HUMAN FACTORS CAUSING MEDICATION ADMINISTRATION ERRORS AS SELF-REPORTED BY REGISTERED PROFESSIONAL NURSES

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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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ABSTRACT

Medication administration is a core function of the registered professional nurse, yet multiple human factors cause errors to happen in the administration process, with a negative impact on patient safety. The aim of this study was to determine the human factors as self-reported by registered professional nurses which cause medication administration errors. The study objectives were set to determine what are the human factors the registered professional nurses report to be the cause of medication administration errors in their own practice; determine whether a lack of knowledge and skills contributed to medication administration errors; establish the current orientation and in-service training related to medication administration and describe the availability of policies related to medication administration and the frequency of monitoring and evaluation practices. The research question asked was "What are the human factors that cause medication administration errors amongst registered professional nurses?"

A non-experimental, descriptive design with a quantitative approach was applied. The total population of N=120 registered professional nurses working in units that administer medications in a public health care institution, were invited to participate in the study. A structured, self-administered questionnaire was used for data collection. Reliability and validity were assured through means of a pilot study, consultation with nursing and pharmacy experts, the study supervisor, co-supervisor and a statistician. Reliability was further assured by applying the Cronbach's alpha coefficient test with the coefficients being 0,78 – 0,95.

Ethical approval was obtained from the Health Research Ethics Committee of the University of Stellenbosch (S14/08/161). Permission for access to the healthcare institution was obtained from the Provincial Department of Health and a public healthcare institution. Informed consent was obtained from the participants before data collection took place over a three-week period.

A response rate of n=88(73.3%) was obtained. Descriptive and inferential analyses were performed with the support of the statistician by utilising the SPSS version 22 (IBM) program. Results are presented in bar graphs, histograms and tables. Comparisons of variables were done with the application of the Spearman correlation test, Mann-Whitney U tests, Kruskal-Wallis H tests and Pearson chi-square tests.

The results indicated the following main human factors that cause medication administration errors: medicine knowledge deficits (67%) and lack of training about adverse drug effects (60.8%), work pressure (75%) and high nurse to patient ratio's (63%), distractions (69%) and non-adherence to medication administration policies (64%). Results showed an increase in age ($p<0.01$; $r=-.314$), level of experience as a registered professional nurse (RPN) and experience in administering medication ($p<0.01$; $r=-.325$) resulted in a decrease in the number of nurses who reported to make errors due to work pressure. An increase in experience as a RPN ($p=0.01$; $r=-.258$) and in administering medication ($p<0.01$; $r=-.284$) resulted in decreasing the number of mistakes despite high patient/nurse ratios.

Recommendations include the development of adequate quality processes and risk-management strategies. Furthermore, it includes strengthening of the 'five rights' principle of medication administration and the introduction of the continuing professional development model, with the focus on establishment of a medication skills laboratory, which may assist in the reduction of medication administration errors to improve patient safety.

Key words:
Patient safety, medication errors, medication administration and human factors

OPSOMMING

Medikasie-toediening is ‘n kernfunksie van die geregistreerde professionele verpleegkundige, tog veroorsaak verskeie menslike faktore dat foute gebeur in die toedieningsproses met ‘n negatiewe impak op die veiligheid van pasiënte. Die doel van die studie was om te bepaal wat die menslike faktore is wat medikasie-toedieningsfoute veroorsaak soos self gerapporteer deur geregistreerde professionele verpleegkundiges. Die doelwitte van die studie was gestel om te bepaal watter menslike faktore word gerapporteer deur die geregistreerde professionele verpleegkundiges wat die oorsaak is van medikasie-toedieningsfoute in hul eie praktyk; om te bepaal of ‘n gebrek aan kennis en vaardighede bygedra het tot medikasie-toedieningsfoute; om die huidige oriëntasie en indiensopleiding rakende medkasie-toedieningsfoute te bepaal en om die beskikbaarheid van beleide rakende medikasie-toediening en die frekwensie van monitoring en evaluering praktyke te beskryf. Die navorsingsvraag wat gevra was is, "Watter menslike faktore veroorsaak medikasie-toedieningsfoute onder geregistreerde professionele verpleegkundiges?”

’n Nie-eksperimentele, beskrywende ontwerp met ‘n kwantitatiewe benadering is gebruik. Die totale bevolking van N=120 geregistreerde professionele verpleegkundiges werksaam in eenhede wat medikasie toedien in ‘n openbare gesondheidsorginstelling is genooi om deel te neem aan die studie. ’n Gestruktureerde, self-toegediende vraelys is gebruik om data in te samel. Betroubaarheid en geldigheid is verseker deur middel van ‘n loodsstudie, in oorlegpleging met verpleeg- en apteekkenners, die studie toesighouer, medetoesighouer en ‘n statistikus. Betroubaarheid is verder verseker deur die toepassing van die Cronbach Alfa-koëffisiënttoets met die koëffisiënte van 0,78 – 0,95.

Etiese goedkeuring is verkry van die Etiese Navorsingskomitee vir Gesondheid van die Universiteit Stellenbosch (S14/08/161). Toestemming vir toegang tot die gesondheidsorginstelling is verkry van die Provinsiale Departement van Gesondheid en die openbare gesondheidsorginstelling. Ingeligte toestemming is verkry van die deelnemers voordat data insameling oor ‘n periode van 3 weke plaasgevind het.

’n Reaksie-koers van n=88(73.3%) is verkry. Beskrywende en inferensiële ontledings is gedoen met die hulp van die statistikus deur gebruik te maak van die SPSS weergawe 22 (IBM) program en word verduidelik deur middel van staafgrafieke, histogramme en tabelle. Die veranderlikes is vergelyk deur die toepassing van Spearmen korrelasietoetse, Mann-Whitney U-toetse, Kruskal-Wallis H H-toetse en Pearson Chi-vierkanttoetse.

Die resultate het die volgende menslike faktore uitgewys wat medikasie-toedieningsfoute veroorsaak: gebrek aan medikasie kennis (67%) en gebrek aan opleiding oor nadelige medikasie effekte (60.8%), werksdruk (75%) en hoë verpleegkundige pasiëntverhoudings (63%), afleidings (69%) en nie-nakoming van medikasie-administrasie beleide (64%). Beduidende resultate het aangedui dat ‘n toename in ouderdom ($p<0.01$; $r=-.314$), ondervinding as geregistreerde professionele verpleegkundiges en in die toediening van medikasie ($p<0.01$; $r=-.325$) gelei het tot ‘n afname in verpleegkundiges wat gerapporteer het dat hul foute gemaak het vanweë werksdruk. ‘n Toename in ondervinding as geregistreerde professionele verpleegkundiges ($p=0.01$; $r=-.258$) en in die toediening van medikasie ($p<0.01$; $r=-.284$) het gelei tot ‘n afname in foute ten spyte van ‘n hoë pasiënt/verpleegkundige verhouding.

Aanbevelings sluit die ontwikkeling van voldoende kwaliteitprosesse en risiko-bestuurstrategieë in. Verder sluit dit in die versterking van die “vyf regte” beginsel van medikasie-toediening en bekendstelling van die voortgesette professionele ontwikkelingsmodel, met die fokus om ‘n medikasie-vaardigheidslabarotorium te ontwikkel wat mag help met die vermindering van medikasie-toedieningsfoute ter verbetering van pasiëntveiligheid..

Sleutel woorde:
Pasiëntveiligheid, medikasie-foute, medikasie-toediening, menslike faktore

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LIST OF ACRONYMS USED IN THE RESEARCH STUDY

RPN	Registered Professional Nurse
EN	Enrolled Nurse
ENA	Enrolled Nursing Assistant
SANC	South African Nursing Council
DENOSA	Democratic Nursing Association of South Africa
WHO	World Health Organization
IOM	Institute of Medicine
MAEs	Medication Administration Errors
NPSA	National Patient Safety Agency
NCC MERP	National Coordinating Council for Medication Error Reporting and Prevention

CHAPTER 1: SCIENTIFIC FOUNDATION OF THE STUDY

1.1 INTRODUCTION

Medication administration errors are considered to be a global problem resulting in an increase in mortality rates, length of hospital stay, and related costs (Cheragi, Manoocheri, Mohammadnejad & Ehsani, 2013:228). Multiple human factors contribute to medication administration errors (Hughes & Blegen, 2008:415; Ulanimo, O'Leary-Kelley & Connolly, 2007:28; Wolf, Hicks & Serembus, 2006:39; Buckley, Erstad, Kopp, Theodorou & Priestley, 2007:145). For the purpose of this study a medication administration error is defined as "a deviation from the doctor's prescription as written on the patient's chart, manufacturers' preparation or administration instructions, or relevant institutional policies" (Keers, Williams, Cooke & Ashcroft, 2013:1047).

One of the core functions of the registered professional nurse is to administer medication as outlined in the Scope of Practice of the Registered Professional Nurse, Regulation 2598 as promulgated through the Nursing Act 50 of 1978 (Republic of South Africa, 1978). Identifying the human factors that cause medication administration errors will assist in developing strategies to reduce medication administration errors and improve the quality of healthcare and safe nursing practices.

This chapter introduces the scientific foundation of the study. The rationale for the study, problem statement, research aim, objectives and conceptual framework are presented. In addition, a brief account of the research methodology as applied in the study is outlined.

1.2 RATIONALE

Nursing is considered to be a caring profession and is guided by the Nursing Act 33 of 2005 (Republic of South Africa, 2005). As a caring profession the human being is at the centre of caring and has intrinsic worth as is enshrined in the Constitution of the Republic of South Africa, Act 108 of 1996 (Republic of South Africa, 1996). The Nursing Act clearly stipulates the professional requirements of the nursing profession and the consequences of any possible transgressions. Of the three main categories of nurses allowed to practise in terms of the Nursing Act 33 of 2005, the registered professional nurse is the category with the most responsibilities which includes the supervision of the other two categories (Republic of South Africa, 2005). The registered professional nurse delivers a comprehensive service with medication administration a core function according to the scope of practice, Regulation 2598 as promulgated through the Nursing Act 50 of 1978 (Republic of South Africa, 1978).

Although the occurrence of medication administration errors is a significant issue in the healthcare setting, total avoidance of errors is impossible. The report “To Err is Human” highlighted the prevalence of medication errors as the most frequent cause of morbidity and mortality in hospitals (Institute of Medicine, 2003:18). These errors include system errors, process errors and human errors which, if not managed carefully, can have a detrimental effect on the patient’s health, as well as on the registered professional nurse’s future psychological health and career opportunities (Hughes & Blegen, 2008:400).

The researcher became aware of medication administration error incidents in a public healthcare institution during 2011, whilst working as a Quality Assurance manager in the institution. During medicine chart reviews in the institution the researcher observed that medication was not administered by the registered professional nurses according to the doctor’s prescriptions. It often was only administered once a day, despite the different times prescribed with a negative impact on the patients’ length of hospital stay. When the researcher informally inquired what the reasons were for this practice, the registered professional nurses would tend to use staff shortages as the only excuse for this practice. It appeared that they did not realise the negative impact of the wrong practice on patients’ safety. Coetzee (2011:3) conducted a two-month study to evaluate the medication errors encountered in an orthopaedic ward at the same institution. These results indicated that nursing personnel were involved in 71% of the reported errors and doctors were involved in 28.6%. Furthermore, 94% of reported medication errors were due to dose omissions with 4.8% errors due to over-dosage and 1.2% due to under-dosage. Coetzee (2011:6) also made the observation that the registered professional nurses displayed a negative attitude when they were confronted with the results. They tended to refuse to accept the results and continued to project on a shortage of staff as their reason for causing a lack of care for patients. In this particular orthopaedic ward where the study was undertaken the registered nurse to patient ratio is 1: 10 during the day and 1: 40 during the night. There are no clearly defined and prescribed staffing norms available in South Africa (Democratic Nursing Organisation of South Africa, 2012).

According to the Government Gazette (Republic of South Africa, 2012:57) the prevalence of medication administration errors is underestimated and underreported in South Africa. From July 2008 until December 2013 only 10 registered professional nurses and midwifes, one enrolled nurse and one enrolled nursing assistant were disciplined due to medication errors by the South African Nursing Council (SANC, 2013). These incidents do not reflect a true picture as many of the cases are not reported to SANC and many cases are settled out of court. According to Fin24 (2011) and Health24 (2015) reports, the number of negligence claims have increased tremendously over the past 10 years. Thus, the findings of Coetzee (2011:7) have

prompted a need for further investigation into the underlying causes and contributing factors associated with medication administrative errors at this institution as per recommendations from his study.

1.3 RESEARCH PROBLEM

It appears that medication administration errors, which have a negative effect on patient safety, occur more often than reported in health establishments, including the tertiary institution of interest. Many cases are settled out of court, thus the actual human factors are unknown in South Africa (Fin24, 2011 & Health24, 2015). Registered professional nurses blame staff shortages as the only reason for committing these errors, whereas literature has shown that several other human factors also cause medication administration errors (Hughes *et al*., 2008:415; Ulanimo *et al*., 2007:28; Buckley *et al*., 2007:145; Wolf *et al*., 2006:39).

During the literature research conducted by the researcher, no studies about human factors causing medication administration errors in South Africa were found. Thus, by completing this study the researcher attempted to identify human factors that influence medication administration errors. This assisted in developing strategies which may improve current medication administration practices.

1.4 RESEARCH QUESTION

Which human factors cause medication administration errors amongst registered professional nurses?

1.5 RESEARCH AIM

The aim of this study was to determine the human factors as self-reported by registered professional nurses which cause medication administration errors.

1.6 RESEARCH OBJECTIVES

The objectives of the study were to

- determine what human factors the registered professional nurses report to be the cause of medication administration errors in their own practice;
- determine whether a lack of knowledge and skills contributed to medication administration errors;
- establish the current orientation and in-service training related to medication administration and
- describe the availability of policies related to medication administration and the frequency of monitoring and evaluation practices.

1.7 CONCEPTUAL FRAMEWORK

For the purpose of this study Patricia Benner's model of Caring and Expert Nursing Practice was selected and applied. Benner emphasises that expert nursing care differs in accordance with the skill acquisition level of the nurse (Benner, 2001:13). Benner's model identifies five levels of expertise based on the five-stage model of skill acquisition as identified by Dreyfus and Dreyfus which are: novice, advanced beginner, competent, proficient and expert (Dreyfus, 2004:177).

The researcher has chosen this model because it provides a better understanding of the theoretically complex relationships between skill acquisition and human factors influencing medication administration errors amongst registered professional nurses. The knowledge and clinical skills required for medication administration should improve as the registered professional nurse gradually moves through the various stages of Benner's model, but unique human factors causing medication errors can occur in each phase. This will be discussed further in Chapter 2.

1.8 RESEARCH METHODOLOGY

The research methodology utilized for this research study will be briefly discussed with a more detailed discussion in chapter 3.

1.8.1 Research Approach and Design

A non-experimental, descriptive design with a quantitative approach was applied for the purpose of this study. This design has been chosen because this structured approach allowed objective measurement of the chosen variables.

1.8.2 Study Population and Sampling

The target population consisted of the total population of 120 registered professional nurses working in the only tertiary institution in the Nelson Mandela Bay Metropole district in the Eastern Cape of South Africa.

1.8.3 Instrumentation

A self-administered questionnaire from Cronje (2012:157) was used as a rough guideline to develop the questionnaire for the purpose of this study. The questionnaire was developed based on the literature search, the research objectives, the clinical knowledge and experience of the researcher.

1.8.4 Pre-testing of the questionnaire

The pre-testing of the questionnaire was conducted to determine the feasibility of the study and to assess whether the questions are clear, easily understandable and to correct errors before the main study was conducted. The questionnaire was issued to n=21(17.5%) participants in another tertiary healthcare institution with similar wards in another South African province. The n=21(17.5%) refers to the actual population of the main study.

1.8.5 Reliability and Validity

1.8.5.1 Reliability

This refers to the input from the various experts assisted to increase the reliability and quality of measurement, thus enabling reliable data analysis. The questionnaire was tested during the pre-testing of the questionnaire and with Cronbach's alpha coefficient test which indicated that the questionnaire was sufficiently reliable to use for this study (coefficients being between 0,78 – 0,95).

1.8.5.2 Validity

The questionnaire from Cronje (2012:157) was used as a rough guideline to develop the questionnaire for the purpose of this study. Validity was acquired through pre-testing of the questionnaire and in accordance with the literature review, the research objectives, the clinical knowledge and experience of the researcher. Content validity, face validity and construct validity were assured with the support of the supervisor, co-supervisor, two pharmacy specialists and the statistician..

1.8.6 Data Collection

A self-administered questionnaire was utilised to collect the data for this study. The data collection for this study occurred over a period of three weeks.

1.8.7 Data Analysis

For the purpose of this study, the data collected from the questionnaires were collated and analysed with the assistance of a qualified statistician from the Centre for Statistical Consultation at Stellenbosch University using the SPSS statistical software, version 22. Descriptive and inferential analyses, including analysis of variance (ANOVA), the Spearman correlation test, Mann-Whitney U tests, Kruskal-Wallis H tests and Pearson chi-square tests were applied in the analysis of the data obtained in this study.

1.9 ETHICAL CONSIDERATIONS

According to Burns and Grove (2007:203) ethical considerations make reference to the protection of the human rights of individuals when participating in a research study. The ethical principles used in this research study were derived from the Declaration of Helsinki. The Declaration of Helsinki was developed to define ethical principles for medical research involving human subjects, which includes research on identifiable human material and data (World Medical Association, 2015:1).

1.9.1 Ethical approval

Ethical approval to conduct the research study was obtained from the Health Research Ethics Committee (HREC) of the University of Stellenbosch; reference number S14/08/161 (Appendix 1). After approval was granted by the HREC to conduct the study, permission to conduct the research study at the tertiary healthcare institution was obtained from the Eastern Cape Provincial Health Ethics Committee (Appendix 2), after which permission was also obtained from the Chief Executive Officer of the institution (Appendix 3).

1.9.2 Informed consent

Burns and Grove (2011:123) indicate that informed consent suggests that the researcher has divulged information to the subjects and that the information is understood by the potential subjects. Information provided in a questionnaire might be seen as a threat. Voluntary participation and withdrawal at any time before or during the study were discussed with the participants during the information sessions and it was also explained in the cover letter. The English language was used in the cover letter. Participants were assured that withdrawal from the study would not affect them negatively in any way. It was explained to them that the researcher is obliged to respect the privacy of the participants who are involved in the study. The research objectives and the nature of the research study were explained to all participants before written consent was obtained by the researcher. However, signing of the consent forms were not compulsory, as return of the questionnaire indicated that consent was given voluntary. Through this research study, systems can be developed to support the registered professional nurses to improve their medication administration practices which will be beneficial to both the patient and the nurse and to ensure that harmful practices do not take place.

1.9.3 Right to privacy, confidentiality and anonymity

According to Burns and Grove (2011:117) the research subject has the right to anonymity and confidentiality based on the basis of the right to privacy. The principles of maintaining participants' confidentiality and anonymity are vital ethical considerations and were explained to the participants. Privacy is the freedom people have to determine to what extent and under

which circumstances they will share their private information with others. Privacy is violated when a person gains access to another person's personal data, without a person's knowledge or against his or her will (Burns & Grove, 2011:114). Privacy of participants was ensured through informed consent and voluntary participation in the research study. To further enhance privacy, the participants completed the questionnaire in a private room. According to Burns and Grove (2011:117) confidentiality is how the private information shared by the participants is managed by the researcher. Confidentiality is violated when the researcher allows an unauthorised person to gain access to raw data of a research study or a person discloses information about another person without consent. Collected data was only accessible to the researcher, the statistician, supervisor and co-supervisor. The raw data and final results will be kept in a locked cabinet for a period of five years after completion of the study. Anonymity implies that the questionnaire responses cannot be linked to the identity of the participants, not even by the researcher (Burns & Grove, 2011:117). Anonymity was ensured through placing the nameless questionnaires in sealed envelopes and sealed dedicated boxes.

Privacy, confidentiality and anonymity of participants were maintained throughout the duration of the study.

1.9.4 Avoidance of fabrication, falsification and plagiarism

The researcher ensured self-adherence to scientific honesty through the avoidance of fabrication and falsification in reporting and recording of the research results. To avoid fabrication, the findings were published as accurately as possible on completion of the research study. Avoidance of falsification was done through ensuring that the results were not manipulated to suit the researcher's self-interest. In order to avoid plagiarism, appropriate credit was given to all researchers whose theses, dissertations, books, journal articles and publications were used. Furthermore, the thesis was submitted through Turnitin to check for originality. Findings will be communicated to participants on completion and acceptance of this thesis.

1.9.5 Beneficence and non-maleficence

According to Muller (2002:67) the ethical principle, beneficence refers to "the duty to do good and to promote good" and the ethical principle, non-maleficence refers to "the duty not to inflict harm". Based on the principle of beneficence, the researcher must prevent physical, emotional, psychological, spiritual, and moral or any other harm to the participants of the study (Burns & Grove, 2011:118).This research study requested the participants to complete a questionnaire with duration of 15-20 minutes. This has involved minimal risk to the participants. Individual participants did not suffer any consequences if poor practices or

knowledge was identified. The principle of non-maleficence can be violated through the researcher's acts or omissions. If the researcher does not understand the participants' needs properly and act on possible misinterpretations, the researcher will inflict harm. These include inadequate skills and competence in the researcher; failing to anticipate foreseeable harmful effects of interventions and failing to expose incompetent colleagues. These two ethical principles were discussed in detail with the participants.

Through this research study, systems can be developed to support the registered professional nurses to improve their medication administration practices which will be beneficial to both the patient and the nurse and ensure that harmful practices do not take place.

1.10 OPERATIONAL DEFINITIONS

Medication

Medication is a drug (or a combination of drugs) that has been pharmaceutically prepared for administration to patients (Schellack, 2011:37).

Medication error

The National Coordinating Council for Medication Error and Prevention (NCC MERP) refers to a medication error as the improper use of medication by the healthcare professional, manufacturer or patient, which may cause harm to the patient (NCC MERP, 2001:1).

Medication administration

This refers to the provision of prescribed medications by authorised nursing personnel in a manner that assures proper patient and medication identification, monitoring of the medication's effects, and appropriate documentation (University of Michigan Health System, 2010:1).

Medication administration error

A medication administration error is referred to as a deviation from the doctor's prescription as written on the patient's chart, manufacturers' preparation/administration instructions, or relevant institutional policies (Keers, Williams, Cooke & Ashcroft, 2013:1047).

Registered professional nurse

This is a person who has completed a three or four year diploma or four year Bachelor's degree nursing course and is registered with the South African Nursing Council in terms of section 31 of the Nursing Act 33 of 2005, and practises comprehensive nursing independently and assumes responsibility and accountability for such practice (Republic of South Africa, 2005).

Tertiary healthcare institution

A tertiary healthcare institution can be defined as a Level 3 hospital which provides specialist and sub-specialists care to Regional Hospitals (Kerry Cullinan, 2006:17).

Patient safety

Patient safety refers to the avoidance or reduction of actual or potential harm to a patient in a healthcare institution (Australian Commission on Safety and Quality in Healthcare, 2004:69).

1.11 DURATION OF THE STUDY

Ethical approval was obtained on 27 November 2014 and the thesis was submitted on 1 December 2015. Data was collected from 5 January 2015 until 26 January 2015. The pre-testing of the questionnaire was conducted on 12 December 2014.

1.12 CHAPTER OUTLINE

Chapter 1: Foundation of the study

In this chapter the general overview of the research study was specified. This is inclusive of the introduction to the research topic, rationale, research aim and objectives and a brief overview of the research methodology and conceptual framework.

Chapter 2: Literature review

This chapter outlines the literature review related to human factors associated with medication errors. The conceptual framework that was selected for this study is also explained.

Chapter 3: Research Methodology

In this chapter a detailed description of the research methodology applied for this study is presented.

Chapter 4: Results

This chapter provides the data analysis, interpretation and discussion of the results from the study.

Chapter 5: Conclusions and recommendations

In this chapter the conclusion, recommendations and limitations of the study are presented.

1.13 SIGNIFICANCE OF THE STUDY

The findings of the study will be valuable as information obtained regarding this complex phenomenon will be used to improve patient safety. Furthermore, it will assist in reviewing policies on medication administration. The study will also contribute towards improving nursing

standards and risk-associated behaviour and contribute toward the general body of knowledge about human factors contributing to medication errors.

1.14 SUMMARY

In chapter 1 the introduction and rationale of the research study are described. Furthermore, the aim, objectives, a brief outline of the research methodology, ethical considerations, conceptual framework, study duration and chapter outline of the study are described.

In chapter 2, an extensive literature review on human factors as a cause of medication administration errors will be discussed.

1.15 CONCLUSION

Medication administration errors are complex phenomena that cannot be completely avoided. Numerous studies have been conducted to determine the causative and underlying factors that influence the prevalence of medication administration errors, which can be prevented if the relevant guidelines and standards are adhered to.

Registered professional nurses have a vital role to play in reducing these errors as they are the key role players in the medication administration process. The researcher therefore strived to determine what the main human factors are that cause medication administration errors as self- reported by registered professional nurses administering medication.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

A literature review provides one with the current theoretical and scientific knowledge about a specific problem, integrating the known and unknown (Burns & Grove, 2011:189).

The literature search was conducted by using the following sources:

- Electronic databases: Stellenbosch University library: CINAHL, PubMed, PubMed – Medline, Science Direct, Cochrane library and Archives;
- Relevant electronic Journals;
- Textbooks, Acts and Regulations.

Only studies reported in the English language published between 2005 and 2015 were considered. The researcher could not find any published study on human factors as a cause of medication administration errors in South Africa.

Keywords used for the search were patient safety, medication errors, medication administration and human factors.

The purpose of the literature review was to examine the prevalence of medication errors at international, national and local levels; explore findings of recent research studies about human factors that cause medication administration errors in the hospital environment; explore the influence of orientation and in-service training related to medication administration errors; review what influence the use of policies has on the prevalence of medication administration errors and to explore intervention strategies influencing medication administration practices positively.

2.2 AN OVERVIEW OF MEDICATION ERRORS

2.2.1 Prevalence of medication errors

The Institute of Medicine (IOM) released the report “To Err is Human” during 1999. Thereafter, attention was drawn to patient medication administration safety worldwide. The prevalence of medication errors, which is the most frequent cause of morbidity and mortality in hospitals, was highlighted in this report (Institute of Medicine, 2003:18). The concern of the World Health Organization (WHO) about the increase in the prevalence of medication errors resulted in the WHO World Alliance for Patient Safety launching the Africa project in Durban in 2005, where

emphasis was on medication errors as one of the healthcare errors that needs to be managed (WHO, 2005).

Numerous direct observational studies conducted on evaluation or assessment of medication administration errors in healthcare institutions revealed that errors are common in the medication administration process (Berdot, Sabatier, Gillaizeau, Caruba, Prognon & Durieux, 2012:3; Wong, Herndon, Canale, Brooks, Hunt, Epps, Fountain, Albanese & Johanson, 2009:547; Cheragi *et al.,* 2013:228; Westbrook & Woods, 2009:429).

The medication management process includes prescribing, dispensing, administration and monitoring. Medication errors can occur throughout these phases. Main contributing factors to administration errors were found to be a lack of medication knowledge in doctors who are prescribing drugs and nurses who are administering drugs (Alsulami, Conroy & Choonara, 2012:33).

The National Patient Safety Agency in England (NPSA, 2010:4) stated that between 2006 and 2009 reports were received of 21 383 patient safety incidents in England relating to omitted or delayed administering of medication. According to the NPSA (2007:22) 56.5% of those errors associated with severe harm occurred during the administration phase. Middle Eastern countries reveal that medication administration error rates range between 9% and 80%. A prospective observational study in a tertiary hospital in South India detected a general error rate of 11.7%, of which administration errors accounted for 28.35% followed by 8.9% dispensing errors (Karthikeyan & Lalitha, 2013:13). A survey conducted in America in orthopaedic departments indicated that medication errors caused serious potential patient harm in 9.7% of cases (Wong *et al*., 2009:554). Berdot *et al*. (2012:3) found in their study at a teaching hospital in Paris that amongst 1 501 opportunities for error, 415 administrations had one or more errors detected, adding up to a total of 430 errors, which represent 27.6% of the administrations. Of these 430 errors, 6% caused serious potential patient harm, whilst 94% had no clinical impact on the patient. In a study of deaths caused by medication errors, the most common causes of 469 deaths due to medication administration errors were human factors (65.2%), followed by miscommunication (15.8%) (Hughes & Blegen, 2008:401).

2.2.2 Classification of medication errors

A classification system of medication errors based on the degree of seriousness and or harm, which include nine categories, was developed by the National Coordinating Council for Medication Error Reporting and Prevention in the United States of America (NCC MERP) (NCC MERP, 2001:1). The classification of medication errors may assist with the analysis of medication errors and may be of assistance in developing strategies to reduce or eliminate

medication administration errors. Aronson (2009:602) agrees that classification of medication errors assist in understanding how medication errors happen and the prevention thereof. He divided medication errors into four categories, i.e.:

- knowledge-based errors: related to general, specific or expert knowledge;
- rule-based errors: refer to misappropriation of a good rule or non-compliance with a good rule, and the enactment of a bad rule;
- action-based errors: refer to slips and technical errors; and
- memory-based errors; relate to lapses, when something is forgotten.

Johnson and Young (2011:131) based their research on Aronson's classification and found that **action-based errors** are the highest-ranking cause of errors (70.2%), followed by knowledge-based errors (14.4%), memory-based errors (8.6%) and rule-based errors (6.7%) occurring the least. In addition to these findings, Keers *et al*. (2013:1045) found that slips and lapses were the most commonly reported **action-based errors**, followed by knowledge-based errors and deliberate rule-based errors.

2.2.3 Use of infusion devices

Nurses are predisposed to make dosing errors while setting the infusion devices (Chuo, Lambert & Hicks, 2007:104). Fahimi, Sistanizad, Abrishami and Baniasadi (2007:296) indicated that incorrect dose (70%), labelling error (20%) and infusion pump errors (10%) were the most common medication administration errors reported in their study. Fahimi *et al*. (2007:297) further stated that medication errors of the infusion pump seem to occur mostly due to a lack of knowledge and that 10% of doses administered through infusion pump were unauthorised medication. According to Cheragi *et al*. (2013:228) the most common types of errors are caused by wrong dosage and infusion rate, and 60.78% were caused by intravenous injections of medication.

The ability to calculate medication to be administered seems to be a variable influencing accurate medication administration. Fahimi *et al.* (2007:295) state that calculations for continuous infusions through infusion pumps are error-prone due to the complexity thereof and Cologna, Pederzini, Capretta, Malossi and Barelli (2005:12) indicate that these are the main causing factors of errors.

2.2.4 Education

To reduce risks during the medication preparation stage, nurses need to be educated in the calculation of dosages (Fahimi *et al.,* 2007:298; Fry & Dacey, 2007:680). Johnson *et al*. (2011:134) recommend that regular training sessions on mathematical calculations should be done to improve the skills of nurses. Wright (2007:831) believes that the focus of nurses'

education must be shifted to research and examination on adequate support, assessment and development of nurses' mathematical skills to ensure that they are fit for practice. Johnson *et al*. (2011:134) motivate for continuous education with regard to the "five rights" principle and drug calculation during orientation programmes of new staff to ensure they are adhered to.

2.3 HUMAN FACTORS

George, Henneman and Tasota (2010:136) indicate that human errors are the main contributing causes of medication errors. Reason (2008:393) states that errors are evoked by human behaviour. A study conducted by Shahrokhi, Ebrahimpour and Ghodousi (2013:18) on contributing factors to medication errors indicate that nurse-related factors contribute to 55.4% of medication errors. Several contributing factors like human, process and system factors leading to medication administration errors are highlighted by the NCC MERP Taxonomy of Medication Errors (2001:1) and Hughes *et al*. (2008:415).

2.3.1 Distractions and interruptions

Thought processes can be influenced by distractions and interruptions (Hughes *et al*., 2008:415). Petrova (2010:47) indicates that the nurses' focus could easily be distracted by interruptions which may result in serious mistakes. A study conducted through direct observation indicated that slips and memory lapses were associated with 46.7% of medication administration errors and the lack of drug knowledge causing 13.3% of medication errors (Buckley *et al*., 2007:145).

2.3.2 Fatigue, work-pressure and staff shortages

Anderson and Townsend (2010:25) substantiate that a near-miss may be the result of an exhausted nurse, which could result in a medication error and Ulanimo *et al*. (2007:28) agree that 33.3% of nurses reported that fatigue played a big role in medication administration errors. According to Hughes *et al*. (2008:415) human factors causing administration errors include fatigue, cognitive abilities not up to par, lack of knowledge, skills and experience. In addition, Evans (2009:178) found new inexperienced staff and incorrect recordkeeping as contributing factors whilst Brady, Malone and Fleming (2009:679) identified illegible prescriptions, frequent interruptions, non-adherence to policies and medication dispensing systems. Shahrokhi, Ebrahimpour and Ghodousi (2013:20) reported inadequate nursing staff and heavy workload as contributing factors which increase medication errors, which are supported by Yaghoobi, Navidian, Charkhat-gorgich and Salehiniya (2015:1) who identified that medication errors are related to heavy workload (99.2%). Frith, Anderson, Tseng and Fong (2012:288) found that for every 20% decrease in staffing below the staffing minimum, medication errors increased by 18%.

2.3.3 The 'five rights' principle

According to Hughes *et al*. (2008:401) the five rights principle of medication administration is critical for nurses to adhere to during the medication administration process. Shane (2009:546) indicated that the five rights of medication administration is to ensure that the right patient is offered the right drug (including the form of drug), the right dose (including the strength and rate of the infusion), via the right route at the right time. Westbrook *et al*. (2009:429) state that over 33% of preventable medication errors such as a drug given to the wrong patient and the wrong dose, results in harm. Lisby, Nielsen and Mainz (2005:20) found that 36% of medication doses were administered without any previous verbal verification of the patient's identity (the 'right patient' being the first of the 'five rights' of medication administration). Barcode scanning of the patient's identification band to confirm identity can prevent misidentification (Anderson & Townsend, 2010:23).

Buck, Hofer and McCarthy (2008:2) found that 14% of documented errors are as a result of the use of an unauthorised or wrong drug in paediatric areas. Wrong dose, dose omission (Anselmi, Peduzzi & Dos Santos, 2007:1847), wrong administration time and wrong administration rate, especially of continuous infused drugs are identified as the most common type of errors (Kiekkas, Karga, Lemonidou, Aretha & Karanikolas, 2011:36). Agalu, Ayele, Bedada and Woldie (2012:5) agree about wrong timing (30.3%), omission due to unavailability (29.0%) and missed doses (18.3%) as being the most common medication administration errors.

2.3.4 Knowledge, competence, skills and experience

Lack of experience, skills and inadequate knowledge about medication is a constant problem (Hughes *et al*., 2008:415). Those new to a profession or unit may be at higher risk for errors (Armitage & Knapman, 2003:130). This is confirmed by Tang, Sheu, Yu, Wei and Chen (2007:447) in their study conducted in three hospitals in Taiwan that reported causes of errors by nurses were new staff (37.5%), unfamiliarity with medication (31.9%) and insufficient training (15.3%). Wolf *et al*. (2006:39) confirm that the major causes of errors were reported as human performance deficit (51%) and knowledge deficit (27%) with major contributing factors of inexperienced staff (78%) and distractions (20%). Furthermore, Fahimi *et al.* (2007:297) indicate that inadequate knowledge and a lack of precision in medication preparation influences medication administration errors.

2.4 NURSING EDUCATION AND TRAINING RELATED TO MEDICATION ADMINISTRATION

2.4.1 Continuing professional development

Clifton-Koeppel (2008:72) indicates that the lack of information accounts for medication errors and states that nurses' attitude towards medication errors must be determined during the planning phase of education programmes in order to enhance patient safety. According to Toth (2007:342) and Cohen and Shastay (2008:47) the nursing profession must define and monitor nursing knowledge on aspects about medication, including administration. Montalvo (2007:2) emphasises that nurses are responsible to evaluate and improve nursing practices to ascertain the fundamental knowledge needed to ensure safe medication practices.

The Institute of Medicine of America (2003:1) recommends the training of all staff, maintenance of staff competence and the application of nurses' knowledge and skills to guide safe practices. Armutlu, Foley, Surette, Belzile and McCusker (2008:58) indicate that there is a need for continuous training programmes on medication safety, regardless of the fact that no relationship was identified between error rating sources and years of experience. Senior nurses may take risks due to their familiarity with the medication administration process, and the junior nurses emulate the practices of senior nurses (Thomka, 2007:24). Sulosaari, Suhonen and Leino-Kilpi (2011:465) indicate that nurses need adequate competence in the medication process to fulfill their role. They identify three major categories of nursing competency areas, namely decision-making, theoretical and practical competences. According to Sulosaari *et al*. (2011:476) medication competence requires of the nurse to have expert knowledge and to be able to apply that knowledge in complicated and dynamic patient medication processes, and to demonstrate decision-making competence. Dilles, Van der Stichele, Van Rompaey, Van Bortel and Elseviers (2010:1078) conclude that nurses' responsibilities include pharmaco-therapy and that the educational level as well as the clinical environment influence nursing practice patterns. The participation of knowledgeable and skilled nurses is thus highly valued to ensure excellent, safe and patient-centered care (Batalden & Davidoff, 2007:2; Hall, Moore & Barnsteiner, 2008:417; Toth, 2007:342).

2.4.2 Legislation

The registered professional nurse in South Africa has an independent function, therefore remains accountable and responsible towards ensuring she is knowledgeable about all the aspects she is responsible for in her practice (RSA, 2005).

The Institute for Safe Medication Practices in Horsham (2013:2) as well as the Medicines and Related Substances Control Act 101 of 1965 (RSA, 1965) recommend that written drug

information leaflets are given to patients that contain clear instructions about the dosing schedule. A well-informed patient will be able to alert the nurse if the wrong drug and wrong dose is administered, at the wrong time and the wrong frequency, and can therefore assist with adherence to the 'five rights principles'.

2.4.2.1 South African Nursing Council Regulations applicable to medication administration

The South African Nursing Council (SANC) regulates the training and practice of nurses by means of the Nursing Act 33 of 2005 (RSA, 2005). Regulations applicable to medication administration by registered nurses are:

a) Regulation 2598 of 1984 (Regulation Relating to the Scope of Practice of Persons who are Registered or Enrolled under the Nursing Act 50 of 1978)

The scope of practice of a registered nurse entails the execution of a programme of treatment or medication prescribed by a registered person for a patient, as well as the administration of medicine to a patient, including the monitoring of the patient's vital signs and of his reaction to medication and treatment. A new scope of practice is being drawn up which may influence the practice of medication administration (RSA, 2005).

b) Proposed Regulation 1044 of 2011 (Regulations Relating to the Keeping, Supply, Administering, Prescribing or Dispensing of Medicines by Registered Nurses)

This regulation will authorise the nurse, subject to the provisions of section 56(6) and the conditions listed in regulation 3, to keep, supply, administer, prescribe or dispense an unscheduled medicine and any medicine or substance listed in schedule 1 to schedule 6 of the Medicines and Related Substances Control Act 101 of 1965 for the use of a person. The regulation requires an authorised nurse who administers a prescribed medicine to a patient in terms of these regulations to directly after administering enter the name, quantity, strength, dosage and route of the medicine administered, the date and time administering on the patient's file or treatment record. Furthermore, the Medicines and Related Substances Control Act 101 of 1965 prescribes who will dispense medication, as well as the control of potential and habit forming drugs from schedule 5 to schedule 9 (RSA, 1965).

c) Regulation 767 of 2014 (Acts or Omissions)

The acts or omissions set out in this regulation are deemed to be acts or omissions in respect of which the council can take disciplinary steps against a registered nurse in terms of Chapter 4 of the Nursing Act 33 of 2005 (RSA, 2005). This refers to the willful or negligent omission to

maintain the health status of a patient under his care or charge, and include correct patient identification, as well as the correct administration of treatment, medication and care.

2.5 MEDICATION ADMINISTRATION POLICIES

According to Anderson and Townsend (2010:24) protocols, order sets, computerised drug information systems and medication administration records must be available to ensure the accuracy of information on medication to nurses.

2.5.1 International standards for administration of medication

The Joint Commission International (JCI) is a United States based nonprofit organisation with the purpose to improve patient safety and quality of healthcare internationally and they recommend that staff members must receive ongoing in-service and other education and training to maintain or to advance their skills and knowledge (2013:62).

2.5.2 South African standards for medication administration

The National Core Standards (NCS) for Health Establishments in South Africa were developed in 2011 to improve the quality of care of the citizens of the country (Republic of South Africa, 2011:22). Domain two of the NCS provides guidance on how to ensure quality nursing, clinical care and ethical practice and how to reduce unintended harm to healthcare users. These standards require that a protocol regarding the safe administration of medicines to patients must be available, including a protocol for the safe administration of medicines to children. This medication administration protocol must contain the 'five rights principles'. In addition to this, the standards also require that there is evidence that adverse events for the health establishment are monitored against relevant targets which include medication errors. Furthermore, it is a requirement from the NCS that the annual in-service training plan includes training on how to carry out safety checks and prevent accidents in the environment.

Domain six of the NCS gives guidance on staff orientation to the health establishment and to their specific responsibilities. The standards require that the health establishment provides induction and orientation for all new members of staff which focus on policies, procedures, health and safety and quality clinical care. Furthermore, the standards require that records are kept for each healthcare professional in terms of their current status of continuing professional development and their further education needs.

2.5.3 Institutional standard operating procedures on medication administration

The Medication Administration (Appendix 8) and Paediatric Medication Administration standard operating procedures (Appendix 9) guide medication administration practices at the

healthcare institution where the research was conducted. Both standard operating procedures include the basic rules for safe medication administration, which are:

- to ensure availability of medicines
- work with one medication at a time to prevent any potential confusion that could result in medication errors
- following the 'five rights' principles, i.e. the right patient to ensure the patient receiving the dose is the one it was prescribed for; the right medication to ensure the medication given to the patient is the one prescribed by the doctor; the right time to ensure the dosing intervals are adhered to and doses are given on time; the right dose to ensure the correct dose as prescribed is given to the patient and the right route to ensure the right route is chosen
- the assessment of the patient on admission and before discharge to establish the patient's need for assistance in medication administration
- storage of medication
- recording of medication
- labelling of medication
- medication error reporting which is mandatory for all professionals on a prescribed form and submitted to the quality assurance department or clinical audit committee and
- the disposal of medicines.

The Department of Quality Assurance at the research healthcare institution analyses medication errors in collaboration with the Department of Pharmacy through the use of an incident reporting system, chart reviews and direct observation by the postgraduate pharmacy students allocated to the wards/units on a monthly basis. The reporting of medication errors is communicated to the operational managers and the area managers of the wards/units, who are required to develop and implement a quality improvement plan and if indicated, taken disciplinary steps. This includes policy review if and when non-compliance with hospital policies has been identified. Brady *et al*. (2009:679) state that managers should evaluate and audit medication administration practices.

Availability of medication administration policies, standard operation procedures, auditing of safe medication practices as a medication safety strategy, are thus seen to be variables in the control of medication administration errors.

2.6 ERROR PREVENTION STRATEGIES

Aronson (2009:602) indicates that prevention of medication errors can be done according to the classification of errors that occur:

- knowledge-based errors: knowledge can be improved through educational programmes starting with the student nurse; keeping prescribers up to date; implementation of computerised decision support systems to train prescribers to make less mistakes;
- rule-based errors: rules can be improved through revision, implementation and monitoring of policies and standard operating procedures, as well as auditing and feedback of safe administration practices;
- action-based errors: training can be organised to decrease technical errors;
- memory-based errors; systems can be developed to detect errors due to memory lapses, such as check lists and computerised systems.

Kiekkas *et al*. (2011:41) proposed a number of error prevention strategies to reduce medication administration errors. These include participation of pharmacists in ward rounds, independent double checks by more than one service provider, using barcode technology, medication reconciliation programmes and computerised order entry by physicians. Adequate knowledge of the epidemiology of medication errors should assist with the redesigning of faulty systems.

According to Van Rosse, Maat, Rademaker, Van Vught, Egberts and Bollen (2009:1184) and Anthony, Wiencek, Bauer, Daly and Anthony (2010:22) computerized physician order entry systems have been shown to be effective in adult medical care to reduce medication errors and to improve patient outcome. Anthony *et al*. (2010:22) report that the implementation of computer-based order entry by physicians led to 90% reduction of medication errors caused by misunderstanding of a physician's handwriting or verbal orders in the paediatric intensive care unit.

Hohenhaus and Powell (2008:108) recommend a regulated programme which will include partnership, communication skills, differential opinions and situation apprehension, whilst Johnson and Young (2011:134) motivate for the continued reinforcement of the five rights' principles and calculation skills evaluation of newly appointed staff during induction and orientation. George *et al*. (2010:136) suggest using patient simulation as an educational method to empower student and young nurses to master medication administration principles in the clinical environment. Ford, Seybert, Smithburger, Kobulinsky, Samosky and Kane-Gill (2010:1526) agree that simulation-based learning instead of lectures has significantly reduced medication administration errors from 30.8% to 4.0% and this reduction in errors were sustained.

Anthony *et al*. (2010:22) also report that the

- implementation of patient barcodes showed a reduction of 60% in the administration of wrong medication or to the wrong patient.
- introduction of ancillary pharmacies reduced floor stock and the introduction of ward-based pharmacists in clinical rounds reduced adverse drug events by 66%.
- introduction of a No Interruption Zone (NIZ) whilst administering medication has led to a remarkable reduction (40.9%) in interruptions after a 3-week period, indicating that a NIZ can decrease interruptions during the preparation phase of medication.

Vazin and Fereidooni (2012:194) suggest the establishment of a multidisciplinary group approach of physicians, nurses and pharmacists to investigate and discuss past episodes of medication errors routinely to prevent reoccurrence of medication errors. Furthermore, they state that increasing the number of nurses, reducing their responsibility and having protocols for intravenous infusion will assist in the reduction of errors.

2.7 CONCEPTUAL FRAMEWORK

For the purpose of conceptualizing for this research study, Benner's model of nursing practice was selected and is discussed under paragraph 2.7.1, highlighting the five levels of competency and skills development for the novice nurse, advanced beginner, competent nurse, proficient nurse and the expert nurse (Benner, 2001:13). The novice nurse is someone who could fall in the age category of 21-25 years of age (having qualified at a mean age of 22 and having no experience). The advanced beginner is a nurse who could fall in the category of 22 – 26 years of age having at least one year experience. The competent nurse could fall in the age category of 24 – 27 years with about one and a half to two years' experience in a specific unit. The proficient nurse could fall in the age group 26 – 30 years with two to four years' experience. The expert nurse could fall in the age group of 30 years and more with more than four years' experience.

2.7.1 Stage 1: Novice

The novice nurse is inexperienced and should not be used in the clinical environment, which could be a major contributing factor to medication administration errors (Benner, 2001:13).

The nurse applies knowledge and experience to understand the patient's response during drug administration. The judgement of the novice nurse which involves analysing situations is not well developed yet. Human factors influencing medication administration errors in this category may include the lack of medication knowledge and understanding of the patient's unique circumstances.

2.7.2 Stage 2: Advanced Beginner

The advanced beginner nurse demonstrates improved skills due to additional exposure to the clinical environment (Benner, 2001:13).

The thought processes of the advanced beginner nurse are not yet sophisticated enough to analyse clinical situations (Benner, 2001:13). Although the advanced beginner starts to identify changes of a particular situation, the lack of experience hampers the ability to manage these changes. Human factors influencing medication administration errors in this category may include a lack of medication knowledge and knowledge of the patient which negatively influences their ability to apply professional knowledge during medication administration.

2.7.3 Stage 3: Competent

The competent nurse has worked in a similar clinical environment for one and a half to two years, which improves the ability to take charge of the situation. The nurse is able to assess, plan and evaluate patient care (Benner, 2001:13).

The analytical skills of the competent nurse are more developed, thus the nurse is able to integrate theoretical knowledge with practical knowledge (Benner, 2001:13). This nurse is able to apply professional knowledge during medication administration. Fewer errors are expected. Human factors influencing medication administration errors in this category may include not following the '5 rules' principles of medication administration due to shortcuts taken, memory lapses and fatigue.

2.7.4 Stage 4: Proficient

The proficient nurse has more experience in the clinical environment; therefore the nurse relies less on theory and more on experience (Benner, 2001:13).

The thought processes of the proficient nurse have developed to such an extent that the nurse can analyse situations quickly. According to Benner (2001:13) the nurse still lacks experience; therefore the nurse does not respond intuitively to the situation without considering other options. Although the nurse is able to read a situation she lacks the skill to determine the correct course of action. The proficient nurse acts as a change agent, therefore the nurse is able to apply professional knowledge during medication administration; therefore fewer errors are expected. Human factors influencing medication administration errors in this category may include shortcuts that can cause errors, as well as memory lapses and fatigue.

2.7.5 Stage 5: Expert

The expert nurse has gained a lot of experience in the clinical environment, therefore relies more on experience and only uses theory or rules when clarity is needed in a particular unclear situation (Benner, 2001:13).

The thought processes of the expert nurse are highly developed and she is able to analyse situations, thus knowing when to act and when to wait (Benner, 2001:13). Her knowledge and experience assist her to apply her professional knowledge during medication administration. It is therefore expected that she will make less mistakes and develop systems to reduce medication administration errors. Human factors influencing medication administration errors in this category may include taking shortcuts and being fatigued.

In Figure 2.1 the conceptual map for the research study explains the contribution of the error producing factors and the advancement of the registered professional nurse in the clinical environment to medication administration errors. Fewer mistakes are expected as the nurse advances in the clinical environment. The five stages, in ascending order are novice, advanced beginner, competent, proficient and expert as per Benner's model (Benner, 2001:13). Error producing causes are divided into four categories: knowledge-based, action-based, memory-based and rule-based.

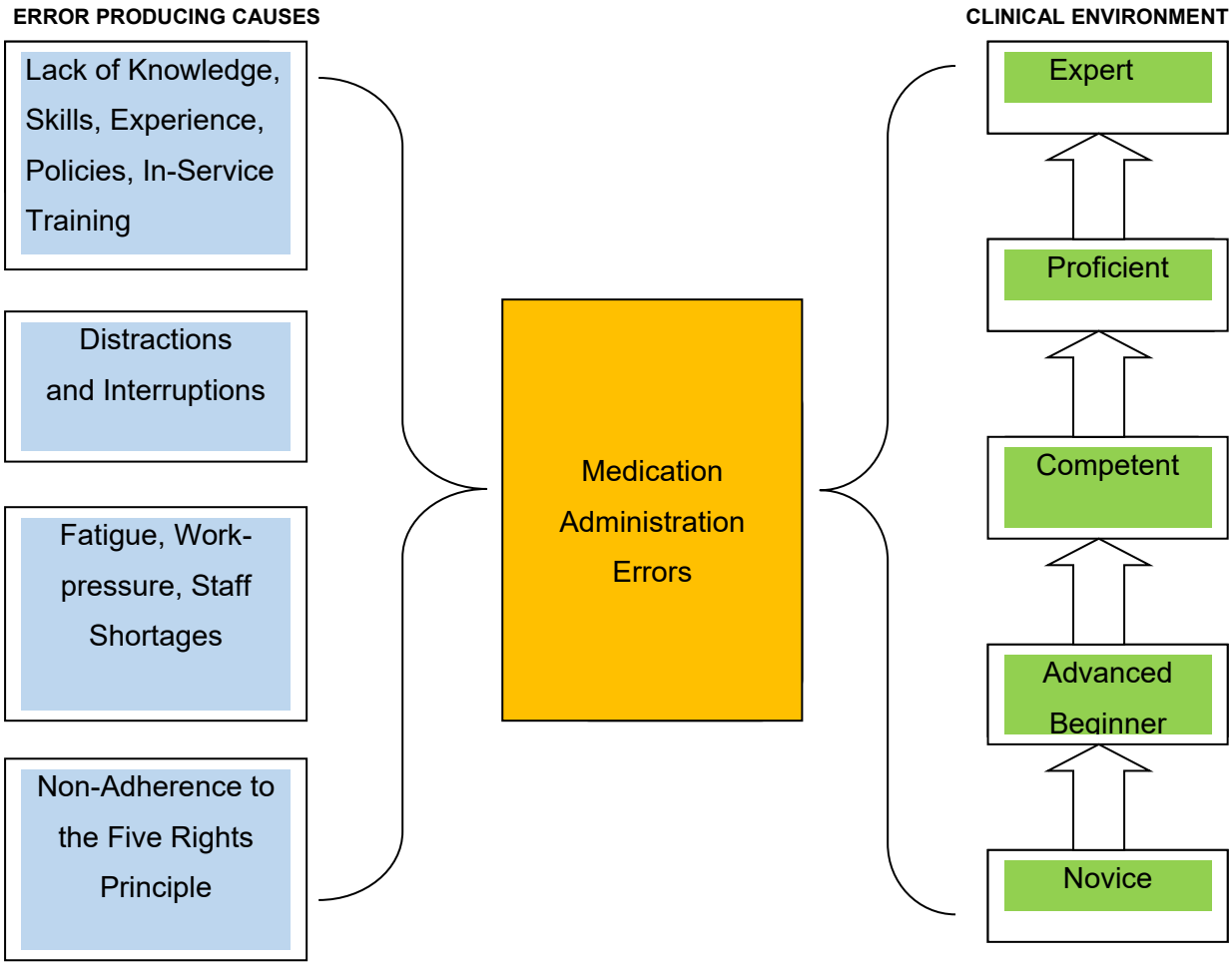

Figure 2.1: Conceptual framework as illustrated by the researcher based on Benner's levels of competency in the clinical environment and showing medication error producing causes (Benner, 2001:13)

2.8 SUMMARY

In chapter 2, an extensive review of the literature on human factors causing medication administration errors was described. This chapter also included a discussion of Benner's model of caring and expert nursing practice as the conceptual framework for the study.

In chapter 3 the research methodology applied to determine which human factors cause medication administration errors will be discussed.

2.9 CONCLUSION

The literature review revealed that amongst many causative factors, human factors are a large contributor to medication administration errors. Fatigue, cognitive abilities, experience, skills, knowledge deficit, shortage of staff, illegible prescriptions, frequent interruptions, non-adherence to policies and medication dispensing systems, heavy workload, distractions and interruptions, memory lapses, new staff, unfamiliarity with medication and insufficient training,

were reported in the literature to be the main human factors that impact negatively on medication administration practices. Furthermore, adequate orientation and training programmes seem to be a factor or variable, influencing the prevalence of medication errors as made by nurses.

Patricia Benner's model of Caring and Expert Nursing Practice was applied in this research study to explain the interplay between the error producing factors (human factors) and the professional life stage of the nurse to cause medication administration errors.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

In chapter 3 the research methodology that was applied to determine the human factors that cause medication administration errors is discussed.

Burns and Grove (2011:253) refer to a research design as a blueprint to conduct a research study to maximize control over factors that can interfere with the validity of the study outcome results.

3.2 RESEARCH APPROACH AND DESIGN

For the purpose of this study, a non-experimental, descriptive design with a quantitative approach was selected. A descriptive design provides a picture of what is happening in a specific situation and may be applied to develop theories and identify gaps in practices without manipulation of variables (Burns & Grove, 2011:256). Descriptive designs are quantitative in nature, therefore a questionnaire as a data collection method is required (De Vos, Strydom, Fouché & Delport, 2005:137).

According to De Vos, Strydom, Fouché and Delport (2011:63) a quantitative approach is used to determine, confirm or validate relationships and objectively measure the variables of interest. This design was chosen because the structured approach allows objective measurement of the chosen variables. In this research study, the phenomena explored were human factors, as independent variables, that cause medication administration errors, as dependent variable, as self-reported by registered professional nurses in a tertiary health care institution in South Africa.

3.3 POPULATION AND SAMPLING

Burns and Grove (2011:290) describe a population as a specific group of individuals or elements who will be focused on during the research. The total population of RPNs, 120 responsible for administering medications in all wards and ICUs were illegible to participate in the study. Outpatient departments were excluded.

Strydom (2005:195) says that when a population is too small, the selection of a sample becomes impossible; hence it is advisable that the total population be used. Thus, the total population of 120 registered professional nurses working in the accident and emergency department, intensive care unit, two orthopaedic wards, four medical wards, four surgical

wards and one paediatric ward situated in a public healthcare institution in the Nelson Mandela Bay Metropole district in the Eastern Cape of South Africa were approached. From the n=120 who were approached, n=88 completed the questionnaire, whilst n=32 declined.

3.3.1 Inclusion Criteria

The inclusion criteria for the **purpose of this research study included** the selected wards or departments who administer medication; these included all surgical, medical, paediatric and orthopaedic wards, intensive care unit as well as the accident and emergency department.

The inclusion criteria for **the participants** in this research study were all registered professional nurses and operational managers working in the selected wards, day and night shift. Operational managers were included in this study because they also administer medication when there is a staff shortage or when the ward is very busy.

3.3.2 Exclusion Criteria

All registered professional nurses who were on long-term sick leave, study leave or annual vacation leave, as well as area managers and agency nurses were excluded from the research study.

Registered professional nurses working in theatre and the outpatient department were excluded from the study because they were not involved with medication administration as much as the registered professional nurses who work with inpatients. In the operating room theatres, medication is mostly administered by the anaesthetist and in the outpatient department medication is mostly dispensed by the pharmacist for the patient to take home.

Area managers were excluded because they were not directly involved with medication administration in the wards or units as their core functions were performing administrative tasks. Agency nurses were excluded from the study because they were only utilised in the institution when there was industrial action and the institution was experiencing a shortage of nurses, which was not the case during this data collection period.

3.4 INSTRUMENTATION

Burns and Grove (2011:353) refer to a questionnaire as a self-report form which is used to gather information about the beliefs, attitudes, opinions, knowledge, or intentions of the participants. Due to the descriptive research design that was chosen for the study, the questionnaire was seen as an acceptable data collection tool. A self-administered questionnaire (see Appendix 5) was utilised for this study. One open-ended question (Question 88) was added to the five-point Likert type questions in the self-administered

questionnaire. Although an open-ended question is more qualitative in nature, the researcher hoped to strengthen the quantitative data with the opinions of participants on how to improve patient care, specifically referring to the reduction of medication administration errors. The questionnaire was available to the participants in the English language only.

The questionnaire from Cronje (2012:157) was used as a guideline with several adaptations and improvements based on the literature, the research objectives, the clinical knowledge and experience of the researcher and validated by the supervisor, co-supervisor, two pharmacy specialists and the statistician. Cronje's questionnaire was adapted as follows:

- Only Section B, number 8 inclusive of 20 questions related to human factors causing medication administration errors was used.
- Cronje's questionnaire requested the participants to select the most important human factors causing medication errors in **one** section only by ticking the appropriate boxes. The researcher's questionnaire had **two** sections on human factors: Section C and section D as explained below.

By responding to a five-point Likert scale the participants were requested to consider every relatedness of the statement to human factors causing medication errors in their ward (Section C) and then the relatedness of the statements to human factors causing individuals to make medication errors (Section D).

The following sections were thus included in the questionnaire:

- Section A: Demographic profile
- Section B: Professional profile
- Section C: Medication administration errors – human factors (as perceived **why and how** it occurred **in the unit)**
- Section D: Medication administration errors – human factors (**why and how** it occurred amongst **the participants**)
- Section E: Orientation, in-service training and policies regarding medication administration errors.

To determine what registered professional nurses reported to be the main human factors that cause medication administration errors, the questionnaire was developed as follows:

- Sections A (Questions 1 – 2) and B (Questions 3 – 10) of the questionnaire consisted of close-ended questions and were designed to include the demographic and professional data of the participants as follows:

- Section A (2 items)
  - Gender
  - Age
- Section B (8 items)
  - Nursing category
  - Level of nursing education
  - Post-basic nursing qualification
  - Years of experience as a registered professional nurse
  - Type of employment
  - Type of shift work
  - Area of work
  - Years of experience in administering medication as a registered professional nurse

- In Section C (Questions 11 – 44) a five-point Likert scale was used to determine the frequency responses which included statements such as 'never (=1)', 'very rarely (=2)', 'sometimes (=3)', 'often (=4)' and 'always (=5)' (Appendix 5).
- In Section D (Questions 45 – 80) a five-point Likert scale was used to determine the frequency responses which included statements such as 'never (=1)', 'once per month (=2), 'once per week (=3)', 'once per shift (=4)' and 'every time I work with medication (=5)' (Appendix 5).
- In Section E (Questions 81 – 87) a five-point Likert scale was used to determine the agreement options which included statements such as 'strongly disagree (=1)', 'disagree (=2), 'neutral (=3)', 'agree (=4)' and 'strongly agree (=5)' (Appendix 5).
- In Section E (Questions 88-90), Question 88 consisted of an open-ended question to supplement the quantitative data with recommendations on how to improve patient care with regard to medication administration. Questions 89 and 90 consisted of close-ended questions with two options only (yes or no) to determine whether the participants would like to have regular training (Question 89) or more training (Question 90).

3.5 PRE-TESTING OF QUESTIONNAIRE

Burns and Grove (2011:49) refer to a pilot study as a smaller size of the proposed study, used to refine the methodology and help to determine reliability and validity.

Pre-testing of the questionnaire was conducted for a period of two days at a second hospital, a similar tertiary institution with similar wards in another province than the study institution, to assess whether the questions were clear and easily understood and to correct errors before

the main study was conducted. Furthermore, as indicated by Burns and Grove (2011:49), it was conducted to refine the methodology which included the questionnaire.

The self-administered questionnaire was issued to and tested by 21(17.5%) participants of the population of 120 of the actual main study. These participants indicated that it took them between 15 – 20 minutes to complete the questionnaire and that they easily understood the questionnaire with no suggestions for changes.

3.6 RELIABILITY AND VALIDITY

3.6.1 Reliability

Brink, Van der Walt and Van Rensburg (2012:118) refer to reliability as the consistency, stability and repeatability of the participant's version, as well as the accurate collection and recording of information by the researcher. Measurement of the same variables under the same conditions should produce identical results when using the data collection tool (questionnaire). The questionnaire was designed in such a manner to ensure that questions are asked to all participants in a consistent way and are clear.

According to De Vos *et al*. (2005:163), reliability is achieved in different ways which includes conceptualizing constructs in the questionnaire and increasing the level of measurement.

The questionnaire was reviewed by the researcher's supervisor, co-supervisor and two experts in the field of pharmacy: a specialist in pharmacy at the Medical University of South Africa and the Head of Pharmacy at the Dr George Mukhari Academic Hospital. A statistician from the Bioethics Unit at Stellenbosch University's Tygerberg Campus was also requested to review the questionnaire for an expert opinion. In addition, a presentation of the research proposal including the questionnaire was done to the post-graduate committee at the Division of Nursing and reviewed by the Health Research Ethics Committee at Stellenbosch University.

A pilot study of 17.5% of the actual population of the main study was conducted at another tertiary institution. The majority of the participants used to pre-test the questionnaire are experienced registered professional nurses and they found that the questions were clear and no correction or clarifications were required.

The input from the various experts assisted to increase the reliability and quality of measurement and have ensured that the questionnaire measured what it was supposed to measure, thus enabling reliable data analysis. The Cronbach's alpha coefficient tests were done on the questionnaire and the results indicated that the questionnaire was sufficiently

reliable to use for this study. An alpha of 0.7 indicates acceptable reliability and 0.8 or higher indicates good reliability (Zaionts, 2013:1). The results were as follow:

- Section C: 0.95
- Section D: 0.89
- Section E: 0.78

The distribution and collection of the questionnaires were done by the researcher only. Furthermore, the researcher provided the information about the study to ensure consistency. The researcher was the only contact person for guidance and answering of questions, adding to the reliability of using the instrument consistently.

3.6.2 Validity

Burns and Grove (2011:334) define the validity of an instrument as how well the instrument shows the abstract concept being examined. Validity has two important aspects to it, namely 'that the instrument actually measures the concept in question, and that the concept is measured accurately' (De Vos *et al*., 2005:160). The questionnaire from Cronje (2012:157) was used with several adaptations. Validity was acquired through the pre-testing of the questionnaire and with adaptations according to the literature, the research objectives, the clinical knowledge and experience of the researcher and the suggestions made by the supervisor, co-supervisor, two pharmacy specialists and the statistician.

Content validity, face validity and construct validity were applied in this study as discussed below:

3.6.2.1 Content validity

In order to ensure content validity, items and concepts in the questionnaire were based on an extensive literature review, as well as on the objectives set for the study. Literature indicated that human factors are those that cause the most medication administration errors amongst all other reasons researched as discussed under par. 2.3. The questions were designed specifically to test what is perceived in the literature to be the main human factors that influence medication administration errors.

The questionnaire was reviewed as discussed under par. 3.6.1 for expert opinion about the feasibility of using it and the questions included. In addition, a pre-test of the questionnaire amongst registered professional nurses (n=21) in another tertiary institution enabled the researcher to determine whether there were any ambiguity or inaccuracies with the data collection instrument.

3.6.2.2 Face validity

According to De Vos *et al*. (2005:161) face validity is "the least scientific definition of validity and relates to the superficial appearance (face value) of a measurement procedure" or technique. In order to ensure face validity, two experts in the pharmacy reviewed the questionnaire to ensure that the instrument measures the variables it is supposed to measure. Registered professional nurses of another tertiary institution participated in the pre-testing of the questionnaire to review the questionnaire, to determine whether it was relevant to those participants who were to complete it. The involvement of especially the registered professional nurses ensured face validity.

3.6.2.3 Construct validity

Burns *et al*. (2007:535) define construct validity as the establishment of whether the instrument measures the theoretical construct that it claims to do. Benner's theory of the stages of Caring and Expert Practice were used as theoretical construct for this study and an attempt was made to describe which human factors cause errors in each of Benner's stages of Caring and Expert Practice by comparing the demographic data with errors reported. According to Benner's theory the novice nurse will make more mistakes because the nurse is inexperienced in the clinical environment. As the nurse progresses and gain more experience in the clinical environment, fewer knowledge and judgement errors are expected, but errors due to memory lapses, fatigue and shortcuts taken might be more prevalent. However, due to their experience, skills and knowledge of the participants of this research study, it was expected that fewer medication administration errors altogether would be reported to occur in the clinical environment. Guided by the literature review of this study, the researcher compiled a list of all human factors that influence medication administration errors to test the relationship between these factors and the experience of the participants as per Benner's theory.

3.7 DATA COLLECTION

Data collection is dependent on the study design and measurement techniques and is described as a process to collect data for the planned study (Burns & Grove, 2011:361).

The data collection for this study occurred over a period of three weeks during January 2015. The data was collected by the researcher at the end of each day from all the selected wards. The issuing of consent forms and questionnaires was done between 08:00 – 10:00 in the morning for day shift and 20:00 – 22:00 in the evening for night shift. The time of collection for day shift was between 17:00 – 19:00, and for night shift between 06:00 – 07:00 in the morning. A blank opaque self-sealing envelope was issued by the researcher for each

participant. Participants were requested to place the completed questionnaire in the envelope and seal it. A sealed box was provided for the wards and it was marked completed questionnaires. The participants were requested to place the sealed completed questionnaires in the sealed box to further enhance confidentiality. The number of consent forms and questionnaires delivered and collected was documented in a register that is kept by the researcher. Participants did not have to sign the consent forms as return of the questionnaire indicated that consent was given voluntary. However, the majority of the participants 60/88 (68.2%) did sign and return the consent form. When participants are asked to complete and return a questionnaire, the questionnaire should be accompanied by a participant information sheet but no consent form is needed: **consent is implied by returning the questionnaire** (Oxford Brookes University, 2015:1).

During the distribution of the questionnaires, the researcher briefly introduced herself to the operational managers and the registered professional nurses, explained the aim of the research study and the methods by which the questionnaires could be returned and offered an opportunity for any questions and answers, if needed. Potential participants were assured that no information that could possibly identify a particular individual would be revealed. Furthermore, the participants were also guaranteed that the purpose of the research was not to identify wrongdoers and to discipline them, but merely to determine the main human factors that influence medication administration practices. Assurance was also given in the cover letter which accompanied the questionnaire that privacy, confidentiality and anonymity would be maintained by the researcher throughout the study.

The researcher was the only person allowed to collect questionnaires, by opening and re-sealing the sealed box as an additional measure to maintain participants' anonymity. The collected data was only accessible to the researcher, the statistician, supervisor and co-supervisor. The participants were not known by the researcher and therefore there was no risk to recognise the handwriting on any questionnaire. The raw data and final results are kept in a locked cabinet for a period of five years.

The response rate of the participants was n=88 (73.3%) and is discussed in detail under par. 4.3.

3.8 DATA ANALYSIS

De Vos *et al*. (2011:249) describe quantitative data analysis as "the technique by which data is converted to a numerical form and subjected to statistical analysis". For the purpose of this study, the data collected from the questionnaires was collated and analysed with the

assistance of a qualified statistician from the Centre for Statistical Consultation at Stellenbosch University, using the SPSS version 22 (IBM) program.

3.8.1 Descriptive statistics

According to Sullivan-Bolyai and Bova in LoBiondo-Wood and Haber (2010:310) descriptive analysis refers to the procedure to describe and summarize the data. In this chapter, descriptive data will be displayed in the form of tables, bar graphs or histograms.

3.8.2 Inferential statistics

According to Sullivan-Bolyai and Bova in LoBiondo-Wood and Haber (2010:324) inferential statistics are applied to the data to determine significant statistical differences between groups or relationships between variables.

The Spearman's correlation coefficient is a non-parametric test used to determine the strength and direction of association that exists between two variables measured on an ordinal scale (Lund & Lund, 2012:1). In this study, the Spearman nonparametric correlation test compared the age profile, years of experience as a RPN and years of experience in administration of medication (ordinal data) of the participants with their responses to the causes of medication administration error variables. Due to the small number of operational managers in this study, their responses were collapsed to be included with those of the professional nurses. For the purpose of this study a Spearman's correlation factor of >0.5 or -0.5 was applied to establish the strength of the relationship of two variables and to establish any statistically significant differences ($p \leq 0.05$) between variables. This also gives the direction of the variables, whether strong positive or strong negative (Pallant, 2010:103).

Burns and Grove (2007:545) refer to the Mann-Whitney U test as a non-parametric test which is used to determine differences between two groups of ordinal or continuous data. **The Mann-Whitney U test was used to compare the years of experience (ordinal data) of the participants with their responses to the causes of medication administration error variables.** Furthermore, the Mann-Whitney U test was used to understand whether causes of medication administration errors differ based on gender, type of employment, level of nursing education and post-basic nursing qualifications. In this test unlike in the T-tests in which means are compared the medians are compared between the two groups (Pallant, 2010:227).

The Kruskal-Wallis H test, or the one-way ANOVA is a rank-based nonparametric test used to determine statistically significant differences between two or more groups and an extension of the Mann-Whitney U test to allow the comparison of more than two independent groups (Lund & Lund, 2014:1). In this study, the Kruskal-Wallis H test was applied to determine statistically

significant differences between night duty, work area variables and level of nursing education with the responses to the causes of medication administration errors, as well as the significant differences between Section D and Section C.

Howell (2014:1) refers to the Chi-square as a statistical distribution and a hypothesis testing procedure that produces a statistic that is approximately distributed as the chi-square distribution. The Pearson Chi-square test was used to determine statistically significant differences between the gender distribution, level of nursing education, post-basic qualifications, night duty and the responses to the causes of medication administration error variables, as well as the significant differences between Section D and Section C.

Burns and Grove (2011:541) refer to the mean as "the value obtained by summing all the scores and dividing the total by the number of scores being summed". The median is defined as "the score at the exact center of the ungrouped frequency distribution" (Burns & Grove, 2011:541). The mode is described as "the numerical value or score that occurs with the greatest frequency in a distribution but does not necessarily indicate the center of the data set" (Burns & Grove, 2011:542).

Statistical significance is referred to as the extent to which the observed results are likely not due to chance (Burns & Grove, 2011:549). For the purpose of this study a p-value of ($p < 0.05$) was used to determine statistically significant differences between variables.

3.8.3 Preparing the data for analysis

The raw data was captured on an Excel spreadsheet after a serial number was ascribed to each questionnaire for easy reference during the capturing process. The variables on the questionnaire were pre-coded and entered in the columns of the spreadsheet. Each row on the spreadsheet represented one respondent. The researcher personally entered each individual response on the spreadsheet and verified each entry twice to ensure that it was captured correctly. The cell on the spreadsheet was left blank where missing data was found. Incomplete questionnaires were included for the data analysis process to ensure sufficient data collection. The questionnaire was seen as incomplete when all the questions on the questionnaire were not responded to.

After completion of the data capturing process, the completed spreadsheet was submitted to a qualified statistician for analyses. Analyses were conducted with the Statistical Package for the Social Sciences (SPSS) version 22 (IBM) program.

Descriptive and inferential analyses were performed. The interpreted results are presented in a narrative form with the use of bar graphs, pie graphs and histograms that showed the relationships between the variables and enabled the researcher to draw conclusions.

Quantitative data was analysed in this study (Questions 1 to 87, 89 and 90), with one open-ended question (Question 88). In the open-ended question (Question 88) the participants were requested to indicate what they thought is necessary to improve patient care with regard to medication administration. The data obtained from the open-ended question (Question 88) was thematically analysed, by grouping them into categories which were then quantified. The frequency of the responses of the participants was analysed to support the findings and recommendations on how to improve medication administration practices. The responses were grouped and summarised as discussed in chapter 4.

3.9 QUESTIONNAIRE RESPONSE RATE

Operational managers and registered professional nurses in a tertiary healthcare institution, in the Nelson Mandela Bay Metropole district in the Eastern Cape of South Africa working in the accident and emergency department, intensive care ward, two orthopaedic wards, four medical wards, four surgical wards and one paediatric ward, were surveyed.

The total population of the study consisted of 120 participants (N=120). According to Brink, Van der Walt and Van Rensburg (2012:177), the questionnaire response rate is calculated by “dividing the number of returned questionnaires by the number of the study population”. In this research study, the number of returned questionnaires (n=88) was divided by the number of **the study population (N=120)** to reveal a response rate of 73.3%. **According to Delport (2005:168) this is an acceptable response rate for a self-administered questionnaire.**

3.10 ETHICAL CONSIDERATIONS

The ethical principles used in this research study were derived from the Declaration of Helsinki. The ethical considerations were discussed in detail under par. 1.9.

3.11 SUMMARY

The research approach and design, population and sampling, instrumentation, pilot study, reliability and validity of the study were discussed. The data collection and analysis processes were outlined.

In chapter 4 the results of the study are presented.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This chapter outlines the data analysis and interpretation of the data collected during the research study. De Vos *et al*. (2011:249) describe quantitative data analysis as "the technique by which data is converted to a numerical form and subjected to statistical analysis".

The aim of this study was to determine main human factors that cause medication administration errors as reported by registered professional nurses. According to the literature review and Benner's framework the researcher expected that experience as a human factor would have an influence on the occurrence of medication errors (Hughes *et al*., 2008:415 & George, 2011:579).

4.2 SECTION A: DEMOGRAPHIC PROFILE

In Section A, the participants were requested to indicate their demographic profile in terms of gender and current age. As this is a descriptive study, comparative results and inferences made must be interpreted with caution, also because of small numbers in certain categories which could not have been representative of that category.

4.2.1 Question 1: Indicate your gender

As indicated in table 4.1 the majority of the participants were females n=81(92%).

Table 4.1: Gender

Gender	Frequency (*f*)	Percentage (%)
Male	7	8
Female	81	92
TOTAL	**n=88**	**100**

4.2.2 Question 2: Indicate your current age in years

The response rate to this question was n=83(94%). In figure 4.1 the age distribution of the participants is illustrated. The mean age of the participants is 47.77 years with a minimum age of 23 years and a maximum age of 63 years and a standard deviation of 9.27 years. The distribution of the participants is skewed to the right on the Bell curve for normal distribution, indicating an older generation of nurses working in this healthcare institution.

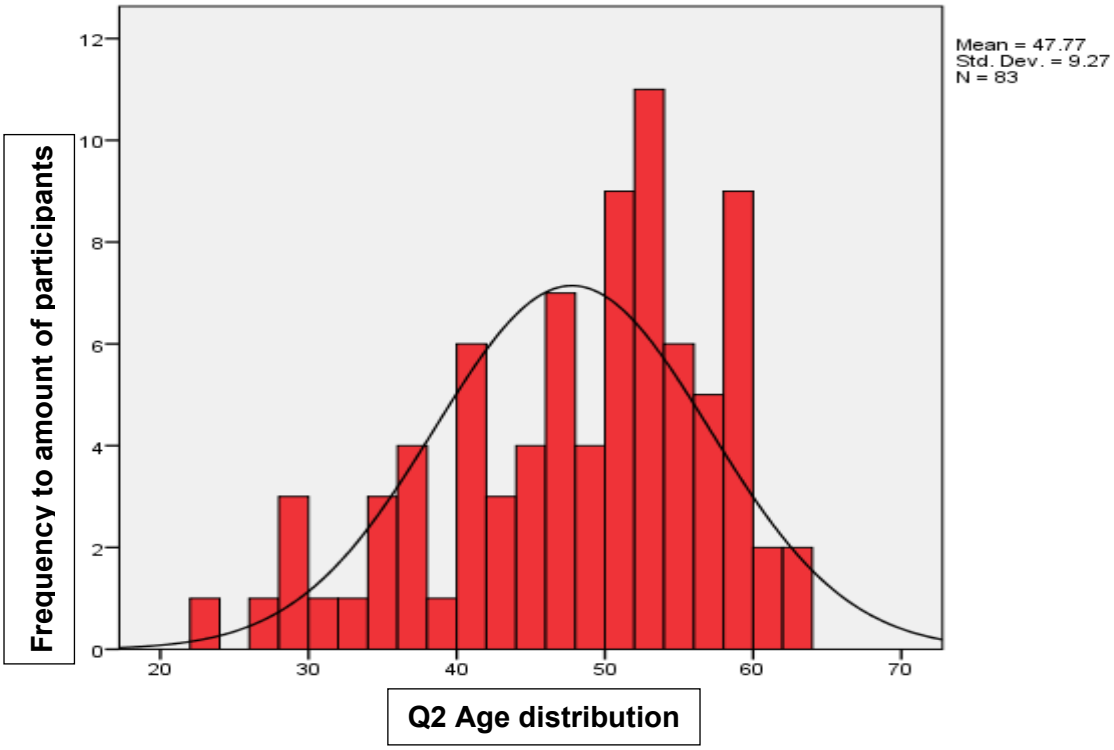

Figure 4.1: Q2 Age distribution and the frequency of the number of participants

4.3 SECTION B: PROFESSIONAL PROFILE

In Section B the participants were requested to indicate their professional profile with regard to nursing category, level of nursing education, postbasic nursing qualifications, years of experience as a registered professional nurse, type of employment, night duty, area of work and years of experience in administering medication as a registered professional nurse.

4.3.1 Question 3: Indicate your nursing category

The response rate to this question was n=88(100%). Table 4.2 indicates that the majority of participants were RPNs n=79(89.8%). **One operational manager (OPM)** is appointed per department, however in the accident and emergency department four operational managers are appointed due to the high activity level, which brings the total operational managers to n=16. Due to the small number of OPMs that responded, this category was collapsed to be included with the RPNs.

Table 4.2: Nursing category

Category	Frequency (*f*)	Percentage (%)
Operational manager	9	10.2
Registered professional nurse	79	89.8
TOTAL	**n=88**	**100**

4.3.2 Question 4: Indicate your level of nursing education

Table 4.3 indicates the level of nursing education in terms of diploma, baccalaureate, master or doctorate degrees. The majority of participants obtained a diploma in nursing n=71(80.7%), n=16(18.2%) obtained a Bachelor's degree with only n=1(1.1%) with a master's degree.

Table 4.3: Level of nursing education

Nursing education	Frequency *(f)*	Percentage (%)
Diploma	71	80.7
Baccalaureate	16	18.2
Master	1	1.1
Doctorate	0	0
TOTAL	**n=88**	**100**

4.3.3 Question 5: Do you have any postbasic nursing qualifications? If yes, specify

In table 4.4 the distribution of postbasic nursing qualifications of the participants are indicated. The majority of the participants n=47(53.4%) do not have a postbasic qualification. Of those who have postbasic qualifications, n=25(61%) have one qualification and n=16(39%) have two or more qualifications.

Table 4.4: Postbasic nursing qualifications

Postbasic qualifications	Frequency *(f)*	Percentage (%)
Yes	41	46.6
No	47	53.4
TOTAL	**n=88**	**100**

Despite that 41 participants indicated that they do have a postbasic qualification, the results show that only 35 participants have a SANC recognised postbasic qualification (Figure 4.2). The majority of participants n=13 of the n=41(46.6%) qualified, obtained a postbasic qualification in Nursing Administration/Management.

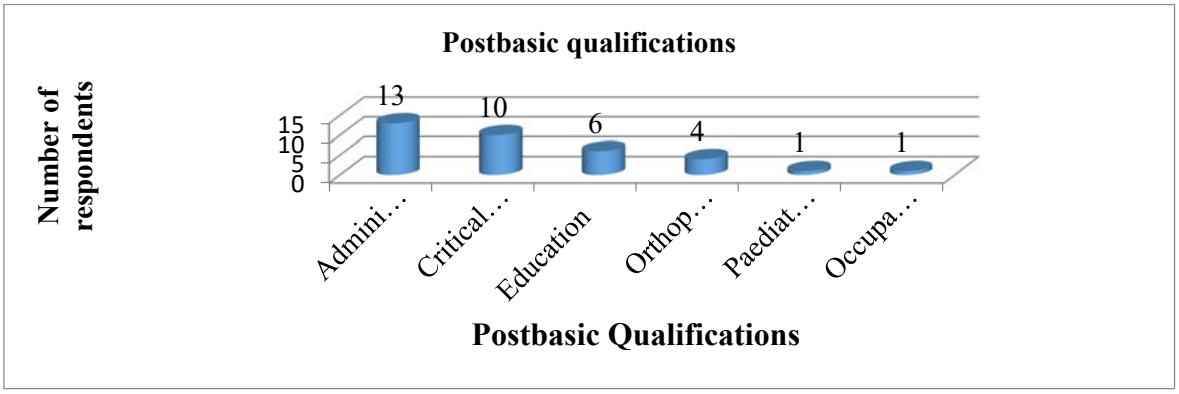

Figure 4.2: Postbasic nursing qualifications

4.3.4 Question 6: How many years of experience as a registered professional nurse do you have?

Table 4.5 indicates the distribution in the years of experience as a registered professional nurse. The results indicate that the majority of participants n=58(68.2%) have more than 9 years experience as a registered professional nurse.

Table 4.5: Years of experience as a registered professional nurse

Years of experience	Frequency *(f)*	Percentage (%)
6-12 months	4	4.7
>1 year – ≤ 2 years	5	5.9
>2 years – ≤ 3 years	6	7.1
>3 years – ≤ 4 years	1	1.2
>4 years – ≤ 9 years	11	12.9
>9 years	58	68.2
TOTAL	**n=85**	**100.0**

4.3.5 Question 7: Indicate whether you are in a full-time or part-time post

In table 4.6 the type of employment of the participants is indicated. The majority of the participants n=82(98.8%) are full-time employed at the hospital. Part-time employees are those who work sessions at the hospital (less than forty hours per week).

Table 4.6: Type of employment

Type of employment	Frequency *(f)*	Percentage (%)
Full-time	82	98.8
Part-time	1	1.2
TOTAL	**n=83**	**100**

4.3.6 Question 8: How many months did you work night duty the last 12 months?

Table 4.7 indicates the night duty of the participants. The results indicate that the majority of the participants n=29(34.1%) did not work night duty during the last 12 months. The minority of participants (n=5) worked night duty for 6 to 12 months (these participants are working permanent night duty). RPNs working permanent night duty may be deprived from attending formal and informal training. Furthermore, less staff is scheduled to work on night duty which may increase the work pressure on the RPNs.

Table 4.7: Night duty shift

Night duty shift	Frequency *(f)*	Percentage (%)
No night duty	29	34.1
Less than 1 month	2	2.4
>1 month – ≤ 2 months	9	10.6
>2 months – ≤ 3 months	14	16.5
>3 months – ≤ 4 months	12	14.1
>4 months – ≤ 6 months	14	16.5
>6 months – ≤ 11 months	4	4.7
>11 months – ≤ 12 months	1	1.2
TOTAL	**n=85**	**100.0**

4.3.7 Question 9: Indicate your area of work

In table 4.8 the area of work of the participants is indicated. The results indicate that the majority of the participants n=26(30.6%) work in the Intensive Care Unit and the minority (n=1) in the Accident and Emergency Unit. Due to the low response rate from the Accident and Emergency Department and Paediatric wards, some inferences could not be drawn about them. Only the data of the units that responded well could be compared statistically, these include: ICU, Surgical wards, Medical wards and Orthopaedic wards.

Table 4.8: Area of work

Area of work	Frequency *(f)*	Percentage (%)
Intensive Care Unit	26	30.6
Accident and Emergency Unit	1	1.2
Surgical Ward	19	22.4
Medical Ward	22	25.9
Orthopaedic Ward	10	11.8
Paediatric Ward	3	3.5
Other	4	4.7
TOTAL	**n=85**	**100.0**

4.3.8 Question 10: How many years of experience in administering medications as a registered professional nurse do you have?

Table 4.9 indicates the years of experience in administering medication as a registered professional nurse of the participants. The majority of the participants n=54(63.5%) have 10 years and more experience.

Table 4.9: Years of experience in administering medication as a registered professional nurse

Years of experience in administering medication	Frequency *(f)*	Percentage (%)
6-12 months	4	4.7
> 1year – ≤ 2 years	8	9.4
> 2years – ≤ 4 years	6	7.1
>4 years – ≤ 9 years	9	10.6
>9 years – ≤ 10 years	4	4.7
>10 years	54	63.5
TOTAL	**n=85**	**100.0**

4.4 SECTION C: MEDICATION ADMINISTRATION ERRORS – HUMAN FACTORS

Section C required the participants to indicate how often medication administration errors occurred **in their units** according to their own perceptions by marking the appropriate column with a cross (x). The participants had to choose either 'never'; 'very rarely'; 'sometimes'; 'often'; or 'always'. The responses are discussed according to the data findings.

4.4.1 Question 11: I believe that medication errors occur in my unit because nurses are tired and exhausted

Table 4.10, shows the participants' responses to medication errors occurring in their units because nurses are tired and exhausted. Most of the participants n=41(47.7%) believe that **sometimes** medication errors occur in their units because nurses are tired and exhausted while n=21(24.4%) believe that it **never** occurs in their units.

Table 4.10: I believe that medication errors occur in my unit because nurses are tired and exhausted

Category	Frequency *(f)*	Percentage (%)
Never	21	24.4
Very rarely	18	20.9
Sometimes	41	47.7
Often	4	4.7
Always	2	2.3
Total	**n=86**	**100.0**

4.4.2 Question 12: I believe that medication errors occur in my unit because the thought processes of nurses are interrupted

As indicated in table 4.11, most of the participants n=32(36.4%) believe that **sometimes** medication errors occur in their units because the thought processes of nurses are interrupted, however n=24 (27.2%) believe it **never** occurs in their units.

Table 4.11: I believe that medication errors occur in my unit because the thought processes of nurses are interrupted

Category	Frequency (*f*)	Percentage (%)
Never	24	27.2
Very rarely	17	19.3
Sometimes	32	36.4
Often	13	14.8
Always	2	2.3
Total	**n=88**	**100.0**

4.4.3 Question 13: I believe that medication errors occur in my unit because nurses fail to check the patients' name bands with medication administration records

Most of the participants n=29(33%) as shown in table 4.12 believe that **very rarely** medication errors occur in their units because nurses fail to check the patients' name bands with medication administration records, with n=28(31.8%) believing it **never** occurs in their units.

The Mann-Whitney U test showed a statistically significant difference between the level of nursing education and the participants who believe that medication errors occur due to nurses failing to check the patients' name bands with medication administration records (***p***=0.03). Based on the 25th percentile the participants with a Bachelor's degree qualification were more likely to believe that medication errors occur because nurses in their unit fail to check the patients' name bands with medication administration records.

A statistically significant difference was also found between years of experience in administering medications and participants believing that medication errors occur due to nurses failing to check the patients name band with medication administration records in their units applying the Spearman's rho correlation test p=0.03; r=-.226. Despite being a weak negative correlation it does indicate that with an increase in experience in administering medication there is a decrease in the number of participants who believe that medication errors occur due to nurses failing to check the patients name bands with medication administration records.

Table 4.12: I believe that medication errors occur in my unit because nurses fail to check the patients' name bands with medication administration records

Category	Frequency (*f*)	Percentage (%)
Never	28	31.8
Very rarely	29	33.0
Sometimes	21	23.9
Often	7	7.9
Always	3	3.4
Total	**n=88**	**100.0**

4.4.4 Question 14: I believe that medication errors occur in my unit because the nurses are inexperienced

As indicated in table 4.13, the majority of the participants n=46(52.3%) believe that medication errors **never** occur in their units due to the nurses being inexperienced.

Applying the Mann-Whitney U test, a statistically significant difference was identified between the level of nursing education and participants believing that medication errors occur in their units due to the inexperience of nurses (***p***=0.04). The participants with the Bachelor's degree qualification has a higher median score and are more likely to believe that medical errors occur in their units as a result of inexperience of nurses.

Table 4.13: I believe that medication errors occur in my unit because nurses are inexperienced

Category	Frequency (*f*)	Percentage (%)
Never	46	52.3
Very rarely	28	31.8
Sometimes	12	13.6
Often	2	2.3
Total	**n=88**	**100.0**

4.4.5 Question 15: I believe that medication errors occur in my unit because there is insufficient training of the nurses

The responses to this question are shown in table 4.14. Most of the participants n=32(37.2%) believe that medication errors **never** occur in their units because there is insufficient training of the nurses however, n=26(30.2%) believe that **sometimes** medication errors do occur in their units due to insufficient training of the nurses.

Table 4.14: I believe that medication errors occur in my unit because there is insufficient training of the nurses

Category	Frequency *(f)*	Percentage (%)
Never	32	37.2
Very rarely	16	18.7
Sometimes	26	30.2
Often	10	11.6
Always	2	2.3
Total	**n=86**	**100.0**

4.4.6 Question 16: I believe that medication errors occur in my unit because the nurses miscalculate the doses

Most of the participants, n=37(42%) as shown in table 4.15 believe that medication errors **never** occur in their units due to nurses miscalculating the doses followed by n=28(31.8%) who believe that it **very rarely** occurs in their units.

Table 4.15: I believe that medication errors occur in my unit because nurses miscalculate the doses

Category	Frequency *(f)*	Percentage (%)
Never	37	42
Very rarely	28	31.8
Sometimes	20	22.8
Often	3	3.4
Total	**n=88**	**100.0**

4.4.7 Question 17: I believe that medication errors occur in my unit because the physicians prescribe the wrong doses

As indicated in table 4.16 most of the participants, n=34(38.6%) believe that medication errors do occur **very rarely** in their units due to the physicians prescribing the wrong doses, followed by n=27(30.7%) who believe it **never** occurs in their units.

Table 4.16: I believe that medication errors occur in my unit because the physicians prescribe the wrong doses

Category	Frequency *(f)*	Percentage (%)
Never	27	30.7
Very rarely	34	38.6
Sometimes	23	26.1
Often	4	4.6
Total	**n=88**	**100.0**

4.4.8 Question 18: I believe that medication errors occur in my unit because there is a lack of medication knowledge amongst the nurses

An equal number of participants believe that medication errors do occur **sometimes** n=29(33%) and **never** n=29(33%) in their units due to nurses having a lack of medication knowledge, followed by n=25(28.4%) who believe that it **very rarely** occurs as shown in table 4.17.

Table 4.17: I believe that medication errors occur in my unit because there is a lack of medication knowledge amongst the nurses

Category	Frequency *(f)*	Percentage (%)
Never	29	33
Very rarely	25	28.4
Sometimes	29	33
Often	4	4.5
Always	1	1.1
Total	**n=88**	**100.0**

4.4.9 Question 19: I believe that medication errors occur in my unit because nurses are not taught/trained to be aware of adverse drug effects

As shown in table 4.18 most of the participants, n=34(39.1%) believe that medication errors **never** occur in their units because nurses were not taught/trained to be aware of adverse drug effects, while n=21(24.1%) participants believe it **sometimes** occur.

The Mann-Whitney U test identified a statistically significant difference between **postbasic nursing** qualifications and participants who believed that in their units medication errors occur because nurses were not taught/trained to be aware of adverse drug effects (***p***=0.01). Based on a higher median, the nurses without a postbasic qualification were more likely to believe that medication errors occur because nurses were not taught / trained to be aware of adverse drug effects.

Table 4.18: I believe that medication errors occur in my unit because nurses are not taught/trained to be aware of adverse drug effects

Category	Frequency (f)	Percentage (%)
Never	34	39.1
Very rarely	15	17.2
Sometimes	21	24.1
Often	11	12.6
Always	6	7.0
Total	**n=87**	**100.0**

4.4.10 Question 20: I believe that medication errors occur in my unit because nurses fail to ensure that they are dealing with the right patients

The majority of participants n=45(51.1%) believe that medication errors **never** occur in their units because nurses fail to ensure that they are dealing with the right patients, followed by n=30(34.1%) who believe that it occurs **very rarely** in their units (table 4.19).

A statistically significant difference was also found between the years of experience in administering medications as a registered professional nurse and participants who believe that medication errors occurred in their units because nurses fail to ensure that they are dealing with the right patients in their unit applying the Spearman's rho correlation test p=0.024; r=-.244. Although the result shows a weak negative correlation, it does show that with an increase in experience in administering medication, the number of participants decreases who believe that medication errors occur due to nurses failing to ensure that they were dealing with the right patients.

Table 4.19: I believe that medication errors occur in my unit because nurses fail to ensure that they are dealing with the right patients

Category	Frequency *(f)*	Percentage (%)
Never	45	51.1
Very rarely	30	34.1
Sometimes	13	14.8
Total	**n=88**	**100.0**

4.4.11 Question 21: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the right drugs

In table 4.20 the majority of participants, n=46(52.3%) believe that medication errors **never** occur in their units because nurses fail to ensure that they administer the right drugs followed by n=35(39.8%) that believe it **very rarely** occurs.

A statistically significant difference was identified between the level of nursing education and the participants who believed that medication errors occur in their units because nurses fail to

ensure that they administer the right drugs (***p***=0.02) having applied the Mann-Whitney U test. Based on a higher median, the participants with a Bachelor's degree were more likely to believe that medication errors occur in their wards because the nurses fail to ensure that they administer the right drug.

Table 4.20: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the right drugs

Category	Frequency (*f*)	Percentage (%)
Never	46	52.3
Very rarely	35	39.7
Sometimes	7	8.0
Total	**n=88**	**100.0**

4.4.12 Question 22: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the right dosages

As indicated in table 4.21, half of the participants, n=44(50%) responded that medication errors **never** occur in their units because nurses fail to ensure that they administer the right dosages followed by **very rarely** n=34(38.6%).

Having applied the Mann-Whitney U test, a statistically significant difference was identified between the level of nursing education and the participants who believe that medication errors occur in their units because nurses fail to ensure that they administer the right dosages (***p***=0.01). Due to a higher median the participants with a Bachelor's degree qualification were more likely to believe that medication errors occur in their units because nurses fail to ensure that they administer the right dosages.

A Kruskal-Wallis H test identified statistically significant differences between the number of months doing night duty during the last 12 months and the participants who believe that medication errors occur in their wards because nurses fail to ensure that they administer the right dosages (***p***=0.03). The results further show due to a higher median, that those participants with no night duty worked in the last 12 months were more likely to believe that nurses in their units fail to administer the right dosages, than participants with more than six months night duty and those with ≤ six months of night duty.

Table 4.21: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the right dosages

Category	Frequency *(f)*	Percentage (%)
Never	44	50.0
Very rarely	34	38.6
Sometimes	9	10.3
Often	1	1.1
Total	**n=88**	**100.0**

4.4.13 Question 23: I believe that medication errors occur in my unit because nurses fail to ensure that they use the right route

The majority of participants, n=49(57%) believe that medication errors **never** occur in their units because nurses fail to ensure that they use the right route followed by **very rarely** n=33(38.3%) as shown in table 4.22.

The Mann-Whitney U test showed a statistically significant difference between the level of nursing education and participants who believe that medication errors occur in their units because nurses fail to ensure that they use the right route (***p***=0.01). Based on a higher median the participants with a Bachelor's degree were more likely to believe that medication errors occur in their units because nurses fail to ensure that they use the right route when administering medication.

Table 4.22: I believe that medication errors occur in my unit because nurses fail to ensure that they use the right route

Category	Frequency *(f)*	Percentage (%)
Never	49	57.0
Very rarely	33	38.3
Sometimes	4	4.7
Total	**n=86**	**100.0**

4.4.14 Question 24: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the medication at the right frequency

As indicated in table 4.23 the majority of the participants n=54(61%) believe that medication errors do occur in their units because nurses fail to ensure that they administer the medication at the right frequency.

Having applied the Mann-Whitney U test, a statistically significant difference was identified between the level of nursing education and participants who believe that medication errors occur because nurses in their units failed to ensure that they administer the medication at the right frequency (***p***<0.01). The participants with a Bachelor's degree qualification were more

likely to believe that nurses in their units fail to ensure that they administer medication at the right frequency based on the 75th percentile.

Table 4.23: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the medication at the right frequency

Category	Frequency *(f)*	Percentage (%)
Never	34	38.6
Very rarely	29	33.0
Sometimes	20	22.7
Often	4	4.6
Always	1	1.1
Total	**n=88**	**100.0**

4.4.15 Question 25: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the medication at the right time

Most of the participants, n=30(34.1%) believe that medication errors **sometimes** do occur in their units because nurses fail to ensure that they administer the medication at the right time followed by **never** n=26(29.5%).

A statistically significant difference was also found between years of experience as a registered professional nurse and participants who believe that medication errors occur in their units because nurses fail to ensure that they administer the medication at the right time applying the Spearman's rho correlation test p=0.03; r=-.224. Although a weak negative correlation was obtained it does indicate that with an increase in experience as a RPN, the number of participants decreased who believe that medication errors occur in their units because nurses fail to ensure that they administer medication at the right time.

Table 4.24: I believe that medication errors occur in my unit because nurses fail to ensure that they administer the medication at the right time

Category	Frequency *(f)*	Percentage (%)
Never	26	29.5
Very rarely	25	28.4
Sometimes	30	34.1
Often	5	5.7
Always	2	2.3
Total	**n=88**	**100.0**

4.4.16 Question 26: I believe that medication errors occur in my unit because of work pressure, e.g., running out of time before handing over to the next shift

Table 4.25 shows most of the participants n=34(38.6%) believe that medication errors do occur in their units **sometimes** because of work pressure, e.g., running out of time before handing over to the next shift followed by n=22(25%) who believe it **never** occurs.

A statistical significant difference was identified between postbasic nursing qualifications and the participants who believe that medication errors occur in their units due to work pressure, e.g., running out of time before handing over to the next shift variable applying the Mann-Whitney U test (***p***=0.03). Further analyses show that those without postbasic qualifications were more likely to believe that medication errors occur due to work pressure based on the 75th percentile.

A statistically significant difference was also found between years of experience as a registered professional nurse and participants who believe that medication errors occur in their units due to work pressure, applying the Spearman's rho correlation test p=0.03; r=-.230. Despite being a weak negative correlation it does show that an increase in experience as a RPN resulted in a decrease of participants who believe that medication errors occur in their units due to work pressure.

Table 4.25: I believe that medication errors occur in my unit because of work pressure, e.g., running out of time before handing over to the next shift

Category	Frequency (*f*)	Percentage (%)
Never	22	25.0
Very rarely	14	15.9
Sometimes	34	38.6
Often	11	12.5
Always	7	8.0
Total	**n=88**	**100.0**

4.4.17 Question 27: I believe that medication errors occur in my unit because medication administration policies are not followed

As indicated in table 4.26 most of the participants, n=31(36%) believe that medication errors **never** occur in their units because medication administration policies are not followed while n=28(32.6%) believe that medication errors **very rarely** occur in their units.

The Mann-Whitney U test identified a statistically significant difference between the level of nursing education and the participants who believe that medication errors occur in their units because of medication administration policies not being followed (***p***=0.02). Based on a higher

median, the participants with a Bachelor's degree are more likely to believe that medication errors occur in their units because nurses do not follow medication administration policies.

Table 4.26: I believe that medication errors occur in my unit because medication administration policies are not followed

Category	Frequency *(f)*	Percentage (%)
Never	31	36.0
Very rarely	28	32.6
Sometimes	22	25.6
Often	4	4.6
Always	1	1.2
Total	**n=86**	**100.0**

4.4.18 Question 28: I believe that medication errors occur in my unit because another nurse is asked for clarification and not the physician directly

As shown in table 4.27 most of the participants n=32(36.4%) believe that medication errors do **sometimes** occur in their units because another nurse is asked for clarification and not the physician directly, followed by n=26(29.5%) who believe it **never** occurs.

A statistically significant difference was also found between years of experience as a registered professional nurse and participants who believe that medication errors occur in their unit because another nurse is asked for clarification and not the physician directly by applying the Spearman's rho correlation test p=0.03; r=-.229. A weak negative correlation was obtained which indicated that with an increase in experience as a RPN, the number of participants decreased who believe that medication errors occur in their units because another nurse is asked for clarification and not the physician directly.

Table 4.27: I believe that medication errors occur in my unit because another nurse is asked for clarification and not the physician directly

Category	Frequency *(f)*	Percentage (%)
Never	26	29.5
Very rarely	17	19.3
Sometimes	32	36.4
Often	9	10.2
Always	4	4.6
Total	**n=88**	**100.0**

4.4.19 Question 29: I believe that medication errors occur in my unit because abbreviations are used

As indicated in table 4.28 most of the participants, n=32(36.4%) believe that medication errors do occur **sometimes** in their units due to abbreviations that are used followed by **very rarely** n=25(28.4%).

Table 4.28: I believe that medication errors occur in my unit because abbreviations are used

Category	Frequency *(f)*	Percentage (%)
Never	22	25.0
Very rarely	25	28.4
Sometimes	32	36.4
Often	5	5.7
Always	4	4.5
Total	**n=88**	**100.0**

4.4.20 Question 30: I believe that medication errors occur in my unit because of hesitance to request clarification from the physician's order, if it is unclear

As shown in table 4.29, most of the participants, n=33(37.5%) responded that medication errors **never** occur in their units because of hesitance to request clarification from the physician's order if it is unclear, followed by **very rarely** n=25(28.4%).

A Kruskal-Wallis H test identified statistically significant differences between the number of months doing night duty the last year and participants who believe that errors occur in their units because of hesitance to request clarification from the physician's order if it is unclear (***p***=0.04). Due to a higher median, participants with no night duty are more likely to believe that medication errors occur in their units because nurses hesitate to request clarification from the physician's order, than participants with six months and more night duty.

Table 4.29: I believe that medication errors occur in my unit because of hesitance to request clarification from the physician's order, if it is unclear

Category	Frequency *(f)*	Percentage (%)
Never	33	37.5
Very rarely	25	28.4
Sometimes	22	25.0
Often	7	8.0
Always	1	1.1
Total	**n=88**	**100.0**

4.4.21 Question 31: I believe that medication errors occur in my unit because of unfamiliarity with the handling of the medication

Most of the participants, n=36(40.9%) as shown in table 4.30 believe that medication errors **never** occur in their units because of unfamiliarity with the handling of the medication followed by n=28(31.8%) who believe that it occurs **very rarely**.

Table 4.30: I believe that medication errors occur in my unit because of unfamiliarity with the handling of the medication

Category	Frequency *(f)*	Percentage (%)
Never	36	40.9
Very rarely	28	31.8
Sometimes	20	22.7
Often	4	4.6
Total	**n=88**	**100.0**

4.4.22 Question 32: I believe that medication errors occur in my unit because of distractions and interruptions during medication administration

Table 4.31 shows most of the participants, n=31(35.2%) believe that medication errors do occur **sometimes** in their units because of distractions and interruptions during medication administration followed by n=27(30.7%) who believe that it **never** occurs in their units.

Table 4.31: I believe that medication errors occur in my unit because of distractions and interruptions during medication administration

Category	Frequency *(f)*	Percentage (%)
Never	27	30.7
Very rarely	20	22.7
Sometimes	31	35.2
Often	10	11.4
Total	**n=88**	**100.0**

4.4.23 Question 33: I believe that medication errors occur in my unit because of incorrect dilution calculations

Most of the participants, n=41(46.6%) as shown in table 4.32 believe that medication errors **never** occur in their units because of incorrect dilution calculations followed by an equal number of participants who believe **sometimes** n=21(23.9%) and **very rarely** n=21(23.9%).

Table 4.32: I believe that medication errors occur in my unit because of incorrect dilution calculations

Category	Frequency *(f)*	Percentage (%)
Never	41	46.6
Very rarely	21	23.9
Sometimes	21	23.9
Often	5	5.6
Total	**n=88**	**100.0**

4.4.24 Question 34: I believe that medication errors occur in my unit because of incorrect dosage calculations

In table 4.33 most of the participants, n=39(44.8%) believe that medication errors **never** occur in their units because of incorrect dosage calculations followed by n=29(33.3%) who believe it occurs **very rarely**.

Table 4.33: I believe that medication errors occur in my unit because of incorrect dosage calculations

Category	Frequency *(f)*	Percentage (%)
Never	39	44.8
Very rarely	29	33.3
Sometimes	15	17.2
Often	4	4.7
Total	**n=87**	**100.0**

4.4.25 Question 35: I believe that medication errors occur in my unit because of incorrect rate calculations

Most of the participants n=36(42.4%) believe that medication errors **never** occur in their units because of incorrect rate calculations followed by **very rarely** n=29(34.1%) (table 4.34).

A statistically significant difference was also found between years of experience in administering medication as a registered professional nurse and participants who believe medication errors occur in their units because of incorrect rate calculations, by applying the Spearman's rho correlation test p=0.04; r=-.221. Although a weak negative correlation was identified it does indicate that with an increase in experience in administering medication as a RPN a decrease resulted in the number of participants believing that medication errors in their units were due to the nurse calculating the rate incorrectly.

Table 4.34: I believe that medication errors occur in my unit because of incorrect rate calculations

Category	Frequency *(f)*	Percentage (%)
Never	36	42.4
very rarely	29	34.1
Sometimes	17	20.0
Often	3	3.5
Total	**n=85**	**100.0**

4.4.26 Question 36: I believe that medication errors occur in my unit because of the nurse's lack of concentration

Most of the participants, n=39(44.3%) as shown in table 4.35 believe that medication errors **never** occur in their units because of the nurse's lack of concentration followed by n=25(28.4%) who believe it occurs **sometimes**.

Table 4.35: I believe that medication errors occur in my unit because of the nurse's lack of concentration

Category	Frequency *(f)*	Percentage (%)
Never	39	44.3
Very rarely	21	23.9
Sometimes	25	28.4
Often	3	3.4
Total	**n=88**	**100.0**

4.4.27 Question 37: I believe that medication errors occur in my unit because of misplaced decimal points, e.g. when programming IV pump rate

Table 4.36 shows that most of the participants, n=37(42.5%) believe that medication errors **never** occur in their units because of misplaced decimal points, e.g. when programming IV pump rate followed by **very rarely** n=28(32.2%).

A statistically significant difference was also found between years of experience in administering medication as a registered professional nurse and participants who believe that medication errors occurs in their units because of misplaced decimal points, e.g. when programming IV pump rate by applying the Spearman's rho correlation test p=0.04; r=-.221. Despite that a weak negative correlation was obtained, it does indicate that with an increase in experience in administering medication as a RPN, a decrease will result in the number of participants believing that medication errors occur because nurses misplace decimal points when programming the IV pump rate.

Table 4.36: I believe that medication errors occur in my unit because of misplaced decimal points, e.g. when programming IV pump rate

Category	Frequency *(f)*	Percentage (%)
Never	37	42.5
Very rarely	28	32.2
Sometimes	17	19.5
Often	5	5.8
Total	**n=87**	**100.0**

4.4.28 Question 38: I believe that medication errors occur in my unit because of high patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly

As indicated in table 4.37, most of the participants believe that medication errors **never** n=31(36.9%) occur in their units because of high patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly, followed by **sometimes** n=21(25%).

A statistical difference was found between gender and participants who believe that medication errors occur in their units because of a high patient/nurse ratio (p=0.01) by applying the Mann-Whitney U test. Based on a higher median the female participants were more likely to believe that medication errors occur in their units because of high patient/nurse ratio.

Table 4.37: I believe that medication errors occur in my unit because of high patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly

Category	Frequency *(f)*	Percentage (%)
Never	31	36.9
Very rarely	17	20.2
Sometimes	21	25.0
Often	11	13.1
Always	4	4.8
Total	**n=84**	**100.0**

4.4.29 Question 39: I believe that medication errors occur in my unit when only one RPN checks the rate of the pump without another colleague

Table 4.38 shows that most of the participants, n=31(35.6%) believe that medication errors **sometimes** occur in their units when only one RPN checks the rate of the pump without another colleague, followed by n=28(32.2%) who believe it **never** occurs.

The Mann-Whitney U test identified a statistical difference between gender and participants who believe that medication errors occur in their units only when one RPN checks the rate of the pump without another colleague (p=0.02).

Table 4.38: I believe that medication errors occur in my unit when only one RPN checks the rate of the pump without another colleague

Category	Frequency *(f)*	Percentage (%)
Never	28	32.2
Very rarely	20	23.0
Sometimes	31	35.6
Often	7	8.0
Always	1	1.2
Total	**n=87**	**100.0**

4.4.30 Question 40: I believe that medication errors occur in my unit because of advanced drug preparation without rechecking

Most of the participants, n=34(40.5%) as shown in table 4.39 believe that medication errors **never** occur in their units because of advanced drug preparation without rechecking, followed by **very rarely** n=27(32.1%).

Table 4.39: I believe that medication errors occur in my unit because of advanced drug preparation without rechecking

Category	Frequency *(f)*	Percentage (%)
Never	34	40.5
Very rarely	27	32.1
Sometimes	19	22.6
Often	3	3.6
Always	1	1.2
Total	**n=84**	**100.0**

4.4.31 Question 41: I believe that medication errors occur in my unit because of failed communication, e.g. unclear verbal order

In table 4.40 most of the participants, n=32(36.3%) believe that medication errors **never** occur in their units because of failed communication, followed by an equal number of participants believing **very rarely** n=24(27.3%) and **sometimes** n=24(27.3%).

Table 4.40: I believe that medication errors occur in my unit because of failed communication, e.g. unclear verbal order

Category	Frequency *(f)*	Percentage (%)
Never	32	36.3
Very rarely	24	27.3
Sometimes	24	27.3
Often	7	8.0
Always	1	1.1
Total	**n=88**	**100.0**

4.4.32 Question 42: I believe that medication errors occur in my unit because of misidentification of the medication

Most of the participants, n=35(39.8%) believe that medication errors **never** occur in their units because of misidentification of the medication followed by **sometimes** n=26(29.5%) (table 4.41).

Table 4.41: I believe that medication errors occur in my unit because of misidentification of the medication

Category	Frequency *(f)*	Percentage (%)
Never	35	39.8
Very rarely	23	26.1
Sometimes	26	29.5
Often	4	4.6
Total	**n=88**	**100.0**

4.4.33 Question 43: I believe that medication errors occur in my unit because the RPN does not perform double-checks or does incomplete double-checks

In table 4.42, most of the participants n=29(34.1%) believe that medication errors occur in their units **very rarely** because the RPN does not perform double-checks or incomplete double-checks followed by **never** n=26(30.6%).

Table 4.42: I believe that medication errors occur in my unit because the RPN does not perform double-checks or does incomplete double-checks

Category	Frequency *(f)*	Percentage (%)
Never	26	30.6
Very rarely	29	34.1
Sometimes	21	24.7
Often	8	9.4
Always	1	1.2
Total	**n=85**	**100.0**

4.4.34 Question 44: I believe that medication errors occur in my unit because of other causes

Table 4.43 shows that an equal number of the participants believe that medication errors occur in their units **often** n=2 and **never** n=2 because of other causes followed by an equal number of participants that believe that it happens **very rarely** n=1 and **always** n=1. The participants did not specify the other causes.

Table 4.43: I believe that medication errors occur in my unit because of other causes

Category	Frequency *(f)*	Percentage (%)
Never	2	33.3
Very rarely	1	16.7
Often	2	33.3
Always	1	16.7
Total	**n=6**	**100.0**

4.5 SECTION D: MEDICATION ADMINISTRATION ERRORS – HUMAN FACTORS

Section D required the participants to indicate how often medication administration errors have been made **by them personally** in the unit by marking the appropriate column with a cross (x). The participants had to choose either 'never'; 'once per month; 'once per week'; 'once per shift' or 'every time I work with medication'. The responses are discussed according to the data findings.

4.5.1 Question 45: Medication errors have been made by me personally in this unit because I was tired and exhausted

Although the majority of participants n=75(86.2%) as indicated in table 4.44 have **never** made medication errors because they were tired and exhausted, the frequency by which medication errors are made by some **once per month** n=11(12.6%) and **once per shift** n=1(1.2%) are noteworthy.

Table 4.44: Medication errors have been made by me personally in this unit because I was tired and exhausted

Category	Frequency *(f)*	Percentage (%)
Never	75	86.2
Once per month	11	12.6
Once per shift	1	1.2
Total	**n=87**	**100.0**

4.5.2 Question 46: Medication errors have been made by me personally in this unit because my thought process was interrupted

As shown in table 4.45 the majority of the participants n=72(82.0%) indicated that they have **never** made medication errors personally due to thought processes being interrupted, however n=12(13.6%) indicated making errors at least **once per month** due to their thought processes being interrupted, '**once per week'** n=3(3.4%) and '**every time I work with medication** n=1(1.1).

Table 4.45: Medication errors have been made by me personally in this unit because my thought process was interrupted

Category	Frequency *(f)*	Percentage (%)
Never	72	82.0
Once per month	12	13.6
Once per week	3	3.4
Every time I work with medication	1	1.0
Total	**n=88**	**100.0**

4.5.3 Question 47: Medication errors have been made by me personally in this unit because I failed to check the patient's name band with the medication administration record

Although the majority of participants n=80(90.9%) indicated that they have **never** made medication errors because they failed to check the patient's name band with the medication administration record, the frequency by which medication errors were reported made by some **once per month** n=5(5.7%), **once per shift** n=1(1.1%) and **every time they worked with medication** n=2(2.3%) is noteworthy (table 4.46).

Having applied the Mann-Whitney U test, a statistically significant difference was identified between the level of nursing education and the participants who personally made medication errors because they fail to check the patient's name band with the medication administration record (***p***=0.02). Further analysis shows that the participants with Bachelor's degrees were more likely to make medication errors because they fail to check the patient's name band with the medication administration record (***p***=0.02) based on 75th percentile.

A Kruskal-Wallis H test identified statistically significant differences between the number of months of doing night duty during the last 12 months and the failure of participants to check the patient's name band with the medication administration record (***p***=0.04).

Table 4.46: Medication errors have been made by me personally in this unit because I failed to check the patient's name band with the medication administration record

Category	Frequency *(f)*	Percentage (%)
Never	80	90.9
Once per month	5	5.7
Once per shift	1	1.1
Every time I work with medication	2	2.3
Total	**n=88**	**100.0**

4.5.4 Question 48: Medication errors have been made by me personally in this unit because I was inexperienced

In table 4.47, the majority of the participants n=82(93.2%) indicated that they have personally **never** made medication errors because they were inexperienced, however n=6(6.8%) have personally made errors **once per month** because they were inexperienced.

A statistically significant difference was also found between participants who personally made medication errors in their units because they were inexperienced and years of experience as a registered professional nurse (p<0.01; r=-.408), as well as years of experience in administering medications as a registered professional nurse (p<0.01; r=-.370) applying the Spearman's rho correlation test. A medium strong negative correlation was identified between

the two variables, indicating that with an increase in years as a registered professional nurse and years of experience in administering medications as a registered professional nurse, the number of participants decreased who make medication errors due to being inexperienced.

The Mann –Whitney U test identified a statistically significant difference between gender and the participants who made medication errors because they are inexperienced, ***p***=0.01. Based on the 75th percentile, males were more likely to indicate medication administration errors once per month due to inexperience than females.

Table 4.47: Medication errors have been made by me personally in this unit because I was inexperienced

Category	Frequency (*f*)	Percentage (%)
Never	82	93.2
Once per month	6	6.8
Total	**n=88**	**100.0**

4.5.5 Question 49: Medication errors have been made by me personally in this unit because I have insufficient training

The majority of participants indicated that medication errors have **never** n=85(97.7%) been made personally by them because of insufficient training followed by n=2(2.3%) that reported that they do make errors at least **once per month** due to insufficient training (table 4.48).

The Pearson Chi-square test identified a statistically significant difference between gender and medication errors made personally in the unit by the participants due to insufficient training, χ^2 df =1, ***p*** = 0.02.

Further analysis identified a statistically significant difference between years of experience as a registered professional nurse and medication errors made personally in the unit by the participants due to insufficient training (p=0.01; r=-.278); as well as with years of experience in administering medications as a registered professional nurse (p=0.02; r=-.254) and medication errors made personally in the unit by the participants due to insufficient training applying the Spearman's rho correlation test. Although the results showed weak negative correlations, these results do indicate that with an increase in experience as a registered professional nurse or an increase in experience in administering medication, the number of participants decreased who made medication errors due to insufficient training.

A Kruskal-Wallis H test identified statistically significant differences between the number of months doing night duty the last 12 months and the indication of insufficient training (***p***=0.02).

Table 4.48: Medication errors have been made by me personally in this unit because I have insufficient training

Category	Frequency (*f*)	Percentage (%)
Never	85	97.7
Once per month	2	2.3
Total	**n=87**	**100.0**

4.5.6 Question 50: Medication errors have been made by me personally in this unit because I miscalculated the dose

In table 4.49 the majority of participants, n=82(93.2%) indicated that medication errors have **never** been made by them personally because they miscalculated the dose.

Having applied the Mann-Whitney U test, a statistically significant difference was identified between the postbasic nursing qualifications and the medication errors made personally in the unit by the participants due to miscalculation of the dose (***p***=0.01).

A statistically significant difference was also found between medication errors made personally in the unit by the participants due to miscalculation of the dose and years of experience as a registered professional nurse (p=0.01; r=-.261), as well as years of experience in administering medications as a registered professional nurse (p=0.02; r=-.244) applying the Spearman's rho correlation test. Although the results show weak negative correlations these results do indicate that with an increase in experience as a registered professional nurse and experience in administering medication, the number of participants decreased who made medication errors personally due to miscalculation of the dose.

Table 4.49: Medication errors have been made by me personally in this unit because I miscalculated the dose

Category	Frequency (*f*)	Percentage (%)
Never	82	93.2
Once per month	6	6.8
Total	**n=88**	**100.0**

4.5.7 Question 51: Medication errors have been made by me personally in this unit because the physician prescribes the wrong dose

Although the majority of participants, n=75(85.2%) indicated that medication errors have **never** been made by them personally because the physician prescribed the wrong dose, n=13(14.8%) of the participants indicated that they have made medication errors at least **once per month** due to physicians prescribing the wrong dose (table 4.50).

Applying the Spearman's rho correlation test a statistically significant difference was found between medication errors made personally in the unit by the participants due to the physician

prescribing the wrong dose and the age of the participants (p=0.02; r=-.245), as well as the years of experience as a registered professional nurse (p=0.04; r=-.217).

Although the results show a weak negative correlation it does indicate that with an increase in age and experience as a registered professional the number of participants decreased who personally have made medication errors in their units due to the physician prescribing the wrong dose.

Table 4.50: Medication errors have been made by me personally in this unit because the physician prescribes the wrong dose

Category	Frequency *(f)*	Percentage (%)
Never	75	85.2
Once per month	13	14.8
Total	**n=88**	**100.0**

4.5.8 Question 52: Medication errors have been made by me personally in this unit because I have a lack of medication knowledge

As indicated in table 4.51, the majority of participants n=84(95.5%) responded that medication errors have **never** been made by them because of a lack of medication knowledge.

A statistically significant difference was found between participants who personally have made medication errors in their units due to a lack of medication knowledge and years of experience as a registered professional nurse (p=0.01; r=-.269), as well as years of experience in administering medications as a registered professional nurse (p=0.02; r=-.245) applying the Spearman's rho correlation test. Although the results show a weak negative correlation it does indicate that an increase in experience as a registered professional nurse and in administering medication resulted in a decrease in the number of participants who personally have made medication errors in their units due to a lack of medication knowledge.

Table 4.51: Medication errors have been made by me personally in this unit because I have a lack of medication knowledge

Category	Frequency *(f)*	Percentage (%)
Never	84	95.5
Once per month	4	4.5
Total	**n=88**	**100.0**

4.5.9 Question 53: Medication errors have been made by me personally in this unit because of not ensuring that I am dealing with the right patient

The majority of participants, n=87(98.9%) indicated that medication errors have **never** been made by them personally because of not ensuring that they are dealing with the right patient (table 4.52).

Table 4.52: Medication errors have been made by me personally in this unit because of not ensuring that I am dealing with the right patient

Category	Frequency *(f)*	Percentage (%)
Never	87	98.9
Once per month	1	1.1
Total	**n=88**	**100.0**

4.5.10 Question 54: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the right drug

In table 4.53 the majority of participants, n=87(98.9%) indicated that medication errors have **never** been made by them personally because of not ensuring that they are administering the right drug.

Table 4.53: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the right drug

Category	Frequency *(f)*	Percentage (%)
Never	87	98.9
Once per month	1	1.1
Total	**n=88**	**100.0**

4.5.11 Question 55: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the right dosage

Table 4.54 shows that the majority of participants, n=85(96.6%) indicated that medication errors have **never** been made by them personally because of not ensuring that they are administering the right dosage.

Table 4.54: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the right dosage

Category	Frequency *(f)*	Percentage (%)
Never	85	96.6
Once per month	3	3.4
Total	**n=88**	**100.0**

4.5.12 Question 56: Medication errors have been made by me personally in this unit because of not ensuring that I am using the right route

As shown in table 4.55 all the participants (n=88/100.0%) indicated that medication errors have **never** been made by them personally because of not ensuring that they are using the right route.

Table 4.55: Medication errors have been made by me personally in this unit because of not ensuring that I am using the right route

Category	Frequency *(f)*	Percentage (%)
Never	88	100.0
Total	**n=88**	**100.0**

4.5.13 Question 57: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the medication at the right frequency

In table 4.56 the majority of participants, n=86(97.7%) indicated that medication errors have **never** been made by them personally because of not ensuring that they are administering the medication at the right frequency.

Table 4.56: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the medication at the right frequency

Category	Frequency *(f)*	Percentage (%)
Never	86	97.7
Once per month	2	2.3
Total	**n=88**	**100.0**

4.5.14 Question 58: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the medication at the right time

As shown in table 4.57, the majority of the participants n=83(94.3%) indicated that medication errors have **never** been made by them personally because of not ensuring that they are administering the medication at the right time.

Table 4.57: Medication errors have been made by me personally in this unit because of not ensuring that I am administering the medication at the right time

Category	Frequency *(f)*	Percentage (%)
Never	83	94.3
Once per month	5	5.7
Total	**n=88**	**100.0**

4.5.15 Question 59: Medication errors have been made by me personally in this unit because of work pressure, e.g. running out of time before handing over to the next shift

Although the majority of participants n=73(83%) indicated that medication errors have **never** been made by them personally because of work pressure, n=11(12.5%) participants indicated that medication errors have indeed been made by them at least **once a month**.

A statistically significant difference was found between participants who personally made medication errors in their units because of work pressure, e.g. running out of time before handing over to the next shift and years of experience in administering medications as a registered professional nurse ($p<0.01$; $r=-.325$), as well as the age of the participants ($p<0.01$; $r=-.314$) applying the Spearman's rho correlation test.

The results show a medium strong negative correlation between the two variables showing that an increase in age and experience in administering medication resulted in a decrease in the number of participants who made mistakes due to work pressure (once a month and more regularly).

Having applied the Mann-Whitney U test, a statistically significant difference was identified between the postbasic nursing qualifications and the participants who made mistakes due to work pressure ($p=0.02$). Based on the 75th percentile, the participants without postbasic qualifications were more likely to indicate that due to work pressure they personally made medication errors in their units.

Table 4.58: Medication errors have been made by me personally in this unit because of work pressure, e.g. running out of time before handing over to the next shift

Category	Frequency *(f)*	Percentage (%)
Never	73	83.0
Once per month	11	12.5
Once per week	3	3.4
Every time I work with medication	1	1.1
Total	**n=88**	**100.0**

4.5.16 Question 60: Medication errors have been made by me personally in this unit because I did not follow the medication administration policy

As shown in table 4.59, the majority of participants n=82(93.2%) indicated that medication errors have **never** been made by them personally because of not following the medication administration policy.

The Mann-Whitney U test showed a statistically significant difference between the level of nursing education and the participants who personally made medication errors due to failing to follow the medication administration policy (***p***=0.04).

A statistically significant difference was also found between participants who personally made medication errors because of not following the medication administration policy and years of experience as a registered professional nurse (p=0.03; r=-.224) applying the Spearman's rho correlation test. Although a weak negative correlation was obtained it does indicate that with an increase in experience as a RPN the number of participants decreased who personally made medication errors due to not following the medication administration policy.

Table 4.59: Medication errors have been made by me personally in this unit because I did not follow the medication administration policy

Category	Frequency (*f*)	Percentage (%)
Never	82	93.2
Once per month	5	5.7
Every time I work with medication	1	1.1
Total	**n=88**	**100.0**

4.5.17 Question 61: Medication errors have been made by me personally in this unit because another nurse is asked for clarification and not the physician directly

Although the majority of participants n=73(83%) indicated that medication errors have **never** been made by them personally because another nurse was asked for clarification and not the physician directly, n=10(11.4%) indicated that medication errors have indeed been made by them personally at least **once a month** (table 4.60).

A statistically significant difference was found between participants who personally made medication errors because another nurse was asked for clarification and not the physician directly and years of experience as a registered professional nurse (p<0.01; r=-.296), as well as years of experience in administering medications as a registered professional nurse (p<0.01; r=-.292) applying the Spearman's rho correlation test. Although the results show a weak negative correlation it does indicate that with an increase in experience as a RPN and in administering medication, the number of participants decreased who personally made

medication errors because another nurse was asked for clarification and not the physician directly.

Table 4.60: Medication errors have been made by me personally in this unit because another nurse is asked for clarification and not the physician directly

Category	Frequency (*f*)	Percentage (%)
Never	73	83.0
Once per month	10	11.4
Once per week	1	1.1
Once per shift	4	4.5
Total	**n=88**	**100.0**

4.5.18 Question 62: Medication errors have been made by me personally in this unit because abbreviations are used

In table 4.61, the majority of participants n=73(83.9%) indicated that medication errors have **never** been made by them personally because abbreviations were used. However, n=10(11.5%) participants indicated that medication errors have indeed been made by them at least **once a month.**

Table 4.61: Medication errors have been made by me personally in this unit because abbreviations are used

Category	Frequency (*f*)	Percentage (%)
Never	73	83.9
Once per month	10	11.5
Once per week	2	2.3
Every time I work with medication	2	2.3
Total	**n=87**	**100.0**

4.5.19 Question 63: Medication errors have been made by me personally in this unit because of hesitance to request clarification from the physician's order, if it is unclear

Although the majority of the participants, n=77(87.5%) indicated that medication errors have **never** been made by them personally because of hesitance to request clarification from unclear physician's orders, n=10(11.4%) participants indicated that medication errors were made by them at least **once a month** (table 4.62).

A Kruskal-Wallis H test identified statistically significant differences between the work area and the indication by the participants of hesitance to request clarification from unclear physician's orders (***p***=0.03). This result indicates that the participants working in the surgical wards were more likely to hesitate on a regular basis to request clarification from unclear physician's orders.

Table 4.62: Medication errors have been made by me personally in this unit because of hesitance to request clarification from the physician's order, if it is unclear

Category	Frequency *(f)*	Percentage (%)
Never	77	87.5
Once per month	10	11.4
Once per shift	1	1.1
Total	**n=88**	**100.0**

4.5.20 Question 64: Medication errors have been made by me personally in this unit because of being unfamiliar with the side effects of the medication

In table 4.63 the majority of the participants n=74(84.1%) indicated that medication errors have **never** been made by them personally because of being unfamiliar with the side effects of the medication. However, about n=11(12.5%) of the participants indicated that medication errors **have been made** by them at least once a month.

Statistically significant differences were also found between participants who personally made medication errors because of being unfamiliar with the side effects of the medication and years of experience as a registered professional nurse (p=0.01; r=-.257), as well as years of experience in administering medications as a registered professional nurse (p=0.04; r=-.220) applying the Spearman's rho correlation test. Although the results show a weak negative correlation it does indicate that an increase in experience as a registered professional nurse and in administering medication resulted in a decrease in the number of participants who made mistakes because of being unfamiliar with the side effects of the medication.

Table 4.63: Medication errors have been made by me personally in this unit because of being unfamiliar with the side effects of the medication

Category	Frequency *(f)*	Percentage (%)
Never	74	84.1
Once per month	11	12.5
Once per week	2	2.3
Every time I work with medication	1	1.1
Total	**n=88**	**100.0**

4.5.21 Question 65: Medication errors have been made by me personally in this unit because of distractions and interruptions during medication administration

Although the majority of participants, n=71(80.7%) indicated that medication errors have **never** been made by them personally because of distractions and interruptions during medication administration, n=12(13.6%) of the participants indicated that medication errors were made by them personally at least **once a month** (table 4.64).

Having applied the Mann-Whitney U test, a statistically significant difference was identified between the postbasic nursing qualifications and participants who made medication errors due to distractions and interruptions during medication administration (***p***=0.02). Based on the 75th percentile this result indicates that the participants without postbasic qualifications were more likely to indicate that they made medication errors due to distractions and interruptions.

Statistically significant differences were also found between participants who made medication errors because of distractions and interruptions during medication administration and years of experience as a registered professional nurse (p=0.01; r=-.260), as well as years of experience in administering medications as a registered professional nurse (p<0.01; r=-.294) applying the Spearman's rho correlation test. Although the results show a weak negative correlation it does indicate that an increase in experience as a registered professional nurse and in administering medication resulted in a decrease in the number of participants who made medication errors because of distractions and interruptions during medication administration.

Table 4.64: Medication errors have been made by me personally in this unit because of distractions and interruptions during medication administration

Category	Frequency *(f)*	Percentage (%)
Never	71	80.7
Once per month	12	13.6
Once per week	2	2.3
Once per shift	2	2.3
Every time I work with medication	1	1.1
Total	**n=88**	**100.0**

4.5.22 Question 66: Medication errors have been made by me personally in this unit because of incorrect dilution calculations

The majority of the participants, n=84(96.6%) indicated that medication errors have **never** been made by them personally because of incorrect dilution calculations (table 4.65), followed by n=3(3.4%) participants who made mistakes at least **once per month**.

Table 4.65: Medication errors have been made by me personally in this unit because of incorrect dilution calculations

Category	Frequency *(f)*	Percentage (%)
Never	84	96.6
Once per month	3	3.4
Total	**n=87**	**100.0**

4.5.23 Question 67: Medication errors have been made by me personally in this unit because of incorrect dosage calculations

In table 4.66 the majority of the participants, n=86(97.7%) indicated that medication errors have **never** been made by them personally because of incorrect dosage calculations, followed by n=1(1.1%) participants who made mistakes **once per month** and n=1(1.1%) **once per shift**.

Table 4.66: Medication errors have been made by me personally in this unit because of incorrect dosage calculations

Category	Frequency *(f)*	Percentage (%)
Never	86	97.7
Once per month	1	1.1
Once per shift	1	1.1
Total	**n=88**	**100.0**

4.5.24 Question 68: Medication errors have been made by me personally in this unit because of incorrect rate calculations

Table 4.67 shows that the majority of the participants, n=86(97.7%) indicated that medication errors have **never** been made by them personally because of incorrect rate calculations, followed by n=2(2.3%) participants who made mistakes **once per month**.

Statistically significant differences were also found between participants who made medication errors because of incorrect rate calculations and years of experience as a registered professional nurse (p=0.01; r=-.255), as well as years of experience in administering medications as a registered professional nurse (p=0.01; r=-.254), applying the Spearman's rho correlation test. These results show a weak negative correlation but it does indicate that an increase in experience as a registered professional nurse and in administering medication resulted in a decrease in the number of participants who made mistakes because of incorrect rate calculations.

Table 4.67: Medication errors have been made by me personally in this unit because of incorrect rate calculations

Category	Frequency *(f)*	Percentage (%)
Never	86	97.7
Once per month	2	2.3
Total	**n=88**	**100.0**

4.5.25 Question 69: Medication errors have been made by me personally in this unit because of lack of concentration

The majority of the participants, n=85(96.6%) indicated that medication errors have **never** been made by them personally because of a lack of concentration, followed by n=2(2.3%) participants who made mistakes **once per month** and n=1(1.1%) **once per week** (table 4.68).

Statistically significant differences were also found between participants who made medication errors because of a lack of concentration and years of experience as a registered professional nurse ($p<0.01$; $r=-.338$), as well as years of experience in administering medications as a registered professional nurse ($p<0.01$; $r=-.310$), applying the Spearman's rho correlation test. A medium strong negative correlation exists between the two variables, which indicate that an increase in experience as a RPN and in administering medication resulted in a decrease in the number of participants who made mistakes because of lack of concentration.

Table 4.68: Medication errors have been made by me personally in this unit because of lack of concentration

Category	Frequency (*f*)	Percentage (%)
Never	85	96.6
Once per month	2	2.3
Once per week	1	1.1
Total	**n=88**	**100.0**

4.5.26 Question 70: Medication errors have been made by me personally in this unit because of misplaced decimal points, e.g. when programming IV pump rate

In table 4.69 the majority participants, n=83(94.3%) indicated that medication errors have **never** been made by them personally because of misplaced decimal points, e.g. when programming IV pump rate, followed by n=5(5.7%) participants who made mistakes **once per month**.

Having applied the Mann-Whitney U test, a statistically significant difference was identified between postbasic nursing qualifications and errors being made because of misplaced decimal points, e.g. when programming IV pump rate variable (***p***=0.03).

Table 4.69: Medication errors have been made by me personally in this unit because of misplaced decimal points, e.g. when programming IV pump rate

Category	Frequency *(f)*	Percentage (%)
never	83	94.3
once per month	5	5.7
Total	**n=88**	**100.0**

4.5.27 Question 71: Medication errors have been made by me personally in this unit because of high patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly

Although the majority of participants, n=70(79.5%) indicated that medication errors have **never** been made by them personally because of high patient/nurse ratios, n=14(15.9%) of the participants indicated that they have made medication errors at least **once a month**, followed by n=3(3.4%) participants who made mistakes **once per shift** and n=1(1.2%) **every time I work with medication** (table 4.70).

Statistically significant differences were also found between participants who made medication errors because of high patient/nurse ratio and years of experience as a registered professional nurse (p=0.01; r=-.258), as well as years of experience in administering medications as a registered professional nurse (p<0.01; r=-.284) applying the Spearman's rho correlation test. Despite weak negative correlations the results do show that the number of participants who made mistakes because of a high patient/nurse ratio decreased with an increase in the years of experience as a RPN and experience of administering medication.

Table 4.70: Medication errors have been made by me personally in this unit because of high patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly

Category	Frequency *(f)*	Percentage (%)
Never	70	79.5
Once per month	14	15.9
Once per shift	3	3.4
Every time I work with medication	1	1.2
Total	**n=88**	**100.0**

4.5.28 Question 72: Medication errors have been made by me personally in this unit because I was the only RN checking the rate of the pump without another colleague

The majority of the participants, n=76(86.4%) indicated that medication errors have **never** been made by them personally because they were the only RN checking the rate of the pump without another colleague (table 4.71). However, n=11(12.5%) participants indicated that

medication errors have been made by them at least **once a month** when checking the rate of the pump alone, followed by **every time I work with medication** n=1(1.1).

Table 4.71: Medication errors have been made by me personally in this unit because I was the only RN checking the rate of the pump without another colleague

Category	Frequency *(f)*	Percentage (%)
Never	76	86.4
Once per month	11	12.5
Every time I work with medication	1	1.1
Total	**n=88**	**100.0**

4.5.29 Question 73: Medication errors have been made by me personally in this unit because of advanced drug preparation without rechecking

In table 4.72 the majority of the participants, n=82(93.2%) indicated that medication errors have **never** been made by them personally because of advanced drug preparation without rechecking, followed by n=5(5.7%) participants who made mistakes **once per month** and n=1(1.1%) **once per shift.**

Table 4.72: Medication errors have been made by me personally in this unit because of advanced drug preparation without rechecking

Category	Frequency *(f)*	Percentage (%)
Never	82	93.2
Once per month	5	5.7
Once per shift	1	1.1
Total	**n=88**	**100.0**

4.5.30 Question 74: Medication errors have been made by me personally in this unit because of dilution errors

The majority of the participants, n=80(93%) as shown in table 4.73 indicated that medication errors have **never** been made by them personally because of dilution errors, while n=4(4.7%) of the participants indicated that medication errors were made by them at least **once a month,** followed by n=2(2.3%) participants who made mistakes **once per shift**.

Having applied the Mann-Whitney U test, a statistically significant difference was identified between the level of nursing education and dilution errors (***p***=0.04).

Table 4.73: Medication errors have been made by me personally in this unit because of dilution errors

Category	Frequency (*f*)	Percentage (%)
Never	80	93.0
Once per month	4	4.7
Once per shift	2	2.3
Total	**n=86**	**100.0**

4.5.31 Question 75: Medication errors have been made by me personally in this unit because of failed communication, e.g. unclear verbal order

In table 4.74 it is illustrated that the majority of the participants n=80(92%) have **never** made medication errors because of failed communication **e.g. unclear verbal order**, followed by n=6(6.9%) participants who made mistakes **once per month** and n=1(1.1%) **once per shift**.

Table 4.74: Medication errors have been made by me personally in this unit because of failed communication, e.g. unclear verbal order

Category	Frequency (*f*)	Percentage (%)
Never	80	92.0
Once per month	6	6.9
Once per shift	1	1.1
Total	**n=87**	**100.0**

4.5.32 Question 76: Medication errors have been made by me personally in this unit because of administration of wrong IV medication dilute to central line/peripheral line

Table 4.75 shows that the majority of participants, n=84(95.5%) indicated that medication errors have **never** been made by them personally because of the administration of wrong IV medication dilute to central line/peripheral line, followed by n=4(4.5%) participants who made mistakes **once per month.**

Statistically significant differences were also found between participants who made medication errors because of the administration of wrong IV medication dilute to central line/peripheral line and the years of experience as a registered professional nurse (p=0.03; r=-.229) applying the Spearman's rho correlation test. Although a weak negative correlation was obtained it does indicate that an increase in experience as a RPN resulted in a decrease in the number of participants who made mistakes because of wrong IV medication dilute to central/peripheral lines.

Table 4.75: Medication errors have been made by me personally in this unit because of administration of wrong IV medication dilute to central line/peripheral line

Category	Frequency *(f)*	Percentage (%)
Never	84	95.5
Once per month	4	4.5
Total	**n=88**	**100.0**

4.5.33 Question 77: Medication errors have been made by me personally in this unit because of misidentification

Although the majority of the participants, n=85(96.6%) indicated that medication errors have **never** been made by them personally because of misidentification, n=3(3.4%) made mistakes at least **once per month**.

Table 4.76: Medication errors have been made by me personally in this unit because of misidentification

Category	Frequency *(f)*	Percentage (%)
Never	85	96.6
Once per month	3	3.4
Total	**n=88**	**100.0**

4.5.34 Question 78: Medication errors have been made by me personally in this unit because I did not perform double-checks

The majority of the participants, n=77(87.5%) indicated that medication errors have **never** been made by them personally because they did not perform double-checks, however n=10(11.4%) of the participants made medication errors at least **once a month**, followed by n=1(1.1%) **once per shift** because of not doing double checks (table 4.77).

Table 4.77: Medication errors have been made by me personally in this unit because I did not perform double-checks

Category	Frequency *(f)*	Percentage (%)
Never	77	87.5
Once per month	10	11.4
Once per shift	1	1.1
Total	**n=88**	**100.0**

4.5.35 Question 79: Medication errors have been made by me personally in this unit because I did incomplete double-checks

Table 4.78 shows that the majority of the participants, n=79(89.8%) indicated that medication errors have **never** been made by them personally because of doing incomplete double-checks, followed by n=9(10.2%) who made mistakes **once per month**.

Statistically significant differences were also found between participants who made medication errors which occur because of incomplete double-checks and years of experience as a registered professional nurse (p=0.04; r=-.216) applying the Spearman's rho correlation test. Although a weak negative correlation was obtained, it does indicate that with an increase in experience as a RPN a decrease resulted in the number of participants who made mistakes because of incomplete double-checks.

Table 4.78: Medication errors have been made by me personally in this unit because I did incomplete double-checks

Category	Frequency *(f)*	Percentage (%)
Never	79	89.8
Once per month	9	10.2
Total	**n=88**	**100.0**

4.5.36 Question 80: Medication errors have been made by me personally in this unit because of other causes

In table 4.79 all the participants, n=9(100.0%) indicated that they **have never** personally made medication errors because of other causes in their respective units.

Table 4.79: Medication errors have been made by me personally in this unit because of other causes

Category	Frequency *(f)*	Percentage (%)
Never	9	100.0
Total	**n=9**	**100.0**

In conclusion, the Pearson's correlation coefficient value of p=0.01 shows a significant difference in prevalence of medication errors made in the unit versus medication errors made by themselves as reported by the registered professional nurses (Section C and Section D). A score was calculated for each section. Although the questions were similar, the frequency of reporting differed between Sections C and D. In figure 4.3 the scattergram indicates that the registered professional nurses measured themselves low as shown on the Y-axis, but rated the medication errors occurring in their units higher as shown on the X-axis, although there is a general tendency to measure both more or less the same.

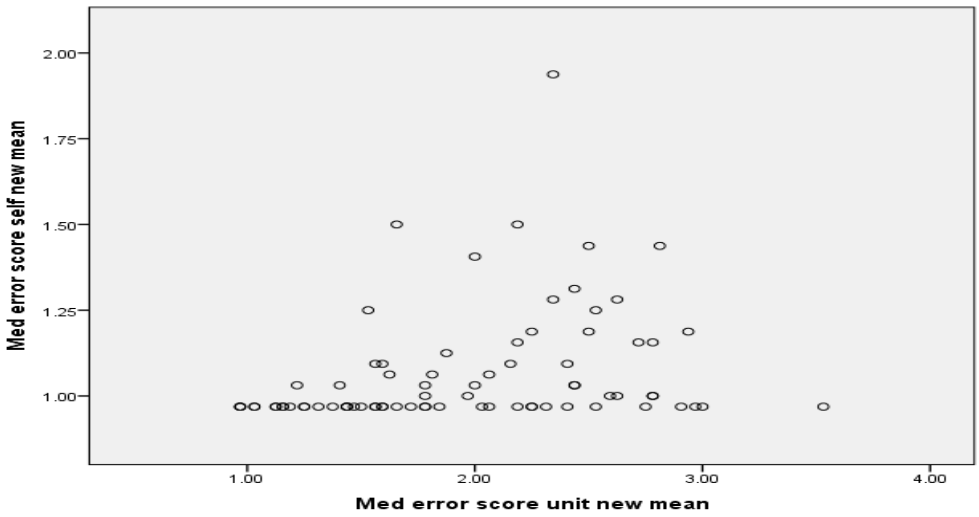

Figure 4.3: Section C versus Section D

4.6 SECTION E: ORIENTATION/IN-SERVICE TRAINING AND POLICIES

Section E required the participants to indicate whether the given statement with regard to orientation, in-service training and policies is typical of what they have experienced in their respective units by marking the appropriate column with a cross (x). The participants had to choose either 'strongly disagree'; 'disagree'; 'neutral'; 'agree'; or 'strongly agree'. The columns were collapsed into agree and disagree.

4.6.1 Question 81: In my work environment medication administration is included in the orientation and induction programme of the ward/unit

The majority of the participants, n=61(69.3%) **agreed** that medication administration was included in the orientation and induction programme of the ward/unit.

Table 4.80: In my work environment medication administration is included in the orientation and induction programme of the ward/unit

Category	Frequency *(f)*	Percentage (%)
Disagree	20	22.7
Neutral	7	8.0
Agree	61	69.3
Total	**n=88**	**100.0**

4.6.2 Question 82: In my work environment formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months

Most of the participants n=41(46.6%) **agreed** that formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months, and

n=33(37.5%) **disagreed** that this happened in their units during the last 12 months (table 4.81).

A Kruskal-Wallis H test identified statistically significant differences between the work area of participants and their reporting that formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months (***p***=0.01). This result indicates that the participants from the intensive care unit and surgical wards are more likely to agree that they received formal in-service training during the last year.

Table 4.81: In my work environment formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months

Category	Frequency *(f)*	Percentage (%)
Disagree	33	37.5
Neutral	14	15.9
Agree	41	46.6
Total	**n=88**	**100.0**

4.6.3 Question 83: In my work environment I have received informal in-service training (on the job training) regarding medication administration during the last 12 months

Table 4.82 shows that most n=41(46.6%) of participants **agreed** that they have received informal in-service training (on the job training) regarding medication administration during the last 12 months. However, an almost equal number of participants n=39(44.3%) **disagreed** with this statement.

A Kruskal-Wallis H test identified statistically significant differences between the work area and participants reporting that informal in-service training (on the job training) has been received regarding medication administration during the last 12 months (***p***=0.01). This result indicates that the participants from the intensive care unit and surgical wards are more likely to agree that they received informal in-service training during the last year than the participants from the medical ward.

Table 4.82: In my work environment I have received in-formal in-service training (on the job training) regarding medication administration during the last 12 months

Category	Frequency *(f)*	Percentage (%)
Disagree	39	44.3
Neutral	8	9.1
Agree	41	46.6
Total	**n=88**	**100.0**

4.6.4 Question 84: In my work environment a policy on medication administration is available in the ward/unit

The majority of the participants n=77(87.5%) **agreed** that a policy on medication administration was available in the ward/unit (table 4.83).

Having applied the Mann-Whitney U test, a statistically significant difference was identified between participants having postbasic nursing qualifications and those that indicated that a policy on medication administration is available in their wards (***p***=0.01). This result indicates that participants with postbasic qualifications agreed more readily that a medication administration policy is available in the ward, based on a higher median.

Table 4.83: In my work environment a policy on medication administration is available in the ward/unit

Category	Frequency *(f)*	Percentage (%)
Disagree	7	8.0
Neutral	4	4.5
Agree	77	87.5
Total	**n=88**	**100.0**

4.6.5 Question 85: In my work environment standard operating procedures on medication administration are available in the ward/unit

The majority, n=67(80.8%) of the participants **agreed** that standard operating procedures on medication administration were available in the ward/unit (table 4.84).

The Mann-Whitney U test show a statistically significant difference between the level of nursing education of the participants and their indication that standard operating procedures on medication administration are available in their wards/units (***p***<0.01). Based on the 75th percentile, participants with Bachelor's degrees are more likely to agree that standard operating procedures on medication administration are available in the ward/unit) than those with diplomas.

Table 4.84: In my work environment standard operating procedures on medication administration are available in the ward/unit

Category	Frequency *(f)*	Percentage (%)
Disagree	8	9.6
Neutral	8	9.6
Agree	67	80.8
Total	**n=83**	**100.0**

4.6.6 Question 86: In my work environment audits are conducted in my ward/unit to evaluate medication administration practices

The majority n=66(75.8%) of the participants **agreed** that audits were conducted in their wards/units to evaluate medication administration practices (table 4.85).

Table 4.85: In my work environment audits are conducted in my ward/unit to evaluate medication administration practices

Category	Frequency *(f)*	Percentage (%)
Disagree	13	15.0
Neutral	8	9.2
Agree	66	75.8
Total	**n=87**	**100.0**

4.6.7 Question 87: In my work environment feedback on audit outcome regarding medication administration practices is given to the ward/unit staff

The majority of the participants, n=62(71%) **agreed** that feedback on audit outcome regarding medication administration practices were given to the ward or unit staff.

Table 4.86: In my work environment feedback on audit outcome regarding medication administration practices is given to the ward/unit staff

Category	Frequency *(f)*	Percentage (%)
Disagree	18	21.0
Neutral	7	8.0
Agree	62	71.0
Total	**n=87**	**100.0**

4.6.8 Question 88: What do you think is necessary to improve patient care with regard to medication administration?

The response rate to this question was n=79(90%). Nine respondents did not answer this question. The majority n=43(54%) of the participants made more than one recommendation on how to improve patient care with regard to medication administration. The frequency of the responses of the participants were analysed to support the findings and recommendations on how to improve medication administration practices. The responses were grouped and summarised as follows:

- Regular in-service training on medication policies, n=24(30.4%);
- Employ more staff to ensure adequate nurse/patient ratio, n=18(22.8%);
- More supervision by shift leader and support from colleagues, n=8(10.1%);
- Patient education on medication usage, n=8(10.1%);
- Ensure RPNs perform double checks, n=7(8.9%);
- Proper patient identification, n=7(8.9%);

- The doctors need to re-board chronic medication and write correct dosages, n=5(6.3%);
- To be provided with a chart indicating generic and trade names, n=4(5.1%);
- Doctors to stop using abbreviations, n=4(5.1%);
- Availability of prescribed medication, n=3(3.8%);
- Orientation and induction programme should include medication administration, n=3(3.8%);
- Each patient must have own medication, n=2(2.5%).

4.6.9 Question 89: Would you like to have regular training?

In table 4.87 the majority n=82(95.3%) of participants indicated that they would like to have **regular training**.

Table 4.87: Would you like to have regular training

Category	Frequency *(f)*	Percentage (%)
Yes	82	95.3
No	4	4.7
Total	**n=86**	**100.0**

4.6.10 Question 90: Would you like to have more training?

The majority n=74(85.1%) of participants indicated in table 4.88 that they would like to have **more training**.

Table 4.88: Would you like to have more training

Category	Frequency *(f)*	Percentage (%)
Yes	74	85.1
No	13	14.9
Total	**n=87**	**100.0**

4.7 SUMMARY

The results and statistical analysis of the data obtained from the questionnaire were discussed and presented. Data was obtained to answer the research question regarding what human factors cause medication administration errors amongst registered professional nurses that administer medication.

In chapter 5, the findings will be discussed and concluded according to the objectives of the study. Limitations of the study will be outlined. Recommendations will be made based on the findings of this study.

CHAPTER 5: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The aim of this research study was to determine what the main human factors were that caused medication administration errors as self-reported by registered professional nurses working in the accident and emergency department, intensive care unit, orthopaedic wards, medical wards, surgical wards and the paediatric ward situated in a public health care institution in the Nelson Mandela Bay Metropole district in the Eastern Cape of South Africa.

In this chapter the conclusions, based on the findings as reported in chapter 4, are discussed. The study limitations as well as the recommendations are presented.

5.2 DISCUSSION

The results are based on self-reported reasons for medication administration errors made and not actual medication administration errors. It may be that registered professional nurses with more experience make fewer errors. However, it may also be that registered professional nurses with more experience become ‘blunted’ or ‘set in their ways’ and may be less aware of making mistakes or to acknowledge mistakes.

5.2.1 Demographic and Professional Profile

The mean age of the participants was 47.77 years with a skewed distribution to the right on the Bell curve indicating an older generation of nurses working in this healthcare institution. This is aligned to the age distribution of SANC statistics (SANC, 2015:1) that indicates 59% of RPNs in South Africa falls in the age group of 40 – 59 years.

According to the findings on the demographic and professional profile of the participants, it is evident that the majority of the participants (93.2%) were full-time employed and female (92%). This is a true reflection of the gender profile of RPNs in South Africa, which according to SANC (2015:2) on 31 December 2014, 91.3% was female and 8.7% male.

The majority (68.2%) of participants, as indicated in table 4.5 were experienced and skilled professional nurses in the clinical environment, which places them in the category of competent, proficient or expert nurses according to Benner (2001:13). It was thus expected that as competent and skilled professional nurses fewer medication errors would be made in the clinical environment. According to Benner’s model of Caring and Expert Nursing Practice, their knowledge and experience should have assisted them during medication administration

and should have helped them to develop systems to reduce medication administration errors. Furthermore, the competent nurse is also able to assess, plan and evaluate patient care and have the ability to take charge of the situation (Benner, 2001:13).

5.2.2 Objectives of the study

The objectives of the study were to determine what the human factors are the registered professional nurses reported to be the cause of medication administration errors in their own practice; to determine whether a lack of knowledge and skills contributed to medication administration errors; to establish the current orientation and in-service training related to medication administration and to describe the availability of policies related to medication administration and the frequency of monitoring and evaluation practices.

5.2.2.1 Objective: Determine what the human factors are the registered professional nurses reported to be the cause of medication administration errors in their own practice

In this research study, the participants indicated that there are multiple human factors that cause medication administration errors amongst registered professional nurses. The **most prevalent** human factors **reported by the participants** that impact on **safe** medication administration **in this healthcare institution as self-reported by the RPNs** are discussed in this section.

a) Nurses are tired and exhausted

The majority of participants (86.2%) as indicated in table 4.44 have never made medication errors because they were tired and exhausted. According to Benner's model (2001:13) the competent, proficient and expert nurses understand the organizational climate much better, thus can manage the workload because they have developed the ability to prioritise elements from most important to least important. However, the frequency by which medication errors are made once per month by some (12.6%) is noteworthy. This calculates to an average of **132 errors** or potential patient adverse events per year, which could result in patient deaths. One death of a patient through error is unacceptable, thus this number of medication errors are too high. Anderson and Townsend (2010:25) substantiate that an exhausted nurse may not notice a near-miss, which could result in a medication error. In addition, Ulanimo *et al*. (2007:28) found in their study that a third of nurses reported that fatigue played a major role in medication administration errors.

b) The thought processes of nurses are interrupted

According to Benner's model (2001:13) the thought processes of the competent, proficient and expert nurses have developed to such an extent that the nurses are able to analyse situations quickly. They direct care on multiple levels and simultaneously apply their professional knowledge and skills during medication administration. Fewer mistakes are therefore expected. Contrary to this, the majority of participants (73%) in this study indicated that medication errors occur in their units because the thought processes of nurses are interrupted (table 4.11). Of these (13.6%) indicated that medication errors have been made by them personally in their respective units on a monthly basis, because their thought processes were interrupted (table 4.45).This calculates to a total of **144 errors** or potential patient adverse events per year, which could result in patient deaths.

c) Lack of Concentration

The majority of participants (96.6%) indicated as shown in table 4.68 that medication errors have never been made by them personally due to a lack of concentration, contrary to Beyea (2014:3) and Hughes *et al*. (2008:11) who in their studies found a lack of concentration **as** a cause of medication errors. The results show that with an increase in experience as a RPN and years of administering medication there was a decrease in reported medication errors (table 4.68).

d) The physicians prescribed the wrong doses

The competent, proficient and expert nurses act as change agents (Benner, 2001:13). Thus, they should be able to identify incorrect prescriptions and correct it before it is administered. The majority of participants (69%) indicated that medication errors occur in their units because the physicians prescribe the wrong doses (table 4.16). This finding is consistent with the study findings on errors in dose selection, which indicate that physician prescription errors occur most commonly, and represent more than 50% of prescribing faults (Velo & Minuz, 2009:624). Alsulami, Conroy and Choonara (2012:1) reported an incidence rate from 0.15 % to 34.8 % of incorrect doses prescribed by physicians. Fortunately in this study, 85.2% have **never** made medication errors personally due to wrong prescriptions as shown in table 4.50. This indicates that they are able to detect these errors as expected according to Benner.

However, 14.8% of the participants reported medication errors made once per month because the physician prescribed the wrong dose. This calculates to an average of **156 self-reported errors** or potential patient adverse effects per year. This study found that an increase in age ($p=0.02$; $r=-.245$) and experience as a registered professional nurse ($p=0.04$; $r=-.217$) resulted in a decrease in the number of errors made because the physician prescribed the wrong dose.

e) Work pressure, e.g. running out of time before handing over to the next shift

Most of the participants (38.6%) indicated that medication errors occurred sometimes in their units because of work pressure (table 4.25) while 12.5% indicated that medication errors have been made by them personally at least once per month (table 4.58) because of work pressure. These findings are aligned with studies conducted by Tang *et al*. (2007:447) and Anderson and Townsend (2010:25) who indicate that heavy workload contribute mainly to medication administration errors. The study further found that an increase in age ($p<0.01$; $r=-.314$) and experience as a RPN and experience in administering medication ($p<0.01$; $r=-.325$) resulted in a decrease in the number of nurses who reported to make errors due to work pressure which is aligned to Benner's model which states that the more experienced nurse is supposed to cope better with the work pressure than the less experienced nurse.

f) Another nurse is asked for clarification, and not the physician directly

Most of the participants, (36.4%) believed that medication errors occurred in their units because another nurse is asked for clarification and not the physician directly (table 4.27). These results are supported by Coggins (2015:6) who states that miscommunication among physicians and nurses are a common cause of medication errors. According to Benner's (2001:13) model it is expected that incomplete, illegible prescriptions and breakdown in communication will be addressed immediately as a competent, proficient and expert nurse is assertive enough to engage with the doctor in her independent and interdependent function as part of the multi-disciplinary team. This includes dealing with complex or complicated prescriptions as they are communicating extensively with other professionals and act as the patient's advocate. The study further shows that an increase in experience as a RPN ($p=0.03$; $r=-.229$) resulted in a decrease in the number of nurses who will be asking another nurse for clarification and not the physician directly.

g) Hesitance to request clarification from the unclear physician's order

In table 4.60, (11.4%) of participants indicated that medication errors have been made by them personally at least once per month because of hesitance to request clarification from the unclear physician's order. This calculates to an average of 120 medication errors per year. Further results indicate that an increase in experience as a RPN ($p<0.01$; $r=-.296$) and in administering medication ($p<0.01$; $r=-.292$) will result in a decreased number of errors because clarification directly with the physician does not take place. According to Hughes *et al*. (2008:3) nurses can be confronted with aggressive behaviour by the physician when seeking clarity which may inhibit future questioning or clarity seeking. Whilst it is good to ask a

colleague's opinion, one cannot guarantee that clarity will be obtained and hence direct communication should rather be with the doctor or the pharmacist for any queries.

Contrary to these findings, most of the participants, (37.5%) indicated that medication errors do occur in their units because of hesitance to request clarification from the physician's prescription, especially those participants who have not worked night duty (***p***=0.04) (table 4.29).

h) Abbreviations are used

Most of the participants, (36.4%) as shown in table 4.28 believed that medication errors **do occur sometimes** in their units due to abbreviations that are used. According to the Pennsylvania Patient Safety Authority (2005:19) abbreviations and nonstandard dose designations are frequently misinterpreted, and often lead to errors resulting in patient harm. Over 200 reports have been received by this Patient Safety Authority indicating that the use of abbreviations has led to medication errors. Wakefield, Uden-Holman and Wakefield (2005:475) found that abbreviations are often used instead of writing the orders out completely.

According to Benner's model (Benner, 2001:13) it is expected of the competent, proficient and expert nurses to communicate extensively with other professionals and act as the patient's advocates by addressing unclear abbreviations immediately before continuing with medication administration, causing less medication errors than reported amongst this experienced group of nurses.

i) Distractions and interruptions during medication administration

Table 4.31 shows most of the participants, (35.2%) believed that medication errors **do occur sometimes** in their units because of distractions and interruptions during medication administration, whilst 13.6% acknowledged (table 4.64) that medication errors have been made by them personally in their respective units at least once per month due to this phenomenon. This finding is supported by Wakefield *et al*. (2005:475) who indicated that distractions and interruptions can disrupt the clinician's focus, leading to serious mistakes. Benner's model (Benner, 2001:13) indicates that the competent, proficient and expert nurses direct care on multiple levels simultaneously, therefore interruptions and distractions are not expected to lead to medication administration errors, contrary to the findings of this study. In this study, the participants **without** postbasic qualifications (***p***=0.02) were more likely to indicate that they make medication errors due to distractions and interruptions. This implies that those equipped with more knowledge are less likely to make medication errors due to

distractions and interruptions. It further indicated that an increase in experience as a registered professional nurse (p=0.01; r=-.260) and in administering medication (p<0.01; r=-.294) result in a decrease in reported medication errors made, due to distractions and interruptions.

j) High patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly

Most of the participants, (36.9%) believe that medication errors never occur in their units because of high patient/nurse ratio where an ICU patient's condition deteriorates quickly (table 4.37). Although medication errors have been made by 15.9% of the participants personally at least once a month, calculating to an average of **168 errors** or potential patient adverse effects per year (table 4.70), it was found in this study that an increase in experience as a RPN (p=0.01; r=-.258) and in administering medication (p<0.01; r=-.284) result in a decrease in the number of mistakes despite a high patient/nurse ratios. According to Benner's theory staff shortages and workload should not have a major effect on the performance of the competent, proficient and expert nurses because their expertise assist them when dealing with a negative organizational climate as they direct and lead on multiple levels at once (Benner, 2001:13). However, Frith, Anderson, Tseng and Fong (2012:288) found that for every 20% decrease in staffing below the staffing minimum, medication errors increased by 18%.

k) When only one RN checks the rate of the pump without another colleague

Most of the participants, (35.6%) in this study believed in table 4.38 that medication errors do **sometimes** occur in their units when only one RPN checks the rate of the pump without another colleague. Although the minority of participants, (12.5%) acknowledged that medication errors have been made by them personally **once per month** due to this phenomenon, this is noteworthy as it calculates to an average of **132 errors** or potential patient adverse effects per year, which could include patient deaths (table 4.71). Many errors were the result of the nurse's misinterpretation of the modes (i.e., time, volume, or rate) on the infusion device or by not recognizing the decimal point on the device's display panel (Hicks, Becker & Chuo, 2007:300; Cronje, 2012:89 and Chuo, Lambert & Hicks, 2007:108).

l) The RN does not perform double-checks or incomplete double-checks

In this study most of the participants (34.1%) as indicated in table 4.42 believe that medication errors occur in their units **very rarely** because the RPN does not perform double-checks or incomplete double-checks and in table 4.78 the majority of the participants, (89.8%) indicated that medication errors have **never** been made by them personally because they did incomplete double-checks. This study further indicates that with an increase in experience as a RPN (p=0.04; r=-.216), a decrease in incomplete double-checks will result. Alsulami, Conroy

and Choonara (2012:1) revealed in a systematic review, that there is insufficient evidence to confirm that double checking of medication reduces the risk of medication errors. However, the Institute for Safe Medication Practices (2013:1) indicated that the proper use of independent double checks can play a vital role in medication safety because it has been shown by numerous studies that it can detect up to 95% of errors. According to Benner's model (Benner, 2001:13), the competent, proficient and expert nurses rely less on rules and guidelines and more on practical experience to perform duties and carry out tasks, hence they are expected to make less mistakes.

m) Nurses are inexperienced

Table 4.13 shows that the majority of the participants (52.3%) believe that medication errors **never** occurred in their units due to the nurses being inexperienced, and as shown in table 4.47, 93.2% indicated that they have personally **never** made medication errors because they were inexperienced. Further results indicate that the participants in this study with the Bachelor's degree qualification (***p***=0.04) were more likely to believe that medication errors occur as a result of inexperience. Amongst participants with increased experience as a RPN ($p<0.01$; $r=-.408$) and in administering ($p<0.01$; $r=-.370$), a decrease in medication errors were reported due to being inexperienced which is aligned to Benner's theory that the more experienced nurses will make less mistakes. Wolf, Hicks and Serembus (2006:39) and Hughes *et al*. (2008:415) in their studies found that the major contributing factor to medication administration errors is inexperience.

n) The five rights principle of medication administration:

According to Hughes *et al*. (2008:401) the five rights principle of medication administration are critical for nurses to adhere to during the medication administration process. These rights include: the right patient, right drug, right time, right frequency, right route and right dose. The five rights principle is also summarized in the institutional medication administration policy (Liv/SOP Pharmacy 1 and Liv/SOP Pharmacy 2), which is clearly not adhered to according to the findings of the study.

o) The right patient

The majority of participants, (51.1%) in this study believe that medication errors **never** occur in their units because nurses fail to ensure that they are dealing with the right patients (table 4.19) and it occurs **very rarely** (33%), that nurses fail to check the patients' name bands with medication administration records (table 4.12). Further analysis found that an increase in experience in administering medication ($p=0.03$; $r=-.226$) will result in a decrease in failure to ensure that nurses are dealing with the right patients and in the number of nurses that fail to

check patients' name bands with medication administration records. Westbrook *et al*. (2009:429) and Lisby *et al*. (2005:20) also found that medication doses were administered without any previous verbal verification of the patient's identity.

Although previous studies have not indicated a difference in quality of nursing between those with diplomas and those with Bachelor's degrees (Clinton, Murrells & Robinson, 2005:82; Robinson & Griffiths, 2008:8), this study found that participants with a Bachelor's degree qualification (***p***=0.03) were more likely to believe that nurses in their unit fail to check the patients' name bands with medication administration records**.** These results could indicate differences in observation, or in application of knowledge, possibly due to teaching methods in the different institutions, which is supported by McHugh and Lake (2010:11) who have shown that the nurse's education level and years of experience influence the level of expertise. Failure to follow policies or procedures was identified as contributing factors of medication errors (Keers *et al*., 2013:1063).

p) The right drug

In table 4.20 the majority of participants, (52.3%) believe that medication errors **never** occur in their units (table 4.53) and even more as (98.9%) indicated that medication errors have never been made by them personally because nurses fail to ensure that they administer the right drugs. Participants with a Bachelor's degree (***p***=0.02) were more likely to believe that nurses fail to ensure that they administer the right drug in their unit. The findings by McHugh and Lake (2010:11) who have shown that the nurse's education level and years of experience influence the level of expertise, as discussed under the right patient, also supports this finding.

q) The right time

Most of the participants, (34.1%) believe in table 4.24 that medication errors **sometimes do occur** in their units because nurses fail to ensure that they administer the medication at the right time, whilst (94.3%) indicated that they have never made mistakes due to this phenomenon (table 4.57). Furthermore, with an increase in experience as a RPN (p=0.03; r=-.224), failure to ensure that medication is administered at the right time decreases. Findings of the National Patient Safety Agency (2010:1) indicate that death and severe harm are related to delayed medicines. Similarly Elliott and Liu (2010:301) state that administration of medication at the incorrect time account for 31% of all medication errors. This corresponds with the observations of the researcher and the findings of Coetzee (2011:3) at this institution as discussed in the rationale (1.2).

r) The right frequency

Although the majority of the participants (61%) believe that medication errors **do occur** in their units because nurses fail to ensure that they administer the medication at the right frequency (table 4.23), the majority of the them (97.7%) indicated that medication errors have **never** been made by them **personally** because of this phenomenon (table 4.56). This study also found that the participants with a Bachelor's degree qualification (***p***< 0.01) were more likely to believe that nurses in their units fail to ensure that they administer medication at the right frequency.

s) The right route

In table 4.22, the majority of participants,(57%) believe that medication errors **never** occur in their units because nurses fail to ensure that they use the right route, whilst 100% indicated that medication errors have **never** been made by them personally because of this phenomenon (table 4.55). These results further indicated that the participants with a Bachelor's degree (***p***=0.01) were more likely to believe that nurses fail to ensure that they use the right route when administering medication. This finding is supported by Gimenes, Marques, Teixeira, Mota, de Camargo Silva and de Bortoli Cassiani (2011:13) who found that the wrong route was used in 6.5% of cases during medication administration.

t) The right dosage

In this study, half of the participants,(50%) did not believe that medication errors occur in their units because nurses fail to ensure that they administer the right dosages (table 4.21), whilst as shown in table 4.54, 96.6% indicated that medication errors have **never** been made by them personally due to this phenomenon. Further results indicate that the participants with a Bachelor's degree qualification (***p***=0.01) are more likely to believe that nurses fail to ensure that they administer the right dosages. In addition, participants working day duty only are more likely to believe that nurses fail to administer the right dosages than participants that worked night duty in the last 12 months (***p***=0.03). Findings by Westbrook *et al*. (2009:429) and Anselmi *et al*. (2007:1847) found that administering the wrong dose are of the most common preventable medication errors which supports this finding.

In conclusion, as discussed above, the study has shown that there are multiple human factors that cause medication administration errors as reported by the RPNs.

5.2.2.2 Objective: Determine whether a lack of knowledge and skills contributed to medication administration errors

The reported lack of knowledge and skills of the participants regarding safe medication administration practices are as follows:

a) Lack of knowledge

A third of the participants (33%) in this study believe that medication errors **do occur sometimes** in their units due to nurses having a lack of medication knowledge (table 4.17). Brady *et al*. (2009:679) found that knowledge deficit is one of the main contributing factors leading to medication administration errors amongst nurses and Hughes and Blegen (2008:408) confirms that it remains a continuous problem.

b) Unfamiliar with side effects of medication

It is believed by 24.1% of participants that medication errors occur **sometimes** in their units because nurses are not taught or trained to be aware of adverse drug effects (table 4.18), whilst 84.1% indicated that medication errors have **never** been made by them personally because of this phenomenon (table 4.63) This result also indicates that participants without a postbasic qualification (p=0.01) are more likely to believe that medication errors occur because nurses were not taught or trained to be aware of adverse drug effects. Further results indicate that an increase in experience as a registered professional nurse (p=0.01; r=-.257) and in administering medication (p=0.04; r=-.220) resulted in a decrease in the number of participants who reported to make mistakes because of being unfamiliar with the side effects of the medication.

c) Miscalculation of the dose

The participants, (22.8%) believe that medication errors **sometimes** occur in their units (table 4.15) or were made by them personally **once per month**, (6.8%) due to miscalculation of the doses (table 4.49). This study found that an increase in experience as a registered professional nurse (p=0.01; r=-.261) and in administering medication (p=0.02; r=-.244) result in a decrease in the number of nurses who reported to miscalculate the dose. The global mathematical challenges influences the calculation skills of the nurses as referred to by Modisaotsile (2012:2). The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2012:3) indicate that many pupils' mathematics knowledge and competencies fall short of the expected level on completion of basic education, which affects their abilities to understand and apply calculations later in life. This could possibly apply to the professional nurse. South African youth's mathematical abilities was reported as being as low as second from the bottom worldwide (News24, 2015).

d) Incorrect rate calculations

Although the majority of participants (97.7%) indicate in table 4.67 that medication errors have **neve**r been made by them personally because of rate errors, (20%) believe **sometimes** and **very rarely** (34.1%) that medication errors do occur in their units because of incorrect rate calculations (table 4.34). In addition, the study further indicates that an increase in experience as a RPN (p=0.01; r=-.255) and in administering medication (p=0.01; r=-.254) result in a decrease in the number of nurses who calculated the rate incorrectly.

e) Misplaced decimal points

Most of the participants, (42.5%) believe that medication errors **never** occur in their units because of misplaced decimal points, e.g. when programming IV pump rate (table 4.36), with the majority participants 94.3% indicating that medication errors have **neve**r been made by them personally due to this phenomenon (table 4.69). The results further indicate that with an increase in experience in administering medication as a RPN a decrea**se** results in misplacing decimal points when programming the IV pump rate (p=0.04; r=-.221).

Cronje (2012:83) found that the implementation and maintenance of standard IV medication concentrations help to provide reliable infusion rates. Rosseter (2014:1) indicated that additional education enhances the nurses' professional development and that better patient outcomes are linked to graduates. These findings support the recommendations made to improve medication administration practices.

In conclusion, the objective to determine whether a lack of knowledge and skills of the registered professional nurses contributed to medication administration errors was investigated. Deficits in their knowledge are evident as described in the poor compliance with the five rule principles, the lack of knowledge in handling of medication and the dose, dilution and rate calculation errors. In accordance with the conceptual framework of Benner the expected level of knowledge amongst competent, proficient and expert nurses in this sample was not identified. It was expected that they would report fewer mistakes made as they had sufficient basic training to qualify as RPNs and should be familiar with the medication administration policy in the ward. Their knowledge and experience should have assisted them to apply their professional knowledge during medication administration and to develop systems to reduce medication administration errors.

5.2.2.3 Objective: Establish the current orientation and in-service training related to medication administration

a) Orientation and induction programme

It was reported by 31% of participants (almost a third of the study population) that medication administration is not included in the orientation and induction programme of the ward, which is a concern (table 4.80). Johnson and Young (2011:134) emphasized the reinforcement of the observation of the five medication rights prior to administration of medication for all newly employed staff.

b) Formal in-service training

Only 46.6% of the participants **agreed** that formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months. This study further indicated that the participants from the intensive care unit and surgical wards were more likely to agree that they received formal in-service training during the last year. Manuti, Pastore, Scardigno, Giancaspro and Morciano (2015:1) reported that skills and competencies are rapidly outdated; therefore there is a need for continuous formal and informal training in the workplace.

c) Informal in-service training

With reference to informal in-service training, only 46% of participants **agreed** that they have received informal in-service training (on the job training) regarding medication administration during the last 12 months. Further tests indicated that the participants from the intensive care unit and surgical wards were more likely to agree that they did receive informal in-service training during the last year. The South African Association for Anaesthesiologists (2009:22) indicated that both formal and informal in-service training are vital to ensure a competent and knowledgeable nursing staff complement.

d) Regular and more training

The majority of participants (95.3%) indicated that they would like to have **regular training** (table 4.87) and (85.1%) indicated that they would like to have **more training** (table 4.88) on medication administration practices. These findings correspond with Sulosaari, Suhonen and Leino-Kilpi (2011:465) who indicate that nurses need adequate competence in the medication process to fulfill their role, which can be achieved through regular training. Armutlu *et al.* (2008:58) identified a need for continuous training programmes on medication safety regardless of years of experience. The Institute of Medicine (2003:1) recommends the training

of all staff, maintenance of staff competence through regular refresher training and the application of nurses' knowledge and skills to guide safe practices.

In conclusion, the objective to establish the current orientation and in-service training related to medication administration errors was successfully explored. Limited formal and in-formal in-service training are conducted in the institution after orientation and induction. It is clearly indicated by the participants that they need more knowledge on medication administration practices on a formal, regular basis, inclusive of all staff.

5.2.2.4 Objective: Describe the availability of policies related to medication administration and the frequency of monitoring and evaluation practices

a) Availability of medication administration policies and standard operating procedures

The majority of the participants (87.5%) **agreed** that a policy on medication administration is available in the ward (table 4.83). The study found that participants with postbasic qualifications (***p***=0.01) **agreed** that a medication administration policy is available in the ward, possibly being more aware of policies due to advanced training. About a quarter of participants (25.6%) believe that errors **do occur sometimes** in their units because medication administration policies are not followed (table 4.26); participants with a Bachelor's degree (***p***=0.02) were more likely to believe this.

It is believed by 93.2% participants that medication errors have **never** been made by them **personally** because they did not follow the medication administration policy (table 4.59). The results further indicate that an increase in experience as a RPN (p=0.03; r=-.224) resulted in a decrease in the number of nurses who made mistakes due to this phenomenon. This study also found a possible trend that the participants with Bachelor's degrees were more likely to report that both nurses in their unit and they themselves do not follow the medication administration policy.

With reference to the availability of standard operating procedures on medication administration, the majority (80.8%) of the participants agreed that standard operating procedures on medication administration are available in the ward (table 4.84). This study further indicated that participants with Bachelor's degrees (***p***<0.01) were more likely to agree that standard operating procedures on medication administration were available in the ward or unit than those with diplomas, indicating a lack of awareness of the availability of policies amongst the greatest component of participants in this study. This corresponds with the finding of Keers *et al*. (2013:1063) who identified that inadequate knowledge and failure to follow policies or procedures are contributing factors to medication administration errors.

b) Conducting of audits on medication administration practices and feedback on audit outcomes

The majority (75.8%) of the participants **agreed** that audits were conducted in their wards/units to evaluate medication administration practices (table 4.85). Furthermore, the majority (71%) of the participants **agreed** that feedback on audit outcome regarding medication administration practices were given to the ward (table 4.86). Regular audits of clinical practice should be done to assist in reduction of errors (Brady *et al*., 2009:679).

In conclusion, the objective to review the presence of policies related to medication administration errors was explored. Although the institutional policies and standard operating procedures of medication administration were available, some participants were not aware of it and some of them did not adhere to it, thus the high rate of reported medication administration errors.

5.3 RECOMMENDATIONS

Aronson (2009:604) indicated that prevention of medication errors can be done as per classification category: memory-based errors, rule-based errors, action-based errors and knowledge-based errors. Based on the findings of the research study, the following strategies are recommended to improve the medication administration practices in the institution as per Aronson's classification category:

5.3.1 Memory-based errors: developing systems to detect errors

5.3.1.1 Quality processes and risk management

An adequate quality processes and risk-management strategy should be developed. The institution should establish a safety culture that encourages discussion of medication errors and near-misses, errors that do not reach a patient, in a non-punitive manner. It is therefore advisable that a platform be created for this i.e., to establish a medication administration review and safety committee that deals with medication errors by sharing of information about the causes of errors and strategies to prevent re-occurrence.

The use of an independent double-check system when giving high-alert drugs, can identify and correct errors before they reach the patient.

5.3.1.2 Avoiding medication errors

To avoid medication errors, it is imperative to perform the "five rights" of medication administration every time - right patient, right drug, right dosage, right time, right frequency and right route. Supervisors and unit managers should be more involved with ensuring that

these rights are enforced, with training included about the necessity for this and the cultivation of an atmosphere where staff feels obliged to do this because of inherent ethics and a moral drive to do right by the patient. A notice with the five 'R's could be displayed in learning centres, dressing rooms and on medication trolleys.

The institution should develop and implement a 'do not use' list of abbreviations. This list could be displayed in all clinical areas and all staff members dealing with medication should be trained on it.

The pharmacist should collaborate with the prescriber to develop and implement a therapeutic plan to ensure good therapeutic outcomes for the patient. One clinical pharmacist should be assigned to each ward to monitor the implementation of such therapeutic plans and to do daily random checks of prescription records.

Address staff shortages by implementing the workload indicators of staffing need (WISN) tool to ensure that the nurse-patient ratio is adequate (WHO, 2010). This will assist in the reduction of fatigue and workload of the nurses. A recognition by the institutional management of their role in preventing medication errors and supporting safe staff practices by adequate staffing and adequate span of control by supervisors is paramount.

A preceptor could be assigned to every newly appointed registered professional nurse in the ward/unit for at least 3-6 months, especially for mentoring of the community service professional nurses.

5.3.1.3 Avoid Distractions and Interruptions

It is vital to eliminate or reduce interruptions of a nurse who is preparing medications or in the process of dispensing medications. One RPN should be assigned per shift to deal with medication administration, which means that there must be at least two RPNs per shift for night duty allocated in the medical, surgical, orthopaedic and paediatric wards. No-distraction zones, "do not disturb" signs over medication preparation areas, and the use of coloured aprons worn by nurses during the medication administration process can be introduced to alert colleagues not to interrupt nurses whilst they are busy with the preparation or administration of medications as supported by Coggins (2015:6) and Anthony *et. al*. (2010:21).

5.3.2 Rule-based errors: improving rules

5.3.2.1 Adequate communication

Standardized order sets and protocols must be developed and implemented to assist clinicians with prompt selection of the correct dosing regimens, routes, and parameters while

eliminating ambiguous abbreviations and the risk of misreading a prescriber's handwriting. The five rights principles and assessment of drug calculation skills during orientation programmes of new staff must be continuously reinforced. Hohenhaus and Powell (2008:108) recommend a standardised curriculum for in-service training with components for teamwork, communication techniques, respectful assertion and situation awareness. The establishment of a inter-professional care group approach and interdepartmental collaboration of physicians, nurses and pharmacists to investigate and discuss past episodes of medication errors routinely to prevent reoccurrence of medication errors is needed (Vazin & Fereidooni, 2012:194). Furthermore, increasing the number of nurses, reducing their responsibility and having protocols for intravenous infusion can assist in the reduction of errors.

5.3.3 Action-based errors: training to improve technical errors

Proper redesigning of faulty systems should be based on an in-depth understanding of the epidemiology of medication errors.

The introduction of a computerised physician ordering entry system (CPOE) can reduce the risk of misreading prescriptions (Van Rosse *et al*., 2009:1184; Anthony, Wiencek, Bauer, Daly & Anthony, 2010:26). Kiekkas *et al*. (2011:36) proposed a number of error prevention strategies including: pharmacists' participation in clinical rounds, independent double-checks by more than one service provider, using barcode technology, medication reconciliation programmes and computerised order entry by physicians.

The implementation of barcodes to match each patient's electronic order and other medical information can reduce medication errors involving administration of the wrong medication or to the wrong patient. The introduction of satellite pharmacies and unit-based pharmacists to reduce floor stock, a potential source of medication error are more examples provided by the literature to prevent errors.

5.3.4 Knowledge-based errors: improving knowledge

5.3.4.1 Staff education and competency

Continuous formal and informal education of all the registered professional nurses can help reduce medication errors. The introduction of the continuing professional development (CPD) model will ensure that registered professional nurses improve their knowledge and skills with regard to medication administration practices.

The establishment of a medication skills laboratory that will be accessible to all registered professional nurses will assist with continuous professional development. Furthermore, the introduction of an online competence testing module for the prevention of medication errors

will improve safe medication practices. Registered professional nurses should be compelled to take this electronic module annually and obtain a 90% mark in order to receive a certificate. The module may be designed in such a way that it marks itself and produces a certificate if you have obtained the result of competence. If not, the registered professional nurse will have to work through the modules and when ready takes the test.

Simulation of medication administration and errors can be used to educate nurses to recognize and manage medication errors as supported by Ford *et al*. (2010:1526) and George *et al*. (2010:136).

Information on new drugs, infrequently used drugs and non-formulary drugs should be made easily accessible to clinicians prior to ordering, dispensing and administering medications.

Updates on both internal and external medication error reports should be discussed with staff as a risk management tool, as an error that has occurred at one institution can occur at another.

As soon as medication-related policies, procedures, and protocols are updated, it should be made available to staff members. Pharmacy rounds with doctors and nurses should be introduced to keep staff members competent.

Further research is recommended to observe the impact of more and regular formal training on medication administration practices.

5.3.4.2 Patient education

Literature studied also mentioned that patient education regarding the safe and effective use of their medications enhances their involvement in their own care, which is an important component of any medication error reduction strategy. Nurses, pharmacists and doctors should teach patients the name of each medication they are taking, how to take it, the dosage, potential adverse effects and interactions, what it looks like, and what it is being used to treat, so that they are aware of inaccurate medicine administration and can warn the nurse if the medication given is not due.

5.4 LIMITATIONS OF THE STUDY

Limitations of a study are the constraints that may reduce the credibility and generalisability of the findings (Burns & Grove, 2011:48).

The research setting for the study was conducted in only one tertiary institution in the Eastern Cape Province and did not include regional and district hospitals. However, the results of the

study are in accordance with former studies conducted on causes of medication administration errors, therefore it can be generalized.

The poor response rate of the Accident and Emergency Department (n=1) hampered the collection of valuable information to ensure that all units are covered when medication administration improvement strategies are developed.

The research study relied on nurses' self-reporting of their units and medication errors made personally, therefore determinations of the actual reasons why medication administration errors occur are beyond the scope of the study.

It is to be noted that systemic factors were not measured, e.g. nurse-patient ratios could confound the findings of this study.

5.5 CONCLUSION

In chapter 5 the conclusions and recommendations of the study were discussed in accordance with the objectives that were set for the study and the applicable literature review by means of cross references.

The aim of the study was to determine what the main human factors are that are the cause of medication administration errors as reported by registered professional nurses in a public tertiary healthcare institution in the Nelson Mandela Bay Metropole in Eastern Cape Province in South Africa. It can be concluded that there are multiple human factors that impact negatively on medication administration practices as self-reported by the registered professional nurses working in the accident and emergency department, intensive care unit, orthopaedic wards, medical wards, surgical wards and paediatric wards of this institution.

The majority of respondents have 10 years and more experience as a registered professional nurse in medication administration, therefore it was expected that fewer mistakes would have been reported as occurring regarding medication administration.

However, the request for more and regular training highlighted the quest for more knowledge on medication administration practices. Furthermore, convoluting factors like inadequate nurse-patient ratios could have influenced the medication error occurrence in this tertiary healthcare institution.

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Appendix 1: Ethical Approval from Stellenbosch University

UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvennoot • your knowledge partner

Approval Notice

Response to Modifications- (New Application)

27-Nov-2014
Du Preez, Ronel R

Ethics Reference #: S14/08/161

Title: **Human factors influencing medication administration errors amongst registered professional nurses in a tertiary public healthcare institution in the Eastern Cape.**

Dear Ms Ronel Du Preez,

The Response to Modifications - *(New Application)* **received on 06-Nov-2014, was reviewed by members of Health Research Ethics Committee 2 via Expedited review procedures on 11-Nov-2014 and was approved.**
Please note the following information about your approved research protocol:

Protocol Approval Period: 27-Nov-2014 -27-Nov-2015

Please remember to use your protocol number (S14/08/161) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 219389207.

Included Documents:
Investigator CV (Young)
Investigator declaration (Young)
Investigator declaration (Stellenberg)

Appendix 2: Permission obtained from Eastern Cape Department of Health

Eastern Cape Department of Health

Enquiries:	Zonwabele Merile	Tel No:	040 608 0830
Date:	01st October 2015	Fax No:	043 642 1439
e-mail address:	zonwabele.merile@echealth.gov.za		

Dear Ms R du Preez

Re: Human factors influencing medication administration errors amongst registered professional nurses in a tertiary public healthcare institution in the Eastern Cape

The Department of Health would like to inform you that your application for conducting a research on the abovementioned topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.
2. You are advised to ensure, observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants.
3. The Department of Health expects you to provide a progress on your study every 3 months (from date you received this letter) in writing.
4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Epidemiological Research & Surveillance Management. You may be invited to the department to come and present your research findings with your implementable recommendations.
5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

SECRETARIAT: EASTERN CAPE HEALTH RESEARCH COMMITTEE

Appendix 3: Permission obtained from the Tertiary Healthcare institution

Province of the
EASTERN CAPE
HEALTH

Office of the Chief Executive Officer – Livingstone Hospital and
Co-ordinator – PE Public Hospitals
Livingstone Hospital • Olmer Building • Standford Road • Korsten Port Elizabeth • Eastern Cape
Private Bag X60572 • Greenacres • 6057 • REPUBLIC OF SOUTH AFRICA
Tel.: +27 (0)41 406 2275 • Fax: +27 (0)41 406 2160• Email: kobus.kotze@ecdoh.gov.za;
; ancie.zokufa@ecdoh.gov.za

30 December 2014

Ms R.E. Du Preez
110 Tharon Street
Unit 56, Camlyn Gardens
Clarina
Pretoria North
0118

Dear Ms Du Preez

RESEARCH: HUMAN FACTORS CAUSING MEDICATION ADMINISTRATION ERRORS AS SELF-REPORTED BY REGISTERED PROFESSIONAL NURSES

Your recent letter to the hospital refers.

You are hereby granted permission to proceed with your research.

Please note the following:

1. Your research may not interfere with normal patient care
2. No hospital consumables and stationary may be used
3. Please introduce yourself to the area/operational manager in charge of the unit before commencing

I would like to wish you every success with the project.

Yours sincerely

DR. J.A. KOTZÉ
CHIEF EXECUTIVE OFFICER
LIVINSTONE HOSPITAL AND CO-ORDINATOR – PE PUBLIC HOSPITALS

Appendix 4: Participant information leaflet and declaration of consent by participant and investigator

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT:

Human factors causing medication administration errors as self-reported by registered professional nurses.

REFERENCE NUMBER: S14/08/161

PRINCIPAL INVESTIGATOR: Ronel Eurika Du Preez

ADDRESS: Livingstone Hospital, Stanford Road, Port Elizabeth, 6100

CONTACT NUMBER: 084 209 3471

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the researcher any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

- The aim of this study is to determine what the main human factors are that cause medication administration errors as reported by registered professional nurses.
- The study will be conducted in the tertiary institution located in the Nelson Mandela Bay Metropole district in the Eastern Cape of South Africa. The institution is Livingstone Hospital.
- Only registered professional nurses working in accident and emergency department, intensive care unit, orthopaedic wards, medical wards, surgical wards and paediatric ward will participate in the study. The study will include both day and night nursing staff.

- You will be given a consent form to complete before your participation in the research project. Participation is entirely voluntary and anonymous. On completion of the consent form, you will place the consent form in a sealed envelope and slot it into a special box provided by the researcher. Once the consent form has been completed, you will be given a questionnaire with 90 questions. No names or hospital names are attached to this questionnaire. The answers are in the form of multiple response tick off columns. The questionnaire will take approximately 20 minutes to complete. Once the questionnaire has been completed, it will be placed in a sealed envelope and placed into a second box marked questionnaires also provided by the researcher. All questionnaires will be completed in the ward where you are working. The researcher will deliver and collect all the consent forms and questionnaires in person.

Why have you been invited to participate?

- As a registered professional nurse currently working in the tertiary institution, your input is valuable to determine what the main human factors are that cause medication administration errors as reported by registered professional nurses.

What will your responsibilities be?

- You will receive the questionnaire by the researcher in a sealed envelope by hand, after completion of an informed consent form. A blank opaque self-sealing envelope will be issued to you. Please place the completed questionnaire in the envelope and seal it. The data collection for this study will occur over a period of three weeks. The data will be collected by the researcher at the end of each day from all the selected wards. The issuing of consent forms and questionnaires will be between 08h00 – 10h00 in the morning for day shift and 20h00 – 22h00 in the evening for night shift. The time for collection for day shift will be between 17h00 – 19h00, and for night shift between 06h00 – 07h00 in the morning. A sealed box will be provided to the wards and it will be marked completed questionnaires. You will be requested to place the sealed completed questionnaires in the sealed box to further enhance confidentiality.

Will you benefit from taking part in this research?

- *Although there are no immediate financial or other benefits to you in this research study, increased awareness will assist in dealing with medication administration errors as an indicator for continuous quality improvement, rather than blaming individuals. In order to do this, medication administration errors need to be studied extensively. This includes exploring underlying causes for errors, contributing factors, further education or training if required, and support or professional help to optimise coping mechanisms to prevent errors from happening.*

Are there in risks involved in your taking part in this research?

- There are no risks associated with this research study, but you may experience some anxiety in the completion of the questionnaire because you are requested to reveal information related to medication errors that happened in your unit. Should you experience any distress, the researcher is available and can be contacted immediately.

If you do not agree to take part, what alternatives do you have?

- Partaking is voluntary and you can withdraw from the study at any time without penalty.

Who will have access to your medical records?

- The information collected will be treated as confidential and protected. Your identity will remain anonymous.
- Collected data will only be accessible to the researcher, the statistician, supervisor and co-supervisor. The raw data and final results will be kept in a locked cabinet for a period of five years after the study is completed.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?

- No injuries are anticipated as you are only requested to complete and submit a questionnaire anonymously.

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

- No you will not be paid to take part in the study. There will be no costs involved for you, if you do take part.

Is there any thing else that you should know or do?

- You can contact Ms R.E. Du Preez at 084 209 3471 if you have any further queries or encounter any problems.
- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study doctor.
- You will receive a copy of this information and consent form for your own records.

Appendix 5: Instrument

HUMAN FACTORS CAUSING MEDICATION ADMINISTRATION ERRORS AS SELF-REPORTED BY REGISTERED PROFESSIONAL NURSES

INSTRUCTIONS

- Please answer all the questions by marking your choice with a cross (×), e.g.:
  Are you a registered professional nurse?

Yes	×
No	

- The questionnaire consists of 7 pages and will take approximately 20 minutes to complete.
- Place the completed questionnaire in the self-sealing envelope provided. Post it in the sealed "questionnaires" box.

SECTION A: DEMOGRAPHIC PROFILE	
NO.	**DEMOGRAPHIC INFORMATION**
1	Indicate your gender a) Male ☐ b) Female ☐
2	Indicate your current age in years ☐
SECTION B: PROFESSIONAL PROFILE	
NO.	**DEMOGRAPHIC INFORMATION**
3	Indicate your nursing category a) Operational Manager ☐ b) Registered Professional Nurse ☐
4	Indicate your level of nursing education a) Diploma ☐ b) Baccalaureate ☐ c) Master ☐ d) Doctorate ☐
5	Do you have any postbasic nursing qualifications? a) Yes ☐ b) No ☐ If yes, specify …… ……

6	How many years of experience as a registered professional nurse do you have? a) 6-12 months b) >1 year – ≤ 2 years c) >2 years – ≤ 3 years d) >3 years – ≤ 4 years e) >4 years – ≤ 9 years f) >9 years
7	Indicate whether you are in a full-time or part-time post a) Full-time b) Part-time
8	How many months did you work night duty these last 12 months? a) No night duty b) Less than 1 month c) >1 month – ≤ 2 months d) >2 months – ≤ 3 months e) >3 months – ≤ 4 months f) >4 months – ≤ 6 months g) >6 months – ≤ 11 months h) >11 months – ≤ 12 months
9	Indicate your area of work a) Intensive care unit b) Accident and Emergency unit c) Surgical ward d) Medical ward e) Orthopaedic ward f) Paediatric ward g) Other (please specify)
10	How many years of experience in administering medications as a registered professional nurse do you have? a) 6-12 months b) > 1year – ≤ 2 years c) > 2years – ≤ 4 years d) >4 years – ≤ 9 years e) >9 years – ≤ 10 years f) >10 years

SECTION C: MEDICATION ADMINISTRATION ERRORS - HUMAN FACTORS						
In this section, please indicate how often the following occur (never, very rarely, sometimes, often, always) Choose only one option per statement by marking the appropriate column with a cross (×).						
NO.	**I believe that medication errors occur in my unit because……**	**Never**	**Very rarely**	**Sometimes**	**Often**	**Always**
11	nurses are tired and exhausted					
12	the thought processes of the nurses are interrupted					
13	nurses fail to check the patients' name bands with medication administration records					
14	the nurses are inexperienced					
15	there is insufficient training of the nurses					
16	the nurses miscalculate the doses					
17	the physicians prescribe the wrong doses					
18	there is a lack of medication knowledge by the nurses					
19	nurses are not taught/trained to be aware of adverse drug effects					
20	nurses fail to ensure that they are dealing with the right patients					
21	nurses fail to ensure that they administer the right drugs					
22	nurses fail to ensure that they administer the right dosages					
23	nurses fail to ensure that they use the right route					
24	nurses fail to ensure that they administer the medication at the right frequency					
25	nurses fail to ensure that they administer the medication at the right time					
26	of work pressure, e.g., running out of time before handing over to the next shift					
27	medication administration policies are not followed					
28	another nurse is asked for clarification, and not the physician directly					

NO.	I believe that medication errors occur in my unit because……	Never	Very rarely	Sometimes	Often	Always
29	abbreviations are used					
30	of hesitance to request clarification from the physician's order, if it is unclear					
31	of unfamiliarity with the handling of the medication					
32	of distractions and interruptions during medication administration					
33	of incorrect dilution calculations					
34	of incorrect dosage calculations					
35	of incorrect rate calculations					
36	of nurse's lack of concentration					
37	of misplaced decimal points, e.g. when programming IV pump rate					
38	of high patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly					
39	when only one RPN checks the rate of the pump without another colleague					
40	of advanced drug preparation without rechecking					
41	of failed communication, e.g. unclear verbal order					
42	of misidentification of the medication					
43	the RPN does not perform double-checks or incomplete double-checks					
44	of other causes (specify)					

SECTION D: MEDICATION ADMINISTRATION ERRORS - HUMAN FACTORS

In this section, please indicate how often the following occur (never, once per month, once per week, once per shift, every time I work with medication)
Choose only one option per statement by marking the appropriate column with a cross (×).

NO.	Medication errors have been made by me personally in this unit because ……	Never	Once per month	Once per week	Once per shift	Every time I work with medication
45	I was tired and exhausted					
46	my thought process was interrupted					
47	I failed to check the patient's name band with medication administration record					
48	I was inexperienced					

49	I have insufficient training					
50	I miscalculated the dose					
51	the physician prescribes the wrong dose					
52	I have a lack of medication knowledge					
53	of not ensuring that I am dealing with the right patient					
54	of not ensuring that I am administering the right drug					
55	of not ensuring that I am administering the right dosage					
56	of not ensuring that I am using the right route					
57	of not ensuring that I am administering the medication at the right frequency					
58	of not ensuring that I am administering the medication at the right time					
59	of work pressure, e.g., running out of time before handing over to the next shift					
60	I did not follow the medication administration policy					
61	another nurse is asked for clarification, and not the physician directly					
62	abbreviations are used					
63	of hesitance to request clarification from the physician's order, if it is unclear					
64	of being unfamiliar with the side effects of the medication					
65	of distractions and interruptions during medication administration					
66	of incorrect dilution calculations					
67	of incorrect dosage calculations					
68	of incorrect rate calculations					
69	of lack of concentration					
70	of misplaced decimal points, e.g. when programming IV pump rate					
71	of high patient/nurse ratio, e.g. ICU patient condition that deteriorates quickly					
72	I was the only RPN checking the rate of the pump without					

	another colleague					
73	of advanced drug preparation without rechecking					
74	of dilution errors					
75	of failed communication, e.g. unclear verbal order					
76	of administration of wrong IV medication dilute to central line/peripheral line					
77	of misidentification					
78	I did not perform double-checks					
79	I did incomplete double-checks					
80	of other causes (specify)					

SECTION E: ORIENTATION/IN-SERVICE TRAINING & POLICIES						
In this section, please indicate whether the given statement is typical of what you have experienced, by indicating "strongly disagree" or "disagree" or "neutral" or "agree" or "strongly agree". Choose only one option per statement by marking the appropriate column with a cross (×).						
NO.	**In my work environment……..**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
81	medication administration is included in the orientation and induction programme of the ward/unit					
82	formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months					
83	I have received informal in-service training (on the job training) regarding medication administration during the last 12 months					
84	a policy on medication administration is available in the ward/unit					
85	standard operating procedures on medication administration are available in the ward/unit					
86	audits are conducted in the ward/unit to evaluate medication administration practices					
87	feedback on audit outcome regarding medication administration practices is given to ward/unit staff					

Question 88

What do you think is necessary to improve patient care with regard to medication administration?

_____

_____

_____

Question 89

Would you like to have regular training?

Yes	
No	

Question 90

Would you like to have more training?

Yes	
No	

Thank you for your willingness to participate in this research study. Place the completed questionnaire in the self-sealing envelope provided. Post it in the sealed "questionnaires" box.

Appendix 6: Declaration of language editor

LONA'S LANGUAGE SERVICES

English/Afrikaans
** Translations*
** Editing*
** Proof-Reading*
** Academic Manuscript Preparation*
** Archival Research*
** Transcriptions from Archived Documents*

Member: South African Translators' Institute (SATI)

3 Beroma Crescent
Beroma
Bellville 7530

TO WHOM IT MAY CONCERN

This letter serves to confirm that the undersigned

ILLONA ALTHAEA MEYER

has proof-read and edited the document contained herein for language correctness.

(Ms IA Meyer)

SIGNED

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3 Beroma Crescent Beroma Bellville 7530

Appendix 7: Declaration of technical editor

Lize Vorster Communication

To whom it may concern

This letter serves as confirmation that I, Lize Vorster, performed the Technical Formatting of Ronel du Preez' thesis. Technical formatting entails complying with the Stellenbosch University's technical requirements for theses.

Yours sincerely

Lize Vorster
Language Practitioner

Vygie street 9, Welgevonden Estate, Stellenbosch, 7600 * e-mail: lizevorster@gmail.com * cell: 082 856 8221

Appendix 8: Liv/SOP Pharmacy 1

DEPARTMENT OF HEALTH: EASTERN CAPE

PROTOCOLS: PHARMACEUTICAL SERVICES LIVINGSTONE HOSPITAL

SOP NUMBER:	Liv/SOP Pharmacy 1
TITLE	**MEDICINE ADMINISTRATION**
INSTITUTION	Livingstone Hospital Pharmacy
ISSUE DATE	December 2011 reviewed: 13/3/2015
ISSUED BY	

Objective:

- To enable people to take their medication safely and as prescribed
- Outline responsibilities in the management of medicines
- Support all staff by training and education
- Encourage and enable people taking medicines to take responsibility for their own medication
- Ensure all appropriate records are kept

Assessment:

- Initial assessment is done at first visit or on admission to establish need, level and responsibility for assistance in the administration of medication
- Before discharge an assessment is done by the pharmacist, nurse or doctor, considering
    - Previous approach to medication
    - Personal views how medication should be managed
    - Precise medication to be taken
- Re-assessment might be necessary with every change in medication regimen

Assistance:

Three levels of assistance can be identified

- People unable to self-administer
  - In home setting, relatives will assist the patient
  - In hospital setting nurses and doctors will ensure administration of medicines
- People who require some assistance
  - People need to be prompted (assisted by relatives, nurses or compliance aids, like pill-boxes)
  - Responsibility of every professional needs to be established
  - It needs to be established what needs to be documented by who
- People who can take full responsibility of their own medication

Storage:

- Staff, patient and relatives need to be knowledgeable about special storage conditions (e.g. storage in refrigerator or out of reach of children)
- All medication is stored inaccessible to public
- Stored away from foods, household items or surgical supplies
- In a sanitary and orderly manner
- Medication for self-administration by the patient must be stored out of access to any other patient

Recording:

- Medication recording form is kept in the patient file
- Medication recording must be completed for all patients in the hospital
- Medication recording must be signed by the professional assisting the person
  - Time, date, dosage and route of administration needs to be recorded
  - Side-effects must be recorded and reported
  - Written explanation will be provided why medication was not given
- Medication chart must include the following:
  - Person's name and date of birth
  - Details of medication: name, strength, dosage, route of administration
  - Times at which medicines should be given
  - Date of the prescription
  - Name, signature and speed-dial of the doctor
  - Date of cancellation of treatment
  - Alterations of treatment must be countersigned by the doctor making the change
- Medication packet label must contain the following information:
  - Name of the medicine
  - Name of the patient
  - Directions for the use of the medicine
  - Name and address of the health establishment
  - Date of dispensing
  - Reference number

Basic rules for safe medication administration:

- Ensure availability of medicines (from emergency cupboard or pharmacy or pharmacist on call)
- Wash hands before preparing medication
- Prepare medication on a clean surface, work with one medication at a time to prevent any potential confusion that could result in medication errors
- The right patient
    - Ensure the patient receiving the dose is the one it was prescribed for
- The right medication
    - Ensure the medication given to the patient is the one prescribed by the doctor
- The right time
    - Ensure the dosing intervals are adhered to and doses are given on time
- The right dose
    - Ensure the correct dose as prescribed is given to the patient
- The right route
    - Ensure the right route is chosen
- Wash hands after administering the medication

Medication error reporting:

- Must be done by all professionals on the prescribed form
- Completed forms must be submitted to the quality assurance department / Clinical audit committee

Disposal of medicines:

- Medicines issued to a patient is this patient's property
- Disposal is required when:
    - Expiry date of medicines is reached
    - Treatment course is completed or discontinued
    - Labels have been dislodged
    - Death of the patient
- Medicines for disposal must be returned to the pharmacy

Policy implemented by: _____

Date: _____

Appendix 9: Liv/SOP Pharmacy 2

DEPARTMENT OF HEALTH: EASTERN CAPE

PROTOCOLS: PHARMACEUTICAL SERVICES LIVINGSTONE HOSPITAL

SOP NUMBER:	Liv/SOP Pharmacy 2
TITLE	**PAEDIATRIC MEDICINE ADMINISTRATION**
INSTITUTION	Livingstone Hospital Pharmacy
ISSUE DATE	October 2012 reviewed: 13/3/2015
ISSUED BY	

Objective:

- To ensure children receive medication safely and as prescribed
- Outline responsibilities in the management of medicines
- Support all staff by training and education
- Encourage and enable people giving medicines to children to take responsibility for their own medication
- Ensure all appropriate records are kept

Assessment:

- Initial assessment is done at first visit or on admission to establish need, level and responsibility for assistance in the administration of medication
- Before discharge an assessment is done by the pharmacist, nurse or doctor, considering
    - Previous approach of caregiver to medication
    - Personal views of caregiver how medication should be managed
    - Precise medication to be taken
- Re-assessment might be necessary with every change in medication regimen

Assistance:

Three levels of assistance can be identified

- People unable to self-administer
  - In home setting, relatives will assist the patient
  - In hospital setting nurses and doctors will ensure administration of medicines
- People who require some assistance
  - People need to be prompted (assisted by relatives, nurses or compliance aids, like pill-boxes)
  - Responsibility of every professional needs to be established
  - It needs to be established what needs to be documented by who
- People who can take full responsibility of their own medication

Storage:

- Staff, patient and relatives need to be knowledgeable about special storage conditions (e.g. storage in refrigerator or out of reach of children)
- All medication is stored inaccessible to public
- Stored away from foods, household items or surgical supplies
- In a sanitary and orderly manner
- Medication for self-administration by the patient must be stored out of access to any other patient

Recording:

- Medication recording form is kept in the patient file
- Medication recording must be completed for all patients in the hospital
- Medication recording must be signed by the professional assisting the person
  - Time, date, dosage and route of administration needs to be recorded
  - Side-effects must be recorded and reported
  - Written explanation will be provided why medication was not given
- Medication chart must include the following:
  - Person's name and date of birth
  - Details of medication: name, strength, dosage, route of administration
  - Times at which medicines should be given
  - Date of the prescription
  - Name, signature and speed-dial of the doctor
  - Date of cancellation of treatment
  - Alterations of treatment must be countersigned by the doctor making the change
- Medication packet label must contain the following information:
  - Name of the medicine
  - Name of the patient
  - Directions for the use of the medicine
  - Name and address of the health establishment
  - Date of dispensing
  - Reference number

Basic rules for safe medication administration:

- Ensure availability of medicines (from emergency cupboard or pharmacy or pharmacist on call)
- Ensure availability of appropriate administration utensil for paediatric dosage forms
- Wash hands before preparing medication
- Prepare medication on a clean surface, work with one medication at a time to prevent any potential confusion that could result in medication errors
- The right patient
    - Ensure the patient receiving the dose is the one it was prescribed for
- The right medication
    - Ensure the medication given to the patient is the one prescribed by the doctor
- The right time
    - Ensure the dosing intervals are adhered to and doses are given on time
- The right dose
    - Ensure the correct dose as prescribed is given to the patient
- The right route
    - Ensure the right route is chosen
- Wash hands after administering the medication

Medication error reporting:

- Must be done by all professionals on the prescribed form
- Completed forms must be submitted to the quality assurance department / Clinical audit committee

Disposal of medicines:

- Medicines issued to a patient is this patient's property
- Disposal is required when:
    - Expiry date of medicines is reached
    - Treatment course is completed or discontinued
    - Labels have been dislodged
    - Death of the patient
- Medicines for disposal must be returned to the pharmacy

Policy implemented by: _____

Date: _____