
35. Nurses or nursing students are afraid the physician will reprimand them for the medication error.	1	2	3	4	5	6
36. Nurses or nursing students fear adverse consequences from reporting medication errors.	1	2	3	4	5	6
37. Nurses or nursing students could be blamed if something happens to the patient as a result of the medication error.	1	2	3	4	5	6

E. Percentage of each type of error reported in the unit where students are placed. Based on your experience, please circle the number that best represents <u>what percentage of each type of medication error you believe is actually reported in your unit</u>.

Types of Non-IV Medication Errors	Percentage Reported									
	0–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–99	100
38. Wrong route of administration.	1	2	3	4	5	6	7	8	9	10
39. Wrong time of administration.	1	2	3	4	5	6	7	8	9	10
40. Wrong patient.	1	2	3	4	5	6	7	8	9	10
41. Wrong dose.	1	2	3	4	5	6	7	8	9	10
42. Wrong drug.	1	2	3	4	5	6	7	8	9	10
43. Medication is omitted.	1	2	3	4	5	6	7	8	9	10
44. Medication is given but has not been ordered by the physician.	1	2	3	4	5	6	7	8	9	10
45. Medication administered after the order to discontinue has been written.	1	2	3	4	5	6	7	8	9	10
46. Given to patient with a known allergy.	1	2	3	4	5	6	7	8	9	10

Thank you again for your participation in this questionnaire.

Appendix C: Application for permission to use questionnaire



Gmail — Yousef Abu saksaka <abosiksaka@gmail.com>

Ask permission
3 messages

Yousef Abu saksaka <abosiksaka@gmail.com> — 7 August 2016 at 16:16
To: Wakefielddo@health.missouri.edu

Dear Prof. Wakefield
Good day

My name is Yousef Abu-saksaka.

I am preparing my Master in nursing.

The title of my thesis is: Perception of Medication Error Among Nursing Students.
I need your help please.

I need permission from you to use your questionnaire in my study.

Please help me

Kind regards

Wakefield, Bonnie <wakefieldb@missouri.edu> — 8 August 2016 at 15:50
To: "abosiksaka@gmail.com" <abosiksaka@gmail.com>

permission granted

****
Bonnie J Wakefield, PhD, RN, FAAN
Associate Research Professor
Sinclair School of Nursing
University of Missouri
wakefieldb@missouri.edu

From: Wakefield, Douglas
Sent: Sunday, August 07, 2016 3:46 PM
To: Wakefield, Bonnie
Subject: Fwd: Ask permission

For you

Sent from my iPad

Begin forwarded message:

From: Yousef Abu saksaka <abosiksaka@gmail.com>
Date: August 7, 2016 at 9:16:19 AM CDT

Per your request, this document contains a copy of the Medication Administration Error Reporting Survey. This survey was designed to assess nurses' perceptions of why medication errors occur, why they are not reported, and the extent to which medication errors are reported.

I have included a bibliography outlining our publications in the area of medication administration error reporting; we hope to publish a manuscript in the upcoming months detailing the psychometric properties of the survey. Publication #2 below discusses some preliminary work we conducted with pharmacists. We have not addressed physicians' perceptions of medication errors.

1. Wakefield, B., Blegen, M., Uden-Holman, T., Vaughn, T., Chrischilles, E., & Wakefield, D. (2001). Organizational culture, continuous quality improvement and medication administration error reporting. American Journal of Medical Quality, 16(4), 128-134..
2. Wakefield, B., Wakefield, D.S., & Uden-Holman, T. (2000). Improving medication administration error reporting systems. Ambulatory Outreach, Spring, 16-20.
3. Wakefield, D., Wakefield, B., Borders, T., Uden-Holman, T., Blegen, M., & Vaughn, T. (1999). Understanding and comparing differences in reported medication administration error rates. American Journal of Medical Quality, 14(2), 73-80.
4. Wakefield, D., Wakefield, B., Uden-Holman, T., Borders, T., Blegen, M., & Vaughn, T. (1999). Understanding why medication administration errors may not be reported. American Journal of Medical Quality, 14(2), 81-88.
5. Wakefield, B., Wakefield, D.S., Uden-Holman, T., & Blegen, M.A. (1998). Nurses perceptions of why medication administration errors occur. MedSurg Nursing. 7(1), 39-44.
6. Wakefield, B., Blegen, M., Uden-Holman, T., Vaughn, T., Chrischilles, E., & Wakefield, D. (1998). Organizational Culture and Medication Error Reporting, Annenberg II: Enhancing Patient Safety and Reducing Errors in Health Care Proceedings, Rancho Mirage, California.
7. Wakefield, D.S., Wakefield, B., Uden-Holman, T., & Blegen, M.A. (1996). Perceived barriers in reporting medication administration errors. Best Practices and Benchmarking in Healthcare, 1(4), 191-197.

Appendix D: Permission for the study from the Research Ethics Committee

Cape Peninsula University of Technology

HEALTH AND WELLNESS SCIENCES RESEARCH ETHICS COMMITTEE (HW-REC)
Registration Number NHREC: REC- 230408-014

P.O. Box 1906 • Bellville 7535 South Africa
Symphony Road Bellville 7535
Tel: +27 21 959 6917
Email: sethn@cput.ac.za

26 July 2018
REC Approval Reference No:
CPUT/HW-REC 2016/H23(renewal)

Faculty of Health and Wellness Sciences – Nursing

Dear Mr Yousef Abu-saksaka

Re: APPLICATION TO THE HW-REC FOR ETHICS CLEARANCE

Approval was granted by the Health and Wellness Sciences-REC on 15 September 2016 to Mr Abu-saksaka for ethical clearance. This approval is for research activities related to student research in the Department of Nursing at this Institution.

TITLE: Trends and reporting of medication administration errors amongst nursing students at a higher education institution in the Western Cape

Supervisor: Dr Vember

Comment:

Data collection permission is required and has been obtained.

Approval will not extend beyond 27 July 2019. An extension should be applied for 6 weeks before this expiry date should data collection and use/analysis of data, information and/or samples for this study continue beyond this date.

The investigator(s) should understand the ethical conditions under which they are authorized to carry out this study and they should be compliant to these conditions. It is required that the investigator(s) complete an **annual progress report** that should be submitted to the HWS-REC in December of that particular year, for the HWS-REC to be kept informed of the progress and of any problems you may have encountered.

Kind Regards

Mr. Navindhra Naidoo
Chairperson – Research Ethics Committee
Faculty of Health and Wellness Sciences

Appendix E: Permission from deputy director to conduct the research at Western Cape College of Nursing (WCCN)

Western Cape Government
Health

DIRECTORATE: WESTERN CAPE COLLEGE OF NURSING
Teresa.bock@westerncape.gov.za
Enquiries: Dr T M Bock
Tel: 021 940 4567
Date: 2016/06/08

Mr. Yousef Ahmed Abu-Saksaka.

Student number: 216152232

CPUT

RE: Request to conduct research at WCCN:

Your research titled: "Trends and reporting of Medication Administration Errors amongst Nursing Students at a Higher Education Institution in the Western Cape", refers.

As per request from CPUT this letter serves as an endorsement of your proposed research, on the proviso that you continue to follow the Provincial Government prescripts for application to perform research in a Provincial Government Department of Health Institution. This entails uploading your research application and proof of ethical approval to the National health Research Database on the following web site http://nhrd.hst.org.za

The NHRD will issue you with the necessary permission to approach the Western Cape College of Nursing for the purpose of data collection

Sincerely

TM Bock
Deputy Director: Head of Campus WCCN: Metro East
HOD Psychiatry
Acting Chair WCCN Research Ethics Committee

Pone: 021 648 1202: 021 638 6899 (fax)
Klipfontein Road, Surwell, Athlone 7764

Appendix F: Causes of MAE occurrence among the total respondents

Item No.	Strongly Disagree		Moderately Disagree		Slightly Disagree		Slightly Agree		Moderately Agree		Strongly Agree		Total disagree		Total agree	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
7	47	16.2	42	14.5	40	13.8	79	27.2	45	15.5	37	12.8	129	44.5	161	55.5
8	35	12.0	34	11.7	26	8.9	68	23.4	61	21.0	67	23.0	95	32.7	196	67.3
9	39	13.5	36	12.5	43	14.9	63	21.8	54	18.7	54	18.7	118	40.8	171	59.2
10	22	7.6	20	6.9	28	9.7	37	12.8	43	14.9	139	48.1	70	24.2	219	75.8
11	20	6.9	14	4.8	23	7.9	52	17.9	62	21.3	120	41.2	57	19.6	234	80.4
12	22	7.6	29	10.0	57	19.7	81	27.9	55	19.0	46	15.9	108	37.2	182	62.8
13	19	6.5	14	4.8	21	7.2	38	13.1	44	15.1	155	53.3	54	18.6	237	81.4
14	89	30.7	42	14.5	44	15.2	55	19.0	25	8.6	35	12.1	175	60.3	115	39.7
15	158	54.5	54	18.6	45	15.5	21	7.2	6	2.1	6	2.1	257	88.6	33	11.4
16	174	59.8	62	21.3	34	11.7	11	3.8	4	1.4	6	2.1	270	92.8	21	7.2
17	184	63.4	52	17.9	33	11.4	12	4.1	3	1.0	6	2.1	269	92.8	21	7.24
18	19	6.5	16	5.5	36	12.4	82	28.2	57	19.6	81	27.8	71	24.4	220	75.6
19	15	5.2	22	7.6	23	7.9	58	19.9	85	29.2	88	30.2	60	20.6	231	79.4
20	59	20.3	45	15.5	46	15.8	56	19.2	32	11.0	53	18.2	150	51.5	141	48.5
21	35	12.1	39	13.5	43	14.9	59	20.4	46	15.9	67	23.2	117	40.5	172	59.5
22	78	26.9	39	13.4	55	19.0	50	17.2	38	13.1	30	10.3	172	59.3	118	40.7
23	24	8.2	20	6.9	17	5.8	43	14.8	62	21.3	125	43.0	61	20.9	230	79.1
24	23	7.9	23	7.9	46	15.9	56	19.3	52	17.9	90	31.0	92	31.7	198	68.3
25	34	11.7	23	7.9	49	16.9	65	22.4	45	15.5	74	25.5	106	36.5	184	63.5
26	77	26.5	43	14.8	42	14.4	53	18.2	30	10.3	46	15.8	162	55.7	129	44.3

➞ Medication package ➞ Physician communication ➞ Pharmacy related ➞ Nurse related

Appendix G: Causes of MAE occurrence across each year of study

Item No.	Year of study	Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree	Total disagree	Total agree
		n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
7	2nd	24 (21.8%)	18 (16.4%)	16 (14.5%)	24 (21.8%)	20 (18.2%)	8 (7.3%)	58 (52.7%)	52 (47.3%)
7	3rd	12 (13.0%)	10 (10.9%)	17 (18.5%)	30 (32.6%)	12 (13.0%)	11 (12.0%)	39 (42.4%)	53 (57.6%)
7	4th	11 (12.5%)	14 (15.9%)	7 (8.0%)	25 (28.4%)	13 (14.8%)	18 (20.5%)	32 (36.4%)	56 (63.6%)
8	2nd	13 (11.8%)	17 (15.5%)	13 (11.8%)	21 (19.1%)	22 (20.0%)	24 (21.8%)	43 (39.1%)	67 (60.9%)
8	3rd	13 (14.0%)	6 (6.5%)	7 (7.5%)	19 (20.4%)	30 (32.3%)	18 (19.4%)	26 (27.9%)	67 (72.1%)
8	4th	9 (10.2%)	11 (12.5%)	6 (6.8%)	28 (31.8%)	9 (10.2%)	25 (28.4%)	26 (29.5%)	62 (70.5%)
9	2nd	17 (15.5%)	13 (11.8%)	18 (16.4%)	24 (21.8%)	15 (13.6%)	23 (20.9%)	48 (43.7%)	62 (56.4%)
9	3rd	14 (15.2%)	9 (9.8%)	11 (12.0%)	21 (22.8%)	23 (25.0%)	14 (15.2%)	34 (36.9%)	58 (63.1%)
9	4th	8 (9.2%)	14 (16.1%)	14 (16.1%)	18 (20.7%)	16 (18.4%)	17 (19.5%)	36 (41.4%)	51 (58.6%)
10	2nd	10 (9.2%)	9 (8.3%)	17 (15.6%)	16 (14.7%)	15 (13.8%)	42 (38.5%)	36 (33.1%)	73 (66.9%)
10	3rd	8 (8.7%)	7 (7.6%)	5 (5.4%)	15 (16.3%)	14 (15.2%)	43 (46.7%)	20 (21.7%)	72 (78.3%)
10	4th	4 (4.5%)	4 (4.5%)	6 (6.8%)	6 (6.8%)	14 (15.9%)	54 (61.4%)	14 (15.9%)	74 (84.1%)
11	2nd	9 (8.2%)	10 (9.1%)	11 (10.0%)	16 (14.5%)	25 (22.7%)	39 (35.5%)	30 (27.3%)	80 (72.7%)
11	3rd	7 (7.5%)	4 (4.3%)	7 (7.5%)	18 (19.4%)	23 (24.7%)	34 (36.6%)	18 (19.4%)	75 (80.6%)
11	4th	4 (4.5%)	0 (0.0%)	5 (5.7%)	18 (20.5%)	14 (15.9%)	47 (53.4%)	9 (10.2%)	79 (89.8%)
12	2nd	10 (9.2%)	15 (13.8%)	20 (18.3%)	34 (31.2%)	20 (18.3%)	10 (9.2%)	45 (41.3%)	64 (58.7%)
12	3rd	7 (7.5%)	7 (7.5%)	22 (23.7%)	25 (26.9%)	18 (19.4%)	14 (15.1%)	36 (38.7%)	57 (61.3%)
12	4th	5 (5.7%)	7 (8.0%)	15 (17.0%)	22 (25.0%)	17 (19.3%)	22 (25.0%)	27 (30.7%)	61 (69.3%)
13	2nd	12 (10.9%)	6 (5.5%)	6 (5.5%)	16 (14.5%)	14 (12.7%)	56 (50.9%)	24 (21.8%)	86 (78.2%)
13	3rd	4 (4.3%)	4 (4.3%)	10 (10.8%)	13 (14.0%)	17 (18.3%)	45 (48.4%)	18 (19.3%)	75 (80.7%)
13	4th	3 (3.4%)	4 (4.5%)	5 (5.7%)	9 (10.2%)	13 (14.8%)	54 (61.4%)	12 (13.6%)	76 (86.4%)
14	2nd	39 (35.8%)	10 (9.2%)	12 (11.0%)	23 (21.1%)	13 (11.9%)	12 (11.0%)	61 (55.9%)	48 (44.1%)
14	3rd	29 (31.2%)	17 (18.3%)	18 (19.4%)	13 (14.0%)	7 (7.5%)	9 (9.7%)	64 (68.8%)	29 (31.2%)
14	4th	21 (23.9%)	15 (17.0%)	14 (15.9%)	19 (21.6%)	5 (5.7%)	14 (15.9%)	50 (56.8%)	38 (43.2%)

Item No.	Year of study	Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree	Total disagree	Total agree
		n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
15	2nd	65 (59.6%)	20 (18.3%)	13 (11.9%)	8 (7.3%)	1 (0.9%)	2 (1.8%)	98 (89.9%)	11 (10.1%)
15	3rd	51 (54.8%)	19 (20.4%)	17 (18.3%)	3 (3.2%)	1 (1.1%)	2 (2.2%)	87 (93.5%)	6 (6.5%)
15	4th	42 (47.7%)	15 (17.0%)	15 (17.0%)	10 (11.4%)	4 (4.5%)	2 (2.3%)	72 (81.8%)	16 (18.2%)
16	2nd	74 (67.3%)	22 (20.0%)	8 (7.3%)	3 (2.7%)	1 (0.9%)	2 (1.8%)	104 (94.5%)	6 (5.5%)
16	3rd	52 (55.9%)	20 (21.5%)	15 (16.1%)	3 (3.2%)	1 (1.1%)	2 (2.2%)	87 (93.5%)	6 (6.5%)
16	4th	48 (54.5%)	20 (22.7%)	11 (12.5%)	5 (5.7%)	2 (2.3%)	2 (2.3%)	79 (89.8%)	9 (10.2%)
17	2nd	72 (65.5%)	20 (18.2%)	13 (11.8%)	1 (0.9%)	2 (1.8%)	2 (1.8%)	105 (95.5%)	5 (4.5%)
17	3rd	59 (64.1%)	13 (14.1%)	12 (13.0%)	4 (4.3%)	1 (1.1%)	3 (3.3%)	84 (91.30%)	8 (8.70%)
17	4th	53 (60.2%)	19 (21.6%)	8 (9.1%)	7 (8.0%)	0 (0.0%)	1 (1.1%)	80 (90.9%)	8 (9.1%)
18	2nd	10 (9.1%)	4 (3.6%)	18 (16.4%)	40 (36.4%)	17 (15.5%)	21 (19.1%)	32 (29.1%)	78 (70.9%)
18	3rd	6 (6.5%)	8 (8.6%)	10 (10.8%)	24 (25.8%)	24 (25.8%)	21 (22.6%)	24 (25.8%)	69 (74.2%)
18	4th	3 (3.4%)	4 (4.5%)	8 (9.1%)	18 (20.5%)	16 (18.2%)	39 (44.3%)	15 (17.1%)	73 (82.9%)
19	2nd	5 (4.5%)	7 (6.4%)	10 (9.1%)	22 (20.0%)	29 (26.4%)	37 (33.6%)	22 (20.0%)	88 (80.0%)
19	3rd	3 (3.2%)	6 (6.5%)	9 (9.7%)	19 (20.4%)	30 (32.3%)	26 (28.0%)	18 (19.3%)	75 (80.7%)
19	4th	7 (8.0%)	9 (10.2%)	4 (4.5%)	17 (19.3%)	26 (29.5%)	25 (28.4%)	20 (22.7%)	68 (77.3%)
20	2nd	27 (24.5%)	17 (15.5%)	27 (24.5%)	14 (12.7%)	11 (10.0%)	14 (12.7%)	71 (64.5%)	39 (35.5%)
20	3rd	15 (16.1%)	21 (22.6%)	8 (8.6%)	20 (21.5%)	10 (10.8%)	19 (20.4%)	44 (47.3%)	49 (52.7%)
20	4th	17 (19.3%)	7 (8.0%)	11 (12.5%)	22 (25.0%)	11 (12.5%)	20 (22.7%)	35 (39.8%)	53 (60.2%)
21	2nd	12 (11.0%)	14 (12.8%)	15 (13.8%)	30 (27.5%)	16 (14.7%)	22 (20.2%)	41 (37.6%)	68 (62.4%)
21	3rd	9 (9.7%)	19 (20.4%)	13 (14.0%)	19 (20.4%)	13 (14.0%)	20 (21.5%)	41 (44.1%)	52 (55.9%)
21	4th	14(16.1%)	6 (6.9%)	15 (17.2%)	10 (11.5%)	17 (19.5%)	25 (28.7%)	35 (40.2%)	52 (59.8%)
22	2nd	38 (34.9%)	13 (11.9%)	18 (16.5%)	20 (18.3%)	13 (11.9%)	7 (6.4%)	69 (63.3%)	40 (36.7%)
22	3rd	21 (22.6%)	15 (16.1%)	16 (17.2%)	13 (14.0%)	12 (12.9%)	16 (17.2%)	52 (55.9%)	41 (44.1%)
22	4th	19 (21.6%)	11 (12.5%)	21 (23.9%)	17 (19.3%)	13 (14.8%)	7 (8.0%)	51 (57.9%)	37 (42.1%)

Item No.	Year of study	Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree	Total disagree	Total agree
		n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
23	2nd	14 (12.7%)	6 (5.5%)	9 (8.2%)	15 (13.6%)	20 (18.2%)	46 (41.8%)	29 (26.4%)	81 (73.6%)
23	3rd	7 (7.5%)	7 (7.5%)	4 (4.3%)	15 (16.1%)	25 (26.9%)	35 (37.6%)	18 (19.3%)	75 (80.7%)
23	4th	3 (3.4%)	7 (8.0%)	4 (4.5%)	13 (14.8%)	17 (19.3%)	44 (50.0%)	14 (15.9%)	74 (84.1%)
24	2nd	15 (13.6%)	12 (10.9%)	16 (14.5%)	21 (19.1%)	20 (18.2%)	26 (23.6%)	43 (39.1%)	67 (60.9%)
24	3rd	3 (3.3%)	8 (8.7%)	15 (16.3%)	18 (19.6%)	19 (20.7%)	29 (31.5%)	26 (28.3%)	66 (71.7%)
24	4th	5 (5.7%)	3 (3.4%)	15 (17.0%)	17 (19.3%)	13 (14.8%)	35 (39.8%)	23 (26.1%)	65 (73.9%)
25	2nd	18 (16.5%)	12 (11.0%)	20 (18.3%)	22 (20.2%)	15 (13.8%)	22 (20.2%)	50 (45.9%)	59 (54.1%)
25	3rd	10 (10.8%)	4 (4.3%)	16 (17.2%)	24 (25.8%)	18 (19.4%)	21 (22.6%)	30 (32.3%)	63 (67.7%)
25	4th	6 (6.8%)	7 (8.0%)	13 (14.8%)	19 (21.6%)	12 (13.6%)	31 (35.2%)	26 (29.5%)	62 (70.5%)
26	2nd	38 (34.5%)	14 (12.7%)	14 (12.7%)	15 (13.6%)	12 (10.9%)	17 (15.5%)	66 (60.0%)	44 (40.0%)
26	3rd	18 (19.4%)	15 (16.1%)	14 (15.1%)	16 (17.2%)	12 (12.9%)	18 (19.4%)	47 (50.5%)	46 (49.5%)
26	4th	21 (23.9%)	14 (15.9%)	14 (15.9%)	22 (25.0%)	6 (6.8%)	11 (12.5%)	49 (55.7%)	39 (44.3%)

➞ Medication package ➞ Physician communication ➞ Pharmacy related ➞ Nurse related

Appendix H: The result of one-sample *t*-test with regard to the causes of MAE occurrence

One-Sample Test

Test Value = 3.5

		Mean	Std Deviation	Std Error Mean	*t*	95% Confidence Interval of the Difference df	Sig. (2-tailed)
7	The names of many medications are similar	3.50	1.611	0.095	-.036	289	0.971
8	Different medications look alike	3.99	1.667	0.098	4.976	290	0.000
9	The packaging of many medications is similar	3.76	1.657	0.097	2.644	288	0.009
10	Physicians' medication orders are not legible	4.65	1.650	0.097	11.819	288	0.000
11	Physicians' medication orders are not clear	4.67	1.514	0.089	13.151	289	0.000
12	Physicians change orders frequently	3.88	1.448	0.085	4.501	289	0.000
13	Abbreviations are used instead of writing the orders out completely	4.85	1.554	0.091	14.840	290	0.000
14	Verbal orders are used instead of written orders	2.97	1.733	0.102	-5.253	289	0.000
15	Pharmacy delivers incorrect doses to this unit	1.90	1.226	0.072	-22.232	289	0.000
16	Pharmacy does not prepare the medication correctly	1.72	1.116	0.065	-27.247	290	0.000
17	Pharmacy does not label the medication correctly	1.68	1.112	0.065	-27.929	289	0.000
18	Poor communication between nurses and physicians or between the nursing student and the supervisor	4.32	1.464	0.086	9.589	290	0.000
19	Many patients are on the same or similar medications	4.51	1.446	0.085	11.936	290	0.000
20	In this unit, there is no easy way to look up information on medications	3.40	1.758	0.103	-.984	290	0.326
21	Nurses or nursing students get pulled between teams and from other units	3.84	1.688	0.099	3.432	288	0.001

One-Sample Test

	Test Value = 3.5					
					95% Confidence Interval of the Difference	
	Mean	Std Deviation	Std Error Mean	*t*	df	Sig. (2-tailed)
22 Nurses or nursing students do not adhere to the approved medication administration procedure	3.07	1.686	0.099	-4.319	289	0.000
23 Nurses or nursing students are interrupted while administering medications to perform other duties	4.63	1.619	0.095	11.896	290	0.000
24 Unit staffing levels are inadequate.	4.24	1.600	0.094	7.929	289	0.000
25 All medications for one cohort of patients cannot be passed within an accepted time frame	3.99	1.651	0.097	5.014	289	0.000
26 Nurse or the nursing student is unaware of a known allergy	3.19	1.789	0.105	-2.999	290	0.003

Appendix I: Barriers to reporting MAEs among the total of the respondents

Item No	Strongly Disagree		Moderately Disagree		Slightly Disagree		Slightly Agree		Moderately Agree		Strongly Agree		Total disagree		Total agree	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
27	105	36.3	49	17.0	56	19.4	47	16.3	21	7.3	11	3.8	210	72.7	79	27.3
28	74	25.4	45	15.5	36	12.4	61	21.0	49	16.8	26	8.9	155	53.3	136	46.7
29	51	17.5	30	10.3	40	13.7	53	18.2	42	14.4	75	25.8	121	41.6	170	58.4
30	71	24.5	30	10.3	46	15.9	54	18.6	39	13.4	50	17.2	147	50.7	143	49.3
31	62	21.4	32	11.0	46	15.9	59	20.3	43	14.8	48	16.6	140	48.3	150	51.7
32	66	22.7	29	10.0	23	7.9	43	14.8	58	19.9	72	24.7	118	40.5	173	59.5
33	26	9.0	15	5.2	12	4.2	47	16.3	38	13.1	151	52.2	53	18.3	236	81.7
34	22	7.6	15	5.2	15	5.2	39	13.4	56	19.3	143	49.3	52	17.9	238	82.1
35	15	5.2	20	6.9	24	8.3	55	19.0	61	21.0	115	39.7	59	20.3	231	79.7
36	17	5.8	13	4.5	13	4.5	54	18.6	49	16.8	145	49.8	43	14.8	248	85.2
37	21	7.2	7	2.4	12	4.1	28	9.6	41	14.1	182	62.5	40	13.7	251	86.3

➞ Disagree with MEs definition **➞ Reporting effort** **➞ Fear**

Appendix J: Barriers to reporting MAEs across each year of study

Item No	Year of study	Strongly Disagree *n* (%)	Moderately Disagree *n* (%)	Slightly Disagree *n* (%)	Slightly Agree *n* (%)	Moderately Agree *n* (%)	Strongly Agree *n* (%)	Total Disagree *n* (%)	Total Agree *n* (%)
27	2nd	47 (43.1%)	16 (14.7%)	20 (18.3%)	18 (16.5%)	6 (5.5%)	2 (1.8%)	83 (76.2%)	26 (23.8%)
27	3rd	33 (35.9%)	18 (19.6%)	20 (21.7%)	10 (10.9%)	6 (6.5%)	5 (5.4%)	71 (77.2%)	21 (22.8%)
27	4th	25 (28.4%)	15 (17.0%)	16 (18.2%)	19 (21.6%)	9 (10.2%)	4 (4.5%)	56 (63.6%)	32 (36.4%)
28	2nd	36 (32.7%)	20 (18.2%)	15 (13.6%)	23 (20.9%)	10 (9.1%)	6 (5.5%)	71 (64.5%)	39 (35.5%)
28	3rd	21 (22.6%)	11 (11.8%)	16 (17.2%)	19 (20.4%)	20 (21.5%)	6 (6.5%)	38 (45.8%)	45 (54.2%)
28	4th	17 (19.3%)	14 (15.9%)	5 (5.7%)	19 (21.6%)	19 (21.6%)	14 (15.9%)	36 (40.9%)	52 (59.1%)
29	2nd	24 (21.8%)	22 (20.0%)	17 (15.5%)	17 (15.5%)	8 (7.3%)	22 (20.0%)	63 (57.3%)	47 (42.7%)
29	3rd	18 (19.4%)	4 (4.3%)	15 (16.1%)	15 (16.1%)	18 (19.4%)	23 (24.7%)	37 (39.8%)	56 (60.2%)
29	4th	9 (10.2%)	4 (4.5%)	8 (9.1%)	21 (23.9%)	16 (18.2%)	30 (34.1%)	21 (23.9%)	67 (76.1%)
30	2nd	39 (35.5%)	12 (10.9%)	20 (18.2%)	11 (10.0%)	12 (10.9%)	16 (14.5%)	71 (64.5%)	39 (35.5%)
30	3rd	16 (17.2%)	14 (15.1%)	13 (14.0%)	23 (24.7%)	14 (15.1%)	13 (14.0%)	43 (46.2%)	50 (53.8%)
30	4th	16 (18.4%)	4 (4.6%)	13 (14.9%)	20 (23.0%)	13 (14.9%)	21 (24.1%)	33 (37.9%)	54 (62.1%)
31	2nd	26 (23.9%)	14 (12.8%)	18 (16.5%)	20 (18.3%)	18 (16.5%)	13 (11.9%)	58 (53.2%)	51 (46.8%)
31	3rd	20 (21.5%)	10 (10.8%)	16 (17.2%)	18 (19.4%)	14 (15.1%)	15 (16.1%)	46 (49.5%)	47 (50.5%)
31	4th	16 (18.2%)	8 (9.1%)	12 (13.6%)	21 (23.9%)	11 (12.5%)	20 (22.7%)	36 (40.9%)	52 (59.1%)
32	2nd	28 (25.5%)	13 (11.8%)	11 (10.0%)	11 (10.0%)	18 (16.4%)	29 (26.4%)	52 (47.3%)	58 (52.7%)
32	3rd	19 (20.4%)	9 (9.7%)	6 (6.5%)	14 (15.1%)	24 (25.8%)	21 (22.6%)	34 (36.6%)	59 (63.4%)
32	4th	19 (21.6%)	7 (8.0%)	6 (6.8%)	18 (20.5%)	16 (18.2%)	22 (25.0%)	32 (36.4%)	56 (63.6%)
33	2nd	12 (11.0%)	8 (7.3%)	7 (6.4%)	18 (16.5%)	8 (7.3%)	56 (51.4%)	27 (24.8%)	82 (75.2%)
33	3rd	4 (4.3%)	3 (3.2%)	1 (1.1%)	18 (19.4%)	13 (14.0%)	54 (58.1%)	8 (8.6%)	85 (91.4%)
33	4th	10 (11.5%)	4 (4.6%)	4 (4.6%)	11 (12.6%)	17 (19.5%)	41 (47.1%)	18 (20.9%)	68 (79.1%)
34	2nd	13 (11.8%)	5 (4.5%0	7 (6.4%)	17 (15.5%)	19 (17.3%)	49 (44.5%)	25 (22.7%)	85 (77.3%)
34	3rd	3 (3.2%)	6 (6.5%)	5 (5.4%)	11 (11.8%)	16 (17.2%)	52 (55.9%)	14 (15.1%)	79 (84.9%)
34	4th	6 (6.9%)	4 (4.6%)	3 (3.4%)	11 (12.6%)	21 (24.1%)	42 (48.3%)	13 (14.9%)	74 (85.1%)

Item No	Year of study	Strongly Disagree *n* (%)	Moderately Disagree *n* (%)	Slightly Disagree *n* (%)	Slightly Agree *n* (%)	Moderately Agree *n* (%)	Strongly Agree *n* (%)	Total Disagree *n* (%)	Total Agree *n* (%)
35	**2nd**	10 (9.1%)	7 (6.4%)	11 (10.0%)	21 (19.1%)	27 (24.5%)	34 (30.9%)	28 (25.5%)	82 (74.5%)
35	**3rd**	1 (1.1%)	5 (5.4%)	7 (7.5%)	18 (19.4%)	18 (19.4%)	44 (47.3%)	13 (14.0%)	80 (86.0%)
35	**4th**	4 (4.6%)	8 (9.2%)	6 (6.9%)	16 (18.4%)	16 (18.4%)	37 (42.5%)	18 (20.7%)	69 (79.3%)
36	**2nd**	11 (10.0%)	4 (3.6%)	4 (3.6%)	26 (23.6%)	20 (18.2%)	45 (40.9%)	19 (17.3%)	91 (82.7%)
36	**3rd**	1 (1.1%)	4 (4.3%)	3 (3.2%)	16 (17.2%)	10 (10.8%)	59 (63.4%)	8 (8.6%)	85 (91.4%)
36	**4th**	5 (5.7%)	5 (5.7%)	6 (6.8%)	12 (13.6%)	19 (21.6%)	41 (46.6%)	16 (18.2%)	72 (81.8%)
37	**2nd**	14 (12.7%)	3 (2.7%)	6 (5.5%)	14 (12.7%)	18 (16.4%)	55 (50.0%)	23 (20.9%)	87 (79.1%)
37	**3rd**	5 (5.4%)	1 (1.1%)	4 (4.3%)	9 (9.7%)	9 (9.7%)	65 (69.9%)	10 (10.7%)	83 (89.3%)
37	**4th**	2 (2.3%)	3 (3.4%)	2 (2.3%)	5 (5.7%)	14 (15.9%)	62 (70.5%)	7 (7.9%)	81 (92.1%)

➞ Disagree with MEs definition **➞ Reporting effort** **➞ Fear**

Appendix K: The result of one-sample t-test with regard to the barriers to reporting MAEs

One-Sample Test

Test Value = 3.5

		Mean	Std Deviation	Std Error Mean	*t*	95% Confidence Interval of the Difference df	Sig. (2-tailed)
27	Nurses do not agree with hospital's definition of a medication error	2.53	1.484	0.087	-11.160	288	0.000
28	Nurses or nursing students do not recognise an error occurred	3.15	1.687	0.099	-3.527	290	0.000
29	Filling out an incident report for a medication error takes too much time	3.79	1.808	0.106	2.739	290	0.007
30	Contacting the physician about a medication error takes too much time	3.38	1.796	0.105	-1.144	289	0.253
31	Medication error is not clearly defined	3.46	1.747	0.103	-.403	289	0.687
32	Nurses or nursing students may not think the error is important enough to be reported	3.74	1.911	0.112	2.102	290	0.036
33	Nurses or nursing students believe that other nurses will think they are incompetent if they make medication errors	4.76	1.646	0.097	13.024	288	0.000
34	The patient or family might develop a negative attitude towards the nurses or nursing student or may sue the them if a medication error is reported	4.80	1.575	0.092	14.018	289	0.000
35	Nurses or nursing students are afraid the physician will reprimand them for the medication error	4.63	1.495	0.088	12.846	289	0.000
36	Nurses or nursing students fear adverse consequences from reporting medication errors	4.86	1.479	0.087	15.641	290	0.000
37	Nurses or nursing students could be blamed if something happens to the patient as a result of the medication error	5.09	1.503	0.088	18.003	290	0.000

Appendix L: Respondents' agreement with subscale causes of MAE occurrence across each year of study

Subscale cause of MAEs	Year of study	Mean	Std Deviation
Physician communication	Second year	4.00	0.94
	Third year	4.15	0.976
	Fourth year	4.56	0.98
Medication packaging	Second year	3.58	1.29
	Third year	3.82	1.31
	Fourth year	3.88	1.40
Pharmacy related	Second year	1.64	1
	Third year	1.78	1.08
	Fourth year	1.90	1.05
Nurse related	Second year	3.65	0.97
	Third year	3.95	0.90
	Fourth year	4.02	0.90

Appendix M: Respondents' agreement with the subscales of barriers to reporting MAEs across each year of study

Barrier to reporting MAEs	Year of study	Mean	Std Deviation
Disagree with ME definition	Second year	2.97	1.24
	Third year	3.26	1.05
	Fourth year	3.48	1.21
Reporting effort	Second year	3.10	1.63
	Third year	3.67	1.56
	Fourth year	4.10	1.42
Fear	Second year	4.55	1.32
	Third year	5.11	0.96
	Fourth year	4.87	1.24