

**Prevalent elements related to human factors associated
with medication administration errors in private
healthcare institutions within the Western Cape, South
Africa: *A nursing perspective***

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for the degree of Master of Nursing Science in the Faculty of Medicine and Health Sciences

The crest of Stellenbosch University, featuring a shield with various symbols, topped with a crown and flanked by two figures. Below the shield is a banner with the motto 'Wetenskap en Kultuur'.
Stellenbosch University

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DECLARATION

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ABSTRACT

The process of medication administration has been described in terms of medication prescribing, ordering, supplying, administration and documentation (Gordon, 2014). The World Health Organisation views patient safety as a growing global concern. A research study conducted in the United Kingdom reported that complications related to medication administration could increase a patients' hospital stay from 4.6 to 10.3 days (McCleod, Barber & Franklin, 2014). The volume of research that has been conducted into this phenomenon is extensive in the public sector but little in the private healthcare sector; where patient satisfaction is deemed to be linked to their perceptions of the quality of the service they are paying for, which is indirectly affected by the business models in place.

The purpose of this study was to explore the perspectives of the nurses working in private healthcare institutions in the Western Cape, South Africa, regarding the prevalent elements relating to human factors that may be associated with medication administration errors.

Enrolled Nurses (EN) and Registered Nurses (RN) working in the wards and intensive care units of the three participating hospitals were invited to participate. Both groups of nurses were included to deepen the understanding of the human factors affecting the nurses' abilities to safely administer medication to patients, and to determine any stand out elements that might be more prevalent in one of the groups. The nature of the roles and scope of practice of the two nursing categories lends itself to the possibility of challenges varying within the groups.

A quantitative approach with a descriptive design was selected for the study. A non-probability convenience sampling method was utilised. A total of $n=329$ (82.25%) of the total population ($N=400$) completed self-administered data collection questionnaires with Likert style and two open-ended questions. Validity and reliability testing of the data collection instrument was conducted and confirmed through input from nursing, medical, legal and pharmacy experts. The conducting of a pilot study and calculation of the Cronbach alpha coefficient test produced scores ranging between 0.755 to 0.925.

Descriptive and inferential analysis was done to interpret the study findings. A statistician was consulted for the statistical analysis, which included Mann-Whitney testing to determine possible associations between selected components of the demographic data of the study population and those elements deemed to be the most prevalent.

The results highlighted the following key areas of concern as playing a regular or common role in the incidence of medication administration errors (as perceived by the nurses): the pharmacy supply chain (75.68%), patient-nurse workload (74.46%), prescription legibility (71.12%), work

pressure (69.60%), distractions (67.77%) and tiredness or exhaustion (67.47%). In addition to these findings, the study population highlighted the impact that medication substitution in the form of generics is playing in medication safety. The lack of up to date lists of generic medications is posing both a threat and a challenge in terms of patient safety.

Whilst the results presented were in line with those identified in similar studies, there is a clear need for the total concept of incident management to be disseminated to the staff working with the patients. The creation of a “Just Culture” has been proven to reduce adverse events and empower staff in terms of monitoring and improving their own, and others, clinical performance thereby improving patient safety and care.

In addition, and within the South African context, the study results suggest the need to explore the role and responsibilities of the EN's in both the wards and intensive care units (ICU) in the private healthcare institutions. The results show a higher level of concern regarding the effects of human factors such as nurse-patient ratio, work pressure and distractions for the ward based EN as opposed to the EN based in the ICU.

Key words:

Medication, administration, error, nurse, factor, incidence, human, policy and practice.

OPSOMMING

Die proses van medikasietoediening is reeds beskryf met betrekking tot medikasievoorskrifte, -bestelling, -verskaffing-, -toediening en -optekening. Die Wêreldgesondheidsorganisasie beskou pasiëntveiligheid as 'n toenemende wêreldwye bron van kommer. 'n Navorsingstudie wat in die Verenigde Koninkryk uitgevoer is, het getoon dat komplikasies verbonde aan die toedien van medisyne 'n pasiënt se hospitaalverblyf van 4.6 tot 10.3 dae kan verleng. Daar is reeds omvattende navorsing oor hierdie verskynsel in die openbare sektor gedoen, maar min is in die privaat gesondheidssektor uitgevoer, waar pasiënt tevredenheid beskou word as verbandhoudend met hul persepsies van die gehalte van die diens waarvoor hulle betaal, wat indirek deur bestaande sakemodelle beïnvloed word.

Die doel van hierdie studie was om die perspektiewe te verken van verpleegkundiges wat in privaat gesondheidsorginstellings in Wes Kaap Provinsie, Suid-Afrika werk rakende die heersende elemente verbonde aan menslike faktore wat met foute in die toedien van medikasie geassosieer kan word.

Alle ingeskrewe verpleegkundiges (IV's) en geregistreerde verpleegkundiges wat in die sale en intensiewesorg-eenhede van die drie deelnemende hospitale werk, is genooi om aan die studie deel te neem. Albei groepe verpleegkundiges is ingesluit om begrip te bevorder van die menslike faktore wat die verpleegkundiges se vermoë beïnvloed om medisyne veilig aan pasiënte toe te dien en enige opvallende elemente te bepaal wat meer algemeen in een van die groepe kan voorkom. Die aard van die rolle en omvang van praktyke van die twee verpleegkundige-kategorieë lei tot die moontlikheid van verskillende uitdagings onder die twee groepe.

'n Kwantitatiewe benadering met 'n beskrywende ontwerp is vir die studie gekies. 'n Nie-waarskynlikheid gerieflikheidssteekproefnemingsmetode is gebruik. Altesaam $n=329$ (82.25%) van die totale populasie ($N=400$) het selfadministratiewe data-insamelingsvraelyste met Likert-styl- en twee oop vrae voltooi. Geldigheids- en betroubaarheidstoetsing van die data-insamelingsinstrument is uitgevoer en bevestig deur insette van kundiges op die gebied van verpleegkunde, geneeskunde, die reg en farmakologie. Die uitvoer van 'n loodsondersoek en berekening van die Cronbach-alfakoëffisiënttoets, wat tellings voortgebring wat tussen 0.755 en 0.925 wissel.

Beskrywende en inferensiële ontleding is gedoen om die bevindinge van die studie te interpreteer. 'n Statistikus is geraadpleeg vir die statistiese ontleding, wat Mann-Whitney-toetsing ingesluit het om moontlike verwantskappe tussen gekose komponente van die demografiese data van die studiepopulasie en dié elemente wat as die algemeenste beskou is, te bepaal.

Die resultate het die volgende sleutelkommergebiede getoon wat 'n gereelde of algemene rol in die voorkoms van foute met die toediening van medisyne speel (soos deur die verpleegkundiges ervaar): die farmaseutiese-voorsieningsketting (75.68%), pasiënt-verpleegkundige-werklading (74.46%), leesbaarheid van voorskrifte (71.12%), werksdruk (69.60%), afleiding (67.77%) en moegheid of uitputting (67.47%). Benewens hierdie bevindinge het die studiepopulasie die impak uitgelig wat plaasvervanging van medisyne in die vorm van generiese medisyne in medisyneveiligheid speel. Die gebrek aan bygewerkte generiese medisyne lyste van generiese medisyne hou sowel 'n bedreiging as 'n uitdaging met betrekking tot pasiëntveiligheid in.

Alhoewel die huidige studie se resultate ooreenstem met dié van 'n soortgelyke studies verkry is, is daar 'n duidelike behoefte aan verspreiding van die algehele konsep van voorvalbestuur onder personeel wat met pasiënte werk. Daar is bewys dat die skepping van 'n 'regverdige kultuur' negatiewe gevolge verminder en personeel bemagtig met betrekking tot monitering en verbetering van hul eie en ander se kliniese prestasie, waardeur pasiëntveiligheid en -versorging verbeter word.

Hierbenewens, en in die Suid-Afrikaanse konteks, doen die studieresultate aan die hand dat dit noodsaaklik is om die rol en verantwoordelikhede van die IV's in sowel die sale as die intensiewesorg-eenhede in die privaat gesondheidsorginstellings te ondersoek. Die resultate toon 'n hoër vlak kommer rakende die gevolge van menslike faktore soos verpleegkundige-pasiënt-verhouding, werksdruk en afleidings vir die saalgebaseerde IV's teenoor die IV's in die intensiewesorg-eenheid.

Sleutelwoorde: medisyne, toediening, foute, verpleegkundige, faktor, voorkoms, mense, beleid en praktyk

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ABBREVIATIONS

CDE	Centre for Development and Enterprise
COHSASA	Council for Health Services Accreditation
DoH	Department of Health
ENA	Enrolled nurse auxiliary
EN	Enrolled nurse
HFD	Habit forming drug
ICU	Intensive care unit
MAE	Medication administration errors
MIMS	Monthly Index of Medical Specialities
NCS	National Core Standards
NHS	National Health Service
OSCE	Objective structures clinical examination
RN	Registered nurse
SANC	South African Nursing Council
SOP	Standard operating procedure
STATA	Statistical software package from StataCorp
UM	Unit Manager
USA	United States of America
WHO	World Health Organisation

CHAPTER 1

FOUNDATION OF THE STUDY

1.1 INTRODUCTION

Medication administration as a process is more than just the ingestion of medication. In the article “Improving the Process of Medication Administration” by Gordon (2014:18) the process is described in terms of medication ordering, prescription writing, contacting the pharmacy, medication administration and documentation.

An investigative study conducted in the United States of America (USA) by Lahue, Iwasaki, Pyenson, Blumen, Forray and Rothschild (2012: 414) examined medical error data, hospital data and payer claims to determine the distribution, numbers and types of injectable medication related errors alongside calculations of the incremental costs of these errors. The findings reported that at least half of all the adverse drug events that occur are as a result of medication administration errors (MAE) and that decreasing these incidents will improve patient care and safety (Lahue et al., 2012:414).

Unintentional human error is a reality; creating a culture where reporting is encouraged without the risk of blame will allow healthcare workers the opportunity to analyse clinical practices and use the information elicited to drive quality improvements in all healthcare institutions and units (Welzel, 2012:408). A systematic review of empirical evidence relating to the contributors to MAE in hospitals conducted by Keers, Williams, Cooke and Ashcroft (2013:1045-1067) identified hospital systems and policies, managerial decision making, economical constraints alongside safety and clinical structures as leading factors in MAE incidence. A conceptual map, developed by the researcher, showing the relationship between these factors and how they influence the human performance of a nurse during the medication administration process, can be found in Section 1.8 and supports the study foundation.

The South African Department of Health has partnered with the World Health Organisation (WHO) World Alliance for Patient Safety. Action area three of the WHO Alliances’ 2008-2009 Forward Programme First Edition section on Research on Patient Safety requires that patient safety be addressed through the development of a summary of the knowledge gaps on patient safety, alongside evidence of adverse event rates in hospitals. The recommendation is that the quality cycle incorporates the measurement of harm, identification of the causes, listing solutions and evaluation of the impact (WHO, 2008).

The Medication and Related Substances Act 101 of 1965 does not specify any limitations with reference to the categories of nurses who may administer medication; however, all nurses fall

under the legal auspices of the related regulations of the South African Nursing Council (SANC 2005: R2598 as amended, 1984). The administration of medication includes, but is not limited to, numerous routes including oral, intravenous, intra-muscular and sub-cutaneous.

This research explored the human factors that are associated with MAE, as self-reported by the nurses in a private healthcare setting in South Africa.

1.2 SIGNIFICANCE OF THE PROBLEM

Patient safety is a growing global concern. The safety measures instituted by the World Health Organisation (WHO) Working Group support these concerns, as do the National Core Standards (NCS) of South Africa (WHO, 2011:229; Department of Health, 2011).

An article written by McLeod, Barber and Franklin (2014) provided a commentary on MAE in hospitals for the Agency for Healthcare Research and Quality, and reported that hospital stays have increased from 4.6 days to 10.3 days as a result of complications arising from medication administration errors made by nursing staff in the United Kingdom (McLeod, Barber & Franklin, 2014).

In 2014 the British National Health Service (NHS) Litigation Authority paid out £1.6bn in legal claims. This was reported to be an 18% increase on the previous year and the suggestion was that hospitals that fail to prove they have reported a mistake might be liable to pay £10.000 per case to the Litigation Authority (Neville & Gray, 2015).

A quality comparison between the public and private healthcare sectors in Cyprus identified that whilst both services failed to meet the service expectations of their clients, patient satisfaction in the private sector was directly related to the patients' perception of the quality of the service they are paying for. This was in contrast with the patient perceptions in the public sector where the quality of service delivery was seen to be as a result of government decision-making (Yesilasa & Direktor, 2010:969).

As discussed in the research problem (Section 1.4), despite extensive training, in-service education and the availability of innovative resources, medication administration errors continue to occur. In one of the institutions selected for the research study, medication related incidents were reported during the medication safety and incident committee meeting held on the 20th January 2016. These statistics showed a 20% increase in reported medication related incidences from 2013 to 2014 and a 41% increase from 2014 to 2015. These statistics highlight the need for institutional role players to take the necessary actions to ensure that errors are reduced, thereby improving patient safety and the quality of the care being rendered to all patients. Further

information is unavailable as the documents containing the information are not for distribution as indicated on the report.

1.3 RATIONALE

A report by Coetzee, Klopper, Ellis and Aiken (2013:170) stated that the health care system in South Africa faces challenges, with the quality of patient care safety being severely affected by the growing shortage of nurses in both the private and public sector. The report also indicated that more than one in five nurses surveyed rated the quality of patient care as poor or fair. The WHO has suggested that the growing benefits of drug advancement brings with it a greater risk of adverse events related to medication use which, in the light of the increasing shortage of nurses, would add to these concerns (WHO, 2011).

The global focus on patient safety is further entrenched in the NCS of South Africa (Department of Health, 2011:22-23). A retrospective case study conducted by Linegar, Whittaker and van Zyl (2012:146-148) in a teaching hospital in South Africa looked at the benefits of the Council for Health Services Accreditation (COHSASA) within the institution. The findings showed clear evidence of improvements in service delivery through problem identification, the introduction of quality assurance platforms and quality improvement measures as highlighted in the National Core Standards of South Africa where the need for a reduction in the occurrence of adverse events is stipulated (Department of Health, 2011:22-23). In 2011, Ms M. Matsoso, the Director of the National Department of Health in South Africa discussed the importance of adherence to the national standards of healthcare and this incorporates the expectations regarding what denotes safe quality care (Department of Health, 2011:6-7). The six quality improvement areas aimed at improving patient safety incorporate; patient care, clinical management for improved health outcomes, clinical leadership and risk, infection prevention and control along with risk reduction through the management of adverse events (Department of Health, 2011:22-23).

The South African Centre for Development and Enterprise (CDE) research report number 18 of 2011 discussed the role of the private sector in terms of the reformation of healthcare in this country. Whilst this report is clearly focused on the introduction of the proposed National Health Insurance (NHI), the report concludes with an acknowledgement that the private healthcare sector has as much of a role to play in the provision of quality healthcare as the public sector (CDE Executive Summary, 2011:13).

Improving patient safety through the reduction of risk must start with an analysis of the factors that precipitate or play a role in the incidence of adverse events (Welzel, 2012:408). It is important that quality improvement programmes be designed to meet the specific needs of the facility and are focused on the unique challenges and particular culture of that facility. Engaging with the nurses at

the patient interface and delving into their perceptions regarding the factors that influence the incidence of MAE will help create the foundation from which a quality improvement programme can be designed. This premise extends into the managerial process of control. Human error is attributed to poor decision-making and quality control in terms of the execution of safe clinical practice. Ensuring control in the workplace is the means by which the actual performance matches that of the expected performance standards (Muller, Bezuidenhout & Jooste, 2011:37-39).

1.4 RESEARCH PROBLEM

Despite ongoing in-service education, training and the availability of resources, medication administration errors continue to occur. The literature review (refer to chapter 2) has shown that few of the studies that explore the elements that are associated with, or impact upon, the incidence of medication administration errors have involved the private health care sector in South Africa. The current incident management system in the chosen institutions quantifies MAE's in terms of dispensing, administration or omission errors. One of the institutions reported 55 medication related incidents in the last six months, as opposed to 38 for the same period last year. Creating and maintaining a just culture, where incident reporting is encouraged without the risk of blame, is not sufficient to root out the contributory elements.

The findings of this proposed research study could provide evidence to support changes that might benefit clinical practice and demonstrate to the staff that the challenges they face in the workplace are being acknowledged and actions taken. Although both RN's and EN's are reported on no studies have been reported to determine the role of Enrolled Nurses (SANC 2005: R2598 as amended) in this scenario.

1.5 RESEARCH QUESTION

The research question guiding the study was: Within the context of human factors, what are the most prevalent elements associated with medication administration errors, as self-reported by nurses in a private healthcare setting in the Western Cape?

1.6 RESEARCH AIM

The aim of this study was to identify and describe the prevailing elements in making medication administration errors, within the context of human factors, as self-reported by nurses in a private healthcare setting in the Western Cape.

1.7 RESEARCH OBJECTIVES

The objectives of the study were to:

- Determine the prevailing elements related to the human factors associated with MAE's, as self-reported by EN's and RN's working in a private healthcare institutions in the Western Cape.
- Determine associations between professional categories, years of experience and attendance at in-service education, and nurses' perceptions about human factors influencing medication administration errors.
- Unpack the most prevalent elements and factors in terms of meaning, implication and possible ways to address.
- To elicit information from the participants with regards orientation, in-service and policies related to medication administration in their workplace and use this information to determine any shortcomings in these areas.

1.8 CONCEPTUAL FRAMEWORK

A conceptual framework is an abstract representation of the constructs that describe a phenomenon and aids in directing a research study (Burns & Grove, 2011:534).

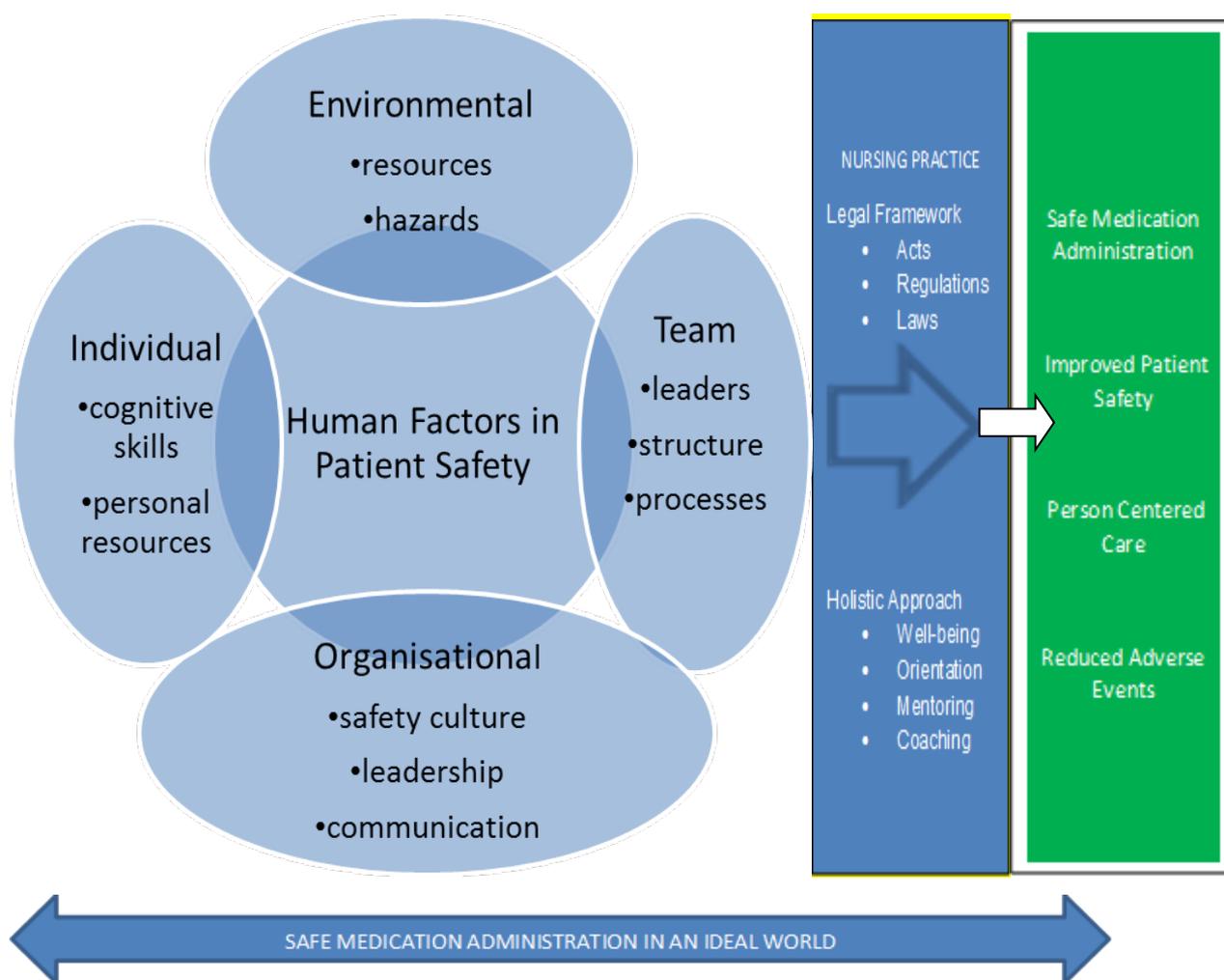
The conceptual framework (Figure 1.1.) outlined below draws upon elements identified in the literature as those that have a direct and indirect effect upon human actions. This framework shows an "ideal world" situation where the nurse is able to deliver the most effective patient care. All institutions have their own inherent culture and practice climate. Understanding the impact the institutional dynamics have on nursing practice is the key to the development of quality innovations that will reduce adverse events, and minimise the impact these events have on our patients. Eliciting the nurses' perceptions of the factors that impact on MAE's will ensure that corrective measures are focused and specific to the institution.

In the framework the blue column speaks to the legislation that underpins nursing practice and the components that the nurse requires to perform her tasks competently. The green column identifies the ideal outcomes as they relate to medication administration.

The conceptual framework is designed in line with the WHO (2009) Patient Safety's Methods and Measures for Patient Safety Working Group report which categorises the human factors that are relevant to patient safety as being related to organisational and managerial, team, work environment and individual components (WHO, 2009).

Figure 1.1: CONCEPTUAL FRAMEWORK based on the WHO definitions for human factors affecting patient safety as discussed above

(Designed by researcher, K Hill)



1.9 RESEARCH METHODOLOGY

Research methodology provides the details of the process that will be used to conduct the research and will be discussed in detail (Grove, Burns & Gray, 2013:707). This section provides the outline that will be used to conduct this research. The results will allow the role players to quantify, in terms of incidence and prevalence, the elements (individual, institutional, environmental, policy and practice) related to the human factors associated with MAE's, in order of their perceived importance, to determine the order of focus when instituting mitigating or corrective strategies to reduce MAE incidence.

The research paradigm found appropriate for this study is Positivism. This is believed to be an appropriate choice for social and natural sciences as it is based on a belief that only phenomena that can be observed either through experience or by using instruments may be perceived as having validity (de Vos, Strydom, Fouche & Delport, 2005:5-6). This research study lies on the

border of positivism, moving towards post positivism. More so this research study is directed towards gaining a deeper understanding of the nurses' perceptions of the human factors that may play a role in MAE. For the nurses to be able to provide this information they will need to have personal experience in terms of the administration of medication in an environment that exposes them (the nurses) to the various human factors described in the data collection questionnaire. In terms of the research paradigm, it is believed that the research process being utilised to conduct this study meets the criteria required.

1.9.1 Research design

This research study was conducted using a quantitative approach with a descriptive design. The quantitative design was used to highlight the cause and effect impact of the variable on the study subjects (Grove, Burns & Gray, 2013:706). A descriptive design was used to elicit detailed information regarding the human factors associated with medication administration errors, as perceived by professional and enrolled nurses, in order to fully understand the phenomenon as it occurs naturally in the workplace. This method does not require any manipulation of variables and the data obtained will be utilised to identify problems with current nursing practice in this situation (Brink, van der Walt & van Rensburg, 2012:112).

1.9.2 Study setting

The study was conducted in three private hospitals from the same hospital group in the Western Cape Metropole. The hospitals are privately listed commercial entities and operate 207, 222 and 175 beds respectively (refer to table: hospitals one, two and three). These hospitals are equipped to provide advanced diagnostic and interventional care with Hospital Two (2) having the status of operating a Level One Trauma Unit. Individual hospitals are not identified in the data analysis in order to maintain institutional anonymity and confidentiality.

Despite the private nature of the business, compliance with the South African National Core Standards for Healthcare Institutions remains a key focus (DoH, 2011:22-23).

The adult medical, surgical, paediatric, maternity wards and intensive care units are the areas where medication administration is the responsibility of RN's and ENA's. In these three institutions, the professional and enrolled nurses deliver care to patients in a number of speciality areas where specialised knowledge and skills are required.

1.9.3 Population and sampling

The researcher used a non-probability convenience sampling method, as this sampling method required that the participants be readily available in the chosen hospitals when the researcher entered the field to collect the data. (Brink et al., 2012:140). The total population was N=400. A

sample of the study population 67.5% (n=270) in tables 1.1 and 1.2 were invited to participate in the study to ensure that the sample was representative of the population and to improve the credibility of study findings (Grove *et al.*, 2013). Sample size determination is discussed in greater detail in section 3.5.

In terms of the inclusion and exclusion criteria, only nurses who are trained and qualified to administer medication and recognise reactions to medications in terms of their scope of practice are included in the study (SANC 2005: R2598 as amended). This will be discussed in detail in Chapter Three.

Table 1.1: Representing the N= population of registered professional nurses within the three institutions

Hospital	Adult surgical ward	Adult medical ward	Maternity ward	Paediatric ward	Surgical ICU	Medical ICU	Paed ICU / high care	Neonate ICU	Training Staff	N= Total
Hosp 1	n=10	n=11	n=6	n=5	n=13	n=17	n=11	n=11	n=5	89
Hosp 2	n=15	n=7	n=10	n=4	n=44	*	n=4	n=9	n=6	88
Hosp 3	n=8	n=5	n=9	n=4	n=20	n=10	n/a	n=10	n=3	69
Total N	N=33	N=23	N=25	N=13	N=77	N=27	N=15	N=30	N=14	N=257

* Combined unit= medical and surgical intensive care patients are in one unit

Table 1.2: Representing the N= population of enrolled nurses within the three institutions

Hospital	Adult surgical ward	Adult medical ward	Maternity ward	Paediatric Ward	Surgical ICU	Medical ICU	Paed High care / ICU	Neonate ICU	N= Total
Hosp 1	n=9	n=12	n=5	n=4	n=16	n=9	n=4	n=4	63
Hosp 2	n=19	n=7	n=3	n=5	n=7	Combined Unit	n=0	n=1	42
Hosp 3	n=9	n=6	n=2	n=4	n=9	n=8	n/a	n=0	38
Total N	N=37	N=25	N=10	N=13	N=32	N=17	N=4	N=5	N=143

1.9.4 Data collection tool

This proposed research was conducted using a structured questionnaire with open-ended questions that were quantified during analysis, which the researcher had made in-depth adjustments to ensure it was fit for purpose. It was based on the WHO definitions for human factors that have an effect on patient safety (WHO, 2009), as well as the Gladstone (1995) questionnaire referred to and modified by Wakefield, Wakefield, Uden-Holden and Blegen (1998:42) as a guideline for questionnaire development within this context. The authors mentioned have used the data collection tools with success in other studies and had given permission for the researcher to use said tools as resources during the development of the questionnaire (see Annexure 7).

During the proposed research study, the researcher made use of a newly designed data collection questionnaire (Appendix 4) that identified the known factors that affect the nurses' ability to safely administer medication based on their clinical experiences, which met the beliefs of the positivist approach to science. This tool has been separated into sections that correlated with the conceptual map as well as the human factors as defined by WHO (2009).

The instrument consisted of six pages (printed both sides) and was subdivided into four sections. A Likert scale type questions were provided which will be further discussed in chapter 3. The estimated time that it took to complete the questions was 15 minutes. The questionnaire was available in English as this is the accepted business language of these healthcare institutions.

Section A consisted of nine questions that related to the participants demographics, qualifications, nursing experience and employment status.

Section B consisted of 49 questions regarding the environmental (B1), organisational (B2), team (B3) and individual (B4) factors associated with MAE's. The participant was asked to score the factors in terms of rarely, regularly and commonly affecting MAE incidence. The Cronbach Alpha was calculated on the Likert scale items and reported in the study.

The last question was open-ended and allowed the participants the opportunity to add any additional elements they felt might have been omitted from the questionnaire.

Section C consisted of seven questions regarding orientation, in-service education and policies. These questions were graded in terms of yes, no and uncertain.

The last question allowed the participants to make suggestions regarding further quality improvements that could enhance patient safety during medication administration. The participants were also given the opportunity to specify any additional training they feel they might need.

Prior to the pilot study, experts who work in the field of specialisation and who are experts in the field of pharmacology, nursing education and medical law, assessed the validity of the data collection tool. Experts in quality, risk management, nursing education and intensive care nursing, also internally validated the instrument.

1.9.5 Pilot study

A pilot study is a smaller version of the research study and is conducted to test the suitability of the data collection instrument in terms of the adequacy and relevance of the instrument content. In addition, the instrument can be evaluated for clarity of the questions, the procedure for data collection in the field as well as to ensure that the responses elicited meet the study objectives (Basavanthappa, 2009:439). Grove, Burns & Gray (2013:343) suggest that ten to 20 participants are sufficient to estimate variances in outcome measures.

The pilot study was used to determine if any components of the planned research methodology needed to be adjusted or modified ahead of the conducting of the formal research study (Burns & Grove, 2011:49). Fourteen candidates from a hospital that is not part of the main study and who met the study inclusion criteria were invited to participate. This hospital is a member of the same hospital group that has been selected for this research study. The pilot study findings, alterations to the MAE questionnaire and participant information forms, along with participant feedback, have been reported on in Chapter Three of this thesis.

1.9.6 Reliability and validity

Reliability and validity in quantitative research relates to the ability of the research tool to consistently measure the attributes of the phenomenon being measured and the extent to which the instrument measures the concept being researched (Grove, Burns & Gray, 2013:289).

The primary researcher, who is involved in quality improvement in the private healthcare institution, has designed the data collection tool. Local experts in the fields of pharmacy, intensive care nursing, hospital risk and incident management, medical law, nursing education and business leadership have reviewed the questionnaire. Validity has been evaluated in terms of criteria, construct, and content and face validity.

De Vos *et al.*, (2005:160) states that validity can be confirmed if the instrument measures the concept being investigated and if it is being measured accurately. In addition to this, content validity is assured if the content measures all the known variables that relate to the phenomenon in question. Face validity is concerned with the appearance of the measurement instrument and if it appears to measure the phenomenon (de Vos *et al.*, 2005:160-161). The findings from the pilot study will be assessed for suitability and adjustments made if necessary.

The comprehensive nature of the questionnaire allowed the researcher to draw conclusions that determine development of generalisations to be suggested in other similar settings. This ensures that content and external validity are achieved.

1.9.7 Data collection

The data collection process for this quantitative research study was designed to elicit information regarding the phenomenon from the participants through the use of a data collection questionnaire (Burns & Grove, 2011:361). All the research participants were provided with participant information and informed consent forms and given the opportunity to question the researcher regarding the study.

A detailed discussion on the data collection process can be found in Chapter Three. This discussion addresses key issues such as the data collection methodology and process, including the management of the questionnaires.

The details of the delivery and collection of the questionnaires was laid out in the table below. Data collection took place on weekends over a period of five weeks until the required sample size was obtained and all of the nursing shifts had been provided with the opportunity to participate. Weekends were selected as this was the time when hospital occupancy was at its lowest and the general hospital activity was less, which allowed the staff time to participate. The participants were asked to complete the questionnaire during their lunchtime to ensure that the process did not impact on patient or company time. A trained research assistant was used to collect data in the researchers' hospital of employment to reduce the risk of researcher bias and undue pressure being placed on the participants. The researcher was responsible for the data collection in the remaining institutions.

Table 1.3: Data collection shift groups

Activity	Hospital 1	Hospital 2	Hospital 3
	Weeks 1 and 2 January 2016	Weeks 3 and 4 January 2016	Weeks 5 and 6 February 2016
Day shift	Questionnaires were handed out between 12h00 and 14h00 and collected the same day between 17h00 and 18h00.	Questionnaires were handed between 12h00 and 14h00 and collected the same day between 17h00 and 18h00.	Questionnaire were handed out between 12h00 and 14h00 and collected the same day between 17h00 and 18h00.

Night shift	Questionnaires were handed out between 22h00 and 24h00 and collected the next morning between 05h00 and 06h00.	Questionnaire were handed out between 22h00 and 24h00 and collected the next morning between 05h00 and 06h00.	Questionnaire were handed out between 22h00 and 24h00 and collected the next morning between 05h00 and 06h00.
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1.9.8 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 was entered onto a Microsoft Excel spreadsheet and the Statistics and Data 14 (STATA) statistical software package programme used for data analysis and then submitted to a statistician at the Stellenbosch Biostatistics Unit for further analysis and interpretation.

The data has been described using measures of central tendency; viz. mean, median and modality with tables and graphs used to display the analysed data. The proportion of responses was tabulated for each response and the median response calculated for each domain. Descriptive statistics have been used to describe the nominal data in Section A. The ordinal data in Section B was discussed using inferential statistics. The open-ended question in Section C has been reported on using a descriptive narrative that separates the findings into themes. A chi – square test was done to determine the level of significance. A p-value of $p < 0.05$ was used for values that describe factors with statistical significance.

1.10 ETHICAL CONSIDERATIONS

Protecting the rights of human beings who participate in research is protected by several landmark documents such as the Nuremberg Code of 1941 and the Declaration of Helsinki of 2013 (Pera & van Tonder, 2014:330). The guidelines that emerged from these landmark documents make it imperative that all researchers act ethically in that they are to carry out their research competently, manage resources with integrity, give acknowledgement to those who participate and report accurately and honestly (Brink *et al.*, 2012:32).

Ethical approval to conduct the study was obtained from the Ethics Committee of Stellenbosch University as well as from the Ethics Committee of the chosen healthcare institutions and all the study participants.

1.10.1 Right to self-determination

In this study this principle was honoured by allowing the participants to freely agree to participate in the study, be fully informed about the purpose of the study and given the option to withdraw at any time during the study. This right is confirmed in the informed participant consent form.

1.10.2 Right to confidentiality and anonymity

The identity of the institutions has been kept anonymous and confidential by the assigning of a code to the institutions and on the questionnaires. Should the research findings indicate the need for changes in policies and practices anonymity will ensure that all actions taken meet the specific needs of the particular institution. The hospital-coded questionnaires were delivered to the participants in a sealed envelope to complete. The participants are not identifiable despite the hospital code being on the questionnaire.

Only the researcher, supervisor and statistician have access to the raw data, which is kept in a locked cabinet. This data will be kept for a period of five years after the completion of the research study.

1.10.3 Right to protection from discomfort and harm

The informed consent form, available in English, Afrikaans and isiXhosa, assured the participants that the data gathered will be used to improve current processes and practices and that there will be no punitive action as a result of their participation. In addition to this, the healthcare institutions' reputation has been protected from any potential harm by the assurance that the data will only be submitted to the Division of Nursing at the University of Stellenbosch and the Ethics committees of the participating institutions.

1.10.4 Right to justice

To comply with this principle the researcher has ensured that all the participants who met the inclusion criteria and were available at the time of data collection, were given an equal chance to participate in the research study.

1.10.5 Right to informed consent

Informed consent supports the principle of voluntary participation. The consent should detail the information required from the participant, the relevant detail of the study and state that participation is voluntary (Brink *et al.*, 2012:38).

The participants were provided with a written consent form that complied with the details as already discussed. The researcher was present when the consent forms were signed and answered any questions the potential participants may have had regarding the study. The consent form also incorporated all other aspects as were mentioned and were available in English, Afrikaans and isiXhosa. Informed consent was also obtained from the specified hospitals in order to conduct this study. Ethical approval was then granted by the holding company (Appendix 2).

1.11 OPERATIONAL DEFINITIONS

- An *Enrolled Nurse (EN)*, previously known as a staff nurse, is a nurse who is qualified to provide basic nursing care under the direct or indirect supervision of the registered nurse and in accordance with her scope of practice (Republic of South Africa, 2005:27).
- *Human Factors*, as defined by the WHO Patient Safety's Methods and Measures for Patient Safety Working Group Report, are categorised as being related to environmental, organisational, team and individual factors (WHO, 2009:4).
- *Medication administration errors* are defined as errors that occur at any point in the process of administering medication to a patient. These may include errors in identification of patient or medication; errors in dosage; route of administration or the time the medication is administered (Jordan & Kyriakos, 2014).
- A *Private Healthcare Institution* is a business entity providing patient care that operates under a corporate mission statement driven by profit motives, and performance that is measured annually and reported to shareholders.
- A *Public Healthcare Institution* is a state funded institution that provides care to the citizens of the country regardless of their ability to pay for the care rendered.
- A *Registered Professional Nurse (RPN)*, also referred to as a professional nurse, is a nurse who is licensed to practice comprehensive nursing independently within her scope of practice (Republic of South Africa, 2005:27).
- A *Shift Leader* is a registered nurse who takes charge of a duty shift and is responsible for the direct and indirect supervision of the nursing staff in accordance with her scope of practice regulation 2598 (SANC 2005: R2598 as amended).

1.12 DURATION OF THE STUDY

Ethical approval was obtained from the Stellenbosch University on 16th November 2015 (protocol number S15/10/249) and from the private healthcare group on 10th March 2016. The pilot study was conducted on the 12th March 2016 and data collection for the main study between the 24th March and the 23rd April 2016. The completed thesis was submitted to the University of Stellenbosch on the 1st September 2016.

1.13 CHAPTER OUTLINE

Chapter 1: Foundation of the study

This chapter discusses the key problem and provides the background, rationale and significance of the problem to support the need for the research study to be conducted. The chapter also provides

a brief introduction of the research methodology that was used to conduct the study as well as a description of how the principles of ethics were adhered to during the conducting of this research.

Chapter 2: Literature review

This chapter highlights key findings from local and internationally conducted studies that demonstrate the importance of this problem and the impact they (medication administration errors) are having on healthcare users, workers and funders across the globe.

Chapter 3: Research methodology

This chapter provides a deep description of all the aspects of the research methodology used to conduct this study. This includes a report on the pilot study conducted as well as the validity and reliability applicable to quantitative research.

Chapter 4: Results

This chapter provides detailed descriptions of the study findings that are in line with the study objectives as laid out in Chapter One.

Chapter 5: Discussion, conclusions and recommendations

This chapter discusses the study findings in terms of the study objectives, draws conclusions and makes recommendations in line with the study findings.

1.14 SIGNIFICANCE OF THE STUDY

Quality care is seen as the core component when it comes to the mitigation of risk and exposure to legal action, and this requires that programmes instituted address the key issues particular to the specific healthcare institution (Muller, 2009:250). According to Welzel (2012:406-408) a quality improvement programme is vital in creating an awareness of the value of incident reporting as a means of improving the quality of care and the safety of the care being rendered.

Further to this, an editorial written by Llewellyn, Gordon and Reed (2011:319) commented on a study conducted on medication errors made by anaesthetists in South African public hospitals where 40% of the respondents admitted to having made an error during their career. The editorial goes on to say those similar findings were seen in three other studies conducted in South African public hospitals. Llewellyn *et al.*, (2011:320) further suggest that national action is vital and urgent if we wish to improve patient safety and that the actions should involve all stakeholders in both the public and private sectors. This report supports the need for investigation and action to also be taken in the private sector. In addition to this, the public image of a private hospital is measured by the quality of the service being delivered and MAE has a direct impact on those outcomes (Yesilasa & Direktor, 2010:969). Furthermore, a cross-sectional survey conducted in the private and public healthcare settings in South Africa suggests that paying heed to hospital safety and quality deficits are key to improving the clinical practice environment (Coetzee *et al.*, 2013:171).

The findings reported in this study may possibly be of value and, as a result, be incorporated into the healthcare institutions risk and incident management processes and programmes as a strategy aimed at the reduction of inherent risks. This would be with the aim of ensuring that the quality of the care being rendered to the patients complies with all standards, including those set out by the Department of Health in the NCS of South Africa (DoH, 2011: Chapter Five), as they endeavour to exceed their patients' expectations.

In addition to this, the Oregon Patient Safety Commission (2015:1) suggests that leadership structures and systems play a pivotal role in creating an awareness of safety and directing accountability for actions being taken to address the gaps in patient safety. This includes being active and visible participants in patient safety initiatives, providing the necessary resources and leading safety briefings where safety measure results are shared and discussed with all staff (Oregon Patient Safety Commission, 2015:1).

1.15 SUMMARY

Medication administration errors are contributing to increased patient injuries and healthcare costs across the globe. Many organisations, both locally and abroad, have made patient safety a clear focus for all members of the healthcare industry. There is extensive research available that supports the need for institution specific identification of the risk factors that contribute to MAE's within the hospital setting.

The South African Department of Health (DoH) Strategic Plan 2014-2019 mission includes striving to consistently improve quality and efficiency, with the aim of improving the health status of all South Africans (DoH, 2014:3). In terms of the DoH list of priorities for achieving the long-term health goals for Vision 2030, point h refers to improving quality through the use of evidence and through the creation of meaningful public-private partnerships (DoH, 2014:13-14). These focus areas support the need for research in areas that impact on patient safety in both the public and the private sector.

The key components of quantitative research applied in this study took place in the private healthcare setting where the enrolled and professional nurses administering medication in the wards and intensive care units were surveyed. The survey instrument explored the perceptions of these nurses regarding the human factors that affect the incidence of MAE along with the environmental, organisational, team and individual factors that may have contributed to these adverse events.

The rights of the participants are protected in accordance with international ethical principles and the data gathered during this study will be made available to facilitate improvements in patient

safety and the quality of patient care whilst maintaining the anonymity of those who have generously shared their personal experiences.

To conclude; current research conducted in public and state funded healthcare facilities have shown factors that demonstrate the causes of medication administration errors are multi-faceted and complex. International studies identified varied responses from the nurses as to their perceptions as to which factors play a role in these adverse events. Understanding why medication errors occur in a private healthcare facility in South Africa and the factors that impact on error incidence have been identified to allow all participating healthcare workers and institutions the opportunity to put appropriate and specific measures in place to reduce the number of errors thereby improving patient care and patient safety. Further studies are required in other individual hospitals to identify factors specific to those institutions so corrective measures can be put in place.

Boyd and Buchannon (2015) suggest that the adaptive nature of the nursing practice is ideally suited to the improvement in the delivery of quality healthcare by reducing the harm to patients through risk reduction and the prevention of errors. In order to maximise this effect, nursing research that is evidence-based will aid in the establishment of international standards.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

There are substantial gaps in our knowledge of happenings in the real world at the patient interface. The difficulty is obtaining accurate information as to WHY nurses make mistakes when administering medicine. Observational studies are somewhat flawed in that subjects are being watched, honesty in answers to questionnaires are naturally biased because of fear of colleague and management backlash. There is a wide chasm between the mission statement of a commercial organisation and the day-to-day operating milieu of a nurse working at a patient's bedside. Studies were selected to tease out information that related to the practical nursing environment and to identity factors for study inclusion.

In terms of the South African context, the Medicine and Related Substances Act 101 of 1965 does not specify any limitations with reference to the categories of nurses who may administer medication. However, all nurses fall under the legal auspices of the related regulations of the South African Nursing Council (SANC 2005: R2598 as amended). Within the private healthcare setting, medication administration is carried out in accordance with hospital policy and is performed by both enrolled and registered nurses. Much of the research discussed here refers to registered nurses only but it is important to note that enrolled nurses have been included in this research study as they play a key role in medication administration.

The global focus on patient safety is further entrenched in the NCS of South Africa (Department of Health, 2011:22-23). The NCS strives to ensure that the public and private healthcare sectors achieve the best possible results in terms of healthcare with the available resources. To ensure that this happens, the NCS have created a common purpose for all healthcare institutions, which includes a common definition of healthcare quality, a standardised benchmark for quality assessment and provision for national certification (Department of Health, 2011:8). Domain two of the NCS checklist deals with patient safety. Within this domain, criterion 2.4.3.4.2 requires that patient safety whilst receiving medication is assured. Criterion 2.5.1.1.2 requires that adverse event reports reflect that immediate action is taken at the time of the incident, and a root cause analysis conducted to prevent recurrence (Department of Health, 2011:23). This national focus highlights the need for adverse event management in both the public and the private healthcare sectors in South Africa.

A mixed method prospective study conducted by Drach-Zahavy, Somech, Peterfreund, Peker and Priente (2013:449) speaks of the influential report by Kohn *et al.* (2000), which was responsible for

triggering an enormous amount of research and which highlighted the need to identify the factors that will promote safe medication administration within all healthcare settings.

As seen in the conceptual framework in Section 1.8, the literature review has been organised by making use of the elements outlined as having both a direct and indirect effect upon human actions in terms of the WHO (2009) Patient Safety Methods and Measures for Patient Safety Working Group report. This report categorises these ten key human factor topics that are relevant to patient safety as being related to organisational and managerial, team, work environment and individual components (WHO, 2009). These elements have been further expanded to include; organisational and safety culture, teamwork dynamics (including processes and structures), communication, managerial and team leadership, situational awareness and decision making, work environment, stress and fatigue (WHO, 2009). Whilst the literature review has been researched and structured to reflect the elements and domains as discussed in the conceptual map and in accordance with the WHO definitions, MAE are the result of a complex situation where the individual factors have to be seen as components that are interconnected and which impact on each other. Alongside these elemental headings are headings that have been found to be prevalent in the research conducted into MAE incidence, types of errors and factors that contribute to error incidence.

2.2 ELECTING AND REVIEWING THE LITERATURE

A literature review was conducted to provide a background for the research study in terms of what is currently known about medication administration errors. This review encompassed error incidence, the factors that are known to contribute to error incidence, both perceived and observed, the categories of errors as well as general compliance with policies and clinical practice.

Several electronic data bases were used to conduct this review which included CINHALL, Medline, Pubmed and the University of Stellenbosch' Library. Keywords were used singularly and in various combined formats and included: medication, administration, error*, nurse*, factor*, incidence, human, policy and practice*. The search extended across the medical disciplines and included approximately eighty five articles and abstracts published and presented between 2008 and 2015. The exception to this is the 2000 article by Kohn *et al.*, was considered to be a pivotal report on this topic and has been included in this study. This search also included special access to the latest abstract material presented at international congresses in 2014/5. During the search the article "To Err is Human" (Kohn *et al.*, 2000) is a commonly referenced piece of literature and has been included as an article that appears to have altered the way of thinking regarding medication administration incidence and management of these adverse events.

2.3 THE ROLE OF THE NURSE IN MEDICATION ADMINISTRATION

In the clinical environment nurses shoulder the responsibilities when it comes to the administration of medication to patients. The Ontario College of Nurses Practice Standard for Medication clearly outlines the nurses' responsibilities (College of Nurses of Ontario, 2015:3). This practice standard describes the nurses' responsibilities in terms of the administration, dispensing, storage, management and disposal of medication. The standard extends further to discuss three core areas of practice. The first requires the nurse to have the authority to perform the necessary medication related actions. The second makes reference to nurse competence in terms of knowledge, skill and judgment required to administer medication. The final area speaks to patient safety and highlights the need for nurses to minimise the risk of error and adverse drug reactions (College of Nurses of Ontario, 2015:3).

Within the South African context, the SANC Regulation R2418 Section 3 (1984) clearly states that a nurse who administers medication to a patient may do so and ensure they record the following details in the patient record: the name, strength, dosage, quantity, date and time of administration (SANC 1984: R2418). In addition, the SANC 2005 R2598 as amended discusses medication administration in terms of the nurses' scope of practice for enrolled and registered professional nurses. In Chapter Two the registered nurse scope includes the administration of medication and monitoring of vital signs and reactions to medication and treatment. Chapter Five makes reference to the scope of practice of the enrolled nurse as including the observation of patients' reactions to medication and treatment (SANC 2005: R2598 as amended).

In addition to the guidelines that regulate the scope of practice of the nurse, SANC Regulation (2014: R767) sets out the acts or omissions in respect of which the council may take disciplinary action against the nurse. In terms of R767 (South African Nursing Council, 2014) failure of the nurse to administer the correct and appropriate treatment and care whilst maintaining and assessing the health status of the patient may result in disciplinary action. This regulation also makes reference to the requirements that nurses check all forms of therapeutic interventions and keep accurate records of all actions performed on patients. These regulations extend to all nursing actions that fall under the scope of practice of the nurse (SANC 2005: R 2598 as amended).

The literature discussed in this chapter confirms and supports the role of the nurse in terms of their multi-faceted responsibilities during the task of patient medication administration.

2.4 MEDICATION ADMINISTRATION ERROR INCIDENCE

Gaining insight into the incidence of medication administration errors is challenging in that it is reliant upon the honesty of the nurses and physicians involved in the disclosure and reporting of the adverse event. For nurses, the reluctance to report errors is generally attributed to a belief that

reporting is used to “tell tales”, find a scapegoat and to get rid of staff (Kuenstler & Henriqson, 2015). Whilst the literature discussed in this research study highlights the extent to which this topic has been researched around the globe, there appears to be little evidence of these studies being conducted in the private healthcare setting. In the private healthcare sector, where company mission statements make a point of promising quality healthcare, a “just climate” at the operating ward level should encourage the honest reporting of adverse events as nursing staff strive to follow management’s lead. This is confirmed when examining the quality indicators and the relative importance in terms of safe clinical practice and the quality of care rendered. This specific focus is in line with the quality indicator report and the requirements in terms of the NCS (DoH, 2011:22-23).

A study conducted in Australia by Westbrook, Rob, Woods, Dunsmuir and Parry (2010:1028) used a prospective observational study of 107 nurses in two teaching hospitals to determine the errors in the administration process. This study identified that almost 70% of the intravenous medications administered had at least one clinical error and at least 25% of these could be considered as serious enough to result in permanent harm to a patient (Westbrook *et al.*, 2010:1031).

A similar study conducted in France by Berdot, Sabatier, Gillaizeau, Caruba, Prognon and Durieux (2012:5) used direct observation of 1501 medication administrations and identified an error rate of 27.6%. This study quantified the errors in terms of days of the week and times of the day. There was little difference in the days of the week. However, the times of administration provided noteworthy information. The noon session showed an error rate of 12.9% in contrast to the morning error rate of 46.4% and evening error rate of 40.7%. Of these errors, oral administration scored the highest at 89.8%. The authors concluded by stating that determining the common factors, such as time of increased error incidence, will allow for the implementation of appropriate interventions to improve the quality of medication administration (Berdot *et al.*, 2012:5).

Fasolino and Snyder (2012:E9-16) conducted a mixed-method descriptive study in 11 medical and surgical units in the United States. Their areas of focus differed from other studies reviewed as they explored the professional practice environment and team member effectiveness. The team member effectiveness Likert-style questions had scoring subscales on team contribution and interaction, keeping on track, quality expectations and availability of the necessary knowledge and skill (Fasolino & Snyder, 2012:E11). During the period under review, there were 295 medication administration errors, which were reported as being fewer than prior years. Despite the reduction in error rate, the findings highlighted that fewer errors are made by the more experienced staff and the belief is that the communication skills demonstrated by the more experienced staff have played a role in this positive change (Fasolino & Snyder, 2012:E13. -14).

Cheragi, Manoocheri, Mohammadnejad and Ehsani (2013:228) conducted a cross sectional study of 237 nurses in Tehran and used descriptive and inferential statistics to quantify the data collected. The findings confirmed that medication errors are a major nursing problem and nursing administrators have a key role to play in error reduction and improvement in the quality and safety of patient care. The study discovered that 64.55% of the nurses had experienced medication administration errors, and that 60.78% of errors were linked to intravenous injections. Despite the high incidence of nurses who have made a MAE, 39.86% had not had a subsequent error incident (Cheragi *et al.*, 2013:230). The authors found this statistic reassuring as they felt it highlighted the fact that most nurses did not make the same mistake a second time.

During 2014, Gordon (2014:20), an Assistant Clinical Professor of Nursing in the USA, conducted a three-phase study into the improvements in the process of medication administration for her doctoral studies. Six of the questions looked at error reporting. The study findings confirmed the challenges in ensuring that error reporting is accurate and that the statistics are reliable. The research reported that 34.8% of the nurses did state that errors were not reported because of management response, with 32.6% stating they did not report errors, as they feared co-worker reactions. In addition 21.7% of the respondents admitted to not reporting MAE because they did not believe that the error was serious enough to report (Gordon, 2014:20). Despite the study findings, the author clearly states that in order to promote a culture of safety, errors need to be reported and investigated, to ensure that change processes take place alongside the creation of a “no blame and shame” culture that demonstrates care for nurses within this complex environment (Gordon, 2014:21).

As it will be noted throughout this review, the incidence and factors contributing to medication errors are varied and often specific to the facility where the research is taking place. This finding confirms the need for individual facilities to conduct their own research into medication administration errors to ensure that the measures taken to reduce adverse events are applicable and appropriate for that healthcare facility (Gordon, 2014:21).

2.5 HUMAN FACTORS CONTRIBUTING TO MAE

Factors that contribute to errors appear to have been the most researched aspect of the medication administration chain. This chain includes the prescribing, dispensing, and administration of medication as well as the monitoring of medication side effects and adverse reactions (Unver, Tastan & Akbayrak, 2012:318).

The conceptual framework in point 1.8 of Chapter One of this thesis sets out the human factors in line with the definitions provided by the WHO in the Patient Safety’s Methods and Measures for Patient Safety Working Group Report of 2009 (WHO, 2009). The literature and research findings

discussed in this section have been presented in line with the WHO definitions and the conceptual framework guiding this research study (Diagram 1.1, Chapter One).

Bergkvist, Karlsson, Bjorksten and Ulfvarson (2012:1) classified the factors that contributed to errors after conducting a comprehensive analysis of 33 reported errors that had been made by registered nurses in Sweden. The findings listed the contributing factors as: negligence, not being focused on the task at hand, responding to a patients' stated need, administering an additional dose of medication, lack of sufficient knowledge of the medication being administered, missing an instruction by not reading the documentation and not following correct procedure as a result of time constraints. These findings are not unusual and are seen throughout the literature being discussed.

Keers *et al.*, (2013:1048) conducted a systematic review of 54 quantitative and qualitative hospital-based research studies. The studies originated from the United Kingdom, United States, Australia, South Africa, Canada, New Zealand, Malaysia and Germany. The authors' findings mirrored those of Bergkvist *et al.*, (2012:1-4) and were significant in that they identified a multitude of latent conditions in which errors took place.

A summary of these findings from the systematic review is as follows:

- 29 incidents were linked to misidentification of medication as a result of incorrect reading, illegibility of the prescription and look-alike-sound-alike medications
- 27 incidents were related to medication supplies that led to wrong time or omission of administration as a result of delayed or no delivery
- 19 incidents were found in each of the following; as a result of increased staff workload, poor written communication and equipment related issues (infusion devices)
- 17 incidents came about as a result of patient factors such as waiting for intravenous access and deterioration in the patients' condition causing an omission error
- 16 incidents were related to nurse interruptions and distractions, as well as to poor knowledge of the medication and use of infusion devices
- 13 incidents were attributed to fatigue, sickness and general staff discomfort related to long hours, stress, anxiety, poor mood and boredom
- 11 incidents were linked to the environment and factors such as noise, lighting, unexpected emergencies and a chaotic work place
- The remaining incidents, that were found to be less than ten, were linked to policy and procedure issues, staff inexperience, inadequate training, lack of supervision and a bad practice culture.

A referral hospital in Ethiopia, where errors during administration were known to be "highly prevalent", was the setting for a cross-sectional observational study of 360 medication administrations (Feleke, Mulatu & Yesmaw, 2015:1). The error incidence during the study was

56.4% with 87.5% of the errors being related to documentation, 73.1% to technique error and 53.6% of errors related to time errors. In addition to these findings, the researchers suggest that minimising interruptions, the creation of clear incident reporting processes and procedure checks would aid in the reduction of MAE. These authors also believe that improving staffing levels, reducing the length of shifts and the retention of experienced nurses to train the inexperienced would improve patient safety during medication administration (Feleke *et al.*, 2015:7).

The findings of the systematic review and studies conducted highlight the complex and multifactorial nature of MAE and the role the human factors, as described by the WHO, play in the clinical situation.

2.5.1 Environmental element 1: the impact of resources on MAE

An article in *American Nurse Today*, written by Anderson and Townsend (2010), "Medication errors: Don't let them happen to you", makes mention of the 2008 statistics where American researchers estimated that at least 7000 Americans died annually as a result of adverse drug events.

The article goes on to discuss environmental factors at length. These factors include: adequate lighting, uncluttered workspaces, minimal distractions, adequate and appropriate staffing which may all affect the incidence of MAE. The authors also stated that nurse fatigue; interruptions, heavy workload and general multi-tasking play a significant role in adverse medication incidents (Anderson & Townsend, 2010:23-27). Identifying the causes of medication administration errors is the key to being able to implement the specific measures that bring about a reduction in adverse event incidence and prevent the need for disciplinary action and possible civil or criminal charges (Anderson & Townsend, 2010:26).

Neonatal Specialists Drs Tooke and Howell looked at the role incorrect syringe selection played in medication administration errors in the Neonatal Intensive Care Unit at the Groote Schuur Hospital in Cape Town (Tooke & Howell, 2014:467). In this study the authors discussed how reliant the care of a neonate is on the accurate continuous medication dose delivery via electronic syringe drivers. The purpose of the study was to investigate if the selection of a non-validated syringe would affect the dose of drug delivered to the patient. The study did show significant volume and dose delivery errors when the incorrect syringe was utilised and suggested that these MAE could be minimised if syringe selection is correct, syringe stock options are reduced to prevent selection errors and staff are trained on the potential hazards should they use the incorrect syringe in the driver (Tooke & Howell, 2014:470-471).

2.5.2 Environmental element 2: the impact of interruptions and distractions on MAE

An observational study conducted in two teaching hospitals in Sydney, Australia observed 98 nurses administering 4271 medications to 720 patients. The study confirmed their hypothesis that interruptions during medication administration increase errors and these interruptions had a significant association with failure in procedure and clinical errors (Westbrook *et al.*, 2010:683). Significantly, medication administration was interrupted 53.1% of the time resulting in a 12.1% increase in clinical errors. In contrast to this, the error incidence if the nurse was not interrupted dropped to 2.3%. This report also stated that one third of all medication related errors suffered by the patient occurred during administration despite the golden standard of the “five rights” (right patient, right drug, right dose, right route, right time) being a core component of all nursing training of medication administration at these two facilities.

This finding is highly significant: the nursing environment is fraught with various interruptions and demands a high level of vigilance during medication administration. The authors commented that controlled studies have shown that a task interruption challenges the persons’ ability to return to the context of the original task because of the shift in focus. The link between interruptions and errors was also found in two different studies conducted by Anderson and Townsend (2010:25); Unver *et al.*, (2012:322); Choo, Johnstone and Manias (2013:106); Gunningberg, Poder, Donaldson and Swenn (2014:414) and Donaldson, Aydin, Fridman and Foley (2014:63) respectively.

Feil, senior patient safety analyst for the Pennsylvania Patient Safety Authority, wrote a review on the impact that distractions in the workplace have on patient safety. During the period under review there were 1,015 reports that were as a result of some form of distraction and of these 59.6% of the events were classified as medication errors (Feil, 2013:1). The article describes distraction under the headings of either self-initiated or other-initiated. With specific reference to medication errors, the distractions were found to be self-initiated because of nurse interaction with other members of the healthcare team and were both internal and external in response to varied stimuli (Feil, 2013:6). Practically, the removal of distractions from the workplace is an unrealistic goal. However, the author suggests that an educational programme raising awareness of the negative effects of workplace distractions should be considered in conjunction with the introduction of strategies that assist staff in managing the distractions (Feil, 2013:6-8). This will assist with the creation, at unit level, of a team leadership structure that is in line with the overall culture and mission of the hospital and improve patient safety through risk reduction.

A group of multi-disciplinary healthcare workers conducted a literature review of 37 papers that explored the impact interruptions have on medication administration in critical care areas (Bower, Jackson & Manning, 2015:183). The authors make mention of the fact that there is significant discrepancy in the definition of “interruption” and found that there are four types of interruptions:

intrusions, distractions, breaks and discrepancies. The authors also found that interruptions were often defined in terms of when they occur: mid task, between tasks and breaking off tasks. Despite all these definition variations, it was found that any form of interruption commonly resulted in an increase in stress and a decrease in focus, which interfered with memory function thereby demonstrating a negative effect on performance (Bower *et al.*, 2015:191). The review reported on studies that show the impact on patient safety and increased risk of adverse events may also be dependent on the skill level of the nurse, the complexity of the task and the nurses' ability to deal with the interruptions (Bower *et al.*, 2015:191-193).

Interruptions and the impact they have on patient safety have been widely researched and reported on and a literature review conducted by four registered nurses' in Australia explored the impact distractions have on undergraduate nurses (Hayes, Jackson, Davidson & Power, 2015:3063). Whilst the 19 articles mirrored the findings of Bower, Jackson and Manning, the authors identified the lack of research being done into how nurses manage interruptions. The authors suggest the need for sustainable programmes and strategies that assist undergraduate nurses in developing skills to be able to manage distractions confidently and safely (Hayes *et al.*, 2015:3075).

2.5.3 Individual element: the impact of burnout and fatigue on MAE

Fatigue, burnout, emotional exhaustion and depression were found across several studies. Unver *et al.*, (2012:21) reported that the most common reason for medication errors given by the 169 nurses involved in the descriptive cross-sectional study was that of being tired and exhausted. These authors referred to studies by Osborne *et al.*, Ulanimo *et al.*, Mayo & Duncan, Mrayyan *et al.* and Karadeniz & Cakmakci where this cause was in the top five causes for medication errors (Unver *et al.*, 2012:321).

A descriptive study conducted in Turkey looked at the perspectives of 87 experienced and 82 newly qualified nurses. This study found that the nurses perceived tiredness and exhaustion to be the leading cause of medication errors. The second biggest reason given for errors was as a result of the medication nurse being distracted. The nurses stated that distractions came from various sources which included patients, colleagues and ward related events and were often linked to long shifts and inadequate staffing quotas. The nurses also reported that failure to perform safety checks was the next leading cause of medication errors (Unver *et al.*, 2012:317-321).

A cross-sectional survey of nurses in the public and private sectors in South Africa explored the quality of patient care and safety as perceived by 1187 nurses (Coetzee *et al.*, 2013:162). The study reported their findings as a "serious cause for concern" in both sectors and both aspects of the survey. One in five nurses rated nursing care as poor or fair with 15% of nurses stating they would not recommend their hospital to their friends and family. The surveyed nurses reported high

levels of burnout and desire to leave their employment, which would worsen the existing nursing shortage. The research concludes by saying that improving the clinical practice environment would aid in the improvements of patient safety and risk reduction through nurse retention. Whilst this study was conducted during the introduction stages of the NCS, the authors believe that these quality core standards, if integrated into institutional funding and staffing requirements, would impact positively on the patient-nurse environment and patient outcomes (Coetzee *et al.*, 2013:170-71).

In the United States of America, Halbesleben, Rathert and Williams (2013:95) examined the link between unsafe work practices and emotional exhaustion. The authors comment on the high incidence of burnout amongst nurses and the impact it has on negative patient outcomes. The population group studied consist of 347 registered nurses in two acute care hospitals. The online survey findings confirmed that exhausted nurses were more likely to make use of unsafe work practices and shortcuts. This study also points out that if the nurses are satisfied with the hospital policies and processes they will be less likely to resort to unsafe practices regardless of their levels of exhaustion. This confirms the findings of Kohn *et al.*, (2000) that policy and procedure guidelines should create the foundation of practice if we are to reduce the risk of adverse events and the risk of medication errors.

A study in Egypt looked at the impact circadian sleep disorders have on fatigue, depression and medication administration errors (Saleh, Awadalla, El-masi & Sleem, 2014:145-153). This research confirms that night duty, shift rotation affects the circadian rhythm, and this in turn has a negative impact on alertness and overall performance. 51.9% of the 52 nurses who participated in the study reported suffering from sleep deprivation. In addition to the sleep deprivation, the depression scores appeared to be significantly affected by the abnormal sleep patterns. The authors' believe that the findings are significant enough for the hospital administration to review the workflow routine and ensure working hours allow for convenient sleep hours to minimise the impact of this problem (Saleh *et al.*, 2014:146).

It is interesting to note that the last point presented the areas where the least number of incidences occurred which is in contradiction to the studies that have highlighted the need for clear policies and guidelines, a comprehensive training programme and clinical supervision (Bourbonnais & Caswell, 2014:394; Donaldson *et al.*, 2014:65 & Aboshaiqah, 2014:67).

2.5.4 Organisational and team elements: their impact of workload, acuities and staffing on MAE

Unver *et al.*, (2012:321-323) also compared the findings in terms of the perceptions of the newly qualified and experienced nurses. The study found that there were no significant differences in terms of the perceptions, reporting of errors as well as the perceived causes of MAE errors. The

statistically significant difference was related to the question regarding what constitutes a medication error. Here 81.7% of the experienced nurses answered “yes” compared to only 65.5% of the newly qualified nurses. The authors conclude by saying that this confirms the need for continuing education for newly qualified nurses and that learning from experienced nurses is considered an effective way of preventing medical errors (Unver *et al.*, 2012:321-323).

Parry, Barriball and White (2015:403-418) conducted a narrative review of 26 papers from North America and Europe with the intention of exploring the factors that contribute to the reasons for medication administration errors by registered nurses. The studies highlighted two themes: workload and work environment and the nurses’ experiences and characteristics. The contributing factors were linked to staffing constraints, increased workload, interruptions and patient factors such as high patient acuities and critical illness as an indicator of multiple medications. An interesting theme emerged in this narrative. The authors’ identified that work environments that demonstrated good leadership and a solid relationship of trust, communication, support and teamwork between staff and management recorded fewer adverse events. With regards the lived experiences of the nurses and their characteristics, the results confirmed previous findings that a greater level of experience results in fewer errors in medication administration. The study also found that a positive working environment and a high level of work satisfaction reduced adverse events. Within the clinical setting the findings were expected and have been identified as common denominators. The authors conclude with a reference to Bandura’s framework and suggest that errors are ultimately the result of RN behaviour and that an exploration into the relationship between RN behaviour and the environment is needed to fully understand the causes of MAE (Parry *et al.*, 2013:419).

Three university hospitals in South Korea were the setting for a cross sectional survey of the MAE experiences of 217 nurses (You, Choe, Park, Kim & Son, 2015:277). This study made use of the Wakefield *et al.*, self – reporting questionnaire to quantify the nurses’ perceptions of the reasons for MAE’s occurring. The findings in this study differed in that the leading cause of errors was related to the inadequate number of staff on duty, followed by similar names and labels. This study showed 69.6% of nurses reporting that they had personal experience of MAE. The study concludes by saying that medication administration is a complex task and the appropriate allocation of nurses to tasks is key to the reduction of these adverse events (You *et al.*, 2015:276-282).

Chapter 30 of the Patient Safety and Quality: An Evidence-Based Handbook for Nurses discusses the human factors related to nurse workload and patient safety from an engineering perspective. The authors, Pascale Carayon and Ayse Gurses (2008) categorised nursing workload into four categories: unit level, job level, patient level and situation level. The authors believe that the nurse-patient ratio, type of nursing, clinical condition of the patient and the healthcare microsystem all play a role in patient safety. Whilst the first three factors are self-explanatory, the healthcare

microsystem deserves further explanation. This system incorporates facilitators and obstacles, which may include the working environment, the availability of supplies and resources, the demands of patient family and the quality of team communication within the workplace. The suggestion is that an engineering approach that designs an efficient work system might have a positive impact on the human factors thereby improving patient safety (Carayon & Gurses, 2015:6-10).

Despite the varying results across the globe, the clinical actions showed common focus areas when it comes to the implementation of best practice policies. In addition to the implementation of best practise guidelines and standardisation in clinical practice, Gordon (2014:21) also highlights the importance of workplace design and workplace processes in the reduction of MAE. Despite these findings and the global healthcare focus on patient safety (WHO, 2009), there remains a need to ensure that best practise is seen at the interface between nurse and patient.

2.5.5 Nurse training and education elements: their impact on MAE

Focus groups conducted with twenty-four nursing students in Tehran explored the students' perceptions of why medication errors occur (Vaismoradi, Jordan, Turunen & Bondas, 2014:434). This study identified two key themes: underdeveloped caring skills when it came to medication management and a lack of pharmacological education. The student nurses reported that the skills taught dealt purely with the administration of medication but failed to address the need for them to be able to discuss medication with their patients in terms of patient education, the long-term side effects and general monitoring of efficacy and side effects. In terms of pharmacological education, the students felt that they were poorly prepared for the reality of this role as their learning was mostly simulated with little experiential learning in the real life setting (Vaismoradi *et al.*, 2014:437). Tenhunen, Tanner and Dahlen (2014:306-311) conducted a quality improvement project in the United States that targeted 72 nurses in two nursing homes with the aim of identifying if MAE can be reduced through education. The participant nurses were provided with a workbook and asked to complete a pre- and post workbook test. Whilst the study results confirmed that knowledge is improved through education and quality improvement projects, previous research shows that behaviour and attitude changes also play a role in practice improvements (Tenhunen *et al.*, 2014:309). A further study conducted in Saudi Arabia by Asboshaiqah (2014:63) used a descriptive cross-sectional study of 309 hospital-based nurses to report on the nurses' reasons for medication errors. These results identified a lack of in-service education as a contributor to errors in (69.6%) of the respondents. Workload featured strongly as a contributing factor along with physician related issues.

Similar findings were detected in a descriptive exploratory cross-sectional study conducted at a university hospital in Sweden. Gunningberg, Poder, Donaldson and Swenne (2014:411) conducted

this study with the aim of observing adherence to safe medication administration practices. This was the first study done in Sweden that looked at RN practices. The study found multiple errors in practice, which include wrong time (9%), wrong form (4%), wrong dose (2%) and wrong technique (1%). The authors acknowledge that the study limitation is linked to the fact that this study only provides a snapshot of the phenomenon and that additional focus needs to be placed on the role, responsibilities and environment of the nurses in terms on medication administration practices (Gunningberg *et al.*, 2014:415).

Medication administration errors are commonly categorised according to either the “five or eight Rights” of medication administration that are taught to all nurses and which are commonly accepted as the standard set for this nursing action. The College of Nurses of Ontario make use of the “eight rights” which include the right client, right medication, right reason, right dose, right frequency, right route, right site and right time (Bourbonnais & Caswell, 2014:392).

An article written by Bourbonnais and Caswell (2014) speaks of the importance of medication administration as a vital skill for nurses and the need for nurses to adhere to the prescribed process for administering medication to patients. Whilst the authors do acknowledge the role that communication, organisational structures and the environment play in MAE incidence, the article recommends the linking of theory and practice alongside maths skills revision, and opportunities to practice medication administration under supervision in realistic settings and scenarios as vital in the preparation of nurses for safe clinical practice (Bourbonnais & Caswell, 2014:391-395).

A qualitative study conducted at an academic centre in Holland interviewed 20 nurses to determine their experiences in terms of medication safety practice (Smeulers, Onderwater, van Zwieten & Vermeulen, 2014:276). The study findings determined that nurses needed to demonstrate not only the ability to determine the legality of prescriptions, but also the need for the medication in terms of the patients’ clinical condition. This highlighted the importance of knowledge and skills alongside the sense of risk attached to nursing actions and the associated consequences. The nurses participating in the study acknowledged that being pressurised reduced their ability to concentrate and follow safe practice guidelines correctly and completely. The authors suggest that management ensure a positive practice environment that includes transformational leadership and a multi-disciplinary approach to patient safety (Smeulers *et al.*, 2014:281-283).

2.5.6 Organisational, environmental, team and individual elements: the impact of compliance with policies and practice on MAE

McEwan (2014:39) the Territory Manager for Zebra Technologies wrote an article in the South African Pharmacy Journal where she reported that, according to the WHO, over 50% of countries do not make use of policies and procedures to ensure the safe use of medications. She also stated

that fewer than 40% of patients in the developing world are treated according to safe clinical guidelines (McEwan, 2014:39).

Alusami, Conroy and Choonara (2013:995) conducted a systematic review on 45 studies taken from Middle Eastern Hospitals. The review provided in depth details of medication administration errors across the healthcare facilities. The review was broad and aimed to identify the incidence, types and reasons for MAE in the region. The highest error was incorrect dose with an incidence of 0.15% to 34.8%. Other errors found related to the frequency, strength, prescribed dosages and duration of therapy. The authors' findings determined that studies from the region were relatively few in number, and of a poor quality, and identified the need for educational programmes for nurses and doctors (Alusami *et al.*, 2013:995).

Several recent studies have looked at the incidence of nurses' adherence to accepted procedure and policy guidelines. A study conducted by Kim and Bates (2012:590) at a teaching hospital in Korea observed 293 medication activities performed by clinical nurses that were measured against the hospitals medication guidelines that were introduced in 2006. The study findings were generally positive with 98.6% of the nurses verifying the name and dose of the medication appropriately for different patients, 85% of the nurses correctly prepared the medication just before administration and 72% of the medications were prepared by the administering nurse and not by a third party. The study found that preparation of the medication by a third party is thought to increase the risk of errors. Administration at the required time scored a 41%. The lowest score was for verification of patient identification with the identification band. This action was only observed 6.5% of the time (Kim & Bates, 2012:590-593). Kim and Bates (2012:594-597) identified high rates of error and non-adherence to guidelines and that near misses, which have the potential for harm, occur most frequently. The authors also found that research indicated that root causes analyses were generally only done for errors that resulted in harm and that by ignoring the low risk errors there is a missed opportunity to create error prevention strategies (Kim & Bates, 2012:594-595).

In the studies conducted by Berdot *et al.*, (2012:1) and Bergkvist *et al.*, (2012) the majority of administration errors fell into the "five rights" categories with the right time proving to be the most common error. The study conducted by Bergkvist *et al.*, (2012:1-4) conducted an in depth analysis of 33 MAE's that had been reported to the National Board of Health and Welfare in Sweden. The aim of the analysis was to develop a taxonomy of reported MAE's as a means of holding nurses accountable for their actions as well as to improve working conditions. The analysis showed incidents of noncompliance and errors for the right dose, right drug, right route as well as failure to identify allergies. The results confirmed the impact of the interaction between human and system factors as role players in MAE (Bergkvist *et al.*, 2012:1-4).

Berdot *et al.*, (2012:1) conducted studies in a teaching hospital in Paris with the aim of evaluating medication administration errors in the teaching hospitals. This prospective disguised observational study detected numerous MAE through this objective and reliable method that does not rely on the subjective nature of incidence reporting. Of the 1501 total opportunities for errors (TOE) there were 415 errors (error rate = 27.6%). Of these errors 72.6% were wrong time errors, 14% were omission errors and 3.7% were errors of unauthorised administration errors. Of the total errors 6% were viewed as serious which when extrapolated would mean an error rate of more than 200 monthly (Berdot *et al.*, 2012:60).

Compliance with best practice guidelines and policies is considered the key to reducing errors. A study conducted in a tertiary paediatric facility in Australia conducted a mixed-method study to explore RN compliance with the protocols for checking and administration of medication. Nurses' perceive medication administration as more complex within the paediatric setting (Gill, Corkish, Robertson, Samson, Simmons & Stewart, 2012:141).

Part one of this mixed-method study used a Likert scale questionnaire to explore the RN's compliance with medication administration protocols. Despite the high reported compliance (>90%) with policies relating to checking the route, dosage and medication prior to administration, the study concluded by saying that there does appear to be a discrepancy between self-reported medication practices and protocols (Gill *et al.*, 2012:141).

Part two of this study made use of focus groups conducted with RN's to explore their perceptions of the factors that influence compliance with protocols. One of the concerning findings is that the nurses reported that if they knew the child they did not comply with the protocol. The same was reported regarding medication that they considered "simple" such as paracetamol. The nurse feedback also identified that in clinical areas such as the burns unit patients rarely have identification bands on them, which made compliance difficult. The nurses' also made mention of the team impact where, if they lack confidence in their colleagues, they would avoid checking medication with them (Gill *et al.*, 2012:141).

Whilst the authors acknowledge that the study was limited in terms of sample size and the self-reporting nature of the questionnaire section, the findings still highlight the need for protocols that make the double-checking of all medication before administration mandatory for all levels of nurses if error incidence is to be reduced. The authors also suggest that understanding what leads to errors is imperative and requires further research (Gill *et al.*, 2012:139-145).

An observational study of 140 registered nurses carrying out medication administration rounds in two acute care facilities in Singapore also looked at overall compliance with the facilities' ten steps in the medication administration guidelines. This study, conducted by Choo, Johnstone and Manias (2013:101) showed a compliance of over 75% for seven of the ten steps. Checking the identity of

the patient scored 73.6% with only 64.1% of the nurses telling the patient the name of the medication and 31% telling the patient the dose being administered. The lowest score was 28.8% and this was for the second check of the medication against the prescription chart (Choo *et al.*, 2013:105). This study also highlights interruptions and distractions as being associated with MAE and this is believed to be linked to the nurses' lack of compliance with safe practice guidelines and policies (Choo *et al.*, 2013:107).

A multi method study (survey, observation and archived administration data) conducted in urban hospitals in Israel surveyed 360 nurses and looked at the link between learnt practice and medication errors. The study found several areas in the required procedure steps lacking: 22% of nurses failed to identify the patient by name; 31% failed to perform the "triple check" principle; 37% failed to carry out relevant clinical measures (such as the taking of blood pressure prior to medication administration). In addition, 62% of nurses failed to provide the patient with the relevant education and 97% of nurses did not monitor for possible side effect of the medication (Drach-Zahavy, Somech, Admi, Peterfreund, Peker & Priente, 2013:453). These authors report a "novel" finding as a result of their study. Their study found that the only learning practice that reduced MAE incidence was the top-down practice of monitoring, correcting and providing feedback during work performance. They also suggest that this type of supervisory monitoring sends a clear message that safe error-free practice is valued the most in the clinical setting (Drach-Zahavy *et al.*, 2013:455). The authors conclude by saying that nurses must be educated with regards the inherent risks of "cutting corners" in terms of medication administration.

An investigative study conducted in two regional hospitals in Saudi Arabia (Asboshaiqah, 2014:63) analysed 288 hospital records to determine the nature of errors in line with the WHO global focus on patient safety. The findings were similar to other international studies in terms of the process of medication administration used by nurses. The results of the analysis showed a 30.9% incidence of medication being given at the incorrect time, 25% of errors were as a result of allergies not being checked, 14.6% of incidences of incorrect patient identification, 13.2% of incorrect dosage and, 7.3% of patients receiving medication via the wrong route. Regardless of the documented errors, it is the belief of the Saudi nurses that poor communication between members of the healthcare team and staffing issues drive error incidence. The authors found that these beliefs support other international studies and findings (Asboshaiqah, 2014:65).

Donaldson *et al.*, (2014:58) performed an extensive collaborative observational study consisting of 33,425 doses of medication administration across 157 acute care units in the United States of America. One of the focus areas of this study was to examine the adherence to a six-step safe practice process for medication administration. The results showed the following deviations from required practice: 12.47% incidence of not checking two pieces of patient identification; 13.90% deviation for not explaining the medication to the patients and a 22.89% incidence of the nurse

being distracted during medication administration rounds (Donaldson *et al.*, 2014:63). The authors found that whilst adherence to safe practice guidelines does reduce MAE incidence, there was an element of failure in interrater reliability when coding wrong technique and wrong time as a result of varying hospital policies and practices (Donaldson *et al.*, 2014:64-65).

A prospective observational study conducted in an urban mental health hospital in the United Kingdom where 4177 doses of medication administration were reported on in terms of their compliance with safe practice and error harm potential (Cottney & Innes, 2014:65). The study identified interruptions, the number of “when required” (prn) medications, the mean number of patients and the number of regular doses due as key predictors of the increase risk for MAE. 37% of errors were due to medication omission, 18% were the incorrect dose being administered, 12% of errors were medications being administered in the incorrect form and 11% of errors had the potential for serious harm (Cottney & Innes, 2014:70-71). Whilst the study acknowledges that observational studies do not take into consideration the internal nurse factors or the condition of the patient, they hypothesise that should the study be conducted in a similar setting the findings would be replicated (Cottney & Innes, 2014:72).

It is important to note that the majority of the studies reported on in this literature review categorise the errors in accordance with the standard acceptable practice of checking the “rights” of medication administration. This highlights the commonalities of nursing practice across the globe as the practice relates to safe medication administration practice.

2.6 THE ROLE OTHER MEMBERS OF THE MULTI-DISCIPLINARY TEAM PLAY IN MAE

In Saudi Arabia a descriptive cross-sectional study was conducted by Al-Youssif, Mohamed and Mohamed (2013:56-70) that looked at the nurses’ perceptions of medication errors and reporting. The authors commence with a statement that highlights the issue of medication administration as key to patient safety and an area that has been a research focus area as these errors are directly related to patient morbidity and mortality. This study sampled 253 nurses in a government hospital. Their findings revealed five common reasons for medication errors. The findings were as follows: 63.5% related errors to the medication packaging such as look-alike and sound-alike factors; 51.4% believed that the systems that involve medication substitution and the use of abbreviations during the medication process often resulted in errors; 47.5% reported that errors were linked to documentation issues that include transcription of medication; 42.8% attributed errors to physician-nurse factors that are often related to unclear and illegible instructions; lastly, 39.3% of errors were related to physician use of abbreviations. The results showed that poor nurse-physician communication contributed to 65.4% of errors; changing orders by the physician (23.3%) and unclear orders (24.9%) (Aboshaiqah, 2014:63).

Physician related errors were particular to this study and the authors reported that these findings were supported by previous international studies that identified multi-disciplinary team communication as a stumbling block in health care settings and that this poor communication contributes to medication related errors (Aboshaiqah, 2014:66).

In 2013, Gunes, Gurlek and Sonmez (2014:295-303) reported on questionnaires completed by 243 nurses working in two state hospitals in Turkey. The study documented a Cronbach alpha coefficient of 0.89 for the section that reported on the factors that the nurses perceive as being associated with MAE. An interesting finding in this study is that the most common error is administration of medication without a physicians' order, which is accepted as normal practice in Turkey. The authors found that this practice was generally as a result of the physician not writing up the medication timeously or failing to update the prescription chart. Illegible prescriptions were also attributed to error incidence. One third of the nurses (31.3%) reported interruptions and distractions as factors that lead to MAE. The authors pointed out that a safety culture is still to be established in Turkey which makes the records on errors potentially unreliable. Despite this, the nurses did acknowledge having made medication administration errors. The authors recommend that nurse knowledge, skill and competence should be enforced and the introduction of incidence error reporting be encouraged and supported by management (Gunes *et al.*, 2014:300-301). Pharmacy related issues included substitution of medication, medication not being prepared by the pharmacist and dispensing errors (Al-Youssif *et al.*, 2013:60). These authors provided a unique comment by suggesting that nurses should understand that errors demonstrate that there are problems somewhere in the medication administration chain and that the problems do not necessarily mean that the nurse is not doing a good job (Al-Youssif *et al.*, 2013:68).

2.7 LATEST RESEARCH AND INTERNATIONAL CONFERENCE PRESENTATIONS

To complete this component of the literature review the researcher was granted privileged access to the MedMene database of abstracts and research summaries that were presented at 2015 medical meetings (New York City, USA).

Van Den Heever, Scribante, Perrie and Lowman's (2015) study conducted at the Chris Hani Baragwanath Hospital examined the use of self-prepared multi-dose vials during anesthesia to determine if the current practice put patients at risk for infections because of vial contamination during aspiration of the vials. The study found microbial evidence of contamination and also identified that vial labelling errors posed serious legal implications for the anesthetist. These findings were reported at the 69th Postgraduate Assembly in Anesthesiology of the New York State of Anesthesiologists.

At the 3rd International Conference on Clinical Pharmacy, Kumar Gampa (2015) suggests that MAE can be classified in terms of knowledge, rule, action and memory related errors. He reports that whilst most medication errors are generally trivial in nature, minor errors can often lead to serious errors and that a blame-free non-punitive environment that encourages reporting to ensure errors in system failures are detected and addressed be encouraged. .

Alsulami (2015) reported on paediatric drug administration at the 3rd International Conference on Clinical Pharmacy. The author states that children are generally more susceptible to MAE than adults with little research being conducted in the Middle East. This study observed 12 pediatric nurses administering 90 patients with 456 medication doses and found that adherence to standard practice occurred in seven of the 16 process steps. Whilst there were no life-threatening errors, the need for a revision to medication administration policies and procedures was urgently required along with action to improve the nurses' knowledge and skills in this clinical area.

At the same conference, Elnour (2015) created an awareness programme regarding medication errors for the nursing staff in the United Arab Emirates. 370 nurses completed a questionnaire about medication errors following which a pre-test, training service with education and resources provided and post-test were conducted. The findings showed an improvement in the nurses' knowledge once the programme had been completed and confirmed the importance of nurse education in terms of the need to understand the causes and reporting of MAE.

A multi-disciplinary study conducted at King Abdulaziz Medical City in Riyadh used self-administered surveys to evaluate the perceptions on the reasons for MAE occurrence and lack of error reporting. The 82% response rate showed significant differences in the healthcare professional's (nurses, physicians, pharmacists) in terms of the roles interruptions, clarity of the order, patient workload and the accurate checking of the medication before administration (Alanazi, 2015).

Skulmoski and Machon (2015) introduced a bar-coded wristband that the caregiver uses to validate the patient before medication administration. They found that by eliminating manual entries medication errors risks are reduced during medication rounds.

At the 27th Annual National Forum on Quality Improvement in Health Care of the Institute for Healthcare Improvement (IHI) Thomas and Donohue-Porter (2015) discussed the study they conducted. The findings of this study are purported to enhance the understanding of how cognitive loading and interruptions result in nurses deviating from standard practice during medication administration leading to MAE. It is the intention of the authors to utilize the study findings to develop short and long-term strategies to reduce MAE.

Many first world countries make use of bar-coded medication administration practices as a component of minimizing risk and improving patient safety. Moizuk and Czekalinski (2015) examined the process and system in Cleveland, Ohio and found that there remains a need to monitor compliance with the processes to ensure the achievement of a safe environment in paediatric hospitals.

A presentation at the 41st National Conference of the Society of Hospital Pharmacists of Australia (SHPA) demonstrated the importance of a collaborative approach to medication management that includes patients, nurses, pharmacists and doctors. Mekhail, Karma and Nair (2015) conducted hospital audits and found that those who had adopted the multi-disciplinary approach showed a significant reduction in the average number of medication errors. These findings were mirrored by a study conducted by Sadowski (2015). The formation of a Core Team consisting of bedside nurses, nursing education, theatre nurses and nursing management, and led by the pharmacy team conducted on-site training with the development of efficient workflows. The results showed improved performance and patient safety with the additional benefit of improved staff and patient satisfaction.

At the same conference and in two separate articles (A & B), Van de Vreede, McGrath and De Clifford (2015) audited eight hospitals in Victoria, Australia to determine the incidence of MAE using an electronic medication management system (EMMS). The study reported fewer errors but concluded that this reduction in errors should not stop hospitals from remaining vigilant and not assuming that electronic systems reduce all error incidence. This same presentation reported high levels of staff satisfaction with the EMMS but noted that the audit showed that errors of patient selection, dose and drug errors with dose omission still occurring despite the electronic system implemented.

This conference provided a large amount of new information on this topic. Munro, Nunn and Lilley (2015) evaluated the outcomes of recent dose error updates on smart pumps in a tertiary paediatric hospital in Melbourne. The study found that most high-risk events happened during the night shift but the overall impact was that the new intervention was thought to possibly prevent significant MAE in this setting. A presentation by Carroll, Albert and Drucker (2015) at the 113th Annual Clinical Research Day at the Massachusetts General Hospital used identification bands on 72 patients receiving intravenous medications to monitor administration and determine the need for improvements in practice to reduce errors related to this mode of medication administration. The authors suggest that nurses are the key users of infusion devices and clinical practice could benefit from the identification and introduction of safe methods of device use.

The Italian Pharmacovigilance Database analysed all adverse drug reactions that occurred as a result of MAE in their database from 2009 to 2015. The frequent incidence of errors brought about

the encouragement of error reporting and evaluation by regulatory authorities to minimize the threat to patient safety (Magro, Arzenton, Viola, Lora, Sottosanti, Capuano, Sportiello, Rossi & Leone, 2015).

Australian public hospitals introduced national patient medication charts as a strategy to minimize patients being harmed by MAE. Turner and Goudie (2015) audited 198 medication orders and found a 6.4% reduction in unclear orders, a 26.1% reduction in abbreviations known to result in MAE and a 70.1% improvement in orders being stopped in a clear and concise manner.. In addition to this, the audit found a 40% improvement in patient identification and a 56.5% improvement in documentation of indications for medications. This study highlighted the improvements in patient safety that came about with compliance with the safety features found in the document.

A presentation titled “Whistling in the Dark: The ethical dilemma of reporting medical errors to save lives” by Amaranth (2015) reported that more than 1000 Americans die daily as a result of preventable medical errors. Efforts to reduce these statistics have involved policy formulation and patient empowerment. Despite these actions, hospital staff remains reluctant to report errors for fear of retaliation in the workplace.

Ramos, Caekelbergh and Lamotte (2015) presented statistics on the impact of hospitalization in Belgium as a result of medication errors. The study estimated that €209 million / year could be saved if these hospitalisations could be avoided. This clearly lays out the economic and health burden of errors.

A multi-modal study conducted by Frawley, Goolsarran, Nirvani and Lu (2015) used simulation and team-based learning with undergraduate students to integrate learning with safe quality care. This endeavor made use of fifty-three senior level students and identified that multi-disciplinary simulated communication and teamwork exercises facilitate learning that helps students to recognise unsafe situations and report adverse events, to improve patient safety and reduce incidents and errors.

A Japanese adverse- event multi-center cohort study conducted by Morimoto, Ohta, Sakuma and Bates (2015) was presented at the 32nd International Conference of International Society for Quality in Health Care (ISQua). The purpose of this study was to scrutinise the incidence and nature of medical errors. Their findings reported a medical error rate of 76 per 100 admissions. Included in these findings were administration and procedure errors of 20% as well as monitoring errors of 54%. Whilst these do not make specific reference to MAE, the findings highlight the grave situation in terms of patient safety in this region.

In Melbourne Australia, 59 nurses were surveyed to explore the factors that prevented adherence to medication administration guidelines. The findings in White and Hay's study (2015) confirmed that this is a complex process and the nurses felt that improvements had taken place following the presentation of an interventional educational programme. The study also suggested that further research is required to identify strategies that will ensure adherence within the constraints of the clinical environment.

Isci and Altuntas (2015) conducted a cross-sectional study in Erzurum where 459 nurses completed questionnaires that explored the effect of occupational professionalism on the tendency towards the making of medical errors. The study reported that 30% of the occupational professionalism attitude was linked to the tendency towards error making.

At the 41st Annual Meeting of the Association of Directors of Medical Student Education in Psychiatry (ADMSEP) Frank (2015) reported on the successes of workshops where the students were allowed to make errors in a safe environment and reflect upon the error. This teaching method could be utilized in nursing education as a means of raising error-awareness and problem solving without the patient being affected negatively.

A presentation at the 2015 Joint Conference of the Canadian Society of Clinical Chemists (CSCC) and Canadian Association of Pathologists (CAP) and Canadian Laboratory Medicine Congress (CLMC) reported on an evaluation of health authority policies with regards the disclosure of medical errors. The evaluation found that healthcare workers were in need of support and training to ensure they understand how crucial disclosure is in the management of the consequences of adverse events (Kalwa, 2015).

Lewis (2015) conducted an investigation into incident-reporting forms in the United Kingdom and identified that the majority of forms do not support either learning opportunities or communication between parties' makes the forms unfit for their purpose. Improving patient safety is reliant upon opportunities for learning from adverse events and near misses, which is being hampered by forms that do not provide the information required.

A research study conducted in the United States evaluated nursing staff working hours, skill mix and patient turnover and acuity, to determine if there is a link between nurse workload and adverse events. The analysis confirmed that a high patient turnover, which includes admissions, transfers and discharges, is linked to an increase in adverse events, and suggests that all staffing plans should make provision for the impact patient turnover has on nurse workload (Patrician, Loan, McCarthy, Swiger & Fridman, 2015).

Diego, Gallardo, Antoran, Gimeno, Zamorano and Sola (2015) reported that 37.4% of adverse events involving Spanish inpatients are medication related and that these figures are inaccurate as

a result of underreporting of incidents. To improve the pharmacovigilance in the hospitals the researchers have commenced with an interactive training programme for registered nurses that highlights the importance of reporting all adverse events.

At the 26th International Nursing Research Congress Kuenstler and Henriqson (2015) presented the findings of a qualitative exploratory study that reported on nurses knowledge regarding the human error factor in incident reporting. The findings were reported as significant and the nurses' feedback suggests that human error is a result of character flaws rather than as a result of complex working systems. The nurses characterized human errors as a lack of competency, education or judgement and that the organisational response as being linked to the severity of the event and need to "remove the bad apple".

At the same congress, Anglade (2015) presented a quantitative descriptive research, which aimed to explore the relationships between patient safety culture, nurse compassion fatigue, nurse compassion satisfaction and the impact these have on patient outcomes. Whilst the study identified that 29.1% of the 127 nurse participants were at risk for burnout, additional research needs to be conducted to further explore the relationships between these components.

A purposive study conducted in Uganda questioned Healthcare professionals in private and public healthcare facilities with regards their attitudes towards error reporting. Furthermore, 91% of the respondents felt the need for a national error reporting system with 65% of the surveyed population supporting patient involvement in error reporting. Respondents admitted to making errors or witnessing others errors and concede that lack of time and inadequate communication may play a role in non-reporting. The authors conclude with the suggestion that a non-punitive confidential reporting system would be beneficial (Kiguba, Waako, Ndagije & Karamagi, 2015).

According to Domen, Connelly and Spence (2015) a voluntary random questionnaire sent to 2500 members of the American Association of Nurse Anesthetists reports that on-call shift fatigue is the leading cause associated with a reduction in patient safety. The authors suggest that administrators consider this when developing policy regarding the frequency and duration of call-shifts.

Kasda and Paine (2015) presented their findings on staff perceptions of event reporting at the 2015 Conference of the International Society for Communication Science and Medicine (ISCOM) – The Golden Bridge: Communication and Patient Safety. The analysis conducted explored the relationship between reporting rates and staff perceptions of safety in order to identify key predictors of reporting. The findings suggest that reporting is directly linked to institutional safety culture as well as to the role the leaders play in communication regarding incident consequences and the learning that should take place.

A study conducted in Portugal by Fonseca and Barros (2015) conducted one-on-one interviews with nurses and physicians at a cardio-thoracic hospital reported that one of the most frequent errors was related to medication and included issues relating to information checks and the changes in medication names as a result of generic usage. The author believes that the study will contribute to improved patient safety through best practice measures being introduced.

Medication simulation training conducted with final year nursing students in Denmark was evaluated using focus group interviews with the aim of uncovering what the nurses' felt about the quality of the training (Keinicke, Gaard, Orbaek & Moller, 2015). The students reported that acting confidently was difficult due to the complex nature of the skill. They were also fearful of making mistakes and found that this situation worsened when the experienced nurses deviated from existing guidelines.

A poster presentation at the 2015 Annual Meeting of the Pediatric Academic Societies (PAS) and 2015 Annual Meeting of Pediatric Endocrine Society (PES) showed the findings of a retrospective study conducted in neonatal intensive care units in Quebec that looked at the effects of nurse overtime on medical incidents on neonates in the unit (Beltempo, Lacroix, Cabot, Beauchesne & Piedboeuf, 2015). The findings confirmed that negative incidents affecting patients were significantly associated with nurse overtime and 78.9% of these incidents were related to medication.

Betts (2015) from the University of Arkansas for Medical Sciences College of Nursing conducted a qualitative case study on student nurses to explore their perceptions of their own knowledge, skill and safety during medication administration in both simulated and real settings. The study findings demonstrated the need for additional training the nurses felt they lacked on many levels. They felt the complexity of the skill and risk of adverse events worsened their fear of making mistakes and that the patients' complex health issues made the process overwhelming with large volumes of medications needing to be administered.

In Roanoke Memorial Hospital a study conducted by Carter, Peter, Collins, Waldeck, De Lapp, Baudreau, Boggs, Rubongoya and Randall (2015) analysed interruptions during medication administration in selected units. The study confirmed that interruptions and distractions increase the risk for MAE and that medical personnel may be interrupted as frequently as every two minutes.

At the 2015 National Conference of the American Society of PeriAnesthesia Nurses (ASPAN) Ventura, Wade and Bates (2015) reported on their project aimed at identifying the sources of noise and reducing these noises. They comment that the stress of noise is linked to emotional

exhaustion, burnout, and increased pressure at work, stress, and annoyance, as well as potentially increasing the risk of medical errors.

In summary, it is clear that the factors that contribute to medication administration errors are not unique and have been found to be fairly commonplace, regardless of the geography of the events and different studies conducted as demonstrated by the above studies, which were presented at international medical meetings, but have yet to appear in publication.

2.8 SUMMARY

The literature reviewed in this chapter provides a comprehensive overview of the various aspects and complexities that are intricately linked to the clinical aspects of medication administration. The literature discussed in this chapter supports the conceptual map in Chapter One, in that the research findings speak to the human factors and components described in the framework. Despite the widespread geographical area covered by these articles and research studies, the factors researched are similar in nature. It is also important to note that all of these research studies have been conducted in state based healthcare institutions using varied research methods. Quantitative research appears to be the more prevalent research method being used with fewer qualitative studies being done where the nurses' perceptions of the reasons for the increasing incidence of MAE are being explored. The research focus leans heavily towards the reasons for errors rather than the nurses' feelings towards the occurrence and incidence of errors.

This observation suggests that there is room for qualitative studies that explore how the nurses feel about medication administration errors. The rising costs of healthcare worldwide are forcing hospital administrators to contain costs by using forward thinking cost-efficient and cost-effective processes and system management tools. There appears to be little available research into how nursing staff interpret the budgetary restrictions and stricter staffing models, and as to whether or not there is a growing belief that the cost of care is taking preference over the quality of patient care. This is of particular importance in the South African context where the private healthcare sectors are receiving a high volume of press with regards the high cost and poor quality of care (Child, 2014:1).

Parry *et al.* (2014:419) suggest that medication administration errors are a direct result of the behaviour of the registered nurse. The authors believe that in order to better understand the causes of errors the behaviour of the registered nurses needs to be better understood.

Exploring how nurses feel towards errors might give us insight into the behaviour of the nurse who is responsible for administering medication, and reveal possible underlying complacency and acceptance of errors that could have a potentially monumental impact on the support, training and education measures that would need to be put in place to reduce these adverse events.

The extent of research done that examines the reasons for MAE confirms that the incidence of these errors is on the increase. Anderson and Townsend's (2010:24) findings present high mortality rates related to MAE. Bourbonnais and Caswell (2014:391) report that patient safety has become the key focus in health care in Canada. This concern is supported by researchers who have conducted studies in Europe, Asia, Australia and North America.

The review of the literature confirms that there is little differentiation in the factors that contribute to administration errors as well as in the categories the errors are placed into. It appears from the studies conducted that regardless of where we are in the world, the issues that relate to medication administration are linked on a common platform and are receiving equal attention in all healthcare institutions.

The South African National Core Standards (DoH, 2011:22-23) confirm the growing need for the creation of a safe patient environment that is focused on quality care and the need for evidence based clinical practice.

Further studies need to be conducted which deliver information for the development and implementation of specific strategies to reduce the MAE incidence. Hospital and ward specific changes need to be designed and implemented to effectively bridge the gap between policy and procedural edicts by management and the ward nurses' goal-directed behaviour when administering medication.

The research clearly shows that innovative actions need to be taken to minimise these adverse events to improve patient safety. Healthcare management could look to the WHO "wash your hands" campaign as an example of creating change through education and awareness. Other suggestions that have been seen in the reviewed literature include the need to consider new strategies that address working hours, nurses using earphones to reduce distractions when handing out medication or prominently placed stickers that remind nurses of the medication "rights" as a means to achieving these outcomes. These studies could reveal whether medication errors could actually be reduced and not just appear in articles as "human error" with the ultimate goal of improving patient safety.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

In Chapter Two (2) recent available literature that highlights the complex components that relate to MAE were described in detail. This literature encompassed MAE incidence, factors contributing to MAE, the impact of environmental, personal, organisational, team, education and training have on MAE as well as the role other members of the healthcare team play in MAE.

This chapter will provide the details of the research methodology that was utilised to describe the nurses' perceptions of the human factors that may be associated with MAE in private healthcare institutions in South Africa.

3.2 AIM AND OBJECTIVES

The aim of this study was to identify and describe the prevailing elements in the making of medication administration errors, within the context of human factors, as self-reported by nurses in a private healthcare setting in the Western Cape.

The objectives of the study were to:

- Determine the prevailing elements related to the human factors associated with MAE's as self-reported by enrolled and professional nurses working in a private healthcare institution in the Western Cape.
- Determine associations between professional categories, years of experience and attendance at in-service education, and nurses' perceptions about human factors influencing medication administration errors.
- Unpack the most prevalent elements and factors in terms of meaning, implication and possible ways to address.
- Elicit information from the participants with regards orientation, in-service and policies related to medication administration in their workplace and use this information to determine any shortcomings in these areas.

3.3 STUDY SETTING

The study was conducted in three private hospitals within the same hospital group in the Western Cape Metropole. These hospitals are privately listed commercial entities and the staffing profile provided by the Nursing Managers of these institutions list the operating beds as 207, 222 and 175 beds respectively. These hospitals are equipped to provide advanced diagnostic and interventional care with two of the facilities having been accredited with the status of a Level One Trauma Unit.

The anonymity and confidentiality of each institution has been protected, as the individual hospitals are not identifiable in the final data analysis.

Despite the private nature of the business, compliance with the NCS for Healthcare Institutions (DoH, 2011:22-23) remains a key focus for all healthcare institutions. In addition to this, these healthcare institutions are all accredited with SANC as facilities that may provide a clinical setting for basic and post-graduate nursing training. Being accredited infers that these institutions are able to provide the scope of nursing training and skills achievement as prescribed by SANC in the nursing curriculums (SANC 1993: R683 as amended, SANC 1997: R2175 as amended). This training includes the mastery and application of the skill of medication administration to patients.

The adult medical, adult surgical, paediatric and maternity wards, along with intensive care units, are all areas where the task of medication administration is the responsibility of Registered Nurses (RN) and Enrolled Nurses (EN) (South African Nursing Council, R2598, 1984). In these three institutions, the professional and enrolled nurses provide care to a multitude of disciplines all requiring specialised knowledge and patient care. It is for this reason these nursing categories have been selected as participants for this study.

3.4 RESEARCH DESIGN

Research methodology provides the details of the process that will be used to conduct the research and will be discussed in detail (Burns, Grove & Gray, 2013:707). This section provides the outline that will be used to conduct this research. The results will allow the role players to quantify, in terms of incidence and prevalence, the elements (personal, environmental organisation and team) related to the human factors associated with MAE's in order of their perceived importance to determine the order of focus when instituting mitigating or corrective strategies to reduce MAE incidence.

This research study was conducted using a quantitative approach with a descriptive design. The quantitative design allows for the identification the nature of the cause and effect impact the study variables have on the study subjects (Grove, Burns & Gray, 2013:706). A descriptive design was selected as this methodology allowed the researcher to elicit detailed information regarding the human factors associated with medication administration errors, as perceived by professional and enrolled nurses, in order to fully understand the phenomenon as it occurs naturally in the workplace. This method did not require any manipulation of variables and the data obtained can be utilised to identify problems with current nursing practice in this situation (Brink *et al.*, 2012:112).

In terms of research paradigms, positivism is believed to be an appropriate choice for social and natural sciences as it is based on a belief that only phenomena that can be observed through experience or using instruments may be perceived as having validity (de Vos *et al.*, 2005:5-6).

This research study lies on the border of positivism moving towards post positivism as this study is directed towards gaining a deeper understanding of the nurses' perceptions of the human factors that may play a role in MAE. For the nurses to be able to provide this information they will need to have personal experience in terms of the administration of medication in an environment that exposes them (the nurses) to the various human factors described in the data collection questionnaire. In terms of the research paradigm, it is believed that the research process being utilised to conduct this study meets the criteria

3.5 POPULATION AND SAMPLING

A population is the total group of people who meet the criteria for selection to participate in a research study and who have knowledge of the phenomenon being studied (Grove *et al.*, 2013:44). The study participants were selected as follows from the population. The RN and EN population for each hospital were calculated based on the nursing posts allocated to those two categories in the selected nursing departments (see tables one and two in Chapter One). The population data was then submitted to a statistician at the Stellenbosch Biostatistics Unit to determine the finite sample size that would ensure a representative sample of the total population was recruited for the study (Appendix 7).

For the purpose of this research study the researcher made use of a non-probability convenience sampling method as this method infers that the study participants are available when the researcher enters the field to collect the data (Brink *et al.*, 2012:140). The total population of registered and enrolled nurses in the three hospitals was N=400. Of the total study population, 82.25% (n=329/400) agreed to participate in the study. Based on the statistician's feedback, a sample size of 67.5% (n=270) of the study population in tables one and two were invited to participate in the study. This sample size ensured that the sample was representative of the population thereby supporting the credibility of the study findings (Grove *et al.*, 2013:343).

Whilst the study population sample (n=270) consists of (n=173 / 64%) RN's and (n=97 / 36%) EN's, the flexible nature of patient occupancy and the associated skill mix, staffing requirements and employee absenteeism meant that the participants recruited were not representative of the total population.

The participant recruitment procedure will be discussed in detail in Section 3.9: data collection.

3.5.1 Inclusion criteria

The study population will consist of the enrolled and professional nurses who have been trained and are qualified to administer medication and / or recognise reactions to medications in terms of their scope of practice (SANC 2005: R2598 as amended). The sampling will include full time and part time nursing staff.

3.5.2 Exclusion criteria

For this research study there were no reasons found to exclude any of the participants who met the criteria for inclusion in the study.

3.6 DATA COLLECTION TOOL

For the purpose of this research study a data collection questionnaire consisting of multiple closed ended questions and two open ended questions, where other factors may be documented and training suggestions made, will allow for the documenting of additional elements and training suggestions.

A questionnaire is defined as a self-report form that is designed to elicit information from the respondent (Grove *et al.*, 2013:425). The nature of a questionnaire does not allow the opportunity to question the participants at a deeper level which suggests that the researcher should ensure that all aspects relating to the phenomenon that is being researched are present in the questionnaire. For this reason, and to ensure the questionnaire fits the local context, the questionnaire was subjected to an in-depth adjustment by the researcher and this was based on an extensive literature review, an analysis of instruments used and referenced by other researchers as well as the researchers own experience of this phenomenon. The data collection questionnaire was then reviewed by local and international experts in the fields of healthcare quality and risk, general and critical care nursing, nursing education, law and clinical pharmacy (Appendix 8).

The data collection questionnaire was divided into three main sections: Section A: demographics questions 1 to 9, Section B with four subsections: B1 are environmental elements: questions 10 to 22; B2 are organisational elements: questions 23 to 31; B3 are team elements: questions 32 to 43 and B4 are individual elements: questions 44 to 58 that are linked to the prevalent elements that are related to the human factors that could be associated with MAE. Section C (questions 59 to 66) contains questions relating to the role education and training play in medication administration.

3.6.1 Section A: Demographic Profile

This section, consisting of questions 1 to 9, required the participants to provide their personal and professional biographical data. The personal data included the gender and age of the participants. The professional data included the nursing category, level of nursing education, years of experience, post basic qualifications, employment status, time spent on night duty in the past year as well as the area of clinical practice.

3.6.2 Section B: Elements associated with medication administration errors

The elements described in this section are all potentially associated with MAE. Each subsection will be described individually. For this section, the questions use a Likert scale format which ask the participants to grade the effect each variable as on MAE according to their perception (Grove et al., 2013:699). The effects are graded as having either a rarely affects (scores 1), regularly affects (scores 2) or commonly affects (scores 3) on MAE.

3.6.2.1 Number B1: Environmental elements: related to medication administration

This section consisted of 13 questions (B1 10-22) that related directly to the clinical action of medication administration in terms of the environmental elements that are known to impact on this task.

3.6.2.2 Number B2: Organisational elements: related to management process

This section had nine questions (B2 23-31) that focused on the management process and the role incident management, policies and physician prescribing habits play in MAE. The participants were again asked to score the elements once on the same Likert scale as discussed in the previous section.

3.6.2.3 Number B3: Team elements

This 12 question section (B3 32-43) was focused on the role team members play during medication administration alongside the patient allocation, workload and the clarity of orders and prescriptions. The scoring for this section mirrored that of the previous two sections.

3.6.2.4 Number B4: Individual elements: related to nursing care

The final element related section consisted of 14 questions (B4 44-58) that were directed towards the nurse herself. The questions explored the practical knowledge and skills of the nurse in terms of her abilities to adhere to medication administration policies, manage infusion devices and calculate dosages and flow rates. The scoring for this section was identical to the previous sections in terms of scoring style, categories and instructions to the participants.

The final question in this section was an open-ended question that allowed the research participants the opportunity to add any elements they felt had been overlooked in the questionnaire.

3.6.3. Section C: Elements relating to the role education and training play in medication administration

This section consisted of seven closed-ended and one open-ended questions (questions C 59-66). The closed-ended questions asked the participants about medication administration training and in-service education, the availability of policies in the units, the conducting of medication audits and feedback on audit findings. The participants had to score these questions in terms of yes, no and uncertain.

The final question was an open-ended question that invited the participants to offer suggestions relating to medication administration practices and training in their institutions.

3.7 PILOT STUDY

As discussed in Chapter One, a pilot study is a smaller version of the research study and is conducted to test the suitability of the data collection instrument. One aspect of the instrument relates to the adequacy and relevance of the instrument content. This process also provides the opportunity to test the clarity of the questions, the procedure for data collection in the field as well as to ensure that the responses elicited meet the study objectives (Basavanthappa, 2009:439). Grove *et al.*, (2013:343) suggest that 10 to 20 participants are sufficient to estimate variances in outcome measures and ensure the instrument is fit for purpose.

The researcher conducted the pilot study on the 13th March 2016 to determine if any components of the planned research methodology needed to be adjusted or modified ahead of the commencement of the formal research study (Burns & Grove, 2011:49). This hospital was not included in the main study but is a part of the chosen healthcare group. Fifteen candidates who met the inclusion criteria and who were not from a healthcare institution selected for the main research study were invited to participate. This healthcare institution is a member of the same hospital group that has been selected for this research study. The return rate was 93% with 14 of the 15 questionnaires being completed and returned.

During the pilot study, the participant information and informed consent form was explained and handed to the participants. All three language options (English, Afrikaans and Xhosa) were requested and found to be clear and comprehensive. On completion of these documents, the data collection questionnaires were handed to the participants along with a self-sealing envelope. The participants suggested a time for the completed questionnaires to be collected by the researcher.

On collection of the completed questionnaires, the participants were invited to provide comments on the document in terms of the language used, the relevance of the elements listed and the ease or difficulty to complete the form. Additional comments were also welcomed.

Participant feedback was generally found to be positive. Four respondents commented on the completeness of the questionnaire and the fact that all the MAE related aspects they thought of had been covered. The questionnaire was reported as easy to understand and complete. In one questionnaire, the participant marked questions 40 and 44 and with multiple crosses, which may suggest that these elements play a significant role in MAE. Two respondents initially found Section B2 unclear but said that when they went on a little further the questions then made sense. One participant gave feedback from her personal experience in terms of patients' chronic medications sometimes being challenging and agency staff being trained but lacking in experience.

The two open-ended questions (59 and 66) provided additional information regarding the study participants' views on the factors affecting MAE incidence. For question 59 (*other factors not identified, please specify*) only one participant made additional suggestions: problems relating to handwriting leading to incorrect dispensing of medication, chronic and genetic medication.

With reference to Question 66 an open-ended question (*Do you have any suggestions regarding medication administration practice or training?*); the comments from six of the participants were as follows:

- *"If an EN/ RN can have reasonable amount of patients or allocated reasonably, medication errors can be minimised."*
- *"Feedback regularly on medication information that was given but not total administration and refreshment training for all staff involved yearly."*
- *"More in service training on administration of medication, not any done in the ward / unit in the past 3 years, especially when Doctors prescribe meds used elsewhere, not familiar to staff at all hospitals."*
- *"Some intravenous infusions should have an accurate dose guideline from pharmacy, very little time in ones training to such an important aspect of treatment, drug interaction and compatibility is seldom checked with IV drugs infusion."*
- *"On medication rounds concentration is necessary, don't want to be disturbed."*
- *"If maybe there can be no interruptions during medication time concentration is the best option."*

In addition to the participant feedback, the researcher made several other observations during the pilot study and amendments was made to suit the main study, namely:

- The participant information and informed consent form contained the name of the hospital group in the section that clarified where the study is taking place. This is in contravention of the ethical principles of confidentiality and anonymity. The sentence was changed to state that the study is being conducted in private hospitals in the Western Cape.
- In 47% (n=7) of the questionnaires, the participants put the hospital name as the place where the consent was signed. In preparation for the data collection for the main study, the

place where the participant signed had the word “town” added encourage institutional anonymity.

The pilot study provided an opportunity to adjust the data collection questionnaire. In 47% (n=7) of the completed questionnaires, there were omissions in one or more fields. These omissions included:

- The questions for years of post-qualification experience and the number of months of night duty worked during the past year.
- In addition to this there were single incidents of questions 16, 23 and 64 not being answered. In the demographics section, point nine, the maternity unit had been omitted from the options list.
- In Section B4 a numbering error had been made with Question 45 being followed by Question 47.

To improve the overall completeness of the questionnaire the participant instruction to answer all the questions now has **ALL** in capitals and bold. In addition to this, maternity has been added as an area of work and the numbering has been rectified.

Further improvements were made to the data collection questionnaire. To improve the post-study feedback and contextualisation of the data, the environmental, organisational, and individual elements headings were expanded to include the associated work-based process. During the writing up of Section 3.6 (instrumentation) of this study, Section C did not integrate well into Section B in terms of logical flow or layout. Section C was subsequently made a separate section and provided with the heading of *“Elements relating to the role education and training play in medication administration.”*

Furthermore, the data collection process during the pilot study was found to be challenging in terms of the handing out and collection of the completed questionnaires. All of the participants requested that the completed questionnaires be collected a few hours later in the day. In light of this, the data collection process has been altered to suit the needs of the research participants (refer to Table 3.1). The information session and signing of informed consent forms will now take place at the commencement of the nursing shift and the collection of the completed questionnaires near the end of the same shift.

As the data from the pilot study has been used to finalize the research documentation and improve the data collection process, the findings have been excluded from the main study.

3.8 VALIDITY AND RELIABILITY

In quantitative research, reliability is concerned with the ability of the instrument to consistently measure the concept being researched. Validity determines how well the instrument measures the attributes of the phenomenon being measured (Grove *et al.*, 2013:289).

A pilot study was conducted under the conditions described in Chapter One (1) to determine the reliability and validity of the data collection instrument. The feedback and findings from the pilot study were incorporated into the adjustments that were made to the instrument as described in section 3.7.

3.8.1 Validity

In terms of validity Grove *et al.*, (2013:712) state that the validity of an instrument is determined by how well it (the instrument) measures the construct being examined. Validity has been evaluated in terms of construct, face and content validity.

3.8.1.1. Construct validity

De Vos *et al.*, (2005:160) states that construct validity can be confirmed if the instrument measures the concept being investigated and this measurement is accurate. In addition to this, content validity is assured if the content measures all the known variables that relate to the phenomenon in question. The use of headings that are in line with those described in the conceptual map (refer to figure 1.1) further enhanced the construct validity of the data collection questionnaire.

3.8.1.2. Face validity

Face validity is concerned with the appearance of the measurement and whether or not it appears to measure the phenomenon being explored (de Vos *et al.*, 2005:160-161). The pilot study was used to evaluate the validity of the instrument. In terms of face validity the participants feedback said the questionnaire was clear, concise and easy to complete.

3.8.1.3. Content validity

Content validity is concerned with assuring that the measurement instrument measures all the known variable that relate to the phenomenon in question and as such is perhaps the most difficult to achieve (de Vos *et al.*, 2005:160-161).

For the purpose of this research study, the data collection tool has subjected to an in-depth adjustment by the primary researcher, who is involved in quality improvement in the private healthcare institution, and based on a tool modified by Wakefield *et al.*, (1998) that was originally designed by Jill Wakefield (1995), a British nurse expert in MAE, whose original instrument has

been utilised and modified by many researchers in this field. Permission to use and modify the Wakefield instrument can be found in annexure 7.

The questionnaire has also been reviewed for content, construct and by validity by local experts in the fields of pharmacy, intensive care nursing, hospital risk and incident management, medical law and nursing education as well as business leadership. These experts include a clinical pharmacist with a masters' degree who is chairperson of the medication committee at the first hospital. The legal expert is a professional nurse who holds a critical care qualification and an advanced nursing education diploma and is now practicing medical law. The third expert is a nurse educator who has achieved a MCur degree and is the lead person for her hospitals' quality and risk committees.

In addition, the instrument was validated in terms of construct, face, and content validity by Professor Douglas Wakefield; an international expert in the field of healthcare quality in the United States of America, who has published numerous articles relating to MAE (Appendix Eight).

The comprehensive nature of the questionnaire will allow the researcher to draw conclusions that will allow for generalisations to be suggested in other similar settings. This will ensure that content and external validity is achieved.

3.8.2 Reliability

In terms of reliability, the internal consistency (or homogeneity) of the instrument was measured during a pilot study as discussed above under point 3.7. The Cronbach alpha (α) coefficient measuring was conducted using the Statistical Programme for the Social Sciences (SPSS) 23 program (2015). This statistical test determines the extent to which all the items contained in the instrument consistently measure the same concept. (Grove *et al.*, 2013:391).

The calculations below demonstrate the Cronbach alpha scores for the element sections (section B) of the data questionnaire, which measures the elements associated with MAE in terms of the environment, the organisation, the team and the individual.

Table 2.1 Cronbach alpha scores for study elements

Questionnaire section	Study element	Number of items	Cronbach Alpha score
Section B1	Environmental	13	.861
Section B2	Organisational	9	.755
Section B3	Team	13	.922
Section B4	Individual	14	.925

These Cronbach Alpha reliability results suggest an acceptable (.755) to high (.925) level of internal consistency in terms of validity of the study variables being measured with this data measurement instrument.

3.9 MAIN STUDY

The main study was commenced following the completion of the pilot study and the minor changes that needed to be made were addressed. These changes have been discussed in detail in this chapter Section 3.7. This part of the study was conducted in three healthcare institutions belonging to the same hospital group and which were not involved in the pilot study. This ensured that no participants were recruited a second time. The sample consisted of Registered Professional and Enrolled Nurses with a total population of N=400. The convenience sampling methodology allowed for a sample population that exceeded the recommended sample size of n=270. Further details of the participating institutions can be found in Chapter One (1), Section 1.9.2.

3.10 DATA COLLECTION

Data collection took place between the 24th March and the 23rd April 2016 over weekends when the patient acuity is lower and the nursing staff are able to participate in the study with minimal disruption to patient care. The researcher conducted data collection in two of the hospitals. As the researcher is employed in the third hospital a field worker who is a qualified nurse educator with a masters' degree was used for data collection. This was to ensure that the study participants did not feel undue pressure to participate which may have introduced a degree of researcher bias. The presence of the researcher may have resulted in the participants either feeling pressured to participate or feeling that their participation may be reported to their managers and used as a punitive measure. Data collection in the first hospital was conducted over a long weekend as this allowed the researcher the opportunity to target all four shifts. For the remaining two hospitals data was collected over two weekends per hospital with two shifts being seen each weekend.

The participants in tables 1.1 and 1.2 (Chapter One) were seen in shift groups at the beginning of the shift (see Table Three), prior to the distribution of the questionnaires, to discuss the purpose of the study, the voluntary, anonymous and confidential nature of participation and the process that will be used during data collection. The participants were then given the opportunity to ask questions and informed consent was obtained during these sessions. All the signed, informed consent forms were taken by the researcher before the questionnaires and envelopes were handed to the participants. Participants who declined to take part in the study were thanked for being willing to listen to the research introduction. In three of the 114 ward and intensive care units visited, the researcher was asked to present proof of ethical approval and hospital managements' permission to be in the hospital. This evidence was presented to the nursing staff on request.

Table 3.1: Revised data collection schedule

Activity	Data collection 1 Hospital 3	Data collection 2 Hospital 2	Data collection 3 Hospital 1
Data collection dates	Week 1 24 th to 28 th March 2016	Week 1 - 1 st & 2 nd April 2016 Week 2 – 8 th & 9 th April 2016	Week 1 – 16 th & 17 th April 2016 Week 2 – 23 rd & 24 th April 2016
Night shift	For both night duty shifts the questionnaires were handed out between 19h00 and 21h00 at the commencement of the shift and were collected between 05h00 and 06h00 the next morning before the end of the shift.	For both night duty shifts the questionnaires were handed out between 19h00 and 21h00 at the commencement of the shift and were collected between 05h00 and 06h00 the next morning before the end of the shift.	For both night duty shifts the questionnaires were handed out between 19h00 and 21h00 at the commencement of the shift and were collected at 05h00 the next morning before the end of the shift.
Day shift	For both day duty shifts the questionnaires were handed out between 07h00 and 09h00 at the commencement of the shift and collected between 17h00 and 18h00 before the end of the shift.	For both day duty shifts the questionnaires were handed out between 07h00 and 09h00 at the commencement of the shift and collected between 17h00 and 18h00 before the end of the shift.	For both day duty shifts the questionnaires were handed out between 07h00 and 09h00 at the commencement of the shift and collected between 17h00 and 18h00 before the end of the shift.

The participants were requested to place the completed questionnaires in a self-sealing envelopes and then placed in a sealable container to further enhance participant anonymity and confidentiality. The number of questionnaires delivered and collected was documented in a register that is being kept by the researcher. The completed questionnaires were collected at the end of each shift to allow the participants sufficient time to complete the document. For the day staff the questionnaires were collected at 17h00 and for night staff at 05h00. Of the **N=345** questionnaires handed out, **N=329** were returned. This equates to a 95% return rate. To maintain the confidential nature of this research study the participants were not questioned regarding the 5% of questionnaires that were returned without having being filled in.

Incomplete questionnaires were included in the study with a numerical total of the missing data for each variable being documented in the data summaries in Chapter Four (4). All study related documents are being kept in a locked cabinet for five years with only the researcher having access to the cabinet.

3.11 QUESTIONNAIRE AND RESPONSE RATE

The research data was collected in three private hospital institutions in the Western Cape Metropole. In all three hospitals, the RN's and EN's (as per the inclusion criteria) were approached to participate.

For Hospital One (1), a total of 124 consent forms were signed and questionnaires distributed. The return rate was 97.58% with 121 questionnaires being returned. In Hospital Two (2), a total of 118 questionnaires were returned from the 126 that were distributed. This was a return rate of 93.65%. In Hospital Three (3), 95 questionnaires were handed out and 90 returned. The return rate for this hospital was 94.73%. Thus, a total of (n=329 / 95.36%) completed and returned questionnaires

3.12 DATA ANALYSIS

Data analysis is conducted to streamline, organise and give meaning to the phenomenon being explored during the research study. This process makes use of descriptive and inferential analysis to meet the research objectives by drawing conclusions, suggesting relationships between variables and highlight significant findings elicited from the research results (Grove, Burns & Gray, 2013:46-47). Descriptive statistics create summaries of the research data, which allow the researcher to find meaning and gain insight into the data (Grove *et al.*, 2013:692). Inferential statistics aid the researcher in using sample statistics and making inferences regarding the study population (Grove *et al.*, 2013:697).

The research data was summarised and analysed by the researcher and with the assistance of a statistician and using the EXCEL programme and the Statistics and Data 14 (STATA) statistical software package. The data was presented using frequency tables, histograms and graphs.

The demographic data of the study population was presented in a tabular format using inferential statistics such as frequencies and means.

Simple descriptive statistics were used to create the variable summaries. In addition to this, inferential non-parametric statistical analysis was conducted on the ordinal and nominal research data. This testing is done for data that is ranked but not interval in nature (Grove *et al.*, 2013:543).

The testing technique used by the statistician was the Wilcoxon Rank sum testing which is used to examine changes that occur when looking at matched-pairs measures (Burns & Grove, 2011:553).

Within this testing, the research data was subjected to Mann-Whitney statistical testing which analyses ordinal data to detect differences between population groups that are normally distributed and reports on the data in terms of variances and probability (Grove *et al.*, 2013:699). This testing was used to identify associations between study variable in accordance with the second research objective. The aim of this study objective was to determine if there were any associations between the nursing categories, years of experience, attendance at in-service education and the nurses' perceptions regarding the human factors that influence MAE incidence. The data was organised into dichotomous variables to enhance the analysis and align the results with the study objective.

The two open-ended questions were reported on in a narrative format and as reported by the participants. As these questions requested that the participants specify any elements not mentioned in the questionnaire and to make suggestions regarding medication training there was no need for the creation of themes or data interpretation.

The data analysis findings will be discussed in greater depth in Chapter Four.

3.12.1 Data preparation for analysis

The research questionnaires were numbered 1 to 329 with each hospital being identifiable through the numbered range for their total quota of returns. Excel spreadsheets were created for the complete raw research data. One page of the excel spreadsheet was used to create a key to describe the coding used to explain the raw data summaries.

The demographic data in **Section A** was coded using numerical symbols. In every question, the individual categories were allocated a number to allow for easier loading of the raw data into the computer (Grove *et al.*, 2013:517). The coding was used to enhance the analysis of the research data.

Data in **Sections B1, B2, B3, B4** and **C** of the research questionnaire, the Likert style questions had already been allocated numerical codes of one, two and three on the questionnaire. These existing codes were used to enter the data into the excel program.

On completion of the capturing of the complete raw data, summary excel sheets were created for each individual section of the questionnaire. This was done to enhance the descriptive analysis and identify differences in the study population (Grove *et al.*, 2013:519).

Data within the open ended questions B58 and C66, was manually transcribed in exact form into an excel spreadsheet for direct reporting. This will be described further in Chapter Four.

3.13 ETHICAL CONSIDERATIONS

In terms of the ethical principles that were discussed in Chapter One, the collection and management of the research study and the research data was done in accordance with the principles discussed.

During data collection, all nurses who met the inclusion criteria for the study were afforded the opportunity to participate. The study was explained to them and Informed consent forms were available in English, Afrikaans and Xhosa. Nurses who declined to participate were thanked for their time. Research questionnaires were handed out at the beginning of the 12-hour shift and collected near the end of the shift to allow the nurses adequate time to complete the questionnaires. This was to ensure that the participants did not feel pressurised by having the researcher / field worker present while they completed the questionnaire.

3.14 SUMMARY

This chapter provides the details of the research methodology that was utilised to conduct this research study. The details support the theory of research methodology in terms of ethical principles and research processes. In the next chapter, the researcher will discuss the findings of the study as they relate to the research study objectives and purpose.

In conclusion, this chapter provides a detailed description of the research methodology used by the researcher to conduct this study. Each section provides evidence of the researchers' compliance with the principles of research and the guiding principles of ethics as they relate to any research study that involves the human subject.

CHAPTER 4

RESEARCH FINDINGS

4.1 INTRODUCTION

This chapter builds upon the foundation laid earlier in the previous chapters in terms of purpose, design, what is already known through research of MAE and the methodology used to conduct this study.

This chapter will describe the data that was collected, the analysis and interpretation of the research findings as they relate to the study objectives as well as a discussion of the findings. How the findings relate to previously discussed research study findings will be discussed in detail in the next chapter. To protect the identity of the nurse participants the overall findings will be discussed in terms of either individual hospitals or the total population for each nursing category.

The total data collection questionnaire return acquired from the study respondents across the three private hospital institutions in the Western Cape Metropole was N=329/345 (95.36%).

4.2 PRESENTING THE STUDY FINDINGS

In this chapter the data will be described using measures of central tendency namely mean, median and modality with frequencies, percentages, tables and graphs being used to display the analysed data. Each individual item in the research questionnaire will be presented. To further enhance the understanding of the research findings and identify the prevailing elements, each question will be supported by an explanation that contains the key findings for each item.

In addition, the statistical analysis conducted to identify possible associations between the study population professional categories, years of experience and attendance at in-service education and their perceptions about human factors influencing medication administration errors will be presented in graph format with a clarification of the findings.

4.3 SECTION A: DEMOGRAPHIC DATA

The demographic data presented in Table 4.1 describes the study population and includes questions relating to participant gender, age, qualifications and nursing education, years of experience, employment, time spent on night duty in the past year and the respondents' primary area of work. The table provides a summary of the total population demographics in terms of frequency, percentages and number of questionnaires where the information was not provided and is listed as "data missing (did not complete).

4.3.1. Question 1: Gender

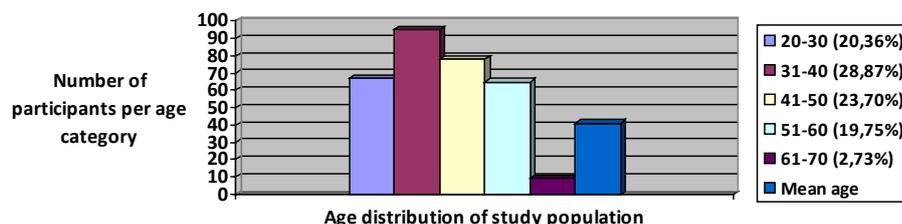
Of the returned questionnaires only 0.3% (n=1) of respondents failed to answer this question. The study population consisted of 95.42% (n=313) females and 4.57% (n=15) males. Whilst this study made use of a convenience sampling methodology, the ratio of male to female nurses in the study population is similar to the Australian Health Workforce Report findings from August 2014, which reported their employed nurse population to consist of only 10% of male nurses (Australia's Future Health Workforce – Nurses detailed report from the Health Workforce Australia, 2014). Similarly, in 2015, the nurse population of the United States of America was found to consist of approximately 16% of male nurses with the majority of nurses being female (Springer Publishing Company 2105 in Minority Report – nursing statistics, 2015). These findings suggest that our nurse population follows the international trends.

Table 4.1. Frequency table reflecting gender distribution in all three hospitals

Nursing Category	Hospital 1	Hospital 2	Hospital 3	Total N
	Frequency (f)	Frequency (f)	Frequency (f)	Frequency (f)
Data missing (did not complete)	0	1	0	1
Male	7	4	4	15
Female	114	113	86	313
Total =N	121	118	90	329

4.3.2. Question 2: Age

Of the N=329 of study participants, 4.55% (n=15) did not complete the question. The respondents' ages ranged from 21 to 64 years with a mean population age of 41 years. Again, the findings were in line with the international findings of the ages of practicing nurses. In Canada, a report on nurses eligible to work found that 49.09% of the 406.817 nurses eligible to practice were between the ages of 40 and 59 years of age (Canadian Institute for Health Information Regulated Nurses 2014 Report, 2015). The Minority Nurse on line publication reported that of the 3514.679 total nurse population, the average age of registered nurses was 44.6 years and the licensed to practice nurses 43.6 years (Springer Publishing Company 2105 in Minority Report – nursing statistics, 2015). The mean age of this research study population falls well within these foreign nurse populations.

Figure 4.1. Age distribution in all three hospitals (population N= 329)

4.3.3. Question 3: Nursing category

For this question, the respondents were asked to document their nursing qualification in terms of being either an RN or an EN. Of the 98.78% (n=325) of nurses who completed this question, 57.75% (n=191) were RN's and 41.03% (n=134) were EN's. This demographic variable will be analysed to determine if there were any associations between the nurse category and their perceptions of the human factors that could be associated with MAE. In Table 4.2. We see that more registered professional nurses than enrolled nurses partook in the study with Hospital One (1) having the most participants.

Table 4.2. Reflects the distribution of nursing categories in all three hospitals

Nursing Category	Hospital 1	Hospital 2	Hospital 3	Total N
	Frequency (f)	Frequency (f)	Frequency (f)	Frequency (f)
Data missing (did not complete)	3	1	0	4
Registered Professional Nurse	65	71	54	191
Enrolled Nurse	53	46	36	134
Total =N	121	118	90	329

4.3.4. Question 4: Level of nursing education

Of the 98.17% (n=323) of nurses completing this question, 37.99% (n=125) of the population have an EN certificate, 46.20% (n=152) have a diploma and 13.06% (n=43) a baccalaureate degree. The South African Governments' National Development Plan (NDP) 2030 has proposed that all universities work to increase the number of African and women with postgraduates and doctorate degrees as a means of encouraging research and innovation (South African National Planning Commission, 2012:ch9). In this sample of the nursing population, Table 4.3. below reflects the percentage of those with master and doctorate degrees is less than 1%.

Table 4.3. Level of basic nursing education in all three hospitals

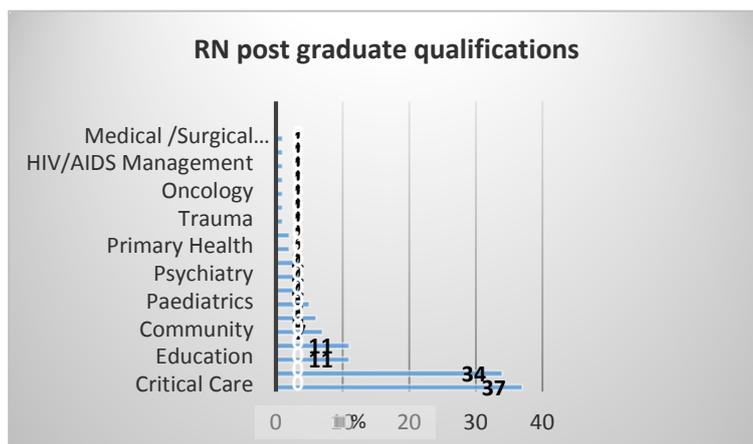
Level of basic nursing education	Participants (n)	%
Data missing (did not complete)	6	1.82
Certificate	125	37.99
Diploma	152	46.20
Baccalaureate	43	13.06
Master	2	0.607
Doctorate	1	0.303
Total= N	329	100

4.3.5. Question 5: Post basic nursing education

Whilst 3.95% (n=13) of the RN respondents failed to complete this question, the results show that only 29.78% (n=98) have post basic training qualifications. This equates to an estimated 50% of the RN population being surveyed. This finding will be discussed further in Chapter Five. The summary in Table 4.4. and Figure 4.2. detailing the post basic qualifications was done to provide a more interesting description of the nursing population but will not be used for statistical purposes. Figure 4.2. Indicates that most of the professional nurses with postgraduate qualifications are qualified in critical care.

Table 4.4. Post basic education of professional nurses in all three hospitals

Post basic education	Participants (n)	%
Data missing (did not complete)	13	3.95
Yes	98	29.78
No	218	66.26
TOTAL =N	329	100

Figure 4.2. List of RN post-graduate qualifications in all three hospitals

4.3.6. Question 6: Years of post-qualification experience

This question was the most poorly answered with 22.18% (n=73) of respondents from all three hospitals failing to answer the question. For the 77.81% (n=256) who supplied the information, the range of experience was from 0 to 43 with a mean of 12.25 years of post-basic experience. The omissions were 38, 27 and 8 (eight) from hospitals one, two and three respectively.

4.3.7. Question 7: Employment status

The study population in the three combined hospitals consisted of 84.04% (n=273) of full time employees and a 15.95% (n=52) of part-time (agency) staff. This variable finding (Table 4.5) will be discussed in the analysis for the Question C61 that asked the respondents if they have attended, medication related in-service training in the past 12 months.

Table 4.5. Combined hospital employment status

Employment status	Full time employees	Part time employees	No response
Data missing (did not complete)	0	0	4
Registered Professional Nurses	170	21	0
Enrolled Nurses	103	31	0
Total N = 329	273	52	4

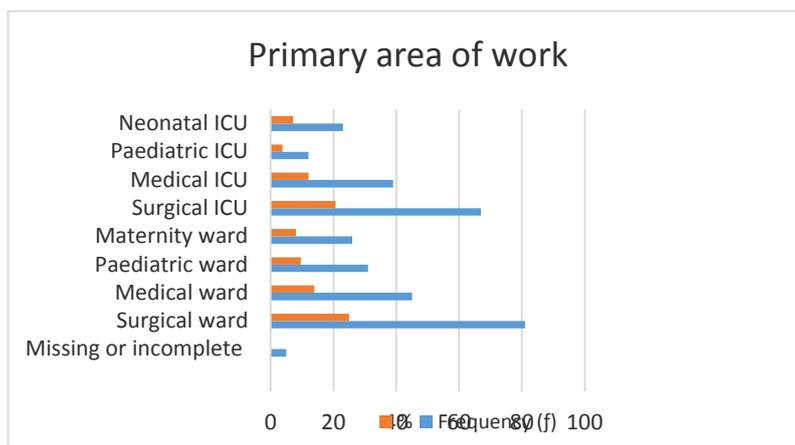
4.3.8. Question 8: Months of night duty worked in the past year

Of the 93.61% (n=308) of the respondents who completed this question, 20.97% (n=68) have worked night duty in the past 12 months. The average time spent on night duty during that time period was 4.92 months. The study did not determine if this was on a continuous or intermittent basis. This will be explored further in Chapter Five in terms of the impact night duty is known to have on error incidence. Due to the incomplete qualification data it was not possible to categorise this data in terms of RN or EN numbers. Of the 68 participants, 52.94% (n=36) work in intensive care units.

4.3.9. Question 9: Primary area of work

The findings for this question (Table 4.3.) provide an overview of the nursing population participating in the study and the disciplines where they work. To honour the confidentiality the participants were assured, no comparisons will be made between the various nursing disciplines.

Figure 4.3. Reflects the primary area of work of the participants in all three hospitals



4.4 SECTION B: THEMES EMERGING FROM THE SUBSECTIONS OF THE QUESTIONNAIRE

The data collection questionnaire consisted of four subthemes which correlate with the human factors that are known to play a role in patient safety as defined by the WHO (2009:4) and as such are set out in the conceptual framework guiding this research study (Figure 1.1: Chapter One). These elements concur with the elements and factors deemed to have both a direct and indirect impact on patient safety as related to MAE and reported on by the authors of the literature presented in this study.

As discussed in the section on data analysis in Chapter Three, the three Likert-style scale options will be collated into dichotomous values to enhance the data analysis and further align the results with the research study objectives. Where the combined scores exceed 50% the findings will be discussed in the table summary. Table 4.6. below provides a layout of the variables as it is indicated in the questionnaire and will be discussed accordingly.

Table 4.6. Human Factors in Patient Safety

	Elements	Questions
ELEMENT 1:	Environmental elements	Variable No B1: Introduction to data analysis B1:10-22
ELEMENT 2:	Organisational elements	Variable No B2: Introduction to data analysis B2:23-31
ELEMENT 3:	Team elements	Variable No B3: Introduction to data analysis B3:32-43
ELEMENT 4:	Individual elements	Variable No B4: Introduction to data analysis B4:44-58
ELEMENT 5:	Education and training elements	Variable No C: Introduction to data analysis C:59-66

4.4.1 ELEMENT 1: ENVIRONMENTAL ELEMENTS: RELATED TO MEDICATION ADMINISTRATION

Variable No B1: Introduction to data analysis questions B1: 10-22

The human factors discussed in Chapter One, and described by the WHO (2009) Patient Safety's Methods and Measures for Patient Safety Working Group report consider workplace resources and hazards as environmental elements that can impact on the action of the employee and the resultant performance outcomes of the worker. The questions asked in this section refer to factors that have been identified by other researchers as being directly linked to their impact upon medication administration and have been presented in the literature review in Chapter Two.

The responses **Regularly** and **Commonly (shaded in green)** were condensed in tables below to analyse the data collected in order to give meaning to the data analysed.

Pie charts below the tables were inserted to indicate the difference in response between RN's and EN's. This will enable the researcher to identify problem areas within the two categories of nurses.

4.4.1.1. Question B1 10: Medication rounds are conducted using an inadequate working surface

Table 4.4.1.1. Medication rounds are conducted using an inadequate working surface

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 5 (4.13%)	n = 5 (4.23%)	n = 4 (4.44%)	14 (3.95%)
Rarely	n = 74 (61.15%)	n = 66 (55.93%)	n = 54 (60%)	194 (58.96%)
Regularly	n = 25 (20.66%)	n = 28 (23.72%)	n = 22 (24.44%)	75 (22.79%)
Commonly	n = 17 (14.04%)	n = 19 (16.10%)	n = 10 (11.11%)	46 (13.98%)
TOTAL =N	121	118	90	329

Of the 95.74% (n=315) respondents, there appears to be a common belief across the three hospitals that at least a third of all nurses in each hospital believe the working surface regularly or commonly affects their ability to safely administer medication (see green shaded area in table 4.4.1.1. above). This suggests a need for hospital management to look at the manner in which nurses are administering medication and the possibility that introducing these trollies may reduce an identified risk.

4.4.1.2. Question B1 11: Nurses are distracted whilst administering medication

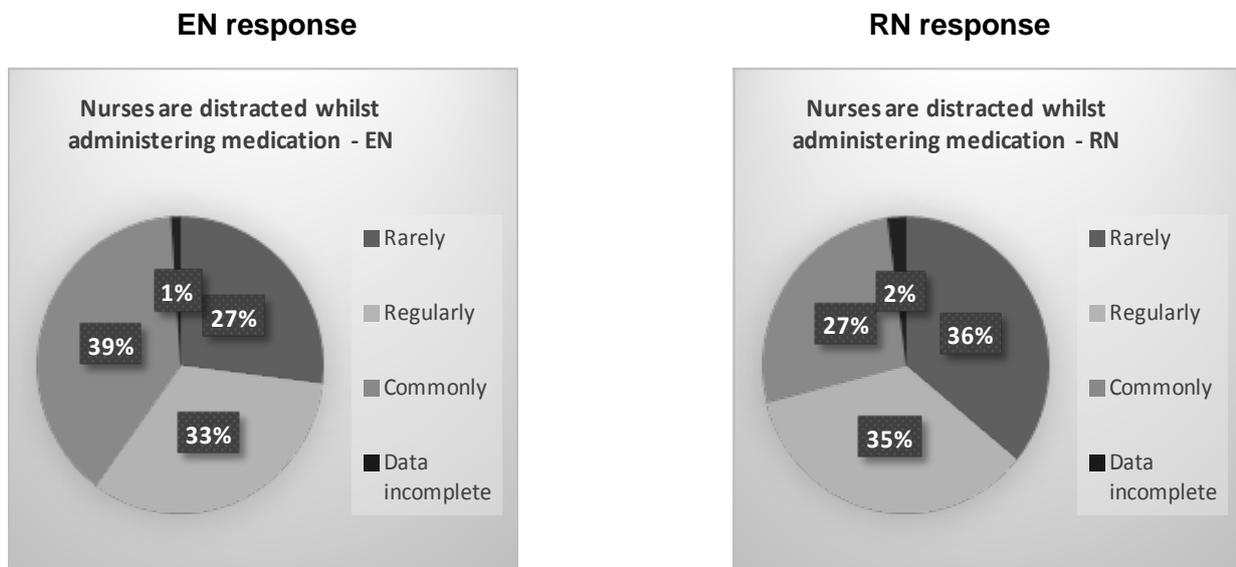
Table 4.4.1.2. Nurses are distracted whilst administering medication

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 2 (1.69%)	n = 1 (1.11%)	4 (1.21%)
Rarely	n = 46 (38.01%)	n = 34 (28.81%)	n = 22 (24.44%)	102 (31%)
Regularly	n = 32 (26.44%)	n = 39 (33.05%)	n = 36 (40%)	107 (32.52%)
Commonly	n = 42 (34.71%)	n = 43 (36.44%)	n = 31 (34.44%)	116 (35.25%)
TOTAL =N	121	118	90	329

With a 98.79% (n=325) response to this question, it is alarming to notice that a total of 67.77% (n=223) of the population view *distractions* as playing a regular or common role in MAE with all three hospitals scoring this factor at over 60%. A deeper analysis of these scores shows that this factor presents a significant challenge for the nursing population with a combined regular and common affect score of 67.77% (n=223) as seen in table 4.4.1.2. For these hospitals one and three, the combined regular and commonly affect scores equate to 71.15% (n=74) and 74.44% (n=67) respectively. A comparison of the scores between the two nursing categories shows little difference between the nurses' perceptions for this factor (see Figure 4.4).

This human factor has been widely reported on in numerous research studies and will therefore be discussed at length in Chapter Five.

Figure 4.4: The pie charts below represent the EN and RN responses regarding nurses being distracted whilst administering medication



4.4.1.3. Question B1 12: There are insufficient resources available for the nurses to confirm the medications

Table 4.4.1.3. There are insufficient resources available for the nurses to confirm the medications

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 2 (2.22%)	4 (1.21%)
Rarely	n = 103 (85.12%)	n = 87 (73.72%)	n = 62 (68.88%)	252 (76.59%)
Regularly	n = 14 (11.57%)	n = 19 (16.10%)	n = 21 (23.33%)	54 (15.19%)
Commonly	n = 2 (1.65%)	n = 12 (10.16%)	n = 5 (5.55%)	19 (5.77%)
TOTAL=N	121	118	90	329

In hospitals one and two, a respective score of 85.12% (n=103) and 73.72% (n=87) suggests that the nurses have sufficient resources for checking medication before administering to the patient. This is higher than in Hospital Three where only 68.88% (n=62) of nurses feel that they have sufficient resources available to them (refer to Table 4.4.1.3).

4.4.1.4. Question B1 13: There is insufficient training in the use and management of infusion devices

Table 4.4.1.4. There is insufficient training in the use and management of infusion devices

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 0 (0%)	0 (0%)
Rarely	n = 73 (60.33%)	n = 80 (67.79%)	n = 61 (67.77%)	214 (65.04%)
Regularly	n = 31 (25.61%)	n = 23 (19.49%)	n = 21 (23.33%)	75 (22.79%)
Commonly	n = 17 (14.04%)	n = 15 (12.71%)	n = 8 (8.88%)	40 (12.15%)
TOTAL =N	121	118	90	329

As infusion devices are commonly in use to ensure the safe administration of some medication, the responses suggest an urgent need for training in all three hospitals listing this factor as regularly affecting MAE with a 25.61% (n=31), 19.49% (n=23) and 23.33% (n=21) respectively (see green shaded areas in Table 4.4.1.4). The staff who feel they are insufficiently trained in the use of

devices may fear the use of the device or of making an error. On the plus side, it is reassuring to see that at least 65.04% (n=214) of the nurses believe that this rarely affects MAE incidence but best practice can be improved if more nursing staff are familiar with the use of these devices.

4.4.1.5. Question B1 14: Labels for look-a-like sound-a-like medication are inadequate

Table 4.4.1.5. Labels for look-a-like sound-a-like medication are inadequate

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 0 (0%)	n = 2 (2.22%)	5 (1.51%)
Rarely	n = 75 (61.98%)	n = 64 (54.23%)	n = 49 (54.44%)	188 (57.14%)
Regularly	n = 23 (19%)	n = 24 (20.33%)	n = 24 (26.66%)	71 (21.58%)
Commonly	n = 20 (16.52%)	n = 28 (23.72%)	n = 17 (18.88%)	65 (19.75%)
TOTAL=N	121	118	90	329

The above table (Table 4.4.1.5) demonstrates that the study population believe that the labelling for look-a-like sound-a-like medication is inadequate to ensure safe administration with hospital 3 reporting the highest score of regularly and commonly affect scores of 26.66% (n=24) and 18.88% (n=17) respectively. Hospital Two scored the second highest of commonly affect at 23.72% (n=28). Hospital One had a high score of 61.98% (n=75) for rarely affects which suggests a need for them to share their approach for labelling these medications.

The management of look-a-like sound-a-like medications will be discussed further in Chapter Five.

4.4.1.6. Question B1 15: Labels for high-risk medication are inadequate

Table 4.4.1.6. Labels for high-risk medication are inadequate

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 1 (0.84%)	n = 2 (2.22%)	4 (1.21%)
Rarely	n = 83 (68.59%)	n = 81 (68.64%)	n = 65 (72.22%)	229 (69.60%)
Regularly	n = 22 (18.18%)	n = 19 (16.10%)	n = 13 (14.44%)	54 (16.41%)
Commonly	n = 15 (12.39%)	n = 17 (14.40%)	n = 10 (11.11%)	42 (12.76%)
TOTAL =N	121	118	90	329

These results, as seen in Table 4.4.1.6 show that the labels for high risk medications rarely affect the incidence of MAE with the three hospitals giving a score of 68.59% (n=83), 68.64% (n=81) and 72.22% (n=65) respectively. There was a commonality across the hospitals with a range of 11.11% to 14.40% of the nurses believing that inadequate labelling commonly leads to MAE.

4.4.1.7. Question B1 16: Medication was dispensed incorrectly by the pharmacy

Table 4.4.1.7. Medication was dispensed incorrectly by the pharmacy

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 2 (1.69%)	n = 0 (0%)	2 (0.60%)
Rarely	n = 58 (47.93%)	n = 86 (72.88%)	n = 47 (52.22%)	191 (58.05%)
Regularly	n = 35 (28.92%)	n = 22 (18.64%)	n = 30 (33.33%)	87 (26.44%)
Commonly	n = 28 (23.14%)	n = 8 (6.77%)	n = 13 (14.44%)	49 (14.89%)
TOTAL =N	121	118	90	329

It would appear from these results in the green shaded area of the preceding table that pharmacy-dispensing errors play a significant role in MAE incidence in hospitals one and three reporting a regular and common affect collectively of 52.06% (n=63) and 47.77% (n=43) each. Hospital Two had a lower score with a 72.88% (n=86) of respondents stating that this rarely affects medication administration and error incidence.

4.4.1.8. Question B1 17: The medication failed to arrive from the pharmacy timeously

Table 4.4.1.8. The medication failed to arrive from the pharmacy timeously

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 0 (0%)	2 (0.60%)
Rarely	n = 27 (22.31%)	n = 34 (28.81%)	n = 17 (18.88%)	78 (23.70%)
Regularly	n = 34 (28.09%)	n = 42 (35.59%)	n = 33 (36.66%)	109 (33.13%)
Commonly	n = 58 (47.93%)	n = 42 (35.59%)	n = 40 (44.44%)	140 (42.55%)
TOTAL =N	121	118	90	329

With a greater than 99% (n=327) response rate for this question, the scores in the green shaded columns of Table 4.4.1.8 suggest a concern that the medication supply chain is deemed to play a significant role in MAE incidence. Across the hospitals the time it takes for medication to arrive from the pharmacy has combined regularly and commonly affect score of 75.68% (n=249).

4.4.1.9. Question B1 18: A high patient-nurse workload

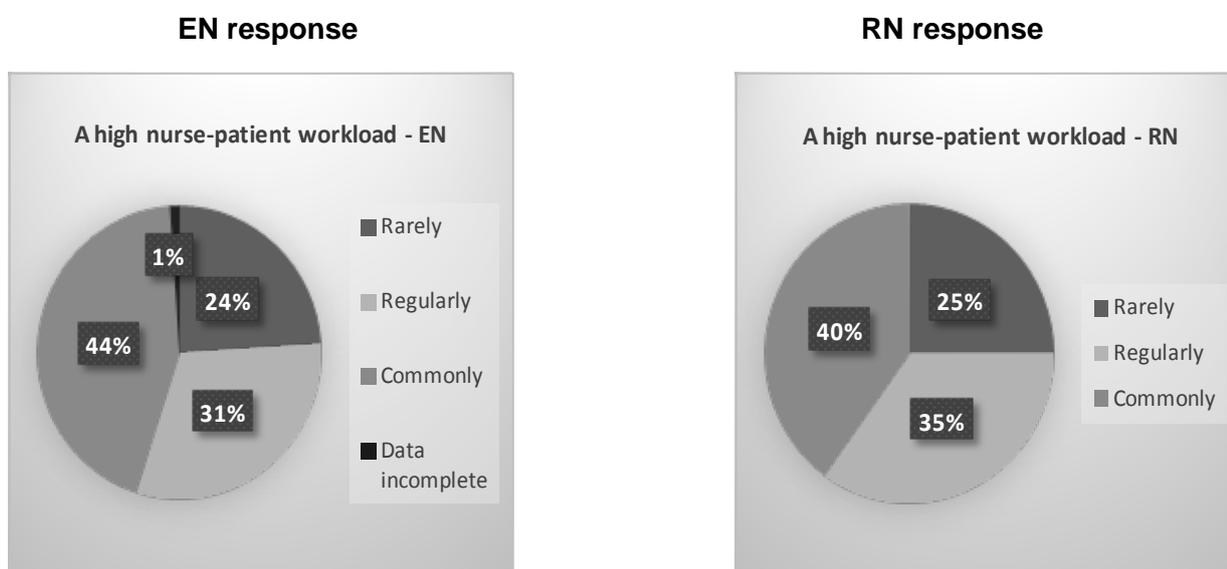
Table 4.4.1.9. A high patient-nurse workload

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 0 (0%)	2 (0.60%)
Rarely	n = 32 (26.44%)	n = 25 (21.18%)	n = 25 (27.77%)	82 (24.92%)
Regularly	n = 33 (27.27%)	n = 39 (33.05%)	n = 37 (41.11%)	109 (33.13%)
Commonly	n = 54 (44.62%)	n = 54 (45.70%)	n = 28 (31.11%)	136 (41.33%)
TOTAL =N	121	118	90	329

Of the 99.39% (n=327) respondents who answered this question, the nurses in all three hospitals attribute a high patient-nurse workload as having a regular or common effect on MAE incidence (see total scores in Table 4.4.1.9). All of the hospitals score these two components as having a >70% impact on safe medication administration practice. This score was highest in Hospital Two with a combined score of 78.75% (n=93) stating that workload commonly or regularly affected their practice. In terms of staffing and skill mix it is important to explore this factor from the EN

perspective as well. When looking at the comparative scores between EN's and RN's in Figure 4.5, both categories have identified a high-patient workload as a key factor in MAE.

Figure 4.5: The pie charts below represent the EN and RN responses regarding the impact of a high patient-nurse workload



4.4.1.10. Question B1 19: It is difficult to find someone to double check medication prior to administration

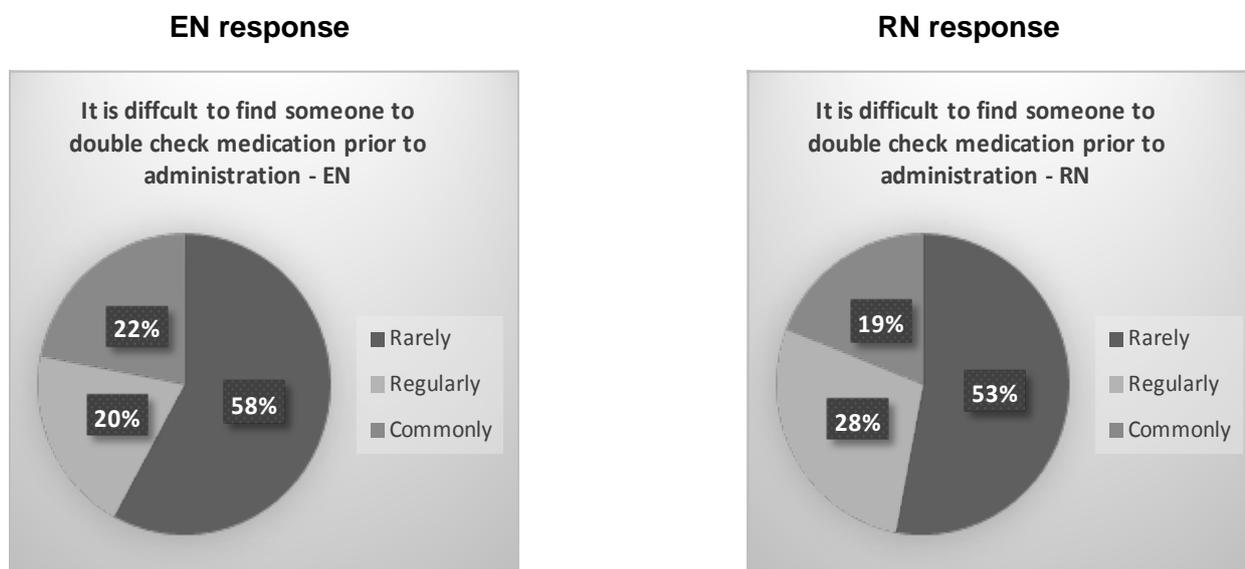
Table 4.4.1.10. It is difficult to find someone to double check medication prior to administration

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 0 (0%)	0 (0%)
Rarely	n = 62 (51.23%)	n = 74 (62.71%)	n = 46 (51.11%)	182 (55.31%)
Regularly	n = 30 (24.79%)	n = 22 (18.64%)	n = 29 (32.22%)	81 (24.62%)
Commonly	n = 29 (23.96%)	n = 22 (18.64%)	n = 15 (16.66%)	66 (20.06%)
TOTAL =N	121	118	90	329

In terms of the availability of a second person to check medication with, Hospital Two scored highest with 62.71% (n=74) of nurses believing that this rarely affects the incidence of MAE. In hospitals one and three, this factor was deemed to have a common and regular impact with both scoring in excess of 45% in terms impact on safe medication administration (refer to Table 4.4.1.10). In Figure 4.6.2 It is interesting to note that whilst the RN population view this as having a

more regular impact on MAE than the EN's the combined scores for regularly and commonly affect only differ with 2% showing the balance of opinion in the two categories.

Figure 4.6: The pie charts below represent the EN and RN responses regarding difficulty in finding a person to double-check medication with

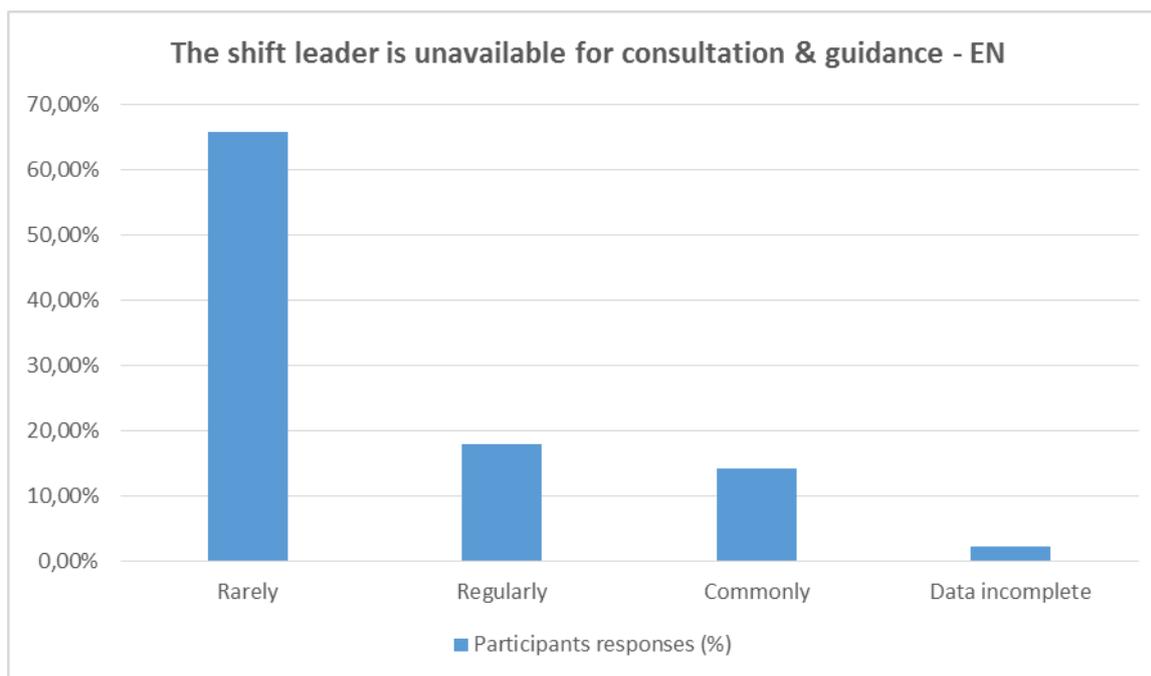


4.4.1.11. Question B1 20: The shift leader is unavailable for consultation and guidance

Table 4.4.1.11. The shift leader is unavailable for consultation and guidance

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 1 (0.84%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 97 (80.16%)	n = 82 (69.49%)	n = 62 (68.88%)	241 (73.25%)
Regularly	n = 14 (11.57%)	n = 26 (22.03%)	n = 17 (18.88%)	57 (17.32%)
Commonly	n = 9 (7.43%)	n = 9 (7.62%)	n = 10 (11.11%)	28 (8.51%)
TOTAL =N	121	118	90	329

In Table 4.4.1.11 we see that for Hospital One, the availability of the shift leader for consultation and guidance is not viewed as a concern as the respondents reported a rarely affects of 80.16%. For hospitals two and three the *availability of the shift leader for consultation and guidance* is more challenging in that it has a regularly affects MAE incidence 22.03% (n=26) and 18.88% (n=17) respectively. With reference to the EN who works under the direct and indirect supervision of the RN (SANC 2005, R2598 as amended), 67% (n=90) of the EN's consider the availability of the shift leader as being a rare affecter in MAE incidence (see figure below).

Figure 4.7 EN responses regarding availability of the shift leader

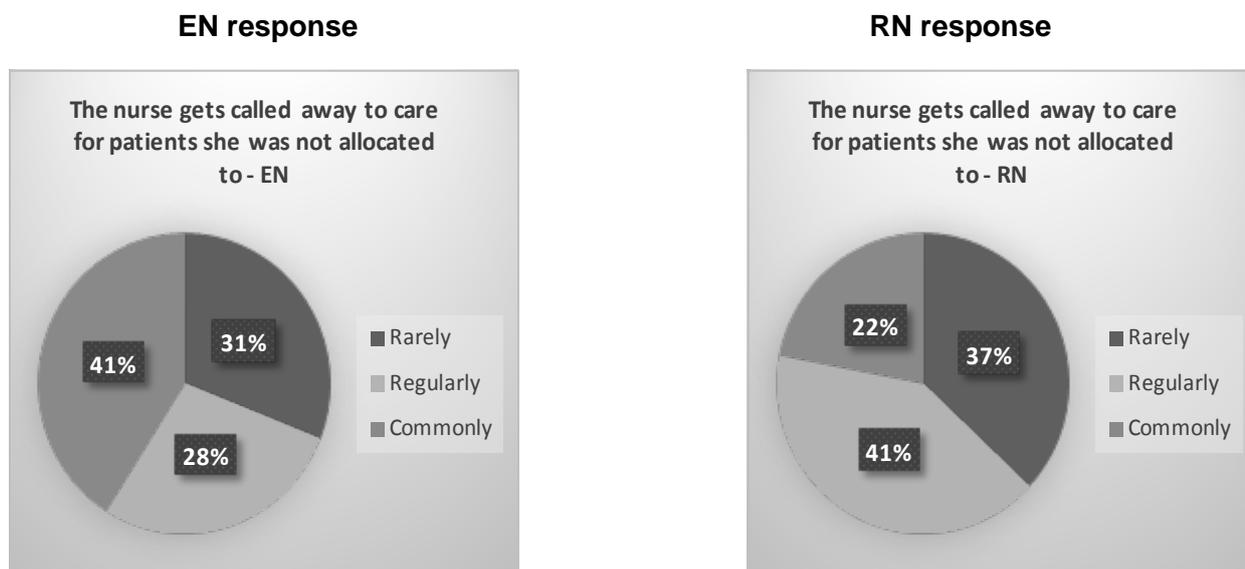
4.4.1.12. Question B1 21: The nurse gets called away to care for patients she was not allocated to

Table 4.4.1.12. The nurse gets called away to care for patients she was not allocated to

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 1 (0.84%)	n = 0 (0%)	1 (0.30%)
Rarely	n = 42 (34.71%)	n = 42 (35.59%)	n = 31 (34.44%)	115 (34.95%)
Regularly	n = 36 (29.75%)	n = 44 (37.28%)	n = 36 (40%)	116 (35.25%)
Commonly	n = 43 (35.53%)	n = 31 (26.27%)	n = 23 (25.55%)	97 (29.48%)
TOTAL =N	121	118	90	329

The greater percentage across the hospitals (as seen in the green shaded areas of the above table) suggest that the nurse being called away regularly or commonly affects the incidence of MAE with regular scoring 35.25% (n=116) and common scoring 29.48% (n=97). Together these score a 64.73% (n=213) effect as opposed to a score of 34.95% (n=115) of respondents who say this has a rare effect on MAE. The RN feedback (shown in Figure 4.8) across the three hospitals suggests that being called away to care for unfamiliar patients presents a regular or common concern for 63% of the study population which is slightly less than the 69% reported by the EN's in the hospitals.

Figure 4.8: The pie charts below represent the EN and RN responses regarding nurses being called away to care for patients she was not allocated to



4.4.1.13. Question B1 22: Work pressure results in the nurse running out of time before handing over to the next shift

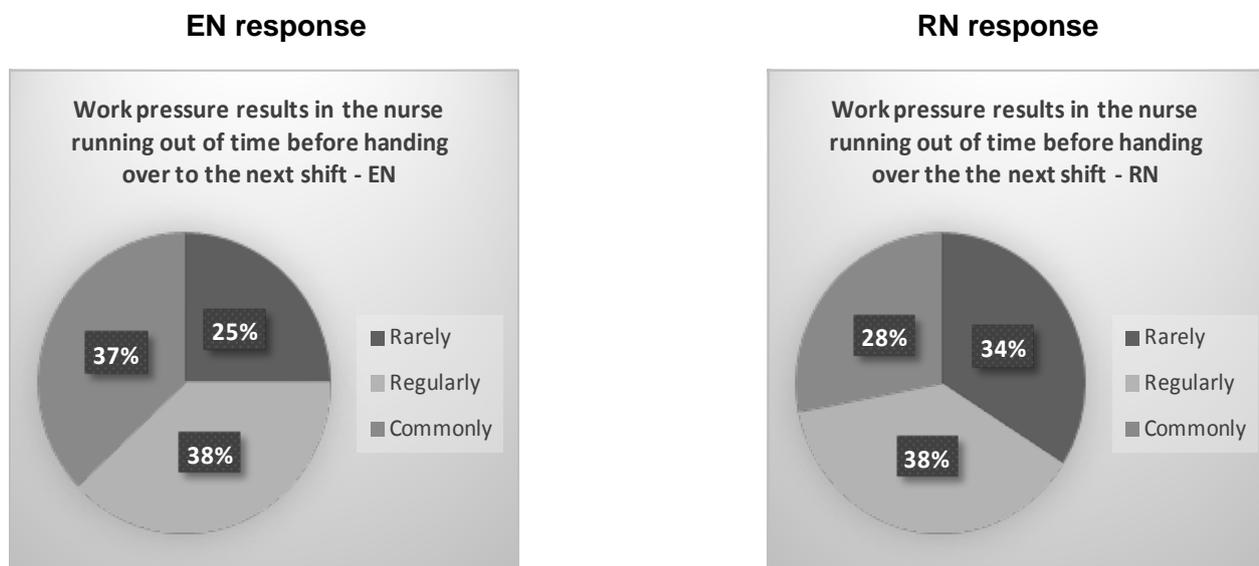
Table 4.4.1.13. Work pressure results in the nurse running out of time before handing over to the next shift

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 0 (0%)	0 (0%)
Rarely	n = 38 (31.40%)	n = 37 (31.35%)	n = 25 (27.77%)	100 (30.39%)
Regularly	n = 41 (33.88%)	n = 45 (38.13%)	n = 39 (43.33%)	125 (37.99%)
Commonly	n = 42 (34.71%)	n = 36 (30.50%)	n = 26 (28.88%)	104 (31.61%)
TOTAL =N	121	118	90	329

These results are similar to the previous question with an average of 30% in each hospital believing that work pressure and running out of time is rarely attributed to MAE. In each hospital, this factor is believed to have a regular effect of over 30% and an average common effect of 31.61% (n=104). Hospitals two and three report the highest incidence of regularly affects with Hospital One reporting this as having a 33.88% effect on incidence (shown in Table 4.4.1.13). Looking at the comparative scores between the two categories, the RN population have a significantly higher score for this being a rare affecter with a 34% (n=64) as opposed to a rare

affecter of 25% (n=33) for the EN's (see Figure 4.9). These results will be discussed in greater detail and linked to other research findings in points 5.2.3.3.4 and 5.2.3.3.5

Figure 4.9: The pie charts below represent the EN and RN responses regarding work pressure leading to running out of time before handover



4.4.2 ELEMENT 2: ORGANISATIONAL ELEMENTS: RELATED TO MANAGEMENT PROCESS

Variable No B2: Introduction to data analysis B2:23-31

Organisational elements speak of the leadership, communication and safety culture of the workplace and the impact they have on the human factors that are linked to patient safety. As with the environmental elements in Section 4.4.1, these factors have also been taken from the WHO (2009) definition as discussed in the conceptual framework in Section 1.8. These questions have been modelled on the same definitions and speak to the general safety and incident related culture as components of management processes and of the organisation as a whole. This section of the questionnaire focuses on the management process in the hospital and as such is not directly affected by the differences in the nursing scope of practice (SANC 2005, R 2598 as amended). For this reason the study data will be presented in tabular format without the separation into nursing categories.

The participant response ***Rarely*** in tables below were shaded in order to indicate the significant response that should be considered when analysing the relevant data in the tables below.

4.4.2.1. Question B2 23: Management are actively involved in incident reporting

Table 4.4.2.1. Management are actively involved in incident reporting

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 1 (0.84%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 37 (30.57%)	n = 36 (30.50%)	n = 32 (35.55%)	105 (31.91%)
Regularly	n = 37 (30.57%)	n = 46 (38.98%)	n = 38 (42.22%)	121 (36.77%)
Commonly	n = 46 (38.01%)	n = 35 (29.66%)	n = 19 (21.11%)	100 (30.39%)
TOTAL =N	121	118	90	329

The feedback from the participants in terms of *managements' involvement in incident reporting* as reflected in green in Table 4.4.2.1. The results did suggest that the regular and common affect domains accounted for 67.16% (n=221) as reported by the study participants. The green shaded area in the table above shows that only a third of participants felt this factor had a rare impact and this was the general belief across all three hospitals.

4.4.2.2. Question B2 24: Management encourage incident reporting

Table 4.4.2.2. Management encourage incident reporting

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 0 (0%)	n = 2 (2.22%)	3 (0.91%)
Rarely	n = 34 (28.09%)	n = 35 (29.66%)	n = 21 (23.33%)	90 (27.35%)
Regularly	n = 37 (30.57%)	n = 34 (28.81%)	n = 34 (37.77%)	105 (31.91%)
Commonly	n = 49 (40.49%)	n = 49 (41.52%)	n = 33 (36.66%)	131 (39.81%)
TOTAL =N	121	118	90	329

The role of managements' encouragement of incident reporting received positive feedback across the board. The grey shaded totals in the table above (Table 4.4.2.2) show a total of 71.72% (n=236) for regularly and commonly affect as opposed to an across the board 27.35% (n=90) for rarely affect (in the green shaded area) MAE incidence.

4.4.2.3. Question B2 25: The hospital has a clear incident reporting policy

Table 4.4.2.3. The hospital has a clear incident reporting policy

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 4 (3.30%)	n = 1 (0.84%)	n = 1 (1.11%)	6 (1.82%)
Rarely	n = 38 (31.40%)	n = 33 (27.96%)	n = 23 (25.55%)	94 (28.57%)
Regularly	n = 31 (25.61%)	n = 33 (27.96%)	n = 33 (36.66%)	97 (29.48%)
Commonly	n = 48 (39.66%)	n = 51 (43.22%)	n = 33 (36.66%)	132 (40.12%)
TOTAL =N	121	118	90	329

For feedback regarding the incident management reporting policy, all three hospitals scored this as a common factor for 43.22% (n=51) of Hospital Two participants and 39.66% (n=48) for Hospital One. For Hospital Three the scores were the same (36.66% / n=33) for regular and commonly affect (refer to Table 4.4.2.3).

4.4.2.4. Question B2 26: Management monitor medication related incidents

Table 4.4.2.4. Management monitor medication related incident

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 4 (3.30%)	n = 1 (0.84%)	n = 4 (4.44%)	9 (2.73%)
Rarely	n = 38 (31.40%)	n = 32 (27.11%)	n = 24 (26.66%)	94 (28.57%)
Regularly	n = 34 (28.09%)	n = 33 (27.96%)	n = 28 (31.11%)	95 (28.87%)
Commonly	n = 45 (37.19%)	n = 52 (44.06%)	n = 34 (37.77%)	131 (39.81%)
TOTAL =N	121	118	90	329

When asked about management monitoring medication related incidents 68.68% (n=226) of the respondents believe that management monitor MAE. This would suggest that staff are aware that their actions are under scrutiny when it applies to reported incidents.

4.4.2.5. Question B2 27: Management give staff feedback about incidents that have been reported

Table 4.4.2.5. Management give staff feedback about the incidents that have been reported

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 0 (0%)	n = 1 (1.11%)	2 (0.60%)
Rarely	n = 47 (38.84%)	n = 54 (45.76%)	n = 43 (47.77%)	144 (43.76%)
Regularly	n = 36 (29.75%)	n = 33 (27.96%)	n = 24 (26.66%)	93 (28.26%)
Commonly	n = 37 (30.57%)	n = 31 (26.27%)	n = 22 (24.44%)	90 (27.35%)
TOTAL=N	121	118	90	329

Although over 68% of respondents believe that management scrutinise MAE incidents (refer to table 4.4.2.4) they fail to give staff feedback nearly half of the time (see green shaded area in the above table (table 4.4.2.5) with 43.76% (n=144) of respondents reporting that incident feedback is rarely reported to the nursing staff. Although the scores for these domains are similar in the hospitals, 30.57% (n=37) of nurses surveyed in hospital 1 attribute this factor as being a common influencer for MAE.

4.4.2.6. Question B2 28: Medication related policies are not adhered to

Table 4.4.2.6. Medication related policies are not adhered to

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 2 (1.69%)	n = 2 (2.22%)	7 (2.12%)
Rarely	n = 58 (47.93%)	n = 60 (50.84%)	n = 55 (61.11%)	173 (52.58%)
Regularly	n = 37 (30.57%)	n = 37 (31.35%)	n = 21 (23.33%)	95 (28.87%)
Commonly	n = 23 (19%)	n = 19 (16.10%)	n = 12 (13.33%)	54 (16.41%)
TOTAL=N	121	118	90	329

For adherence to medication policies the responses in hospitals one and two show that there is little difference in the scores for each category. The overall score in the green shaded area of Table 4.4.2.6 shows that 52.58% (n=173) of the study population believe that policies adherence is

rarely a contributing factor to MAE incidence across the three hospitals. This leaves nearly 45% (n=149) of the study population suggesting policies are not adhered to which is cause for concern.

4.4.2.7. Question B2 29: Nursing staff are aware of the role they play in incident management

Table 4.4.2.7. Nursing staff are aware of the role they play in incident management

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 36 (29.75%)	n = 37 (31.35%)	n = 33 (36.66%)	106 (32.21%)
Regularly	n = 47 (38.84%)	n = 43 (36.44%)	n = 35 (38.88%)	125 (37.99%)
Commonly	n = 36 (29.75%)	n = 38 (32.20%)	n = 21 (23.33%)	95 (28.87%)
TOTAL=N	121	118	90	329

The role the nurse plays in incident management as a factor that affects MAE was deemed to have a regular effect in hospitals one and three with a reported 38.84% (n=47) and 38.88% (n=38) respectively. Although the 66.86% (n=220) did confirm that nurses are aware of the role they play in incident management. The overall highest score for all three facilities was for regularly affects with a total 37.99% (n=125), which is a major concern (refer to Table 4.4.2.7).

4.4.2.8. Question B2 30: Physicians use abbreviations that are not known.

The responses **Regularly** and **Commonly** (shaded in green) were condensed in tables below to analyse the data collected in order to give meaning to the data analysed.

Table 4.4.2.8. Physicians use abbreviations that are not known

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 72 (59.50%)	n = 76 (64.40%)	n = 56 (62.22%)	204 (62%)
Regularly	n = 27 (22.31%)	n = 23 (19.49%)	n = 17 (18.88%)	67 (20.36%)
Commonly	n = 20 (16.52%)	n = 19 (16.10%)	n = 16 (17.77%)	55 (16.71%)
TOTAL=N	121	118	90	329

The physicians' use of unknown abbreviations is perceived as playing a rare role in error incidence for 62% (n=204) of the population and with the hospitals averaging a score of 62% (n=204). Despite this, medication abbreviations still amount to present a regularly or commonly affecting factor with a collective 37.07% (n=122) as seen in the green shaded area of the above table.

4.4.2.9. Question B2 31: Prescriptions are illegible / difficult to read

Table 4.4.2.9. Prescriptions are illegible / difficult to read

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 33 (27.27%)	n = 38 (32.20%)	n = 21 (23.33%)	92 (27.96%)
Regularly	n = 42 (34.71%)	n = 37 (31.35%)	n = 38 (42.22%)	117 (35.56%)
Commonly	n = 44 (36.36%)	n = 43 (36.44%)	n = 30 (33.33%)	117 (35.56%)
TOTAL=N	121	118	90	329

In the green shaded area of Table 4.4.2.9, the legibility of prescriptions has been reported by the study participants to be a regular and common influencer in the incidence of MAE. When combining these scores, this factor scores 71.07% (n=86), 67.79% (n=80) and 75.55% (n=68) in hospitals one, two and three (see Table 4.4.2.9).

4.4.3. ELEMENT 3: TEAM ELEMENTS

Variable No B3: Introduction to data analysis B3:32-43

As with the previous two sections, the conceptual framework identifies the team as another arm of the human factors influencing and affecting employee's actions at work. As discussed in Section 1.8, the team is defined as being the leaders, structures and processes and their contribution to ensuring patient safety. This section of the research questionnaire asks explores the nurses' perceptions of the role of the team leader, structure and process related challenges facing nursing staff when they are tasked with patient care in the hospital.

The responses **Regularly** and **Commonly (shaded in green)** were condensed in tables below to analyse the data collected in order to give meaning to the data analysed.

Pie charts below the tables were inserted to indicate the difference in response from registered professional nurses and the enrolled nurses this will enable to the researcher to identify problem areas within the two categories of nurses.

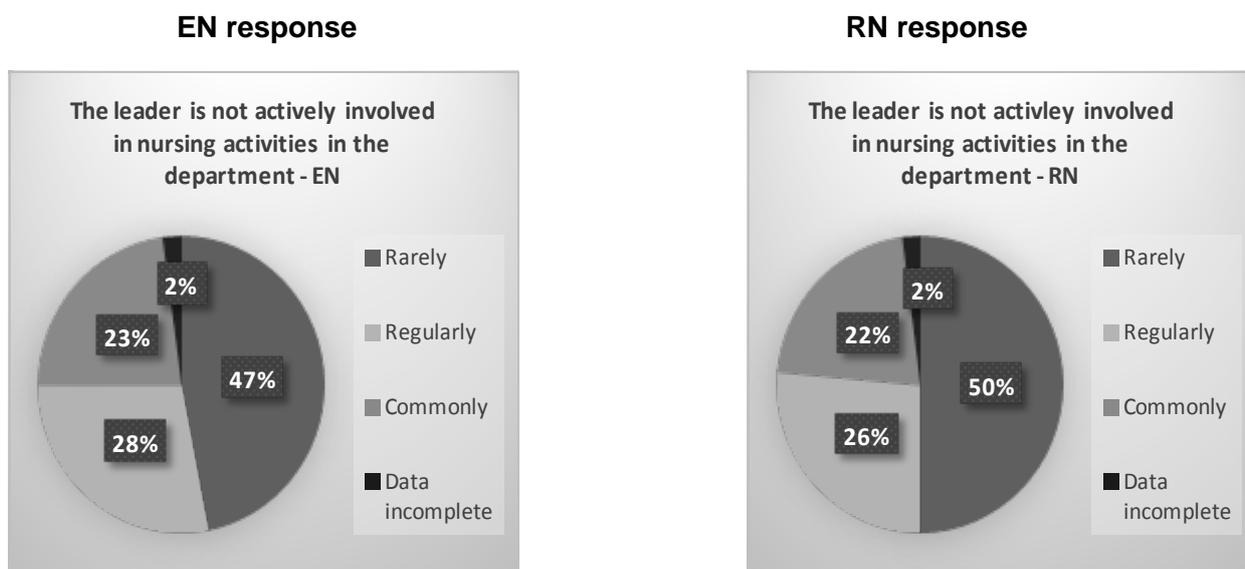
4.4.3.1. Question B3 32: The leader is not actively involved in nursing activities in the department

Table 4.4.3.1. The leader is not actively involved in nursing activities in the department

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 0 (0%)	n = 1 (1.11%)	4 (1.21%)
Rarely	n = 65 (53.71%)	n = 64 (54.23%)	n = 44 (48.88%)	173 (52.58%)
Regularly	n = 29 (23.96%)	n = 33 (27.96%)	n = 29 (32.22%)	91 (27.65%)
Commonly	n = 24 (19.83%)	n = 21 (17.79%)	n = 16 (17.77%)	61 (18.54%)
TOTAL=N	121	118	90	329

It appears from the above table (Table 4.4.3.1) that the availability of the shift leader does not play a role in MAE according to an average of 52.58% (n=173) of the respondents. Hospital Three reports the highest link between the shift leaders' involvement in the department activities and error incidence with a reported 49.99% (n=45) alluding to a regular or common link to error incidence. When looking at the comparison between the perceptions of the EN's and RN's in Figure 4.10 there is only a 5% difference in the ranks perceptions of this having a rare effect on error incidence with a 47:52 percentage split.

Figure 4.10: The pie charts below represent the EN and RN responses regarding the involvement of the leader in department activities



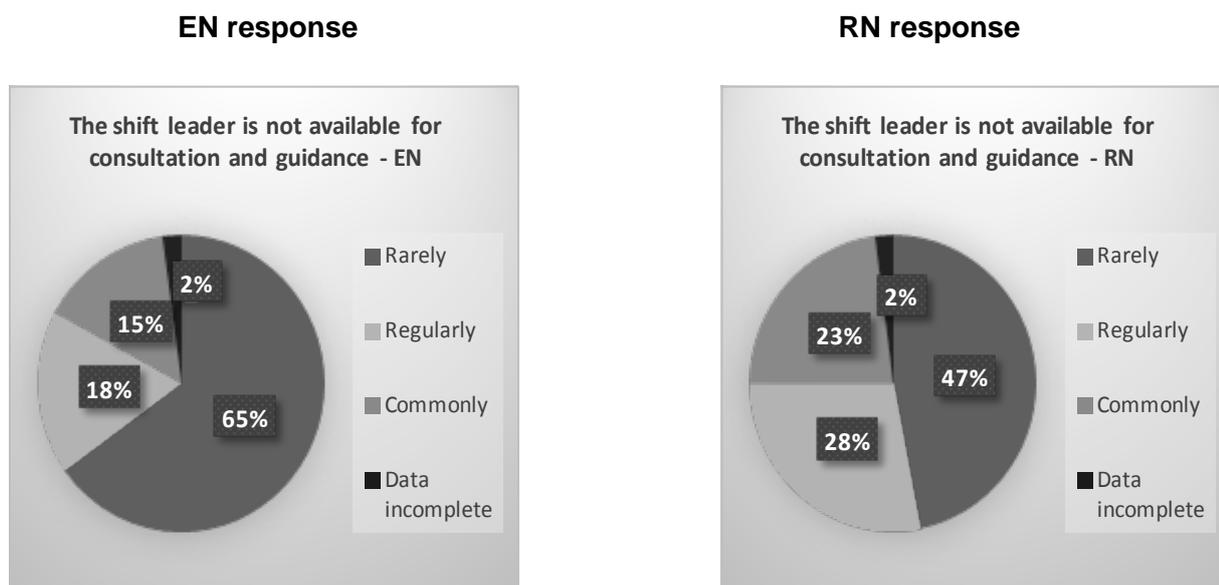
4.4.3.2. Question B3 33: The shift leader is not available for consultation and guidance

Table 4.4.3.2. The shift leader is not available for consultation and guidance

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 1 (0.84%)	n = 1 (1.11%)	4 (1.21%)
Rarely	n = 83 (68.59%)	n = 83 (70.33%)	n = 63 (70%)	229 (69.60%)
Regularly	n = 22 (18.18%)	n = 24 (20.33%)	n = 18 (20%)	64 (19.45%)
Commonly	n = 14 (11.57%)	n = 10 (8.47%)	n = 8 (8.88%)	32 (9.72%)
TOTAL=N	121	118	90	329

The findings for this question suggest that the shift leader is available for consultation and guidance most of the time and that this poses a minimal problem according 69.60% (n=229) of the participants when it comes to MAE incidence (refer to table 4.4.3.2). The green shaded area in the above table reports that in hospitals two and three between 8% (n=10) and 9% (n=8) of the participants believe this plays a common affect in error incidence. In Figure 4.11, we see that across the hospitals the EN's perceptions are that the availability of the shift leader is rarely linked to error incidence with a score of 65% (n=87). These findings are similar to the scores given in terms of this being a component of environmental elements (refer to Table 4.4.4.11).

Figure 4.11: The pie charts below represent the EN and RN responses regarding the availability of the shift leader for consultation and guidance



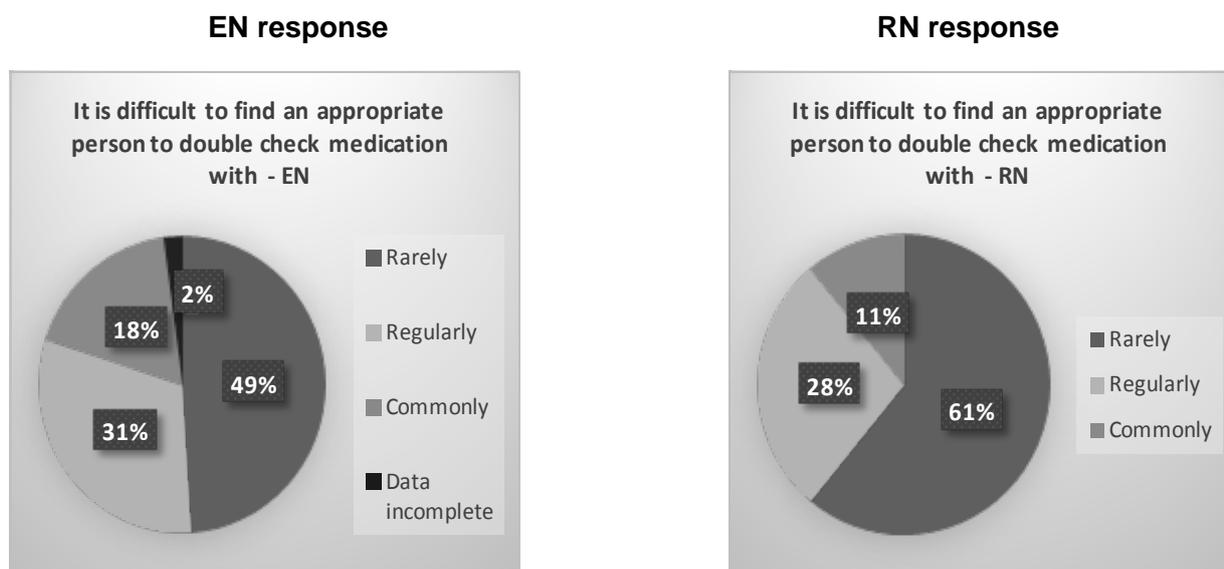
4.4.3.3. Question B3 34: It is difficult to find an appropriate person to double check medication with

Table 4.4.3.3. It is difficult to find an appropriate person to double check medication with

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 0 (0%)	n = 1 (1.11%)	4 (1.21%)
Rarely	n = 62 (51.23%)	n = 75 (63.55%)	n = 47 (52.22%)	184 (55.92%)
Regularly	n = 38 (31.40%)	n = 26 (22.03%)	n = 31 (34.44%)	95 (28.87%)
Commonly	n = 18 (14.87%)	n = 17 (14.40%)	n = 11 (12.22%)	46 (13.98%)
TOTAL=N	121	118	90	329

The results for this question suggest that in hospitals one and three, finding an appropriate person to double check medication with may lead to error incidence regularly or commonly. For Hospital One this totals 46.27% (n=56) of the participants and for Hospital Three it totals 46.66% (n=44) of participants (see Table 4.4.3.3). For the EN's in the three hospitals this factor is reported as presenting a greater problem with 49% (n=65) of the EN component of study population scoring this regular or commonly affecting safe medication administration (refer to Figure 4.12). These scores mirror Question B1 19 in the environmental element section where hospitals one and three score this as playing a regular or common role in MAE incidence (refer to Table 4.4.1.10).

Figure 4.12: The pie charts below represent the EN and RN responses regarding finding an appropriate person to check medication with



4.4.3.4. Question B3 35: The nurse-patient ratio results in too heavy a workload

Table 4.4.3.4. The nurse-patient ratio results in too heavy a workload

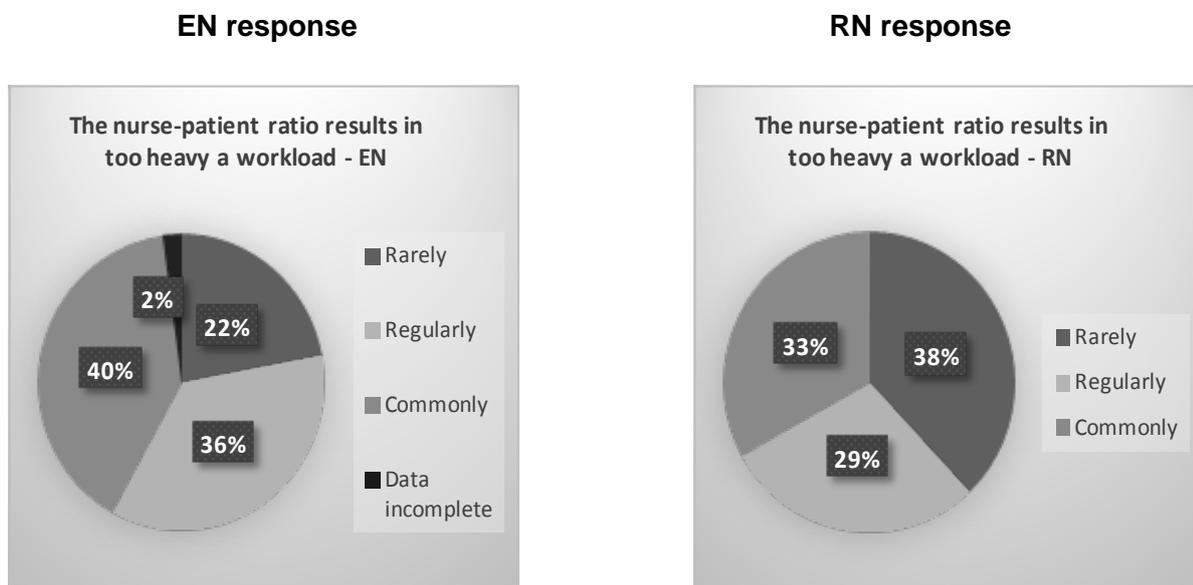
Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 37 (30.57%)	n = 28 (23.72%)	n = 38 (42.22%)	103 (31.30%)
Regularly	n = 29 (23.96%)	n = 49 (41.52%)	n = 27 (30%)	105 (31.91%)
Commonly	n = 53 (43.80%)	n = 41 (34.74%)	n = 24 (26.66%)	118 (35.86%)
TOTAL=N	121	118	90	329

The green shaded area in the above table highlights the participants' perception that the nurse-patient ratio plays a significant role in the incidence of MAE. In hospitals one, two and three this factor plays a regular or common role with a collective 67.76% (n=82), 76.26% (n=90) and 56.66% (n=51) overall. Whilst the EN's have graded this as a greater problem regularly and commonly with a 36% (n=48) and 40% (n=53) respectively, this factor is of significant concern for the total study population (see Figure 4.13).

This mirrors the findings in Question B118 (environmental elements) where the nurses report that a high patient-nurse workload plays a significant role in error incidence for more than 70% of the

respondents (refer to Table 4.4.1.8). As the nurse-patient, workload is deemed to have a significant role in MAE incidence, this factor will be discussed further in Chapter Five.

Figure 4.13: The pie charts below represent the EN and RN responses regarding the impact of nurse-patient ratio on workload



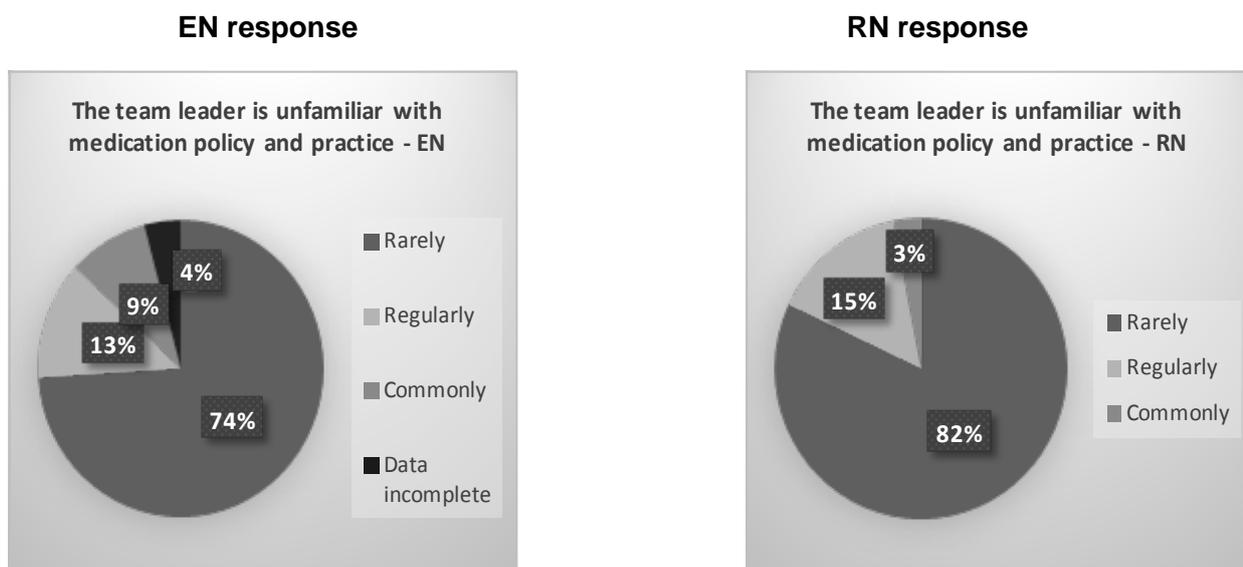
4.4.3.5. Question B3 36: The team leader is unfamiliar with medication policy and practice

Table 4.4.3.5. The team leader is unfamiliar with medication policy and practice

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 4 (3.30%)	n = 0 (0%)	n = 2 (2.22%)	6 (1.82%)
Rarely	n = 94 (77.68%)	n = 97 (82.20%)	n = 68 (75.55%)	259 (78.72%)
Regularly	n = 15 (12.39%)	n = 19 (16.10%)	n = 13 (14.44%)	47 (14.28%)
Commonly	n = 8 (6.61%)	n = 2 (1.69%)	n = 7 (7.77%)	17 (5.16%)
TOTAL=N	121	118	90	329

According to the scores in the above table (Table 4.4.3.5), the team leaders' unfamiliarity with policy and practice rarely affects the MAE incidence. Whilst hospitals one and three report a percentage in the mid 70's, hospital 2, 82.20% (n=97) of respondents view this as having a rare effect on error incidence. A comparison of the scores from the separate nursing categories as shown in Figure 4.14 did not elicit any significant differences in the score totals.

Figure 4.14: The pie charts below represent the EN and RN responses regarding team leader familiarity with medication policies and practices



4.4.3.6. Question B3 37: Nurses are called to administer medication to patients they are unfamiliar with

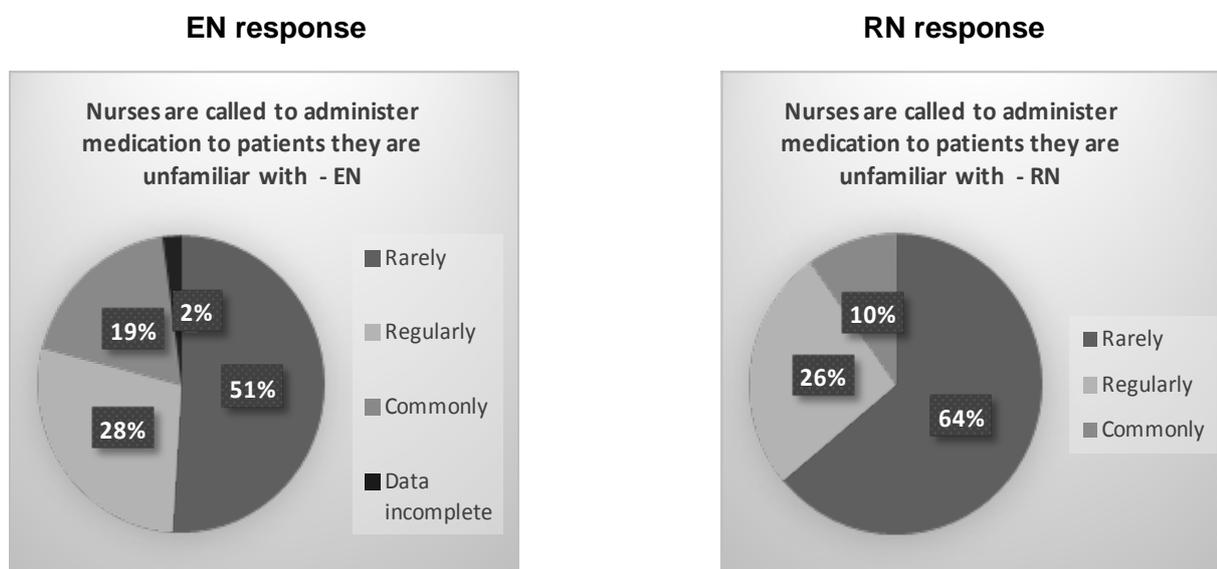
Table 4.4.3.6. Nurses are called to administer medication to patients they are unfamiliar with

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 2 (2.22%)	4 (1.21%)
Rarely	n = 68 (56.19%)	n = 72 (61.01%)	n = 52 (57.77%)	192 (58.35%)
Regularly	n = 37 (30.57%)	n = 29 (24.57%)	n = 23 (25.55%)	89 (27.05%)
Commonly	n = 14 (11.57%)	n = 17 (14.40%)	n = 13 (14.44%)	44 (13.37%)
TOTAL=N	121	118	90	329

Of the 98.09% (n=325) of the nurses who responded to this question, 30.57% (n=37) of the nurses in Hospital One believe that errors are regularly affected by nurses being called upon to administer medication to patients they are unfamiliar with. This is higher than the responses from nurses' at hospitals two and three. Being called to medicate patients the nurse does not know is a rare affecter of 64% (n=122) for the RN's. For the EN's across the hospitals this factor is perceived to regularly or commonly affect medication administration safety among 46% (n=62) of the respondents (refer to Table 4.4.3.6 & Figure 4.15).

In Question B1 21 of environmental elements (see Table 4.4.1.12) the respondents across the three hospitals scored this factor as being a combined regular and common affecter of 64.73% (n=213) which is slightly higher than the scores seen here.

Figure 4.15: The pie charts below represent the EN and RN responses regarding being called to administer medication to unfamiliar patients



4.4.3.7. Question B3 38: Work pressure results in work not being completed before the end of the shift

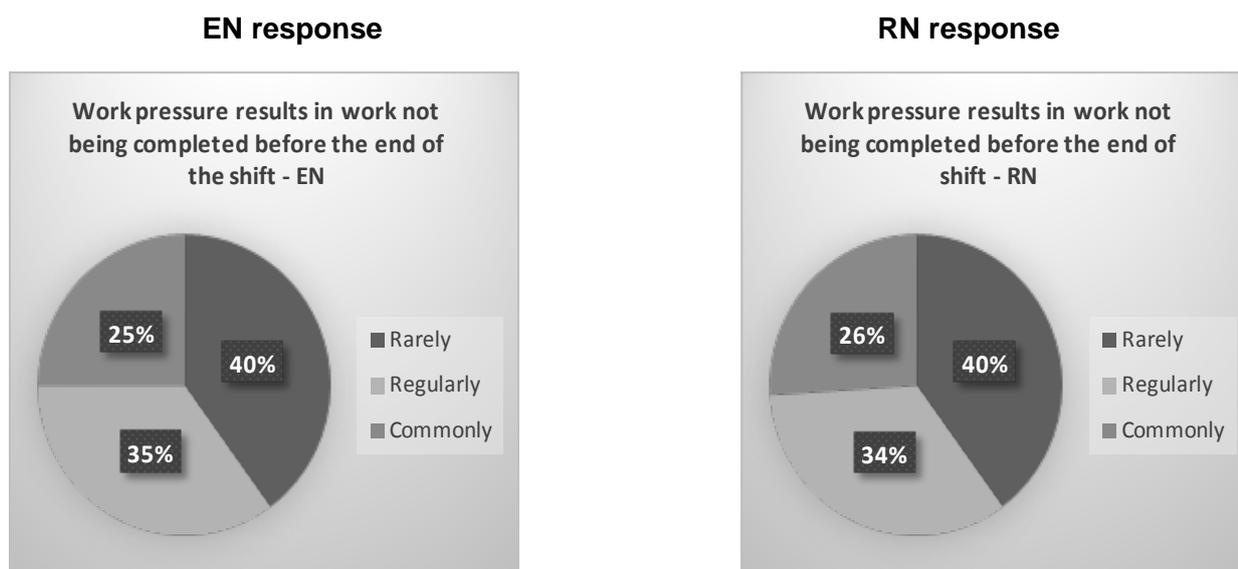
Table 4.4.3.7. Work pressure results in work not being completed before the end of the shift

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 41 (33.88%)	n = 40 (33.89%)	n = 34 (37.77%)	115 (34.95%)
Regularly	n = 36 (29.75%)	n = 51 (43.22%)	n = 35 (38.88%)	122 (37.08%)
Commonly	n = 42 (34.71%)	n = 27 (22.88%)	n = 20 (22.22%)	89 (27.05%)
TOTAL=N	121	118	90	329

When looking at the impact work pressure has on work not being completed before the end of the shift, the highest score is for hospital two reporting that this regularly affects MAE 43.22% (n=51). For Hospital One, this factor scores the highest in the category of commonly affects with a 34.71% (n=42). Hospital Three reports a common affect impact of 22.22% (n=20) (refer to green shaded

area in Table 4.4.3.7). The workload demands on the RN include being available to supervise and support the EN in the department. When looking at the EN scores in Figure 4.16 it would appear that there is a slight increase in scores for regular and commonly affect with a 35% (n=47) and 25% (n=33) respectively. The importance of this factor and the role it plays in adverse events will be linked to the recommendations put forward from this study.

Figure 4.16: The pie charts below represent the EN and RN responses regarding work pressure and its effect on work completion



4.4.3.8. Question B3 39: Work pressure results in handover to the next shift being rushed and incomplete

Table 4.4.3.8. Work pressure results in handover to the next shift being rushed and incomplete

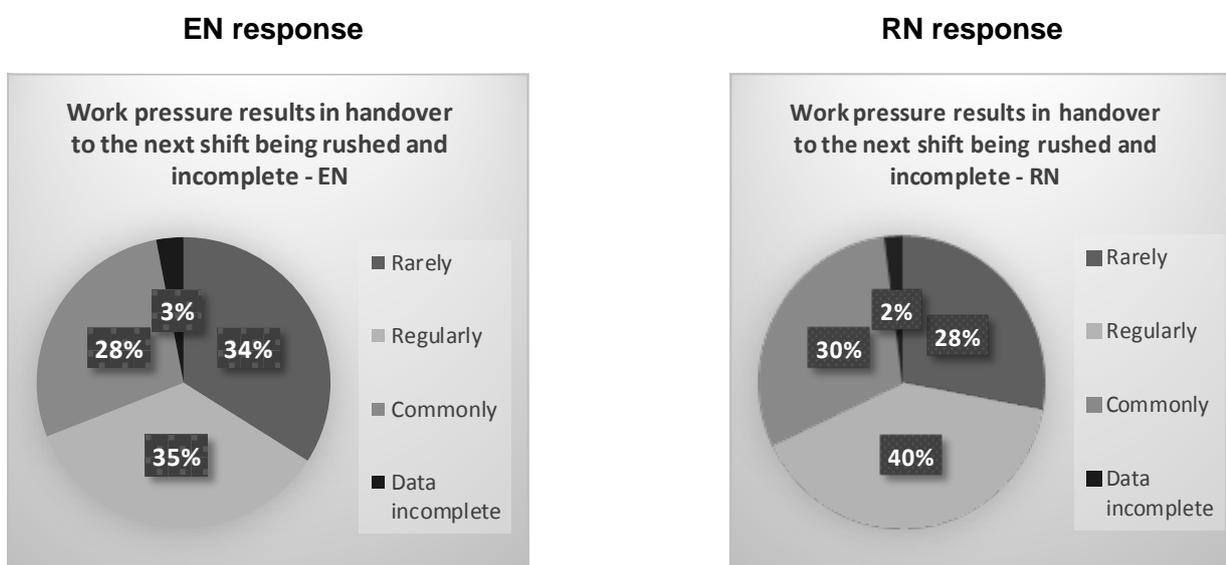
Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 0 (0%)	n = 1 (1.11%)	4 (1.21%)
Rarely	n = 42 (34.71%)	n = 46 (38.98%)	n = 36 (40%)	124 (37.68%)
Regularly	n = 38 (31.40%)	n = 42 (35.59%)	n = 34 (37.77%)	114 (34.65%)
Commonly	n = 38 (31.40%)	n = 30 (25.42%)	n = 19 (21.11%)	87 (26.44%)
TOTAL=N	121	118	90	329

Work pressure and the impact of being rushed when handing over to the next shift scored fairly evenly across the board. The above table shows that for all three hospitals the rarely affect scored 37.68% (n=124), regular affect score averaged at 34.65% (n=114) and commonly affect scored

26.44% (n=87). As in the previous question, work pressure is a key consideration and the EN's feedback links directly to the availability of senior nurse support in the workplace. In Figure 4.17 we see that the EN results mirror those of the total population with a 34% (n=45) for rarely affect and a total of 61% (n=82) for regularly and commonly affect MAE. The comparative scores show similar results between the EN's and the RN's.

Across the questions that relate to work pressure and the impact it has on work completion, the preceding question (Question B3 38) and Question B1 22 in the environmental section (see Table 4.4.1.13) all report scores of greater than 60% (for combined regular and commonly affect scores for this factor).

Figure 4.17: The pie charts below represent the EN and RN responses regarding work pressure affecting handover to the next shift



4.4.3.9. Question B3 40: Physicians change prescription orders without informing the nurse

Table 4.4.3.9. Physicians change prescription orders without informing the nurse

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 1 (1.11%)	1 (0.30%)
Rarely	n = 74 (61.15%)	n = 82 (69.49%)	n = 42 (46.66%)	198 (60.18%)
Regularly	n = 32 (26.44%)	n = 25 (21.18%)	n = 27 (30%)	84 (25.53%)
Commonly	n = 15 (12.39%)	n = 11 (9.32%)	n = 20 (22.22%)	46 (13.98%)
TOTAL =N	121	118	90	329

For hospitals one and two there is a 61.15% (n=74) and 69.49% (n=82) rarely affect score for physicians changing their orders without informing the nurses. In the green shaded area of Table 4.4.3.9 for Hospital Three, the scores suggest that this factor affects MAE regularly 30% (n=27) and 22.22% (n=20) more commonly which highlights the need for this factor to be explored further in this institution.

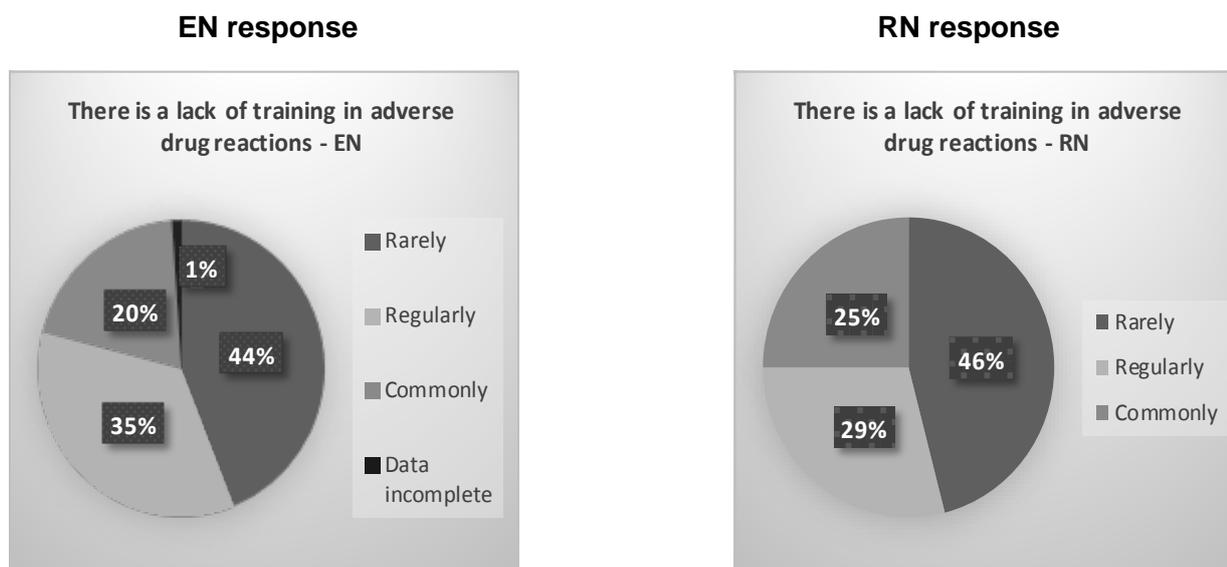
4.4.3.10. Question B3 41: There is a lack of training in adverse drug reactions

Table 4.4.3.10. There is a lack of training in adverse drug reactions

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 1 (1.11%)	1 (0.30%)
Rarely	n = 61 (50.41%)	n = 51 (43.22%)	n = 37 (41.11%)	149 (45.28%)
Regularly	n = 34 (28.09%)	n = 40 (33.89%)	n = 30 (33.33%)	104 (31.61%)
Commonly	n = 26 (21.48%)	n = 27 (22.88%)	n = 22 (24.44%)	75 (22.79%)
TOTAL=N	121	118	90	329

The green shaded area in this table (Table 4.4.3.10) training in adverse drug reactions has been reported as having a higher regular and common effect on error incidence in hospitals two and three. For Hospital Two, these combined scores equate to 56.77% (n=67) and for Hospital Three a 57.77% (n=52). For Hospital One the rarely affects score is 50.41% (n=61) with a combined score of 49.57% (n=60) for the other two scores. For the enrolled nurses the perception that this factor has a common effect on error incidence scored lower with a 20% (refer to Figure 4.18). These results are similar to those in the RN population.

Figure 4.18: The pie charts below represent the EN and RN responses regarding training in adverse drug reactions



4.4.3.11. Question B3 42: Verbal / telephonic prescription orders are unclear

Table 4.4.3.11. Verbal / telephonic prescription orders are unclear

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 0 (0%)	n = 1 (1.11%)	2 (0.60%)
Rarely	n = 81 (66.94%)	n = 96 (81.35%)	n = 61 (67.77%)	238 (72.34%)
Regularly	n = 23 (19%)	n = 14 (11.86%)	n = 21 (23.33%)	58 (17.62%)
Commonly	n = 16 (13.22%)	n = 8 (6.77%)	n = 7 (7.77%)	31 (9.42%)
TOTAL=N	121	118	90	329

The impact of verbal and telephonic prescriptions on MAE is lowest in Hospital Two with 81.35% (n=96) of nurses reporting a rarely affect, regularly affect an 11.86% (n=14) and 6.77% (n=8) saying this affects them commonly. For hospitals one and three this factor presents a slightly higher impact in MAE incidence with a 19% (n=23) regularly affects in Hospital One and a 23.33% (n=21) regularly affects in Hospital Three (refer to Table 4.4.3.11).

4.4.3.12. Question B3 43: The physician prescribed the incorrect dose

Table 4.4.3.12. The physician prescribed the incorrect dose

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 2 (2.22%)	2 (0.60%)
Rarely	n = 87 (71.90%)	n = 101 (85.59%)	n = 67 (74.44%)	255 (77.50%)
Regularly	n = 21 (17.35%)	n = 13 (11.01%)	n = 16 (17.77%)	50 (15.19%)
Commonly	n = 13 (10.74%)	n = 4 (3.38%)	n = 5 (5.55%)	22 (6.68%)
TOTAL=N	121	118	90	329

It would appear from the totals in the above table that the results for this factor has a rare impact on MAE across the three hospitals with Hospital One scoring 71.90% (n=87), Hospital Two 85.59% (n=101) and Hospital Three 74.44% (n=67).

4.4.4. ELEMENT 4: INDIVIDUAL ELEMENTS: RELATED TO NURSING CARE

Variable No B4: Introduction to data analysis B4: 44-58

The final area of human factors that affect patient safety explores the role of the individual in terms of his / her cognitive skills and personal resources (WHO, 2009). These questions are all geared towards identifying areas where the nurses' own knowledge and coping skills may impact on the incidence of MAE and the quality of the nursing care the patient receives.

The responses **Regularly** and **Commonly (shaded in green)** were condensed in tables below to analyse the data collected in order to give meaning to the data analysed.

Pie charts below the tables were inserted to indicate the difference in response from registered professional nurses and the enrolled nurses. This will enable the researcher to identify problem areas within the two categories of nurses.

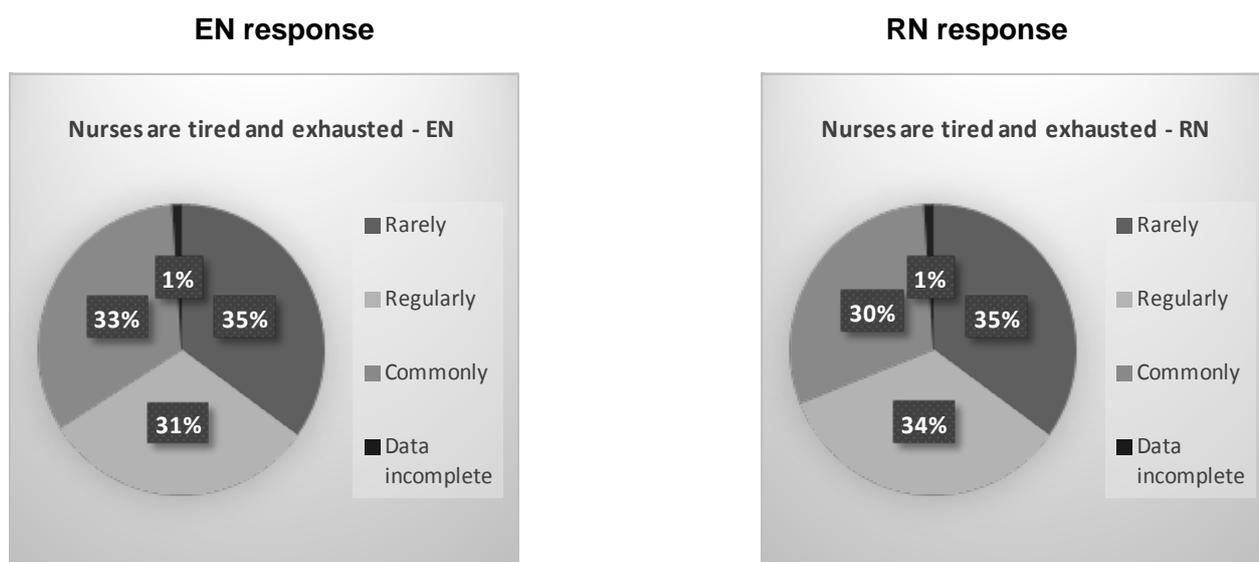
4.4.4.1. Question B4 44: Nurses are tired and exhausted

Table 4.4.4.1. Nurses are tired and exhausted

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 2 (2.22%)	4 (1.21%)
Rarely	n = 46 (38.01%)	n = 32 (27.11%)	n = 25 (27.77%)	103 (31.30%)
Regularly	n = 30 (24.79%)	n = 45 (38.13%)	n = 33 (36.66%)	108 (32.82%)
Commonly	n = 43 (35.53%)	n = 41 (34.74%)	n = 30 (33.33%)	114 (34.65%)
TOTAL=N	121	118	90	329

This factor scored high in all three hospitals for tiredness and exhaustion regularly and commonly affecting the incidence of MAE. Despite the fact that Hospital One had the lowest score (24.79% / n=30) for regular affect, collectively all three facilities had combined scores 67.47% for these two scores (refer to Table 4.4.4.1). The analysis of the EN scores showed a similar distribution with each category being allocated a third of the overall scores and a total combined score for regularly and commonly affects at 64% (see Figure 4.19).

Figure 4.19: The pie charts below represent the EN and RN responses regarding nurse tiredness and exhaustion



4.4.4.2. Question B4 45: Nurses are distracted when administering medication

Table 4.4.4.2. Nurses are distracted when administering medication

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 1 (1.11%)	1 (0.30%)
Rarely	n = 43 (35.53%)	n = 47 (39.83%)	n = 32 (35.55%)	122 (37.08%)
Regularly	n = 34 (28.09%)	n = 41 (34.74%)	n = 31 (34.44%)	106 (32.21%)
Commonly	n = 44 (36.36%)	n = 30 (25.42%)	n = 26 (28.88%)	100 (30.39%)
TOTAL=N	121	118	90	329

The green shaded area in the above table showed distractions during medication rounds to be the highest common effect in Hospital One with a 36.36% (n=44) of responses. In hospitals two and three the results are similar to the totals in Hospital One when looking at the combined regular and common effect measurement in the totals column of the table. These combined scores across the hospitals equates to 62.60% (n=206).

4.4.4.3. Question B4 46: Nurses are inexperienced in medication administration

Table 4.4.4.3. Nurses are inexperienced in medication administration

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 1 (0.84%)	n = 2 (2.22%)	4 (1.21%)
Rarely	n = 71 (58.67%)	n = 78 (66.10%)	n = 50 (55.55%)	199 (60.48%)
Regularly	n = 30 (24.79%)	n = 25 (21.18%)	n = 28 (31.11%)	83 (25.22%)
Commonly	n = 19 (15.70%)	n = 14 (11.86%)	n = 10 (11.11%)	43 (13.06%)
TOTAL=N	121	118	90	329

Of the 98.79% (n=325) response rate regarding the role nurse experience in medication administration plays in MAE, the respondents perceive that this is rarely a factor in error incidence. Hospital Two scored this factor the highest with 66.10% (n=78) of respondents marking rarely affects (refer to Table 4.4.4.3).

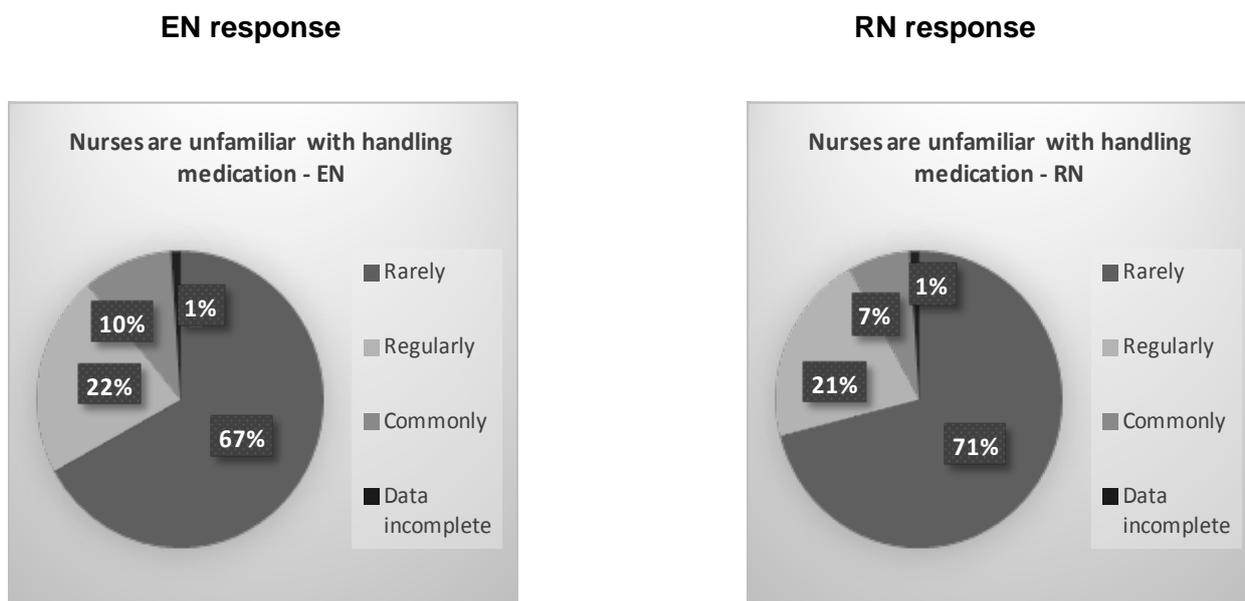
4.4.4.4. Question B4 47: Nurses are unfamiliar with handling medication

Table 4.4.4.4. Nurses are unfamiliar with handling medication

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 1 (1.11%)	1 (0.30%)
Rarely	n = 80 (66.11%)	n = 89 (75.42%)	n = 58 (64.44%)	227 (68.99%)
Regularly	n = 29 (23.96%)	n = 20 (16.94%)	n = 23 (25.55%)	72 (21.88%)
Commonly	n = 12 (9.91%)	n = 9 (7.62%)	n = 8 (8.88%)	29 (8.81%)
TOTAL=N	121	118	90	329

According to the total score for rarely affect in the above table, 68.99% (n=227) of the respondents report that this factor rarely affects the MAE incidence with 68.99% score. The percentage of those believing this plays a regular role is highest in Hospital Three with a 25.55% (n=23) score. The summary of the open-ended questions highlights the need for newly qualified EN's to be supported during their role socialisation period. For this reason the EN's results to this question have been analysed and reported on. In Figure 4.20 the findings suggest that fewer members of this category view this as a significant precursor to MAE with a 67% (n=50) of EN's marking this as a rare affecter. The comparison between the nursing ranks showed little differences in terms of perceptions for this factor.

Figure 4.20: The pie charts below represent the EN and RN responses regarding familiarity with handling of medication



4.4.4.5. Question B4 48: Nurses are unable to calculate dosages

Table 4.4.4.5. Nurses are unable to calculate dosages

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 0 (0%)	n = 1 (1.11%)	2 (0.60%)
Rarely	n = 72 (59.50%)	n = 67 (56.77%)	n = 57 (63.33%)	196 (59.57%)
Regularly	n = 23 (19%)	n = 33 (27.96%)	n = 20 (22.22%)	76 (23.10%)
Commonly	n = 25 (20.66%)	n = 18 (15.25%)	n = 12 (13.33%)	55 (16.71%)
TOTAL=N	121	118	90	329

In Table 4.4.4.5, the calculation of medication dosages and the role this skill plays in MAE has been reported as being a rare factor in Hospital Three with an allocated score of 63.33% (n=57). For Hospital One, this factor has been scored 20.66% (n=25) for being a common affecter in error incidence.

4.4.4.6. Question B4 49: Nurses are unable to calculate dilutions

Table 4.4.4.6. Nurses are unable to calculate dilutions

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 0 (0%)	n = 2 (2.22%)	3 (0.91%)
Rarely	n = 70 (57.85%)	n = 69 (58.47%)	n = 53 (58.88%)	192 (58.35%)
Regularly	n = 27 (22.31%)	n = 32 (27.11%)	n = 21 (23.33%)	80 (24.31%)
Commonly	n = 23 (19%)	n = 17 (14.40%)	n = 14 (15.55%)	54 (16.41%)
TOTAL=N	121	118	90	329

For 58.35% (n=192) of the participants the ability of nurses to calculate drug dilutions is viewed as having a rare effect on error incidence. In terms of this factor having a common effect on errors, the score was highest in Hospital One with a 19% (n=23) feedback score (see Table 4.4.4.6).

4.4.4.7. Question B4 50: Nurses are unable to calculate flow rates

Table 4.4.4.7. Nurses are unable to calculate flow rates

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 0 (0%)	n = 1 (1.11%)	2 (0.60%)
Rarely	n = 71 (58.67%)	n = 72 (61.10%)	n = 60 (66.66%)	203 (61.70%)
Regularly	n = 30 (24.79%)	n = 30 (25.42%)	n = 17 (18.88%)	77 (23.40%)
Commonly	n = 19 (15.70%)	n = 16 (13.55%)	n = 12 (13.33%)	47 (14.28%)
TOTAL=N	121	118	90	329

The calculation of flow rates for medication administration presents a regular or common challenge in terms of error incidence in hospitals one and two with a reported 40.49% (n=49) and 38.97% (n=46) collective score as seen in the green shaded area of the preceding table. Hospital Three scores this factor slightly lower with a total score of 32.21% (n=39).

4.4.4.8. Question B4 51: Staff are unable to work the infusion devices

Table 4.4.4.8. Staff are unable to work the infusion devices

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 1 (0.84%)	n = 2 (2.22%)	6 (1.82%)
Rarely	n = 69 (57.02%)	n = 83 (70.33%)	n = 67 (74.44%)	219 (66.56%)
Regularly	n = 38 (31.40%)	n = 24 (20.33%)	n = 15 (16.66%)	77 (23.40%)
Commonly	n = 11 (9.09%)	n = 10 (8.47%)	n = 6 (6.66%)	27 (8.20%)
TOTAL=N	121	118	90	329

For Hospital One, the ability of the nursing staff to work infusion devices is considered to have a regular or common impact in error incidence to the tune of a total 40.49% (n=49). Hospital Three considers this factor to have a rare impact for 77.44% (n=67) of the respondents (refer to Table 4.4.4.8).

4.4.4.9. Question B4 52: Nurses fail to ensure that they administer medication to the right patient

Table 4.4.4.9. Nurses fail to ensure that they administer medication to the right patient

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 1 (1.11%)	1 (0.30%)
Rarely	n = 107 (88.42%)	n = 100 (84.74%)	n = 75 (83.33%)	282 (85.71%)
Regularly	n = 9 (7.43%)	n = 12 (10.16%)	n = 11 (12.22%)	32 (9.72%)
Commonly	n = 5 (4.13%)	n = 6 (5.08%)	n = 3 (3.33%)	14 (4.25%)
TOTAL=N	121	118	90	329

The total score for the rarely affect category in the above table show that for all three hospitals surveyed in this research study, ensuring the correct patient receives the medication is deemed to be a rare role player in MAE with 85.71% (n=282) of respondents marking the rarely affects option.

4.4.4.10. Question B4 53: Nurses fail to ensure that they administer the correct medication**Table 4.4.4.10. Nurses fail to ensure that they administer the correct medication**

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 1 (0.84%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 100 (82.64%)	n = 99 (83.89%)	n = 75 (83.33%)	274 (83.28%)
Regularly	n = 12 (9.91%)	n = 11 (9.32%)	n = 9 (10%)	32 (9.72%)
Commonly	n = 8 (6.61%)	n = 7 (5.93%)	n = 5 (5.55%)	20 (6.07%)
TOTAL=N	121	118	90	329

It is pleasing to see that 82.64% (n=100), 83.89% (n=99) and 83.33% (n=75) of the nurses in each of the three hospitals perceive that ensuring the correct medication rarely affects administration errors (refer to above table).

4.4.4.11. Question B4 54: Nurses fail to ensure that they administer the correct medication dose**Table 4.4.4.11. Nurses fail to ensure that they administer the correct medication dose**

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 1 (0.84%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 96 (79.33%)	n = 98 (83.05%)	n = 66 (73.33%)	260 (79.02%)
Regularly	n = 16 (13.22%)	n = 11 (9.32%)	n = 18 (20%)	45 (13.67%)
Commonly	n = 8 (6.61%)	n = 8 (6.77%)	n = 5 (5.55%)	21 (6.38%)
TOTAL=N	125	118	90	329

In Table 4.4.4.11, we see that 99.09% (n=326) of nurses who answered this question believe that dose errors rarely affect medication administration incidence. The total score for the participants was 79.02% (n=260) for this scoring category.

4.4.4.12. Question B4 55: Nurses fail to ensure that they administer medication at the correct time

Table 4.4.4.12. Nurses fail to ensure that they administer medication at the correct time

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 1 (0.84%)	n = 1 (1.11%)	2 (0.60%)
Rarely	n = 66 (54.54%)	n = 81 (68.64%)	n = 39 (43.33%)	186 (56.53%)
Regularly	n = 36 (29.75%)	n = 22 (18.64%)	n = 42 (46.66%)	100 (30.95%)
Commonly	n = 19 (15.07%)	n = 14 (11.86%)	n = 8 (8.88%)	41 (12.46%)
TOTAL=N	121	118	90	329

Administering medication at the correct time is a concern in Hospital Three where 46.66% (n=42) of the respondents believe this has a regular effect in terms of MAE as shown in the green shaded area of the above table. For Hospital Two this is seen as being a regular factor for only 18.64% (n=22) of the population. This may be linked to the concern regarding the pharmacy supply chain and the time it takes for medication to reach the patient (refer to Table 4.4.1.8).

4.4.4.13. Question B4 56: Nurses fail to ensure that they administer medication at the correct intervals

Table 4.4.4.13. Nurses fail to ensure that they administer medication at the correct intervals

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 0 (0%)	n = 0 (0%)	n = 1 (1.11%)	1 (0.30%)
Rarely	n = 67 (55.37%)	n = 74 (62.71%)	n = 47 (52.22%)	188 (57.14%)
Regularly	n = 33 (27.27%)	n = 28 (23.72%)	n = 35 (38.88%)	96 (29.17%)
Commonly	n = 21 (17.35%)	n = 16 (13.55%)	n = 7 (7.77%)	44 (13.37%)
TOTAL=N	121	118	90	329

The administration of medication at the correct intervals is a concern for 42.68% (n=140) of the respondents. For this section of the study population this factor was deemed as having a regular or common effect on errors 29.17% (n=96) and 13.37% (n=44) respectively (refer to Table 4.4.4.13).

4.4.4.14. Question B4 57: Nurses fail to ensure that they administer medication via the correct route

Table 4.4.4.14. Nurses fail to ensure that they administer medication via the correct route

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 0 (0%)	n = 1 (1.11%)	3 (0.91%)
Rarely	n = 106 (87.60%)	n = 107 (90.67%)	n = 73 (81.11%)	286 (86.93%)
Regularly	n = 7 (5.78%)	n = 7 (5.93%)	n = 10 (11.11%)	24 (7.29%)
Commonly	n = 6 (4.95%)	n = 4 (3.38%)	n = 6 (6.66%)	16 (4.86%)
TOTAL=N	121	118	90	329

According to the respondents, and the scores in the above table, the nurses checking the correct prior to medication administration is not a factor that warrants concern, The response scores for rarely affecting MAE incidence vary from 81.11% (n=73) in Hospital Three, 87.60% (n=106) in Hospital One up to 90.67% (n=107) in Hospital Two.

4.4.4.15. Question B4 58: Open ended: Other factors not identified: please specify

This open-ended question was analysed according to themes that emerged during the analysis of the open question, the opinions of both the professional nurses and enrolled nurses was recorded.

Table 4.4.4.15. Breakdown of participant responses regarding additional human factors

Additional element / factor	RN	EN
Already mixed drugs not labelled	1	0
Nurses do not know how long infusions should take	1	0
Nurses have to transcribe prescriptions	0	1
Dr's write on the bottom copy of the script	1	0
No training on drugs that can be given together	1	0
Dr's scratch out orders instead of rewriting	2	0
Current habit forming drug protocol leads to short cuts	3	0
Drugs are dispensed with a different name than chart on the	6	0
Total	15	1

Summary of elements / other factors not identified as reported by the study participants

With reference to this question, the participants were asked to add any elements or human factors they felt had been omitted from the data collection questionnaire.

The most prevalent comments related to the use of generic medications. For six RN's "***the use of generics results in the dispensing of medication where the item name differs from that on the prescription chart***". In addition to this, the pharmacy do not always document the generic dispensed alongside the medication name the doctor has written on the chart. All of these respondents were RN's.

The current protocol for the use of habit-forming drugs (HFD) was the next highest practice commented on with three RN's suggesting this as an additional factor in MAE incidence. The current practice requires that both nurses are present when the medication is taken out of the scheduled drug cupboard and administered to the patient. The RN's reported perception is that this process is difficult to enforce due to the work activity and load in the departments and they omit the process, which leads to administration error incidence.

For two of the registered nurses "***the incorrect method of altering medication dosages by the physician***" also leads to MAE. The remaining factors were mentioned by one nurse each and these are related "***to lack of training in drugs that may be mixed together, Dr's writing on the bottom page of the prescription***" and when the top copy is replaced the order is missed by the nurse, nurses transcribing the prescriptions when the chart is full, "***nurses lack the knowledge of how long medications need to infuse over and finally when drugs have been premixed and not labelled nurses still administer them without checking what is in the syringe***" or vial or how long it has been there. Only one EN made an additional suggestion and that was the comment regarding nurses transcribing prescription charts when they are full.

4.4.5. ELEMENT 5: EDUCATION AND TRAINING: RELATED TO THE ROLE THEY PLAY IN MEDICATION ADMINISTRATION

Variable No C: Introduction to data analysis C59-66

This final section of the questionnaire was designed to explore the role education and training could potentially play in MAE incidence. As outlined in the conceptual framework in Chapter One, the human factors in patient safety are linked to nursing practice, improved patient safety, safe medication administration and the reduction of adverse events. These questions have been included to assist with the identification of any possible shortcomings in this area which would facilitate the creation of action plans to mitigate further adverse events.

The responses “**No**” and “**Uncertain**” (shaded in green) were condensed in the tables below to analyse the data collected in order to give meaning to the data analysed.

The pie charts below the tables were inserted to indicate the difference in response from registered professional nurses and the enrolled nurses. This will enable the researcher to identify problem areas within the two categories of nurses.

4.4.5.1. Question C 59: Medication administration is included in the orientation and induction programme in the ward / unit

Table 4.4.5.1. Medication administration is included in the orientation and induction programme in the ward / unit

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 4 (3.38%)	n = 2 (2.22%)	9 (2.73%)
Yes	n = 77 (63.63%)	n = 74 (62.71%)	n = 64 (71.11%)	215 (65.34%)
No	n = 23 (19%)	n = 28 (23.72%)	n = 20 (22.22%)	71 (21.58%)
Uncertain	n = 18 (14.87%)	n = 12 (10.16%)	n = 4 (4.44%)	34 (10.33%)
TOTAL=N	121	118	90	329

In Table 4.4.5.1. It is evident from the responses that 65.34% (n=215) of all respondents acknowledge that medication administration is included in the department orientation programme. Despite this it is concerning that 31.91% (n=105) of the nurses reported that this subject is either not included or they are not aware of it being included in the orientation programme.

4.4.5.2. Question C 60: Formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months

Table 4.4.5.2. Formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 2 (1.69%)	n = 1 (1.11%)	5 (1.51%)
Yes	n = 94 (77.68%)	n = 97 (82.20%)	n = 44 (48.88%)	235 (71.42%)
No	n = 17 (14.04%)	n = 16 (13.55%)	n = 41 (45.55%)	74 (22.49%)
Uncertain	n = 8 (6.61%)	n = 3 (2.54%)	n = 4 (4.44%)	15 (4.55%)
TOTAL=N	121	118	90	329

The results in the above table (Table 4.4.5.2.) suggest that hospitals one 77.68% (n=94) and two 82.20% (n=97) have provided training focused on medication administration during the past year whilst the results for Hospital Three suggest that 50% (n=45) of respondents are uncertain about this training being offered. This finding suggests a need for this nurse perception to be explored further in this hospital.

4.4.5.3. Question C 61: I have received in-formal in-service training (on the job training) regarding medication administration during the last 12 months

Table 4.4.5.3. I have received in-formal in-service training (on the job training) regarding medication administration during the last 12 months

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 2 (1.65%)	n = 2 (1.69%)	n = 1 (1.11%)	5 (1.51%)
Yes	n = 90 (74.38%)	n = 93 (78.81%)	n = 56 (62.22%)	239 (72.64%)
No	n = 25 (20.66%)	n = 19 (16.10%)	n = 30 (33.33%)	74 (22.49%)
Uncertain	n = 4 (3.30%)	n = 4 (3.38%)	n = 3 (3.33%)	11 (3.34%)
TOTAL=N	121	118	90	329

With a 98.49% response rate, the high percentage of nursing staff in hospitals one and two (74.38% / n=90 and 78.81% / n=93) have received formal training on this subject in the last 12

months. Hospital Three has achieved a 62.22% (n=56) of nurses who have received training during that period. As reflected in the green shaded area of the above table (Table 4.4.5.3.) this question identifies the need for at least 25.83% (n=85) of the nursing population across the three hospitals that still need to receive training.

4.4.5.4. Question C 62: A policy on medication administration is available in the ward / unit

Table 4.4.5.4. A policy on medication administration is available in the ward / unit

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 1 (0.82%)	n = 1 (0.84%)	n = 1 (1.11%)	3 (0.91%)
Yes	n = 113 (93.38%)	n = 110 (93.22%)	n = 79 (87.77%)	302 (91.79%)
No	n = 3 (2.47%)	n = 2 (1.65%)	n = 1 (1.11%)	6 (1.82%)
Uncertain	n = 4 (3.30%)	n = 5 (4.23%)	n = 9 (10%)	18 (5.47%)
TOTAL=N	121	118	90	329

It is pleasing to note that across all the hospitals 91.79% (n=302) of the respondents, as shown in the total for yes responses in Table 4.4.5.4, reported that policies relating to medication administration are available in the departments. This would suggest that a target of 100% could be achieved through a focused drive on policy reading in the departments.

4.4.5.5. Question C 63: Standard operating procedures on medication administration are available in the ward / unit

Table 4.4.5.5. Standard operating procedures on medication administration are available in the ward / unit

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 3 (2.47%)	n = 4 (3.38%)	n = 2 (2.22%)	9 (2.73%)
Yes	n = 107 (88.42%)	n = 103 (87.28%)	n = 77 (85.55%)	287 (87.23%)
No	n = 4 (3.30%)	n = 2 (1.69%)	n = 3 (3.33%)	9 (2.73%)
Uncertain	n = 7 (5.78%)	n = 9 (7.62%)	n = 8 (8.88%)	24 (7.29%)
TOTAL=N	121	118	90	329

Safe medication administration practice requires that all nursing staff stay abreast of standard operating procedures. The total score for all yes responses shown in the preceding table (Table 4.4.5.5.) show a high percentage of staff awareness (88.42% / n=107; 87.28% / n=103 & 85.55% / n=77 respectively) of these resource tools.

4.4.5.6. Question C 64: Audits are conducted in the ward / unit to evaluate medication administration practices

Table 4.4.5.6. Audits are conducted in the ward / unit to evaluate medication administration practices

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 5 (4.13%)	n = 2 (1.69%)	n = 1 (1.11%)	8 (2.43%)
Yes	n = 88 (72.72%)	n = 90 (76.27%)	n = 73 (81.11%)	251 (76.29%)
No	n = 21 (17.35%)	n = 14 (11.86%)	n = 8 (8.88%)	43 (13.06%)
Uncertain	n = 7 (5.78%)	n = 12 (10.16%)	n = 8 (8.88%)	27 (8.20%)
TOTAL=N	121	118	90	329

It is pleasing to see that 76.29% (n=251) of respondents answered this question positively. As audits are a key component of quality management within the nursing units it is therefore concerning to see that 21.26% (n=70) of the participants report that they have no knowledge of auditing of medication related practices taking place in their departments (see Table 4.4.5.6).

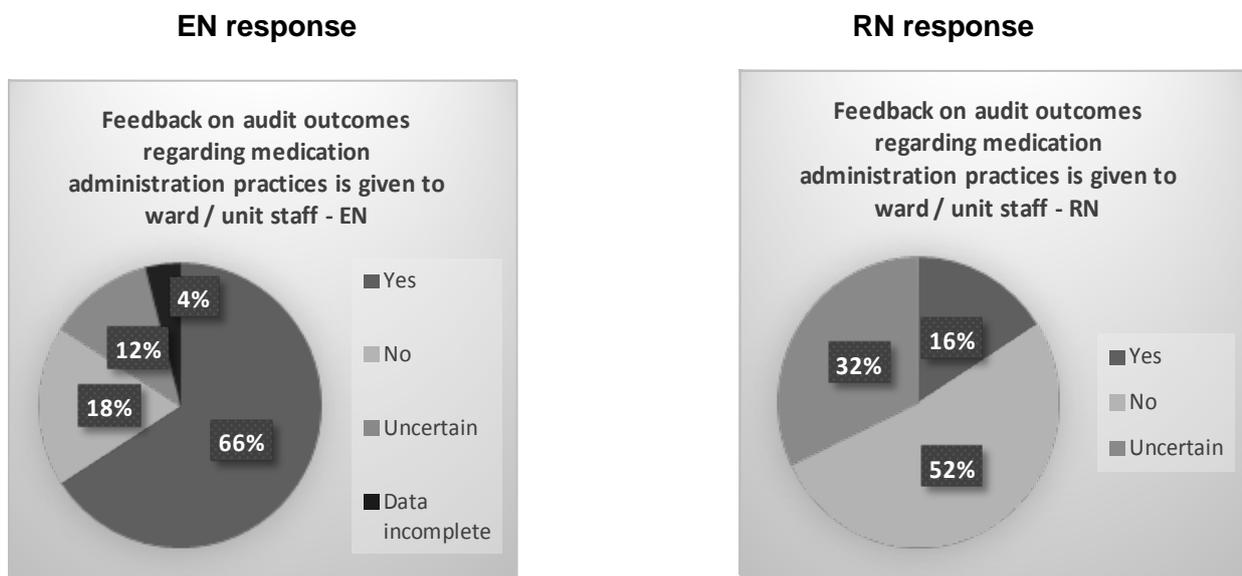
4.4.5.7. Question C 65: Feedback on audit outcomes regarding medication administration practices is given to ward / unit staff

Table 4.4.5.7. Feedback on audit outcomes regarding medication administration practices is given to ward / unit staff

Participant response for question	HOSPITAL 1 Frequency (f)	HOSPITAL 2 Frequency (f)	HOSPITAL 3 Frequency (f)	TOTAL N= (%)
Data missing (did not complete)	n = 5 (4.13%)	n = 3 (2.54%)	n = 1 (1.11%)	9 (2.73%)
Yes	n = 66 (54.54%)	n = 78 (66.10%)	n = 54 (60%)	198 (60.18%)
No	n = 32 (26.44%)	n = 18 (15.25%)	n = 24 (26.66%)	74 (22.49%)
Uncertain	n = 18 (14.87%)	n = 19 (16.10%)	n = 11 (12.22%)	48 (14.58%)
TOTAL=N	121	118	90	329

The response rate for this question shows that only 60.18% (n=198) of the respondents have knowledge of the results of medication practice auditing in the nursing units. The green shaded area in the above table (Table 4.4.5.7) shows that 37.07% (n=122) of the respondents are not aware of the outcomes of the medication practices of the unit they work in. When looking the results from the EN's alone, it would appear the EN's are demonstrate a greater awareness of feedback on auditing taking place in the departments (refer to Figure 4.21).

Figure 4.21: The pie charts below represent the EN and RN responses regarding audit outcome feedback



4.4.5.8. Question C 66: Open ended: Do you have any suggestions regarding medication administration practices or training?

Table 4.4.5.8. Nurse category breakdown for education suggestions

Suggestions regarding education and training	RN	EN
Pharmacy to premix intravenous medication to reduce error and contamination	1	0
On-the-spot training to be done by clinical facilitators	0	1
Experienced and inexperienced staff allocation to be balanced	0	1
Experienced staff need to share their knowledge with others	1	0
Unit Manager to be more visible and active on the floor	1	0
EN's to have all medication co-signed	1	1
All new staff to have medication administration competency assessments	1	1
All Pen II students to be supervised whilst administering medication	2	0
All wards to have a dedicated medication nurse	1	2
Nurses handing out medication should not be disturbed	2	1
The shift leader to do spot checks on medication charts before the end of the shift	3	0
Additional generic medication lists and mims to be available in the department	1	2
UM's and Night Matron to do weekly audits of medication practices and give staff feedback	3	0
Nurses to adhere to the rule of the "5 rights"	2	2
Patient allocation must balance "heavy" patients with less challenging ones	3	1
All agency staff to attend in-service education on medication administration	3	1
All RN's and EN's to complete an annual objective structured clinical examination	4	1
Newly qualified staff and students are to be mentored until they are found competent	3	3
Nursing staff to receive additional training and practice	7	7
Total	39	26

With reference to this question, the study participants were provided with the opportunity to add any suggestions they had with regards any additional education and training they thought might be of benefit to all.

The needs of the individual and team featured highlight with the most common suggestion (n=14) being the need for more training and practice for nursing staff. In Table 4.4.5.8 we see that this suggestion was evenly split between RN's and EN's. The need for supervision and competence assurance featured strongly in this question with six (three RN's and three EN's) respondents suggesting that newly qualified staff and students administer medication under direct RN supervision until their competence has been assessed (refer to Table 4.4.5.8). An annual OSCE was suggested for all RN's and EN's by four RN's and one EN (refer to Table 4.4.5.8). Other suggestions included the need for mentoring and training for agency staff, mentoring for nursing students and for all to adhere to the "five rights" of medication administration. Other safe practice measures were suggested which included having all EN's medication co-signed by an RN, the allocation of a dedicated medication nurse and the need for nursing staff to not be disturbed while they are handing out medication. On-the-spot training by the clinical facilitators was also a recommendation by one participant (refer to Figure 4.23 and Table 4.4.5.8).

From an organisation and environmental aspect, there were numerous suggestions from the respondents. The need for the shift leader to check medication charts before the end of the shift was suggested by three RN's along with a suggestion from one EN that experienced and inexperienced staff being balanced in terms of workload allocation (refer to Table 4.4.5.8). In table 4.4.5.8, we see that three RN's and one EN suggest that a fair allocation of "heavy" patients be considered. One RN commented on the need for experienced staff to share their knowledge with other members of the team. A recommendation that UM's be more involved on the floor came from one participant, alongside a suggestion from three RN's that the both the UM's and the Night Matron should be conducting weekly medication practice audits and provide feedback to the staff (see Table 4.4.5.8). The final two suggestions were pharmacy related; with a request for the pharmacy to provide more reference lists for all medications, especially generics, and for that department to mix intravenous medications to reduce dose and dilution errors and contamination of medications (see Figure 4.23).

4.5 STATISTICAL SUMMARIES FOR OVERALL DOMAINS AND CATEGORY ASSOCIATIONS

These statistical tests were conducted to meet study objective two, which aimed to determine any possible associations between the nurses' perceptions of the study variables in terms of the two categories of nurses, their years of postgraduate experience and the nurses' attendance at in-service education.

4.5.1 Association between overall perception scores by nursing category

This statistical test was conducted to determine any possible association between the overall scores for the RN and EN perceptions of the human factors affecting MAE's for all the elements (as presented in Figure 1.1 conceptual framework). The Mann-Whitney test, which tests for difference between normally distributed populations (Grove, Burns & Gray, 2013:699), found that there was no significant difference between the scores of the RN and EN population with a $p=0.4929$. Despite this, the individual breakdown of scores does highlight several areas of concern as discussed in Section 4.4.

4.5.2 Association between overall perception scores and years of experience

This statistical test explored the possibility of an association between the overall perception scores for all the elements and the study populations' years of experience. The population were separated into those with less than six years of postgraduate experience and those with more than six years of postgraduate experience. The test showed no significant difference between these two population parameters.

4.5.3 Comparative score for in-service attendance in the past twelve months

Question C61 asked the respondents if they had attended in-service education in the past year. The overall score showed a 75% attendance overall. The figure below was extracted from the statistical report and shows the high percentage of staff attendance at in-service sessions.

Figure 4.22 Attendance at in-service education (Mann-Whitney *U* Test)

*Attendance at in-service education				
	Proportion	Std. Err.	[95% Conf. Interval]	
C61				
No	.25	.0240935	.2056396	.300312
Yes	.75	.0240935	.699688	.7943604

4.6 KEY FACTOR DIFFERENCES BETWEEN WARD AND ICU EN'S

The disparate scores between the RN and EN population for certain factors presented in this chapter suggests the need for a more in-depth analysis of the EN population who participated in this research study. In my personal capacity as a nurse educator, my knowledge of the roles and challenges faced by the EN's in the wards and ICU's and of the inherent differences in the methods of patient allocation utilised in those departments, provided the basis for the comparative breakdown of scores presented in Table 4.6 below.

Table 4.6 Results for EN's in wards and intensive care units

RESEARCH QUESTIONS	Ward EN Combined scores for regularly & commonly affect	ICU EN Combined scores for regularly & commonly affect
B1 21: environmental element The nurse gets called away to care for patients she is unfamiliar with	55.22% (n=74)	14.17% (n=19)
B1 22: environmental element Work pressure results in the nurse running out of time before handing over to the next shift	58.95% (n=79)	16.41% (n=22)
B3 35: team element The nurse-patient ratio results in too heavy a workload	58.20% (n=78)	15.67% (n=21)
B3 38: team element Work pressure results in work not being completed before the end of the shift	53.73% (n=72)	13.43% (n=18)
B3 39: team element Work pressure results in handover to the next shift being rushed and incomplete	47.01% (n=63)	13.43% (n=18)
B4 45: individual element Nurses are distracted when administering medication	50.74% (n=68)	9.70% (n=13)

The scores presented suggest a high link between work pressure, workload, distractions and disruptions as well a patient – nurse ratio for the EN based in the general ward as opposed to those EN's based in the ICU. The ward EN's scores for these factors range from 47.01% to 58.94% as opposed to the ICU EN perception score range of 9.69% to 16.41%.

This analysis will be discussed in greater depth in terms of the meaning and implications of the findings in Chapter Five.

4.7 SUMMARY

This chapter presents and describes the research data that was collected during the study. The demographic data have provided an in depth overview of the study population across the three participating hospitals. Each element in the research questionnaire has been presented using a narrative and supportive tables to enhance understanding and the interpretation of the research data. The open-ended questions have been summarised into themes and presented in tabular format with supporting narrative.

On conclusion of the data analysis, certain key human factors have stood out as being of significant influence in MAE incidence as perceived by the EN's and RN's participating in this study. Many of the significant factors were in line with the literature discussed in Chapter Two (2). In terms of the environment, organisation and the team these included the medication supply chain and timeous delivery of medication to the wards, script legibility and a need for nurse training in the use of medication infusion devices. In terms of the nurse as an individual working within a team distractions, tiredness and exhaustion, a high nurse-patient workload and a workload that results in being rushed and work not being completed, rated highly in this nurse population. Alongside these factors, the nurses perceive that the lack of organisational and managerial feedback with regards medication practice auditing and MAE related incidents were also key factors within the realm of MAE. The open-ended questions raised concerns about how the institution manages the use of generic medications and how the information on substitution of medication is shared with the nurses administering medication. There were also numerous suggestions that impact on the team and that spoke of coaching and supervision being a need for nursing students, newly qualified EN's and nurses who are inexperienced in medication administration.

4.8 CONCLUSION

In the next chapter of the study, findings will be discussed and related to what is already known about this phenomenon both locally and internationally as how the findings from this study compare with other research data. In addition, study limitations and recommendations that have come from the research data will be described in detail. In addition, these discussions will provide each hospital the opportunity to identify and address institutional specific factors as reported by their nursing staff.

CHAPTER 5

DISCUSSION, CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In chapters one and two of this thesis the outline of this research study was presented alongside the framework and rationale underpinning the study and a broad introduction of what is already known about the phenomenon of medication administration errors both locally and abroad. Chapter Three presented a detailed description of the methodology chosen to conduct the research. In Chapter Four the findings elicited from the data collection were presented using tables, graphs and narrative.

In this chapter, the study findings will be discussed in terms of the study aim and objectives along with the study limitations, future recommendations and the conclusion of the research study.

5.2 DISCUSSION

The aim of this study was to identify and describe the most prevalent elements associated with the making of medication administration errors, within the context of human factors, as self-reported by nurses in a private healthcare setting. The discussion in this chapter will be conducted using each individual objective and integrating the study findings reported in Chapter Four into each objective.

5.2.1 Objective 1: to determine the most prevalent elements related to the human factors associated with MAE's as self-reported by enrolled and professional nurses working in private healthcare institutions.

The first objective was to determine the most prevalent elements related to the human factors associated with MAE's as self-reported by enrolled and professional nurses working in private healthcare institutions. The conceptual framework (Figure 1.1, Section 1.8) explains the human factors associated with error incidence in terms of environmental, organisational, team and individual elements. For the purpose of clarity, the discussions will be aligned with the framework.

In terms of this study objective, this section will provide an introduction to the conceptual elements and a deeper discussion on the meaning and implications of these results will be discussed under objectives two and three.

5.2.1.1. Environmental elements

In line with the WHO definition of human factors (WHO, 2009) the environmental element encompasses the resources and hazards that are present in the workplace and have an impact on the ability of the employee to perform their tasks.

Regarding the RN's and EN's who participated in this study, several key elements could be linked to the working environment. They reported a need for dedicated working surfaces (e.g. medication trolleys) and, for hospitals two and three, an improved means of identifying look-a-like sound-a-like medications. The time it takes medication to get from the pharmacy to the department was a concern for all of the hospitals. A need for training on the use of infusion devices was also suggested by the study findings.

The most concerning environmental elements encompassed factors that impact on direct patient care. These include nurses being distracted while administering medication as well as being called to provide care for patients' they were not allocated to which are widely known factors associated with MAE (Choo *et al.*, 2013:105; Gunningberg *et al.*, 2014:415; Bower *et al.*, 2015:191 & Hayes *et al.*, 2015:3063). In addition to these were the high scores attributed to the impact the nurse-patient workload has on medication administration safety alongside the impact work pressure has on the nurses' ability to complete her work before handing over to the next shift. These findings are not surprising and have been commonly referred to in research that has been conducted into this phenomenon (Parry *et al.*, 2015:412; You *et al.*, 2015:276).

These findings are not unique to this research study, as will be shown in the detailed descriptions provided under study objective three.

5.2.1.2 Organisational elements

Following the WHO guideline for human factors (refer to Figure 1.1 Conceptual framework, WHO, 2009) the organisational elements speak to the communication, leadership and safety culture of the organisation as key elements affecting patient safety.

The organisational elements highlighted the need to improve communication in terms of incident management, the role the nursing staff play in this area of patient safety and the reported lack of feedback to them regarding errors that have been reported. Kasda and Paine (2015) conducted an analysis of the link between staff perceptions of safety and error reporting rates. The authors concluded that the institutional safety culture is directly linked to the institutional culture and the role the leaders play in communication in terms of the overall safety culture. Frawley, Goolsarran, Nirvani and Lu (2015) found that communication and teamwork exercises enhance the ability of the nurses to identify unsafe situations and reporting of adverse events. Welzel (2012:406) believes that improving patient safety requires a link between the nurse at the patients' bedside, management control of expected performance and a quality improvement programme based on adverse event analysis. It therefore stands to reason that a nurse who is not empowered in terms of incident management is unable to fully comprehend her role in this critical area of patient safety.

An additional factor emerged which reported a high concern regarding the legibility of prescriptions. This factor was also a finding in a cross-sectional descriptive study conducted in Saudi Arabia (Al-Youssif *et al.*, 2013:66).

These findings confirm the reports from several researchers that highlight the importance of the role of the multi-disciplinary team in incident management and error reduction.

5.2.1.3 Team elements

Within the WHO patient safety report and definitions of human factors that impact on patient safety, the team elements incorporate the processes, structures and leaders within the working domain and the impact they have on the safety of the patient (refer to Figure 1.1 Conceptual framework, WHO, 2009).

The function and efficiency of the team presented mixed results. For many, whilst the shift leader was available for consultation and guidance, for many of the enrolled nurses they reported that they commonly struggled to find an appropriate person with whom to check medication.

Work pressure and the ability to complete tasks alongside a high patient-nurse ratio featured highly in terms of the impact these factors have on MAE incidence. These findings have been reported in numerous studies (Keers *et al.*, 2013:1046; Feleke *et al.*, 2014:1 & Patrician *et al.*, 2015) and will be discussed in greater depth in this chapter.

As this study has included both RN's and EN's and it was important to explore key factors from the perceptions of both nurse categories as the scope of practice of the EN (SANC 2005: R2598 as amended) requires a need for both direct and indirect supervision being done by the RN. This breakdown of results has elicited several key differences in the results, which will be discussed in detail under study objective two.

5.2.1.4 Individual elements

With reference to WHO patient safety working group, the individual is a key element associated with patient safety. The organisation views the cognitive skills and personal resources of the individual as playing a key role in patient safety (WHO, 2009). Kuenstler and Henriqson (2015) explored the perceptions nurses' have regarding errors and the findings identified personal character flaws, competency and education as being key factors linked to MAE. Beltempo *et al.*, (2015) reported a link between MAE and overtime hours worked by nurses. Ventura, Wade and Bates (2015) undertook a project to identify the sources of noise in the workplace, as these are associated with emotional exhaustion, burnout, stress and annoyance, which all tax the personal resources of the bedside nurse.

It was interesting to discover that the nurses' perceptions concluded that aside from being tired and exhausted, being distracted and occasionally struggling to calculate dosages and dilutions, the individual elements linked to the "five rights" were deemed to play a minor role in error incidence. These findings mirror those of du Preez *et al.*, (2016), conducted in the public sector in South Africa, and who reported an average of 50% for the right patient, drug, dose and route being graded as never playing a role in MAE. An additional similarity between the two studies is with regards the correct time of medication administration. Du Preez, Young and Stellenberg (2016:50). listed this factor as being the most commonly associated with MAE with a never associated score of 29.5%.

5.2.2 Objective 2: determine associations between professional categories, years of experience and attendance at in-service education and nurses' perceptions about the human factors influencing medication administration errors

The second study objective was to determine associations between professional categories, years of experience and attendance at in-service education and nurses' perceptions about the human factors influencing medication administration errors.

5.2.2.1 Associations between the professional categories

When analysing the overall scores determined by the Mann-Whitney statistical testing for each elemental domain and then comparing the scores between the RN and EN population, the probability scores were $p = 0.3175$; $p = 0.9298$; $p = 0.0118$; $p = 0.3204$ and $p = 0.4929$ for the environmental, organisational, individual, team and educational domains respectively. The lowest scoring element was the team with a $p = 0.0118$ which indicates a remarkable difference between enrolled and professional nurses. This score does suggest that this element represents factors that are deemed by the participants to play a role in MAE incidence alongside some significant differences that were evident in the results from the separate RN and EN population.

As a researcher, I experienced the changeable nature of work logistics within the hospital when collecting data and my capacity as a nurse educator has exposed me to the dynamics and challenges of staffing, acuties and skill mix and the impact these efficiency tools have on the nurse working at the patients' bedside. The concept of patient-centred care is the ideal but it is dependent on the availability of the nurse and the quality of the care rendered. Richards, Coulter and Wicks (2015) suggest that patient-centred care should be central to the healthcare mission as it promotes self-management rather than dependence and believes in need to harness the digitally acquired expertise acquired by the patient. The reality of the working environment that I am familiar with is that the growing shortage of RN's is having an increasing impact on the workload and expectations placed on the EN's. This especially evident in the general wards where the EN is

allocated a section of patients with an auxiliary nurse and the RN is responsible for overseeing the entire ward in a managerial task focused role. In the intensive care unit, setting the EN is generally responsible for one or two high care level patients where she provides total patient care. This setting allows for a more focused approach to patient care without the responsibility of the actions of the junior staff.

In terms of the South African context, the role of the EN is a diverse one that includes the administration of medication (Republic of South Africa, 1974). In Australia, the EN was not afforded the responsibility of medication administration until 2008 in response to the growing shortage of RN's. This was viewed as an innovative strategy to improve the overwhelming workload, the insufficient staffing and inadequate skill mix in Australian Hospitals (Kerr, Mill & Mc Kinley, 2012:203).

In light of this, it seemed appropriate to do a more in depth analysis of the nurses' perceptions for human factors that are most likely to be affected by the different roles of the nurse as is determined by our scope of practice (SANC, 1984). Suffice to say that this additional analysis speaks directly to the four key elements of the conceptual map (refer to Figure 1.1), the control of nurse function in terms of the legislative framework that dictates nurse practice and the outcome of nurse actions in terms of patient safety and quality care.

Several results stood out in terms of differences between the EN and RN perceptions of the human factors associated with MAE. As an environmental factor and for EN's the error risk for work pressure leading to the nurse running out of time before handing over to the next shift was 9% higher for EN's than RN's (refer to Figure 4.9). This question was posed again in the team elements and here the percentage difference increased to 11% with a 76%:59% split for EN's and RN's. In terms of the nurse-patient ratio, 76% (n=102) of the EN's view this as having a regular or common impact on MAE incidence as opposed to 62% (n=119) of the RN's (see Figure 4.13). These findings are of concern and when considering the working dynamics within the hospital these results suggested a need to explore the EN and RN differences in greater depth. Standing alone, the results do not allow for us to determine if these perceptions are as a result of the nurses' individual cognitive and clinical skills, or personal resources such as resilience, ability to plan, organise and deal with daily working challenges, or alternately as a result of the dynamics associated with the business strategies and staffing models.

In relation to the above mentioned, and relying on my own observations of the challenges the EN's face due to the depleting supply of RN's, it seemed prudent to take this analysis one step further and determine if the EN responses differed between those working in general wards and those working in intensive care units. As mentioned earlier, the delegating of responsibilities is increased

in the ward setting so I would expect to see higher scores for questions that speak to being called to unfamiliar patients, workload demands and being distracted from the task at hand.

The results in terms of the EN perceptions were enlightening. The EN population consisted of 71.64% (n=96) whose primary area of work is the general wards and 26.86% (n=36) who are based primarily in intensive care units. Two participants (1.49%) did not complete the primary area of work question.

The findings were overwhelming in terms of the perceptual differences. For between 47% and 59% of the ward EN's being distracted, the impact of work pressure on her ability to complete her work and the patient-nurse ratio were all deemed to have a regular or common effect on MAE. In terms of the ICU EN's, it was only between 10% and 16% of that section of the population who deem these factors as being of concern in terms of MAE (refer to table 4.6).

Whilst this finding is not based on statistical calculations and despite the disparity in the EN populations within the total study population (as mentioned above), the results clearly suggest that, according to the perceptions of the nurses, the challenges are greater for the EN in the general wards as opposed to those in the specialised units. These results suggest that there is a need to create discussion within the institutions to further explore the role and work scope of the EN, alongside a critical assessment of the division of work and degree of supervision within the general wards.

5.2.2.2 Associations between years of experience

The participants' years of experience were categorised in terms of those with less than six years of post-qualification experience and those with more than six years. The categories were determined using Benner's novel to expert theory model (Benner, 2001). As seen in the statistical testing results in Section 5.2.2.1, the team element score was deemed to be the only element to create some indication of significance. Again, the probability of significance in the results between the two categories offered little difference in perceptions for the remaining domains. For the environmental domain the $p = 0.0742$; the individual domain scored a $p = 0.6147$ as did the educational domain.

The team domain comparison produced a probability score of $p = 0.0111$. du Preez, Young and Stellenberg's (2016:51) research into RN perceptions of the human factors causing MAE determined that increased experience as an RN equated to a decrease in the number of nurses who reported MAE as a result of work pressure or increased workload. With reference to this study, it is difficult to interpret the significance of the team element result, as the participants were not asked to comment on their own perceptions or personal experience on whether or not greater experience led to fewer MAE errors. This opens the door for further research into the link between experience and MAE incidence.

5.2.2.3 Attendance at in-service education

The final association explored was to determine the standard deviation of the population of nurses who have attended in-service education and those who have not. The lengthy discussions in Chapter Two confirm the importance of ongoing education and this study demonstrates a successful result with 75% (n=238) of the population having attended training in the past year (refer to Section 4.5.3, Chapter Four).

As an educator, despite the achievement of 75% attendance there remains an opportunity to introduce a focused drive to educate the remaining 25%. One option would be to invite staff who still need training to join this component of the nursing orientation. Utilising this scheduled training session would mean the clinical department could maximise the session and not have to create additional workload for themselves.

The changing dynamics of the healthcare industry lends itself to the need for all healthcare workers to continually strive to update both their knowledge and skills to meet the technical advances as well as the ever-increasing knowledge of the patient. In terms of the individual, being clinically and cognitively competent enhances the strength of the nurses' personal resources and ability to manage challenges and disruptions in the workplace. An interesting observation of the RN population who participated in this study is that only 51.30% (n=98) have post-graduate nursing qualifications. This could create a need for the organisation to consider strategies that might improve, encourage or support the further education of their RN resources.

5.2.3 Objective 3: the most prevalent elements and factors are to be unpacked in terms of meaning, implication and possible ways to address them

With reference to the third objective of this research study, the most prevalent elements and factors are to be unpacked in terms of meaning, implication and possible ways to address them. This discussion will highlight the complex nature of the nursing environment and the interrelatedness of the environment, the organisation, the team and the individual. Many of the key factors that this study population has deemed as playing a regular or common role in MAE incidence are as a result of more than one of the elements. Where this is the case, there will be a slight overlap and reference to the factors that are affected by several of the elements described in the conceptual map (refer to Figure 1.1).

5.2.3.1 Environmental elements

The working environment sets the tone for action, the WHO (2009) definition refers to the role those resources, and hazards play in the working ability of the employee. It is important to note that for the majority of these factors the control does not lie within the ambit of the nurse.

5.2.3.1.1 The need for a dedicated work surface

For 36.77% (n=121) of the study participants the need for a dedicated working surface for medication administration has been identified (refer to Table 4.4.1.1). Whilst this may seem like an insignificant finding, Carayon and Gurses (2015) suggest that work environment obstacles and the availability of resources affect the work systems and that if these factors are addressed they have the ability to have a positive impact on human factors thereby improving patient safety.

5.2.3.1.2 The impact of distractions / interruptions

This highly researched factor is a complex phenomenon that requires a detailed study if the true definition is to be elicited in the chosen study environment. Westbrook *et al.*, (2010:683) conducted an observational study in Australia where the impact of distractions and interruptions were described in detail.

Bower, Jackson & Manning (2015:185) found a significant discrepancy in the definition of "interruption" and found that there are four types of interruptions; intrusions, distractions, breaks and discrepancies. They also found that interruptions were often defined in terms of when they occur; mid task, between tasks and breaking off tasks. Despite all these definition variations, it was found that any form of interruption commonly resulted in an increase in stress and a decrease in focus, which interfered with memory function thereby demonstrating a negative effect on performance.

Within this study population, 67.77% (n=223) attribute this factor to having a regular or common effect on the incidence of MAE. In addition to the role this factor plays in terms of the environmental element, it is also of concern in terms of the nurse as an individual. In light of this, this factor will be explored and discussed in greater depth in Section 5.2.3.4.2.

5.2.3.1.3 The safe use of infusion devices

The safe use of infusion devices is directly linked to training and practice and for 65.04% of the study population this is seen as a rare factor related to MAE incidence (refer to Table 4.4.1.4).

Having said this, the fact that there is a 34.96% (n=115) of the population who view things differently identifies an opportunity to provide the nursing staff with additional training and education on these resource tools as a means of enhancing the clinical competence and confidence of the nurse at the bedside.

5.2.3.1.4 The identification of look-a-like sound-a-like medications

In Table 4.4.1.5, it is clear that Hospital One(1) has managed to implement successful measures to identify these medications with a 61.98% (n=75) score for this factor being a rare MAE affecter. This suggests an opportunity for best practice to be shared with the other hospitals where this was equated to being a regular or common affecter for >40% of the nurses.

5.2.3.1.5 The medication supply chain: from pharmacy to patient

The supply chain challenges can be linked to MAE where the medication is not administered at the correct time. The process is time consuming as the script is first collected from the ward / unit, delivered to the pharmacy where it need to be dispensed and then wait for the ported to return it to the department. The variable nature of the hospital in terms of occupancy, patient activity and staffing may alter the normal flow of this process.

For the study participants, this factor is of great concern with 75.68% (n=249) of nurses giving this a regular or common grading (see Table 4.4.1.8). Whilst this component of the medication supply chain is not evident in the research presented in this thesis, researchers Al-Youssif, Mohamed and Mohamed (2013:60) suggest that these types of errors and problems in the supply chain do not necessarily mean that the nurse is not doing a good job.

These findings do however suggest that the institutional role players need to review their processes in terms of getting medication to the bedside timeously to minimise the incidence of the time-based errors discussed in point 5.2.3.4.4.

5.2.3.1.6 The patient-nurse workload

This highly researched and reported factor is a global challenge in terms of patient safety and the incidence of adverse events. The nurses participating in this study view this as a regular or common component of MAE incidence with 74.46% (n=245) giving this score.

Anderson and Townsend (2010:25) reported that a heavy workload and multi-tasking play a significant role in the incidence of MAE. In 2014, Child stated that the rising costs of healthcare worldwide have led to cost cutting and stricter staffing models. In line with these changes, there has been little research into the nurses' understanding of these constraints and their potential for a growing belief that profit is of greater value than quality patient care. This is of particular importance in South Africa where the private healthcare sector receives a lot of press about the high cost and poor quality of care.

In line with this are the nurses' concerns about the impact their growing workload is having on error incidence, as is demonstrated by these results. As the nurse-patient ratio is also a key component of the team element, the details of what is known about this factor are continued in greater depth under point 5.2.3.3.3.

5.2.3.1.7 The impact of the nurse being called away to care for unfamiliar patients

In Table 4.4.1.12, we see that this factor is deemed significant in terms of the risk it poses for MAE for 64.73% (n=213) of the participants. As it relates to the EN and RN population independently there is little difference in the scores (69%: 63%), which suggests a fairly even result for both categories.

This factor is not identified as a separate factor in the sourced research and most may well fall into a general factor such as distractions or workload. If we apply logical thought to this factor, it could possibly be attributed to the staffing models used in the hospitals. In the intensive care units, they typically use single patient allocation and the ward model most commonly used is the team method. Both of these work allocation methods create a risk in that the staff are only familiar with the patients they are allocated to which can provide challenges when the allocated nurse is on a break or busy with another task or patient. Within these three healthcare institutions there suggests a need to explore this factor further to determine the specific nature of "unfamiliar patients" in order to put supportive measures in place that will reduce this factor as a causative agent for MAE.

5.2.3.1.8 Work pressure leads to running out of time before handing over to the next shift

This factor falls under the general auspices of workload in terms of the research presented in the literature review in Chapter Two. For 69.60% (n=229) of the study participants this is a key factor regularly, or commonly, leading to MAE (refer to Table 4.4.1.13). In terms of the EN and RN population of this study, Figure 4.9 shows a distinct difference in opinion with the EN's scoring a rare effect of 25% (n=33) and the RN's a rare effect score of 34% (n=47).

As this factor is linked to the environmental elements and the team dynamic, the in-depth discussion regarding the impact of work pressure on the nurses will be presented in point 5.2.3.3.4. The finding related to the more significant perception of the EN has been discussed in greater detail in objective two.

5.2.3.1.9 A key finding: the risk of generic medications

The use of generic substitution medication as a factor that influences the incidence of MAE was an omission on the research questionnaire as was identified by six RN's who added drugs dispensed under a different name as an additional factor. The nurses interviewed in a Norwegian hospital also

raised this concern; they reported a sense of insecurity with generic substitution and with their knowledge gap on this growing trend (Hakonsen, Hopen, Abelson, Ek & Toverud, 2010:). In a Portuguese study by Foncesca and Barros (2015) nurse responses confirmed this finding regarding the error risk posed by generic substitution.

This concern was confirmed when three of the study participants suggested a need for additional resources that provide lists and details of the generic medication currently in use. To reduce the stress placed on the nurse and the error risk generic substitution carries, the institutions would be prudent to address this concern as a matter of urgency.

Addressing this concern would require the participation of the pharmacy division. Measures such as updated lists of generic substitutions and a method of documenting the name of the drug dispensed next to the drug prescribed should be relatively simple to institute.

5.2.3.1.10 Suggestions from the study participants

The current practice standard for the administration of habit forming medications (HFD) requires that two nurses, one of which must be an RN, go together with the prescription to take the medication out of the locked drug cupboard, confirm the stock levels and then to the patient bedside where the medication is administered and recorded in the HFD register.

For three of the study participants, this process is deemed to be challenging and often results in shortcut practices that may lead to MAE. The nature of the current work environment supports this suggestion but the current legislation requires that the correct process be followed (Medication and Controlled Substances Act 101, 1965). It is unfortunate that this is one aspect of the human factors that is unlikely to be altered and as such cannot be addressed in terms of changing practices.

5.2.3.2 Organisational elements

This research study explored the nurse perceptions of the role the organisational management play in risk and adverse events. We have already determined that leadership and communication are key components within this domain and therefore have an effect on the human factors influencing patient safety. The study results discussed below speak directly to these organisational elements.

5.2.3.2.1 Feedback on MAE

A key finding was that for this study population, 43.76% (n=144) of respondents report that they rarely receive feedback on MAE (refer to table 4.4.2.5). The importance of feedback and the role it plays in error reduction and change in behaviours is well known. This was a key finding for a multi-

method study conducted in Israel by Drach-Zahavy, Somech, Admi, Peterfreund, Peker & Priente (2013:453). Their study found that the only learning practice that reduced MAE incidence was the top-down practice of monitoring, correcting and providing feedback during work performance.

Asboshaiqah's investigative study in Saudi Arabia (2014:65) confirmed that poor communications between members of the healthcare team are drivers of error incidence.

This result shows a clear need for the revision of the processes involved in incident management to ensure the information is reaching the nurses' at the bedside.

5.2.3.2.2 The role of the nurse in incident management

Further to the reported lack of feedback, 32.21% (n=106) of the respondents they admit to not understanding the role they play in incident management (refer to Table 4.4.2.7). These findings create a platform for a focused drive on information sharing and feedback in terms of adverse event management across the hospitals.

5.2.3.2.3 The legibility of prescriptions

The roles of other members of the multi-disciplinary healthcare team are well-researched components where MAE is concerned. For 71.12% (n=234) of the study population, script legibility was perceived to be a strong precursor to MAE error (see Table 4.4.2.9). Whilst this result is higher than that reported by Asboshaiqah (2014) in Saudi Arabia with a 42.8% of errors being attributed to prescription legibility, the findings of Gunes, Gurlek and Sonmez' (2014:295) qualitative study conducted in Turkey also found that script illegibility contributes to MAE incidence.

This finding presents an opportunity for institutional management to present the study findings at a physician platform to request their support in terms of risk management and quality improvement in terms of safe patient care. Within the private healthcare setting the patients' often, have choices regarding the hospitals they are admitted to and an institution that scores highly in terms of the quality of patient care provided is a strong draw card for the client.

5.2.3.2.4 Suggestions from the study participants

Of the suggestions made by the study participants, three of the nurses suggested that the Unit Managers and Night Matrons conduct audits on medication practices and provide the staff with feedback. These types of interventions are well known strategies within the sphere of education. Confirmation of the value of these suggestions was evident in research conducted by Cronje and Smit (2012:137) in Jeddah where medication safety practices in critical care areas were explored. The study identified that the best awareness creating strategy for this nursing challenge was frequent reminders and discussion with a score of 30.2%. These findings also highlight that

analysis of case reviews and the monitoring of practice are deemed the most successful interventions with a 31.9% and 27.8% respectively.

5.2.3.3 Team elements

The team is an integral component in patient care and extends to all members of the multi-disciplinary team who bring their individual expertise to the patients' bedside with the aim of healing the sick or supporting the terminal. Achieving good teamwork not only requires clear and concise communication, but is also reliant on the ability of each team member to complete their work timeously.

5.2.3.3.1 Positive feedback in terms of the availability of the shift leader for consultation and guidance

In terms of the function of the team, it is important to acknowledge that for 70% (n=229) of the study population the availability of the shift leader to consult with, and for guidance, is rarely a reason for MAE (refer to Table 4.4.3.2). This suggests the presence of a positive working environment. Despite this, it does need to be acknowledged that the participants were not asked to comment on how often they make use of the shift leader and if that impacts on them personally in terms of error incidence.

5.2.3.3.2 The struggle for the EN to find an appropriate person to check with

This question asked the participants about the challenges in finding an appropriate person with whom they can double check medication. Whilst the overall population suggest that this is has a rare effect on MAE for 55.92% (n=184) of the population (see Table 4.4.3.3), Figure 4.2 identifies that this is a concern for 49% (n=65) of the EN's as opposed to 39% (n=75) of the RN's. When we consider that the scope of practice for the EN (SANC, 1984) requires that they work under the direct or indirect supervision of the RN, this result alludes to the need for further investigation into the details of the EN concerns for this factor. The impact of human factors for the EN has been discussed in detail under objective two.

5.2.3.3.3 The impact of the nurse-patient ratio

This factor features strongly in this research study and is supported by studies conducted locally and abroad. As with several factors being reported on, the impact of the nurse-patient ratio is deemed as being an environmental and team element.

In Question B1 18 we have already seen that this working ratio represents a meaningful indicator for regularly and commonly affecting errors for 74.46% (n=245) of the respondents (see Table 4.4.1.9). For this question, Table 4.4.3.4 shows us that 67.77% (n=223) of the study population see this as being a regular or common contributor to MAE.

In terms of the impact this has on the team element, this factor as a regular or common error influencer is highest in Hospital Two for 76.26% (n=90) of the nurses. How this relates to the organisational processes would need to be determined by the institutional management. Welzel (2012) suggests that quality improvement programmes aimed at reducing adverse events must be designed to meet the specific culture, unique needs and challenges of the specific facility.

With regards other researchers' findings, both Cronje and Smit (2012:75) and du Preez, Young and Stellenberg (2016:90) found that high nurse-patient ratios were linked to MAE. Cronje and Smits descriptive quantitative study of N=121 nurses working in Jeddah reported that in terms of human factors, a high nurse-patient workload was deemed to contribute 8.5% to MAE. As an environmental factor, it played a significantly higher contributor with 15.6% (Cronje & Smit, 2012:90).

The phenomenon of the growing nursing shortage and the impact it has on nursing workload is a global concern.

As a result of this growing nursing shortage, the Australian Nursing Federation extended the scope of Enrolled Nurses to include medication administration (Kerr, Mill & McKinley, 2012). This was seen as an innovative solution to a growing problem and the positive results suggest the need for other nursing regulatory bodies to consider innovation in terms of nursing scope.

5.2.3.3.4 Work pressure results in work not being completed before the end of the shift

Work pressure is a known stressor for nursing staff and the results in Table 4.4.3.7 show the impact this factor has with a combined regularly and commonly associated with MAE score of 64.13% (n=211). Whilst work pressure as a concept and a known significant contributor to MAE has been widely researched (Cronje, 2012; Parry, Barriball & White, 2014; Carayon & Gurses, 2015; Patrician, Loan, McCarthy, Swiger & Fridman, 2015; du Preez, 2016).

Work not being completed timeously is not a commonly researched component of MAE but is a key component in terms of the personal resources available to the nurse. This factor may warrant further investigation in terms of the nurses' abilities to manage their workload in terms of planning and prioritising to determine if there is a link between overall personal organisational competence and completing the work on time.

An interesting finding is the discrepancy between the RN and EN perceptions of this factor. In Figure 4.16 we see that regular and common link to error is 59% (n=113) for the RN's as opposed to a 70% (n=94) for the EN's. This has been discussed in greater depth under objective two where the associations between the two categories of nurses have been reported on.

5.2.3.3.5 Work pressure results in handover being rushed and incomplete

As discussed in the preceding question, the pressure of the nurses workload is a well known contributor to MAE incidence worldwide. Ronel du Preez's South African based study reported a 75% link between work pressure and MAE (du Preez, Young & Stellenberg, 2016:51).

For 61.09% (n=201) of the nurses who participated in this study this is viewed as having a regular or common effect on MAE incidence (refer to Table 4.4.3.8). The studies referred to in point 5.2.3.3.5 also apply here and again it is important to mention that the work pressure impact is reported in global terms and not in terms of the effect it has on the nursing handover being rushed and incomplete. This specific area could be explored in greater depth with similar aims as mentioned in the previous section. This would be in line with the findings of a qualitative exploratory study presented at the 26th International Research Congress by Kuenstler and Henriqson (2015) where the nurses' feedback was deemed significant and suggested that human error is a result of character flaws rather than because of complex working systems. The nurses characterised human errors as a lack of competency, education or judgement.

5.2.3.3.6 Suggestions from the study participants

It is interesting to note that three RN's completing this questionnaire suggested that the shift leader conduct spot checks on medication charts before the end of the shift. This would certainly allow for omissions and errors to be identified and, where possible, corrected but would be reliant on the availability of the shift leader. This may be achievable in the ICU setting where a buddy checking system could be put in place. This suggestion would pose greater challenges in a ward setting where the number of RN's is determined by the ward acuity and the total skill mix and patient allocation.

5.2.3.4 Individual elements

When discussing the individual elements the WHO (2009) descriptions guide us to look at both the cognitive skills and personal resources of the individual (refer to Figure 1.1). Cognitive skills are key to nursing practice, as the nurse has to be able to integrate knowledge into her clinical practice with the aim of providing high quality safe patient care. Smeulers, Onderwater, van Zwieten & Vermeulen (2014:276) determined that nurses needed to demonstrate not only the ability to determine the legality of prescriptions, but also the need for the medication in terms of the patients' clinical condition.

Personal resources are an often less considered component that encompasses the ability of the nurse to cope with the challenges, stress and increasing workload that is inherent in the nursing profession. A four year research study conducted by Professor Laetitia Rispel from the Wits Centre for Public Health surveyed 3700 nurses and found that at least a third of them had an additional

employment with 60% of the nurses admitting to a high level of overtime at their own employ (2013). This statistics would suggest that the nurses' personal resources would be under severe pressure, which the researcher confirmed in the statement "almost half of the 3766 nurses felt too tired to work when on duty".

5.2.3.4.1 The impact of tiredness and exhaustion

This factor has been widely researched and reported as being a major influencer in MAE incidence. Regarding the study population there is an equal impact for both EN's and RN's (see Figure 4.19) with a total combined regular and common affect score of 67.47% (n=222) (refer to Table 4.4.4.1). In some studies, this factor may also be linked to burnout and fatigue as stated in the paragraph below.

A key finding from the 347 nurses surveyed in an American study by Halbesleben, Rathert & Williams (2013) was the acknowledgement from the nurses that exhausted nurses are more likely to use unsafe work practices. Saleh *et al.* (2012) attributed the alteration in circadian rhythms resulting from shift rotation as leading cause of nurse exhaustion leading to MAE.

These findings support Professor Laetitia Rispel's survey of 3766 of South African nurses where almost half of the study population reported being too tired to work when on duty (2013). This study titled "The nature and health system consequences of casualization, agency nursing and moonlighting" reported a 42% incidence of moonlighting in the private sector as opposed to 27% in the public sector (Rispel, 2013).

More recently, a poster presentation at the 2015 Annual Meeting of the Pediatric Academic Societies and the 2015 Annual Meeting of Pediatric Endocrine Society presented the findings of a retrospective study conducted in Quebec. The findings confirmed that negative incidents affecting patients were significantly associated with nurse overtime and 78.9% of these incidents were related to medication (Beltempo *et al.*, 2015).

These staggering findings suggest that an investigation into shift rotation and the hours of overtime worked by employees may elicit key information. In addition to this, the feedback from this study population regarding the impact work pressure, work load and the patient-nurse ratio may also warrant a revisit in terms of the capacity of the nursing staff to meet the demands placed on them in the workplace (refer to environmental and team element results).

A key aspect of nurse tiredness and exhaustion did not present itself in this study and that is the impact of night duty. The demographic question on night duty did not ask the participants the nature of these working hours: are they occasional or continuous hours. Night duty is known to be

associated with tiredness and an Egyptian study explored at the impact of shift rotation confirmed that this working method affected the natural circadian rhythm to the point that it had a negative impact on overall performance and general alertness. The authors believed that the study findings were of sufficient significance to warrant an institutional review into the workflow routine and working hours of the nursing staff (Saleh, Awadalla, El-masi & Sleem, 2014:145-153). Munro *et al.*, (2015) evaluated the outcomes of recent dose error updates on smart pumps in a tertiary paediatric hospital in Melbourne. The study found that most high-risk events happened during the night shift.

The concept of nurse tiredness can be multi-faceted and aspects of life such as financial constraints, single parenting and generalised social challenges may contribute to this factor. Whilst the personal nature of factors that influence the ability of the individual to cope under pressure cannot be excluded, they did not form part of this research.

In light of this, there is an opportunity to explore the impact of night duty on the human factor of nurse tiredness and exhaustion.

5.2.3.4.2 The impact of distractions / interruptions

The impact of distractions on patient safety during medication administration has been extensively researched and identified as being a key factor in MAE. In Table 4.4.4.2 we see that the total combined score for regularly and commonly affecting is 63.16% (n=206) with the EN sector of the study population attributing a 61.18% for the same parameters.

These findings mirror those of Westbrook *et al.*, (2010:683) who reported that the nurses were interrupted 53.1% of the time, which led to a 12.1% increase in errors. The impact and incidence of interruptions and errors was also found in studies conducted by Anderson & Townsend (2010:25); Unver, Tastan & Akbayrak (2012:322); Choo, Johnstone & Manias (2013:105); Gunningberg, Poder, Donaldson & Swenn (2014:413); Donaldson, Aydin, Fridman & Foley (2014:63) and du Preez, Young & Stellenberg, (2016:43).

Michelle Feil, senior patient safety analyst for the Pennsylvania Patient Safety Authority, wrote a review on the impact distractions in the workplace have on patient safety. During the period under review there were 1,015 reports that were as a result of some form of distraction and of these 59.6% of the events were classified as medication errors (Feil, 2013:1).

More recently, a study conducted at Roanoke Memorial Hospital found that nurses might be distracted or interrupted as often as every two minutes (Carter *et al.*, 2015).

In addition to these results, Question B11 of this study asks the participants a similar question but under the domain of environmental elements. The results mirrored these with a high regular and common affect score of 67.77% for n=223 of the total study population (refer to Table 4.4.1.2). This suggests that this factor extends beyond the nurse herself and incorporates the environment in which she works.

Six of the respondents made suggestions that there should be a dedicated medication nurse and that the nurse should not be distracted whilst administering medications. Whilst these suggestions alongside other recommendations have been reported in other studies (Feil, 2013:7; Hayes *et al.*, 2015:3075), the complex nature of this factor needs to be explored by the organisation in terms of the types of distractions, when and how they occur and the measures that would meet the unique needs of each department. Instituting these actions would support Feil's recommendation that improving the safety culture of a hospital is achievable if strategies to manage distractions are done at unit level alongside leadership structures that support this change. This suggestion speaks directly to the organisation and environment of the worker in conjunction with meeting the needs of the individual and the team.

5.2.3.4.3 Calculating dosages and dilutions

Whilst the results for the questions that relate to MAE errors being related to the calculation of dosages and dilutions only account for 39.81% (n=131) and 40.72% (n=134) of the combined score for being regular and common error affecters (refer to tables 4.4.4.5 & 4.4.4.6), there is a definite need to provide additional training and education. Closing these loops will reduce adverse events which according studies conducted by Cottney and Innes (2014:68) and Cheragi, Manoocheri, Mohammednejad and Ehsani (2013:231) and Tooke and Howell (2014::471) have the potential to pose serious threats to patient safety.

5.2.3.4.4 The “five” rights and the supply chain

The findings for this study population in terms of the “five” rights of medication administration elicited results that suggest the only concerning area is that of administering medication at the “right” time (Bourbonnais & Caswell, 2014:391). For 43.41% (n=141) of the population this factor was deemed as being a regularly or commonly related to MAE incidence (see Table 4.4.4.12). These findings correlate with studies conducted by Berdot *et al.*, (2012:3); Bergkvist *et al.*, (2012:2) and Feleke *et al.*, (2014:1) where administration of medication at the “right” time was found to be the highest error made. Despite the commonality in the results, this finding may support Question B17 where 75.68% (n=249) of the study participants reported that the medication supply chain (medication from pharmacy to patient) has a regular or common impact on MAE incidence. The

high influence of MAE attributed to this factor suggests a need for the systems related to the medication supply chain to be reviewed across the hospitals.

5.2.4 Objective 4: to elicit information from the study participants regarding orientation, in-service and policies related to medication administration in their workplace and use this information to determine any shortcomings in these areas

The final study objective aimed to elicit information from the study participants regarding orientation, in-service and policies related to medication administration in their workplace and use this information to determine any shortcomings in these areas.

5.2.4.1 Orientation and medication administration

In terms of the inclusion of medication administration in the department orientation programme there is a 63.63% (n=77), 62.71% (n=74) and a 71.11% (n=64) answer of yes from the 97.26% (n=320) of the nurses who answered the question. Whilst this positive response came from almost two thirds of the study population, there remains an opportunity to improve practice through a focused drive to enlighten the few who have missed this exposure. Bourbonnais and Caswell (2014:391-395) recommend that improving the practice of medication administration requires supervised practice. Including these components during the orientation process provides an opportunity to set the required standard and identify the need for practice and skill renewal.

5.2.4.2 In-service training and medication administration

Numerous researchers have highlighted the ongoing need for in-service education concerning the safe administration of medication in this society where technological advances and the increasing numbers of generic medications available on the market. A descriptive cross-sectional study of 309 hospital-based nurses reported that 69.6% of the study population attributed a lack of in-service education as a contributor to MAE (Aboshaiqah, 2014:63).

In this study, 71.42% (n=235) reported that they are aware of in-service education taking place, of those, 74.38% (n=90), 78.81% (n=93) and 62.22% (n=56) of the respondents in hospitals one, two and three respectively have attended in-service on medication administration in the past 12 months. These percentages do suggest that this is a focus area in the hospitals but that there is a need for ongoing in-service to reach the remaining nursing staff. A qualitative research study in Teheran conducted focus group interviews with 24 student nurses to explore their perceptions of why MAE occur. The students felt that the simulated experiential learning did not prepare them adequately for real life (Vaismoradi *et al.*, 2014:434).

The success of other researchers such as these can be utilised to enhance the in-service being provided in our hospitals. A quality improvement project conducted with 72 nurses in the United States of America made use of a workbook with pre and post testing to determine the impact of education on MAE incidence reduction. The study results did confirm that this intervention did improve knowledge and reduce errors (Tenhunen *et al.*, 2014:306-311).

5.2.4.3 Medication administration and the availability of policies and standard operating procedures

In addition to questions regarding the exposure of the nurses to medication related information during department orientation and in-service, the study participants were also asked to confirm the availability of medication administration policies and standard operating procedures (SOP) in their department. The results were overwhelmingly positive with 91.79% (n=302) of the participating nurses confirming the availability of policies and 87.23% (n=287) confirming the availability of SOP's.

The compliance with best practice policies and standards is believed to be the key to safe clinical practice. An article written by McEwan (2014:39), Territory Manager for Zebra Technologies was published in the South African Pharmacy Journal speaks to a WHO report that stated that over 50% of countries do not make use of policies and procedures to ensure the safe use of medications. She also reports that fewer than 40% of patients in the developing world are treated according to safe clinical guidelines (McEwan, 2014:39).

In the direct observational study conducted in France by Berdot *et al.*, (2012:1) and the retrospective MAE analysis conducted in Sweden by Bergkvist *et al.*, (2012:2) the majority of administration errors fell into the "five rights" categories. The right time was proven to be the most common error which links directly to the failure to comply with policy and practice guidelines.

A multi method study (survey, observation and archived administration data) conducted in urban hospitals in Israel surveyed 360 nurses and looked at the link between learnt practice and medication errors. The study found several areas in the required procedure steps lacking: 22% of nurses failed to identify the patient by name; 31% failed to perform the "triple check" principle; 37% failed to carry out relevant clinical measures (such as the taking of blood pressure prior to medication administration); (Drach-Zahavy *et al.*, 2013:453). These authors report a "novel" finding as a result of their study. These authors conclude by saying that nurses must be educated with regards the inherent risks of "cutting corners" in terms of medication administration.

It is important to note that the majority of the studies reported on in the literature review in Chapter Two categorise the errors in accordance with the standard acceptable practice of checking the

“rights” of medication administration and the role adherence to policy guidelines plays in the reduction of MAE incidence.

5.2.4.4 Participant’s suggestions regarding medication administration practices and training

Additional and on-going training and practice, for permanent and agency staff, in medication administration featured strongly in the suggestions put forward by the participants. Alongside this was a recommendation from three RN’s and three EN’s that newly qualified staff be mentored until their competence in this clinical skill has been assured. Five nurses suggested that all RN’s and EN’s undergo an annual Objective Structured Clinical Examination (OSCE).

This focus on the value of training and practice is supported by an article by Bourbonnais and Caswell (2014:391) where the linking of theory and practice alongside math’s skills revision and opportunities to practice medication administration under supervision in realistic settings and scenarios is recommended as being vital in the preparation of nurses for safe clinical practice. Focus group interviews with student nurses in Teheran and reported that the students felt that they were poorly prepared for the reality of this role as their learning was mostly simulated with little experiential learning in the real life setting (Vaismoradi *et al.*, 2014:437). A qualitative study explores the perceptions of student nurses of their own knowledge and skill during medication administration (Betts, 2015). The study findings demonstrated the need for additional training as the nurses felt they lacked sufficient knowledge to match the complexity of the skill and risk of adverse events increased their fear of making mistakes.

The extent of research into the complex nature of medication administration shows a clear link between educations, training and clinical practice and supports the participant suggestions regarding this aspect of risk reduction.

5.3 LIMITATIONS OF THE STUDY

Study limitations are defined as problems or restrictions present in a study that reduce the generalisability of the study findings to other similar populations (Grove *et al.*, 2013:598). These limitations may be related to the theoretical components or the methodological nature of the research study. Theoretical limitations can be related to the concepts or variables used to formulate the study. Methodological limitations may be associated with the study design and can have an impact on the credibility of the findings and as a result limit the generalisability of the research (Grove *et al.*, 2013:598).

The limitations of this study will be discussed in terms of the data collection instrument and the environment in which the study took place.

5.3.1 The data collection instrument

The questionnaire, that was validated by international experts, was a self-reporting instrument that consisted of 66 open and closed-ended questions regarding participant demographics and the human factors and elements associated with MAE. The questionnaire was lengthy and the questions regarding levels of nursing education, post basic qualification, employment status and months of night duty worked, did not provide any additional insight into the research findings and as such, if omitted, would reduce the length of the questionnaire and the time it takes to complete. That being said, of the 329 nurses who participated in the study, only 1.21% (n=4) failed to complete eight or more of the questions (2.43%) which suggests that the length of the questionnaire was not problematic for the respondents.

A further limitation is in that the respondents were not asked if they had ever made a medication administration error. By not asking this question the researcher is unable to determine if the study findings are based on objective or subjective data. It does need to be said that if this question had been asked I doubt whether it would have been truthfully reported. Asking this type of question does pose an ethical risk due to the participants' fear that they may be identifiable. It is a well known fact that human beings are often reluctant to admit mistakes for fear of disciplinary action and retribution (Gordon, 2014:20; Kuenstler & Henriqson, 2015) but if people were willing to admit errors it could provide a deeper meaning to the study.

5.3.2 The research study environment

A further study limitation is related to the study environment. This study was only conducted within one private healthcare group in the Western Cape Metropole. The first reason for this was to be able to compare the results within similar business environments where the staffing models and organisational norms are similar. In addition to this, my role as a clinical facilitator allows me to evaluate and moderate students clinical practice across these hospitals. This factor will allow for a greater depth of understanding of how the study results can be generalised and integrated into the narrow study setting. Having said this, it is important to acknowledge that this narrow focus area reduces the opportunity for the study findings to be generalised across other private healthcare organisations as well as the public healthcare sector in this region. According to Grove *et al.*, (2013:695) generalisability is defined as the ability to extend the study findings to a larger population or from a small study situation to a larger one. The study was conducted in three private healthcare institutions that offer tertiary level healthcare services and specialised medical and surgical care. Having said that, the narrow study environment may also be viewed as an advantage in that it allows the specific healthcare group the opportunity to implement corporate strategies to improve the current situation. These could then be implemented in other institutions belonging to this healthcare group.

The final limitation to be considered is that the participants were completing the questionnaire whilst on duty and there is the possibility that some may have rushed the process which has the potential to impact on the accuracy and validity of the data.

Furthermore, the fact that the data was collected across the varied hospital disciplines might be deemed a study strength as this has allowed for some comparisons to be made in terms of the influencing factors impact differences between wards and intensive care units.

5.4 CONCLUSIONS

Reflecting on the study findings described in this chapter it is clear that the perceptions of the nurses' regarding the human factors that influence the incidence of MAE have been elicited. Many of the high scoring factors, according to the participants, are in line with previously conducted research into this phenomenon in terms of incidence and prevalence. Some examples of these are distractions, workload and patient-nurse ratio, exhaustion and tiredness, the legibility of prescriptions and the pharmacy supply chain process. The high scoring Cronbach alpha scores conducted during the pilot study confirm the internal consistency and homogeneity of the components of the data collection questionnaire and as such correlate with the commonality of the study findings with other study results.

A positive attribute of this research study is that it includes both the RN and EN categories of nurses, which has allowed a unique angle to be presented in terms of the perceptions of the EN population as stand-alone results. These findings have provided a deeper understanding of this section of the nursing population in these healthcare institutions.

In addition, the option of two open-ended questions has provided the study participants with the opportunity to provide additional information that would not otherwise have been identified. For this study, the nurses' challenges with generic substitution have been a key finding that needs to be addressed.

Both of these have the potential to produce a positive outcome for the nursing population across this healthcare group in terms of the implementation of company-wide strategies that enhance patient safety and improve patient care outcomes.

5.5 RECOMMENDATIONS

The purpose of recommendations are to use the study findings to suggest further actions in terms of additional research that could further enhance evidence-based knowledge and understanding of the phenomenon or concept that has been explored in the present study (Grove *et al.*, 2013:599-600).

The recommendations made are based on the study findings and the feedback provided by the professional and enrolled nurses who participated in this research study and which have been presented to support the conceptual framework underpinning this research study (refer to Figure 1.1).

5.5.1 Recommendation 1: The organisation

This is a challenging component as the nature of private healthcare is to provide quality innovative care and still achieve a decent profit margin. Numerous aspects that relate to the organisational norms and practices emerged from this study.

The first relates to the current staffing model and management of acuties and work allocation. This functional area speaks directly to the work-based hazards and provision of resources that underpin the environmental element. There is a reported need for the shift leader to be available and accessible for consultation and support of the nursing team, which is a key component of both the environmental and team elements and is directly affected by the staffing models acuties. In addition to this, the allocation of patients is viewed as having a significant impact on MAE incidence. The study results show that this has a greater impact in the general wards with a regular and common impact of 66.51% for ward staff and a 33.48% for intensive care unit staff.

With reference to the actual task of medication administration, some of the study population believe there is a need for a dedicated medication nurse who is able to perform the task without interruptions and distractions. This nursing challenge is a well-known environmental hazard and has a negative impact on the efficiency of the nursing team and therefore of patient safety. This recommendation may also improve the overall safety of medication administration, as it would allow the nurse to become more knowledgeable and experienced in the cumbersome nature of pharmacology.

The participating nurses also list tiredness and exhaustion as an error-inducing factor, which may suggest the need for management to monitor staff working hours and the financial need for overtime shifts. A leadership structure that works to ensure a healthy work-life balance could have a positive impact on patient safety and a reduction in adverse events. These responsibilities lie in the realm of the organisational element alongside those of the control over processes and structures within the workplace.

The final recommendations speak to the medication supply chain. The study findings indicate a clear need to improve the supply chain and the time it takes for medication to go from being ordered to being back in the department and administered to the patient. This is a process and

structure component of the organisational and team elements and would enhance patient care should a more efficient process be identified and successfully implemented.

In addition, the nurses have suggested a need for Physicians to be included in the policies that govern medication practice as they relate to the legibility of prescriptions, the way in which orders are altered and the expectation that nurses are responsible for transcribing medication charts when they are full. The organisation leaders could be influential in getting the physicians on board and focused on reducing this stressful and risk-laden factor. Identifying the patient as the end user of this process could improve the buy in of the other members of the healthcare team.

Furthermore, the private healthcare environment promotes quality care in their mission statements and are competing with other private healthcare groups for patients. Risk management as a strategy for providing top quality care is concordant with the mission but also reduces the very high risk of negative publicity and should be a top-down focus for everyone in the organisation. Perhaps a risk management seminar could be conducted annually for each hospital.

5.5.2 Recommendation 2: Nursing education

With reference to nursing education, the study findings proposes the need for additional education in pharmacology that focuses on adverse drug reactions and training in the interactions between commonly used drugs and what medications may be administered together. The individual element is concerned with the cognitive skills of the nurse and improving the knowledge and skills of the nursing staff is essential if quality patient care is to be rendered. Harnessing the environmental and organisational resources (e.g. the pharmacist) to provide support and training could reduce errors and patient injury.

In addition to this, there appears to be a need for additional education around infusion devices, knowledge of dilution of drugs and infusion rates to ensure that medications are administered to ensure the patient receives the full therapeutic benefit of the pharmacological treatment. This can be achieved by integrating all of the conceptual framework elements: environmental resources, organisational leadership and communication, team element structures and processes and the individual element as discussed in the preceding paragraph.

A further recommendation may lie in the results that were elicited from the EN population. The high scores for workload being rushed and incomplete, tiredness and being distracted open the door for investigation into the personal resources of the nurses. These findings include the agency staff who moonlight, which is also known to have an effect on depletion of personal resources (Rispel, 2013). Many of these components have the potential to be affected by the nurses' personal abilities to cope with the stress and challenges these factors present. We should also consider that our ability to withstand stress at work might be negatively affected by personal stress, which is a

growing concern with the high cost of living and crime present in our societies. Many companies, such as this specific healthcare organisation, have already identified this as an employee need and subscribe to employee wellness programmes and support services that can be accessed confidentially. This company is one of those who have ensured the availability of this service for their staff. Whilst this is a positive feature, the EN results may suggest that there is a need to nursing training to build in life skills and stress management modules that will equip all nurses to better deal with the numerous challenges and frustrations present in nursing today.

5.5.3 Recommendation 3: Incident management and reporting

In terms of incident management, the creation of a “just culture” is a key component. This patient safety focused environment encourages incident reporting and investigation. The investigation should aim to determine whether the incident is due to human error, risky behaviour where there is a conscious drifting from safe practice or because of reckless behaviour where the employee is consciously aware of conduct and risk (Boyson, 2013:400).

This key focus area in patient safety should be integrated into all of the elements described in the conceptual framework (refer to Figure 1.1).

From the individual’s perspective, the study clearly identified the need for employee empowerment with regards incident management, which could extend to transparency and the inclusion of the nursing staff working at the bedside to be involved in root cause analysis of incidents. This would allow the staff working at the patients’ bedside the opportunity to make suggestions that are practical and achievable, and which could then lead to improved patient safety and have minimal impact on their current work demands.

Furthermore, the participants have identified a need for incident feedback from management, which could improve personal action accountability as well as encourage the nurses to monitor the actions of their colleagues with the aim of minimising the inherent resistance to dealing with the incompetence of colleagues. These recommendations would enhance the interactions and shared responsibilities between the organisation, the team and the individual, which in turn has the potential to drive the creation of a “just culture” within these healthcare institutions.

5.5.4 Recommendation 4: Future research

Due to the limited nature of the study population, it is recommended that the study be extended to include other private healthcare organisations as well as the public sector in order to gain a deeper understanding of the phenomenon of human factors that influence MAE in terms of the South African setting. Alongside this, it would appear that there is a need to explore the role and work function expectations of the EN. A deeper understanding of the particular challenges these nurses face may identify a skill deficit that could be addressed during their formative training.

In addition to this, a further suggestion would be to conduct a prospective study that identifies those who have made a medication administration error and those who have not. The results could then be compared to elicit both objective and subjective data regarding this patient safety concern.

With reference to the study results presented here, there is an opportunity for each hospital to conduct research linked to their specific institutional challenges.

5.6 DISSEMINATION

The findings of this research study will be submitted to the healthcare organisation executive committee (as stipulated in the document that provided ethical approval for the study) for their perusal. With their permission, the findings will be shared with the nursing managers' of the three participating institutions as well as the medication committee of the researchers' place of employment. The researcher will then request permission to present the study findings at the healthcare company's training institutions' annual research day for nursing students, nurse educators, clinical staff and nursing management.

5.7 CONCLUSION

Medication administration errors occur as a result of the impact of a complex array of factors brought to bear upon the nurse and the organisation, which cause harm to both patient and the hospital. Understanding the human factors as perceived by the nursing population is key to the institution of safeguards and improved practice methods that will reduce these adverse events and improve patient outcomes.

The practice of safe medication administration is a multi-faceted nursing task as shown in the conceptual framework in chapter one. It includes factors that relate to the individual, the organisation and environment as well as the nursing team, education and training. All of these aspects have components that influence the process of medication administration.

The results of the research study have been presented, discussed, study limitations reported on and all of this information collated to suggest conclusions and recommendations for the organisation, nursing education, incident management and further research.

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APPENDICES

Appendix 1: Ethical approval from Stellenbosch University

Approval Notice

New Application

26-Nov-2015

Hill, Karen J

Ethics Reference #: S15/10/249

Title: Prevalent elements related to human factors which could be associated with medication administration errors in a private healthcare institution in South Africa: a nursing perspective.

Dear Ms Karen Hill,

The **New Application** received on **28-Oct-2015**, was reviewed by members of **Health Research Ethics Committee 2** via Expedited review procedures on **16-Nov-2015** and was approved.

Please note the following information about your approved research protocol:

Protocol Approval Period: **16-Nov-2015 -16-Nov-2016**

Please remember to use your **protocol number (S15/10/249)** 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 219389819.

Included Documents:

Declaration K Hill, A Damons

Application form

Permission letters to conduct study

Appendix 2: Ethical approval from healthcare group

RESEARCH OPERATIONS COMMITTEE FINAL APPROVAL OF RESEARCH

Approval number: UNIV-2016-0010

Ms Karen Hill

E mail: karenatmousehouse@gmail.com

Dear Ms Hill

RE: PREVALENT ELEMENTS RELATED TO HUMAN FACTORS WHICH COULD BE ASSOCIATED WITH MEDICATION ADMINISTRATION ERRORS IN PRIVATE HEALTH INSTITUTIONS IN SOUTH AFRICA: A NURSING PERSPECTIVE

The above-mentioned research was reviewed by the Research Operations Committee's delegated members and it is with pleasure that we inform you that your application to conduct this research at Private Hospitals, has been approved, subject to the following:

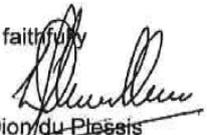
- i) Research may now commence with this FINAL APPROVAL from the Committee.
- ii) All information regarding the Company will be treated as legally privileged and confidential.
- iii) The Company's name will not be mentioned without written consent from the Committee.
- iv) All legal requirements with regards to participants' rights and confidentiality will be complied with.
- v) The Company must be furnished with a STATUS REPORT on the progress of the study at least annually on 30th September irrespective of the date of approval from the Committee as well as a FINAL REPORT with reference to intention to publish and probable journals for publication, on completion of the study.
- vi) A copy of the research report will be provided to the Committee once it is finally approved by the relevant primary party or tertiary institution, or once complete or if discontinued for any reason whatsoever prior to the expected completion date..
- vii) The Company has the right to implement any recommendations from the research.



- viii) The Company reserves the right to withdraw the approval for research at any time during the process, should the research prove to be detrimental to the subjects/ Company or should the researcher not comply with the conditions of approval.
- ix) APPROVAL IS VALID FOR A PERIOD OF 36 MONTHS FROM DATE OF THIS LETTER OR COMPLETION OR DISCONTINUATION OF THE STUDY, WHICHEVER IS THE FIRST.

We wish you success in your research.

Yours faithfully

 23/2/2016
Prof Dion du Plessis
Full member: Research Operations Committee & Medical Practitioner evaluating research applications as per Management and Governance Policy


Shannon Nell
Chairperson: Research Operations Committee
Date: 05/2/2016

This letter has been anonymised to ensure confidentiality in the research report. The original letter is available with author of research

Appendix 3: Participant information leaflet and declaration of consent by participant and investigator

PARTICIPANT INFORMATION LEAFLET AND INFORMED CONSENT FORM

RESEARCH PROJECT TITLE:

Prevalent elements related to human factors which could be associated with medication administration errors in private healthcare institutions in South Africa: *a nursing perspective*

REFERENCE NUMBER: S15/10/249

RESEARCHER: Karen Hill

ADDRESS: 6 Bishoplea Road

Claremont

Cape Town

CONTACT NUMBER: 021 480 6293 (w)

083 318 0066 (c)

You are invited to participate in a research project. It would be appreciated if you would take the time to read this information leaflet, which will explain the details of the research project. It is of great importance that you are fully satisfied that you clearly understand what the research entails and how you could be involved. Participation in this research is completely voluntary and participants are free to decline or withdraw at any time during the research with no negative comeback or recriminations.

This study has been approved by the **Committee for Human Research at Stellenbosch University** and will be conducted in accordance with the ethical guidelines and principles of the International Declaration of Helsinki, the South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

- ❖ This study is being conducted at Private Hospitals in the Western Cape and will aim to recruit a total of 284 enrolled and professional nurses

- ❖ The aim of the study is to identify the individual, institutional, environmental and team elements that are thought to be associated with medication administration errors, as self-reported by the nurses participating in the study.
- ❖ The data collected from this study will be used to make recommendations for modification or changes in work-placed structures and processes that will aid in reducing the incidence of medication administration errors.
- ❖ You will be asked to complete a questionnaire for the purpose of this study.

Why have you been invited to participate?

- ❖ As enrolled and professional nurses who are administering medication to patients, you are in a key position to understand the dynamics that impact on your clinical practice during this procedure
- ❖ By providing honest feedback, you will be assisting us in being able to create a safer working environment for the nurse and the patient.

What will your responsibilities be?

- ❖ Your responsibility will be to complete the consent form and questionnaire and post them in the sealed boxes in your department.

Who will benefit from taking part in the research?

- ❖ All nursing staff working in the chosen facilities as well as their future patients.

Are there risks involved in your participation in this research?

- ❖ There are no risks involved in your participation. Your privacy, anonymity and confidentiality are guaranteed.

What might happen if you do not agree to participate?

- ❖ There will be no comeback should you decide not to participate. The same rule will apply if you change your mind after you initially agreed to participate.

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

- ❖ You will not be paid to participate and there will be no costs to you should you agree to participate.

Is there anything else you should know?

- ❖ This study involves answering questions about the elements that are known to be associated with medication administration errors as well as questions about in-service training and education at your workplace.

DECLARATION BY PARTICIPANT

I declare that:

- ❖ I have read, or had read to me, this information leaflet and consent form.
- ❖ I have fully understood the contents of this document.
- ❖ I understand the purpose of this research project.
- ❖ I have had the opportunity to ask questions and those questions have been answered to my satisfaction.
- ❖ I understand that my participation is voluntary.
- ❖ I am aware that I may leave the study at any time without any prejudice or recriminations.

Signed at: _____ (place) Date: _____

Signature of participant

DECLARATION BY RESEARCHER

I declare that:

- ❖ I have fully explained the purpose of the research study to this participant.
- ❖ I have encouraged the participant to ask questions and taken the time to answer them.
- ❖ I am satisfied that he / she adequately understands all the aspects of the research as set out in this document.
- ❖ I did / did not use an interpreter.

Signed at: _____ (place) Date: _____

Signature of researcher

DECLARATION BY INTERPRETER

I declare that:

- ❖ I have conveyed all the facts as laid out in this document.
- ❖ All questions were answered in Xhosa

- ❖ I am satisfied that the participant fully understands the content of this informed consent document and has had all questions answered satisfactorily.

Signed at _____ (place) Date: _____

Signature of interpreter

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

AFRIKAANS

DEELNEMERINLIGTINGSBLAD EN TOESTEMMINGSVORM

TITEL VAN DIE NAVORSINGSPROJEK:

Bekende elemente van menslike faktore wat met medikasie toedienings foute kan geassosieër word in privaat gesondheidsorg institusies in Suid Afrika: *'n verpleeg perspektief*

VERWYSINGSNOMMER: S15/10/249

HOOFNAVORSER: Karen Hill

ADRES: 6 Bishoplea Straat

Claremont

7708

Wes Kaap

KONTAKNOMMER: 021 480 6293 (w)

083 318 0066 (s)

Ek is 'n student aan die Universiteit van Stellenbosch. U word genooi om deel te neem aan 'n navorsingsprojek. Dit sal hoogstens waardeer word as u asseblief hierdie inligtingsblad op u tyd deeglik deurlees aangesien die besonderhede van die navorsingsprojek daarin verduidelik word. Dit is baie belangrik dat u ten volle moet verstaan wat die navorsingsprojek behels en hoe u daarby kan baat. U deelname is ook volkome vrywillig en dit staan u vry om ter enige tyd deelname te weier. U sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om deel te neem nie. U mag ook te eniger tyd aan die navorsingsprojek onttrek, selfs al het u ingestem om deel te neem, en dat u of projek nie op enige wyse daardeur benadeel sal word nie.

Hierdie navorsingsprojek is deur die Gesondheidsnavorsingsetiekkomitee (GNEK) van die Universiteit Stellenbosch goedgekeur en sal uitgevoer word volgens die etiese riglyne en beginsels soos vervat in die Internasionale Verklaring van Helsinki en die Etiese Riglyne vir Navorsers van die Mediese Navorsingsraad (MNR).

Wat behels hierdie navorsingsprojek?

- Hierdie navorsingsprojek word uitgevoer by privaat hospitale in die Wes Kaap en beplan om `n totaal van 284 ingeskrewe en professionele verpleegsters uit te nooi vir deelname .
- Die doel van die navorsingsprojek is om die elemente met verwysing na individuele, instituut, omgewings en span binne `n werksomgewing te bepaal wat bybehorend is tot die toediening van medikasie foute as self geraporteer deur verpleegsters wat in die betrokke instansies werksaam is.
- Die data wat deur hierdie proses versamel gaan word sal gebruik word om aanbevelings te maak oor veranderings in werk strukture en prosese wat sal help omdie uitkoms te bepaal naamlik die minimiseer van medikasie foute .
- Vir hierdie navrosingsprojek sal u uitgenooi word om `n vraelys in te vul wat omtrent 15minute sal neem.

Waarom is u genooi om deel te neem?

- As ingeskrewe en geregistreede verpleegsters is u verantwoordelik vir die toediening van medikasie en dit beteken dat u in 'n unieke posisie is om te verstaan hoe die elemente binne die verpleegpraktyk medikasie toediening sal affekteer .
- Die terugvoering wat u gaan gee in die vraelys mag bydrae in die opstelling van maatreels vir `n veiliger omgewing vir die pasiënt en die verpleegster.

Wat sal u verantwoordelikhede wees?

- U verantwoordelikede sal om die vraelys in te vul en in die verseëlde kartonne in u departement te sit.

Sal u voordeel trek deur deel te neem aan hierdie navorsingsprojek?

- Die verpleegpersoneel van die hospitale en hulle pasiente sal voordeel trek deur u deelname indien die navorsingsprojek bewysings maak dat daar meer effektiewe maniere is om medikasie in die sale te kan toedien.

Is daar enige risiko's verbonde aan u deelname aan hierdie navorsingsprojek?

- Daar is geen risiko's verbonde aan u deelname. u privaatheid en identiteit gaan anonym wees en die informasie op die vraelys sal met die grootste vertroulikheid deur die navorser behandel word.

Watter alternatiewe is daar indien u nie instem om deel te neem nie?

- U sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om deel te neem nie. U mag ook te eniger tyd aan die navorsingsprojek onttrek, selfs al het u ingestem om deel te neem, en dat ek nie op enige wyse daardeur benadeel sal word nie.

Is daar enige ander inligting wat aan u oorgedra moet wees?

- Die navorsings voorstel van die navorsings projek is aangeheg. Die vraelys wat beantwoord moet word verwys na die bekende elemente wat geassosieer is met medikasie toediening foute en sluit ook vrae in oor hospitaal opleiding.

Sal u betaal word vir deelname aan die navorsingsprojek en is daar enige koste verbonde aan deelname?

- Daar is geen betaling of onkoste vir die deelnemers .

VERKLARING VAN DEELNEMER

Ek verklaar dat:

- Ek hierdie inligtings- en toestemmingsvorm gelees het of aan my laat voorlees het en dat dit in 'n taal geskryf is waarin ek vaardig en gemaklik mee is.
- Ek verstaan die doelwitte van hierdie navorsingsprojek.
- Ek geleentheid gehad het om vrae te stel en dat al my vrae bevredigend beantwoord is.
- Ek verstaan dat deelname aan hierdie navorsingsprojek vrywillig is en dat daar geen druk op my geplaas is om deel te neem nie.
- Ek te eniger tyd aan die navorsingsprojek mag onttrek en dat ek nie op enige wyse daardeur benadeel sal word nie.

Geteken te (plek / stad) _____

Datum:

Handtekening van deelnemer

VERKLARING DEUR NAVORSER

Ek verklaar dat:

- Ek die inligting in hierdie dokument and die doel van die studie deeglik aan die deelnemer verduidelik.
- Ek hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.

- Ek tevrede is dat hy/sy al die aspekte van die navorsingsprojek soos hierbo bespreek, voldoende verstaan.
- Ek 'n tolk gebruik het/nie 'n tolk gebruik het nie. (Indien 'n tolk gebruik is, moet die tolk die onderstaande verklaring teken.)

Geteken te (plek / stad) _____

Datum:

Handtekening van navorser

VERKLARING DEUR TOLK:

Ek verklaar dat:

- Ek by gestaan het om die inligting in hierdie dokument en dien ten doel van hierdie navorsingsprojek deeglik te verduidelik aan die deelnemer
- Ons hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek 'n feitelik korrekte weergawe oorgedra het van wat aan my vertel is.
- Ek tevrede is dat die deelnemer die inhoud van hierdie dokument ten volle verstaan en dat al sy/haar vrae bevredigend beantwoord is.

Geteken te (plek / stad) _____

Datum:

Handtekening van tolk

Appendix 5: Participant information leaflet and declaration of consent by participant and investigator

XHOSA

INGXELO YENTSEBENZISWANO KUNYE NESIVUMELWANO

ISIHLOKO SOPHANDO

Ukuzama ukukhusela impazamo zabantu ezayanyiswa ukunikwa kwamayeza kwizibhedlele zabucala kweli loMantsi Afrika: *kwicandelo lokonga*

AMANANI OQHAGAMSHELWANO:	S15/10/249
UMPHANDI:	Karen Hill
IDILESI:	6 Bishoplea Road, Claremont 7708 Western Cape
TSALELA LAMANANI:	021 480 6293 (emsebenzini) 083 318 0066 (umnxeba nasepokothweni)

Uyamenywa ukuba uthabathe inxaxheba koluphando. Kungumbulelo ukuba uzinike ixesha ufunde lencwadana ikwazisa ngee nkukacha zoluphando. Kubalulekile ukuba ube nolwazi oluphangaleleyo kwaye wazi nenxaxheba ozakuyithatha kulo. Awubophelelekanga ukuthatha inxaxheba ungayeka nanini na ngaphandle kwezibophelelo.

Oluphando luvunyiwe yikomiti yophando loluntu e-Stellenbosch University. Iyakulandelwa yonke imithetho nemigaqo yezophando.

Lungantoni oluphando?

- Oluphando lwenzelwe kwizibhedlele sabucala entshonqa-koloni, injongo kukuqokelela amakhulu amabini anamashumi asibhozo anesine (284) zabongikazi.
- Injongo yoluphando kukukhangela umntu okanye indawo imeko abasebenza phantsi kwayo abantu, eyayanyiswa neempazamo zokukhutshwa kwa mayeza. Kuzobe ku phathwa nqo kubongikazi abachaphazeklekayo.
- Ingxelo ezakuqokelelwa koluphando izakusetyenziswa ukutshintsha kwendlela ekusetyenzwa ngayo ukuze kuncitshiswe iimpazamo zokukhutshwa amayeza.
- uyacelwa ukuba uphendule imibuzo yoluphando.

Isizathu esibangelwa umenywe ukungenela?

- Njengo mongikazi onikezela ngamayeza kwizigulana, nguwe oyiqonda ngqo imiphumela.
- Ukunikeza kwako ingxelo iyakunceda ukuze kwakhiwe unxibelelwano phakathi ko nesi mongikazi nesigulana.

Iyakuba yintoni inxaxheba yakho?

- Inxaxheba yakho iyakuba kukugcwalisa imibuzwana uyifake ngokwe ndawo osebenza kuyo.

Ngubani ozakuzuzwa xa ethe wathatha inxaxheba koluphando?

- Abongikazi bonke abasebenza kwizibhedlele zonke ezikhethiweyo.

Bukhona na ubungozi ekuthatnyeni inxaxheba?

- Akukho ngozi ekuthatheni inxaxheba, ukhuselo lwakho luqinisekisiwe.

Kuzokwenzeka ntoni ba awuvumanga ukuthatha inxaxheba?

- Akukho kubopheleleka ukuba awuthathanga inxaxheba koluphando.

Ingaba kufuneka ndibhatale okanye ndiza kufumana umvuzo?

- Hayi akukho mali uzakuyikhupha okanye oza kuyifumana ngokuthatha kwakho inxaxheba.

Ingaba ikhona enye into ekufanele ndiyazi

- Uthando luquka ukuphendulwa kwalemibuzo kwizinto eziphathelele nempazamo ekukhutshweni kwamayeza.

ISIVUMO SOKUNGENELO

Ndiyavuma ukuba:

- Ndifundile inkcazelo
- Ndiyiqondile
- Nenjongo zayo
- Ndilifumene ithuba lokubuza imibuzo
- Ndiyaqonda ukungenela kuku zigqatsa
- Ndiyazi ndingayeka nanini na

Indawo / idolophu _____

Umhla _____

Tyikitya

ISIVUMO SETOLIKI

Ndiyavuma ukuba:

- Ndidlulisa umyalezo njengoko unjalo kweli cwecwe
- Yonke imibuzo iphendulwe ngesiXhosa
- Ndanelisekile ukuba umthathi nxaxheba uyaqonda imiba ekule ngxelo

Indawo / idolophu _____

Umhla _____

Tyikitya

Appendix 6: Data collection instrument

DATA COLLECTION QUESTIONNAIRE

PREVALENT ELEMENTS RELATED TO HUMAN FACTORS WHICH COULD BE ASSOCIATED WITH MEDICATION ADMINISTRATION ERRORS IN PRIVATE HEALTHCARE INSTITUTIONS IN SOUTH AFRICA: *A NURSING PERSPECTIVE*

INSTRUCTIONS

Thank you for participating in this study. Please read all the instructions carefully and answer all the questions as honestly as you can, ensuring not to leave any questions unanswered. On completion of the questionnaire, return it in the envelope attached. Your cooperation is greatly appreciated. All information gathered is anonymous and will be kept confidential

If you need any assistance please contact me on the number below:

Name: Ms K Hill.

Contact details: 083 318 0066

Or

Supervisor: Mrs A Damons (SU)

Contact details: damonsa@sun.ac.za

- Please answer all the questions by marking your choice with a cross (x), e.g.:

Are you a registered professional nurse?

Yes	x
No	

- The questionnaire consists of 7 pages (printed on both sides) and will take approximately 15 minutes to complete.
- Place the completed questionnaire in the self-sealing envelope provided. Post it in the sealed "questionnaires" box.

Acknowledgements: the data collection tool was compiled by selecting and combining elements stated in the WHO Patient Safety Guideline (2009), the Wakefield, Wakefield, Uden-Holden and Blegen Modified Gladstone Questionnaire (1998) and the Gladstone Drug Error Questionnaire (no date). Data collection tool based on Wakefield, Wakefield, Uden-Holman and Blegen's Modified Gladstone's Scale of Medication Errors and modified to fit current purpose with permission from the authors (see annexure 2).

SECTION A: DEMOGRAPHIC PROFILE										
1	Indicate your gender									
	1.1 Male	<input type="checkbox"/>								
	1.2 Female	<input type="checkbox"/>								
2	Indicate your current age in years									
	<input type="text"/>									
3	Indicate your nursing category									
	3.1 Registered Professional Nurse	<input type="checkbox"/>								
	3.2 Enrolled Nurse	<input type="checkbox"/>								
4	Indicate your level of nursing education									
	4.1 Enrolled Nurse Certificate	<input type="checkbox"/>								
	4.2 Diploma	<input type="checkbox"/>								
	4.3 Baccalaureate	<input type="checkbox"/>								
	4.4 Master	<input type="checkbox"/>								
	4.5 Doctorate	<input type="checkbox"/>								
5	Do you have any post basic nursing qualifications?									
	5.1 Yes	<input type="checkbox"/>								
	5.2 No	<input type="checkbox"/>								
	If yes, Specify _____									
6	How many years of post-qualification experience do you have?									
	<input type="text"/>									
7	Indicate whether you are in a full time post or work through an agency									
	7.1 Full time	<input type="checkbox"/>								
	7.2 Agency	<input type="checkbox"/>								
8	How many months did you work night duty during the last 12 months?									
	<input type="text"/>									
9	Indicate your area of work									
	9.1 Surgical ward	<input type="checkbox"/>								
	9.2 Medical ward	<input type="checkbox"/>								
	9.3 Paediatric ward	<input type="checkbox"/>								
	9.4 Intensive care unit	<input type="checkbox"/>	SICU	<input type="checkbox"/>	CCU	<input type="checkbox"/>	PICU	<input type="checkbox"/>	NNU	<input type="checkbox"/>

SECTION B: ELEMENTS ASSOCIATED WITH MEDICATION ADMINISTRATION ERRORS

The elements listed below are all potentially associated with medication administration errors.

Please read them carefully and give each one a score them according to the frequency you think they are associated with these errors.

Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors. Choose only one option per statement by marking the appropriate column with a cross (x)

NO.	Environmental Elements	Rarely affect	Regularly affect	Commonly affect
B1	Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	[1]	[2]	[3]
10	Medication rounds are conducted using an inadequate working surface			
11	Nurses are distracted whilst administering medication			
12	There are insufficient resources available for the nurses to confirm the medications			
13	There is insufficient training in the use and management of infusion devices			
14	Labels for look-a-like sound-a-like medication are inadequate			
15	Labels for high risk medication are inadequate			
16	Medication was dispensed incorrectly by the pharmacy			
17	The medication failed to arrive from the pharmacy timeously			
18	A high patient – nurse workload			
19	It is difficult to find someone to double check medication prior to administration			

20	The shift leader is unavailable for consultation and guidance			
21	The nurse gets called away to care for patients she was not allocated to			
22	Work pressure results in the nurse running out of time before handing over to the next shift			
NO. B2	Organisational Elements Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
23	Management are actively involved in incident management			
24	Management encourage incident reporting			
25	The hospital has a clear incident reporting policy			
26	Management monitor medication related incidents			
27	Management give staff feedback about the incidents that have been reported			
28	Medication related policies are not adhered to			
29	Nursing staff are aware of the role they play in incident management			
30	Physicians use abbreviations that are not known			
31	Prescriptions are illegible / difficult to read			
NO. B3	Team Elements: Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]

32	The leader is not actively involved in nursing activities in the department			
33	The shift leader is not available for consultation and guidance			
34	It is difficult to find an appropriate person to double check medication with			
35	The nurse – patient ratio results in too heavy a workload			
36	The team leader is unfamiliar with medication policy and practice			
37	Nurses are called to administer medication to patients they are unfamiliar with			
38	Work pressure results in work not being completed before the end of the shift			
39	Work pressure results in handover to the next shift being rushed and incomplete			
NO. B3	Team Elements: Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
40	Physicians change prescription orders without informing the nurse			
41	There is a lack of training in adverse drug reactions			
42	Verbal / telephonic prescription orders are unclear			

43	The physician prescribes the incorrect dose			
NO. B4	Individual Elements: Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
44	Nurses are tired and exhausted			
45	Nurses are distracted when administering medication			
46	Nurses are inexperienced in medication administration			
47	Nurses are unfamiliar with handling medication			
48	Nurses are unable to calculate dosages			
49	Nurses are unable to calculate dilutions			
50	Nurses are unable to calculate flow rates			
51	Staff are unable to work the infusion devices			
52	Nurses fail to ensure that they administer medication to the right patient			
53	Nurses fail to ensure that they administer the correct medication			
54	Nurses fail to ensure that the administer the correct medication dose			
55	Nurses fail to ensure that they administer medication at the correct time			

56	Nurses fail to ensure that they administer medication at the correct intervals			
57	Nurses fail to ensure that they administer medication via the correct route			
58	Other factors not identified: (please specify)			

NO. C	In my work environment.....	Yes	No	Uncertain
59	Medication administration is included in the orientation and induction programme of the ward/unit			
60	Formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months			
61	I have received in-formal in-service training (on the job training) regarding medication administration during the last 12 months			
62	A policy on medication administration is available in the ward/unit			
63	Standard operating procedures on medication administration are available in the ward/unit			
64	Audits are conducted in the ward/unit to evaluate medication administration practices			
65	Feedback on audit outcomes regarding medication administration practices is given to ward/unit staff			

Question 66

Do you have any suggestions regarding medication administration practices or training?

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

Appendix 7: Permission for use of an existing instrument

From: "Wakefield, Douglas" <wakefieldds@health.missouri.edu>
Date: 02 August 2015 at 17:45:48 SAST
To: Karen Hill <karenatmousehouse@gmail.com>
Subject: RE: Request for medication error research tool

Hi Karen,

We would be happy to let you use our tool if you find it helpful. Attached are several of the MAE related papers. The tool is described in them.

Best wishes and good luck in your graduate work.

Best regards,

Doug Wakefield

Douglas S. Wakefield, PhD
Director, Center for Health Care Quality
CE548, One Hospital Drive
The University of Missouri
Columbia, MO 65212
Telephone: 573-882-6578
Email: wakefielddo@health.missouri.edu

From: **Wakefield, Douglas** <wakefieldds@health.missouri.edu>
Date: Tue, Oct 20, 2015 at 9:35 PM
Subject: RE: Request for validity review of data collection questionnaire
To: Karen Hill <karenatmousehouse@gmail.com>

Hi Karen.

I only had a couple of minutes but took a quick look at the MAE survey. I have used change tracker to insert a couple of comments.

Hope this is helpful

Sincerely

DSW

Douglas S. Wakefield, PhD
Director, Center for Health Care Quality
Professor Emeritus, HMI
CE548, One Hospital Drive
The University of Missouri
Columbia, MO 65212
Telephone: [573-882-6578](tel:573-882-6578)
email: wakefielddo@health.missouri.edu

From: Karen Hill [mailto:karenatmousehouse@gmail.com]
Sent: Tuesday, October 20, 2015 1:24 PM
To: Wakefield, Douglas <wakefieldds@health.missouri.edu>
Subject: Request for validity review of data collection questionnaire

Dear Professor Wakefield,

I realise that it is a while since you kindly gave me permission to make use of your data collection questionnaire and I now have a deep understanding of just how challenging conducting research is.

I have had to revise my proposal to fit our local context and that has resulted in me having to design a new questionnaire making use of your tool as a guideline.

I am now at the point where I need to ask experts in the field to review the questionnaire in terms of the specified aspects of validity.

In light of this I was wondering if it would be at all possible that you might consider, should you have the time, reviewing the attached questionnaire. I have also added a validity questionnaire that can be completed.

I trust this is not an imposition and I will understand should you not be able to assist.

Kindest regards,

Karen Hill

6 Bishoplea Road,

Claremont. Cape.7708. South Africa

Mobile: 083 318-0066

Appendix 8: Declaration of language editor

TO WHOM IT MAY CONCERN.

This is to certify that I have proofed and suggested corrections for medical accuracy, grammar and spelling in the Thesis document provided by Karen Jane Hill,

Signed



11 AUGUST, 2016

Robert Wayne Webster

Editor-in-Chief (Retired), Medical Education Network – New York City, NY.

9 Castleview Road,

Constantia, Western Cape, RSA. 7806

021 712-0926.

Appendix 9: Declaration of technical editor

Woodley's Literary Services

16 Herschel Walk
Wynberg 7800

Tel (021) 762 3965

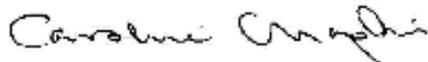
Fax (021) 761 8666

e-mail: caroline@woodleys.co.za

19.08.2016

To whom it may concern

This is to certify that the thesis entitled "Prevalent elements related to human factors which could be associated with medication administration errors in private healthcare institutions in South Africa: A nursing perspective" by Karen Jane Hill has been edited by a professional editor.



Caroline Chaplin (B.Com., M.Phil.)

Member: Professional Editors Guild

TEL: 021 762 3965 FAX: 021 761 8666
16 HERSCHEL WALK WYNBERG CAPE TOWN
CC NO. 2010/071473/23

Appendix 10: Expert validity reports

Feedback reviewer 1

Prevalent elements related to human factors which could be associated with medication administration errors in a private healthcare institution in South Africa: a nursing perspective

Validity	Definition	Comments
Content	The degree to which the measurement instrument examines all the major elements of the concept being measured	Depends on the <u>theoretical basis</u> for assuming that the test is assessing all domains of a certain criterion; Concept / criterion? Is the theoretical basis enough / sufficient?
Construct	An examination to determine if the instrument measures what it intends to measure	Measuring of “<u>intelligence</u>” – is the questionnaire measuring what the theory says they do? To what extend is the questionnaire actually measuring “intelligence?”
Face	Verifies that the instrument appears to measure what it is intended to measure	Measuring a <u>certain criterion</u> Concept / criterion?

Validity report on research study data questionnaire

Feedback by Cornelia Hendrika van Velden:

- B Soc SC Nursing Degree: general, maternity, community, psychiatry;
- Diploma: Critical Care Nursing;
- Advance Diploma: Health Science Education
- LLB Degree (currently 2nd year articles: Candidate Attorney.

Reviewer number 2:**From:** Maletje Griesel (B.Pharm, M.Pharm)**Sent:** 23 October 2015 12:43 PM**To:** Suzanne Wortley**Subject:** Validity questionnaire.docx

Hello Zarn

I have completed the validity questionnaire.

Have a good day

M

Feedback:

Prevalent elements related to human factors which could be associated with medication administration errors in a private healthcare institution in South Africa: a nursing perspective

Validity report on research study data questionnaire

Validity	Definition	Comments
Content	The degree to which the measurement instrument examines all the major elements of the concept being measured	The content of the questionnaire is relevant and can be used in the hospital as a survey to improve the understanding of medication related errors by nursing. It covers a variety of variables that have an impact on the correct administration of medication.
Construct	An examination to determine if the instrument measures what it intends to measure	The aim is to understand what factors contribute to medication errors and this survey addresses a variety of factors, therefore measures what it intends to.

Face	Verifies that the instrument appears to measure what it is intended to measure	This tool empowers the researcher to get a clear understanding what it is intended to measure. It is well presented and easy to read and understand what is expected of the person completing this survey.
------	--	---

Reviewer number 3:**FEEDBACK:**

Prevalent elements related to human factors, which could be associated with medication administration errors in a private healthcare institution in South Africa: a nursing perspective

Validity report on research study data questionnaire

Validity	Definition	Comments
Content	The degree to which the measurement instrument examines all the major elements of the concept being measured	The content appears to provide an adequate and representative sample of the construct being measured. A possible additional question for B1 Environmental Factors: labels for high risk medication are not easily accessible
Construct	An examination to determine if the instrument measures what it intends to measure	The evidence of the data questionnaire being based on previous data collection tools utilised in previous studies as well as the content validity of this

		instrument contributes to the evidence of construct validity.
Face	Verifies that the instrument appears to measure what it is intended to measure	At face value the instrument appears to measure what it is intended to measure.

Suzanne Wortley

RPN, Midw, Paeds, CCRN, DNE, MCUR

Appendix 11: Pilot study MAE research questionnaire

ANNEXURE 1

DATA COLLECTION QUESTIONNAIRE

PREVALENT ELEMENTS RELATED TO HUMAN FACTORS WHICH COULD BE ASSOCIATED WITH MEDICATION ADMINISTRATION ERRORS IN PRIVATE HEALTHCARE INSTITUTIONS IN SOUTH AFRICA: A NURSING PERSPECTIVE

INSTRUCTIONS

Thank you for participating in this study. Please read all the instructions carefully and **answer all** the questions as honestly as you can, ensuring not to leave any questions unanswered. On completion of the questionnaire, return it in the envelope attached. Your cooperation is greatly appreciated. All information gathered is anonymous and will be kept confidential

If you need any assistance please contact me on the number below:

Name: Ms K Hill.

Contact details: 083 318 0066

Or

Supervisor: Mrs A Damons (SU)

Contact details: damonsa@sun.ac.za

- 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 (printed on both sides) and will take approximately 15 minutes to complete.
- Place the completed questionnaire in the self-sealing envelope provided. Post it in the sealed “completed research questionnaires” box.

Acknowledgements: the data collection tool was compiled by selecting and combining elements stated in the WHO Patient Safety Guideline (2009), the Wakefield, Wakefield, Uden-Holden and Blegen Modified Gladstone Questionnaire (1998) and the Gladstone Drug Error Questionnaire (no date). Data collection tool based on Wakefield, Wakefield, Uden-Holman and Blegen’s Modified

Gladstone's Scale of Medication Errors and modified to fit current purpose with permission from the authors (see annexure 2).

SECTION A: DEMOGRAPHIC PROFILE											
1	Indicate your gender <table border="1"> <tr> <td>1.1 Male</td> <td><input type="checkbox"/></td> </tr> <tr> <td>1.2 Female</td> <td><input type="checkbox"/></td> </tr> </table>	1.1 Male	<input type="checkbox"/>	1.2 Female	<input type="checkbox"/>						
1.1 Male	<input type="checkbox"/>										
1.2 Female	<input type="checkbox"/>										
2	Indicate your current age in years <input type="text"/>										
3	Indicate your nursing category <table border="1"> <tr> <td>3.2 Registered Professional Nurse</td> <td><input type="checkbox"/></td> </tr> <tr> <td>3.2 Enrolled Nurse</td> <td><input type="checkbox"/></td> </tr> </table>	3.2 Registered Professional Nurse	<input type="checkbox"/>	3.2 Enrolled Nurse	<input type="checkbox"/>						
3.2 Registered Professional Nurse	<input type="checkbox"/>										
3.2 Enrolled Nurse	<input type="checkbox"/>										
4	Indicate your level of nursing education <table border="1"> <tr> <td>4.1 Enrolled Nurse Certificate</td> <td><input type="checkbox"/></td> </tr> <tr> <td>4.6 Diploma</td> <td><input type="checkbox"/></td> </tr> <tr> <td>4.7 Baccalaureate</td> <td><input type="checkbox"/></td> </tr> <tr> <td>4.8 Master</td> <td><input type="checkbox"/></td> </tr> <tr> <td>4.9 Doctorate</td> <td><input type="checkbox"/></td> </tr> </table>	4.1 Enrolled Nurse Certificate	<input type="checkbox"/>	4.6 Diploma	<input type="checkbox"/>	4.7 Baccalaureate	<input type="checkbox"/>	4.8 Master	<input type="checkbox"/>	4.9 Doctorate	<input type="checkbox"/>
4.1 Enrolled Nurse Certificate	<input type="checkbox"/>										
4.6 Diploma	<input type="checkbox"/>										
4.7 Baccalaureate	<input type="checkbox"/>										
4.8 Master	<input type="checkbox"/>										
4.9 Doctorate	<input type="checkbox"/>										
5	Do you have any post basic nursing qualifications? <table border="1"> <tr> <td>5.3 Yes</td> <td><input type="checkbox"/></td> </tr> <tr> <td>5.4 No</td> <td><input type="checkbox"/></td> </tr> </table> If yes, Specify: _____ _____ _____	5.3 Yes	<input type="checkbox"/>	5.4 No	<input type="checkbox"/>						
5.3 Yes	<input type="checkbox"/>										
5.4 No	<input type="checkbox"/>										
6	How many years of post-qualification experience do you have? <input type="text"/>										
7	Indicate whether you are in a full time post or work through an agency <table border="1"> <tr> <td>7.3 Full time</td> <td><input type="checkbox"/></td> </tr> <tr> <td>7.4 Agency</td> <td><input type="checkbox"/></td> </tr> </table>	7.3 Full time	<input type="checkbox"/>	7.4 Agency	<input type="checkbox"/>						
7.3 Full time	<input type="checkbox"/>										
7.4 Agency	<input type="checkbox"/>										
8	How many months did you work night duty during the last 12 months? <input type="text"/>										
9	Indicate your primary area of work <table border="1"> <tr> <td>9.5 Surgical ward</td> <td><input type="checkbox"/></td> </tr> <tr> <td>9.6 Medical ward</td> <td><input type="checkbox"/></td> </tr> <tr> <td>9.7 Paediatric ward</td> <td><input type="checkbox"/></td> </tr> </table>	9.5 Surgical ward	<input type="checkbox"/>	9.6 Medical ward	<input type="checkbox"/>	9.7 Paediatric ward	<input type="checkbox"/>				
9.5 Surgical ward	<input type="checkbox"/>										
9.6 Medical ward	<input type="checkbox"/>										
9.7 Paediatric ward	<input type="checkbox"/>										

	9.8 Maternity ward						
	9.9 Intensive care unit	SICU		CCU		PICU	NNU

SECTION B: ELEMENTS ASSOCIATED WITH MEDICATION ADMINISTRATION ERRORS

The elements listed below are all potentially associated with medication administration errors.

Please read them carefully and give each one a score them according to the frequency you think they are associated with these errors.

Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors. Choose only one option per statement by marking the appropriate column with a cross (x)

NO. B1	Environmental Elements: related to medication administration Score guideline: rarely affect[1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
10	medication rounds are conducted using an inadequate working surface			
11	nurses are distracted whilst administering medication			
12	there are insufficient resources available for the nurses to confirm the medications			
13	there is insufficient training in the use and management of infusion devices			
14	labels for look-a-like sound-a-like medications are inadequate			
15	labels for high risk medication are inadequate			
16	medication was dispensed incorrectly by the pharmacy			
17	the medication failed to arrive from the pharmacy timeously			
18	a high patient – nurse workload			
19	it is difficult to find someone to double check medication prior to administration			
20	the shift leader is unavailable for consultation and guidance			

21	the nurse gets called away to care for patients she was not allocated to			
22	work pressure results in the nurse running out of time before handing over to the next shift			
NO. B2	Organisational Elements: related to management process Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
23	management are actively involved in incident management			
24	management encourage incident reporting			
25	the hospital has a clear incident reporting policy			
26	management monitor medication related incidents			
27	management give staff feedback about the incidents that have been reported			
28	medication related policies are not adhered to			
29	nursing staff are aware of the role they play in incident management			
30	physicians use abbreviations that are not known			
31	prescriptions are illegible / difficult to read			
NO. B3	Team Elements: Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
32	the leader is not actively involved in nursing activities in the department			
33	the shift leader is not available for consultation and guidance			
34	it is difficult to find an appropriate person to double check medication with			
35	the nurse – patient ratio results in too heavy a workload			
36	the team leader is unfamiliar with medication policy and practice			
37	nurses are called to administer medication to patients they are unfamiliar with			

38	work pressure results in work not being completed before the end of the shift			
39	work pressure results in handover to the next shift being rushed and incomplete			
NO. B3	Team Elements: Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
40	physicians change prescription orders without informing the nurse			
41	there is a lack of training in adverse drug reactions			
42	verbal / telephonic prescription orders are unclear			
43	the physician prescribes the incorrect dose			
NO. B4	Individual Elements: related to nursing care Score guideline: rarely affect [1]; regularly affect [2]; commonly affect [3] medication administration errors	Rarely affect [1]	Regularly affect [2]	Commonly affect [3]
44	nurses are tired and exhausted			
45	nurses are distracted when administering medication			
47	nurses are inexperienced in medication administration			
48	nurses are unfamiliar with handling medication			
49	nurses are unable to calculate dosages			
50	nurses are unable to calculate dilutions			
51	nurses are unable to calculate flow rates			
52	staff are unable to work the infusion devices			
53	nurses fail to ensure that they administer medication to the right patient			
54	nurses fail to ensure that they administer the correct medication			
55	nurses fail to ensure that they administer the correct medication dose			

56	nurses fail to ensure that they administer medication at the correct time			
57	nurses fail to ensure that they administer medication at the correct intervals			
58	nurses fail to ensure that they administer medication via the correct route			
59	Other elements not identified: (please specify)			

SECTION C: ELEMENTS RELATING TO THE ROLE EDUCATION AND TRAINING PLAY IN MEDICATION ADMINISTRATION

Choose only one option per statement by marking the appropriate column with a cross (x)

NO. C	In my work environment.....	Yes	No	Uncertain
60	medication administration is included in the orientation and induction programme of the ward/unit			
61	formal in-service training (e.g. lecture) regarding medication administration has been conducted during the last 12 months			
62	I have received in-formal in-service training (on the job training) regarding medication administration during the last 12 months			
63	a policy on medication administration is available in the ward/unit			
64	standard operating procedures on medication administration are available in the ward/unit			
65	audits are conducted in the ward/unit to evaluate medication administration practices			
66	feedback on audit outcomes regarding medication administration practices is given to ward/unit staff			

Question 67

Do you have any suggestions regarding medication administration practices or training?

Thank you for your willingness to participate in this research study. Place the completed questionnaire in the self-sealing envelope provided and post it in the “completed research questionnaires” box.

Annexure 12: Declaration of Xhosa translation of participant consent form



25 January 2016

Ms Karen Hill

Dear Ms Hill

The Stellenbosch University Language Centre hereby confirms that we have edited the isiXhosa version of your participant information leaflet and informed consent form as provided. We compared the isiXhosa version as provided against the English source text and used MS Word's tracked changes function, as well as comments, to indicate all the changes to the isiXhosa consent form. Problems with the isiXhosa were explained in comments.

Please contact me if you have any questions.

Regards

MvdWaal

Marguerite van der Waal
Head: Language Services
Stellenbosch University Language Centre
Tel: 021 808 3096
Fax: 021 808 2863
E-mail: mvdwaal@sun.ac.za

Annexure 13: Declaration of Afrikaans translation of study abstract



16 August 2016

Ms Karen Hill

Dear Ms Hill

The Stellenbosch University Language Centre hereby confirms that we have translated your thesis abstract from English to Afrikaans.

Please contact me if you have any questions.

Regards

MvdWaal

Marguerite van der Waal
Head: Language Services
Stellenbosch University Language Centre
Tel: 021 808 3096
Fax: 021 808 2863
E-mail: mvdwaal@sun.ac.za

Appendix 14: Confirmation of statistical assistance for research study

Hi Karen

Thanks for the email, I can see the proposal is greatly improved, well done. Thus far you have three categories (1,2,3 respectively), rarely effects, regularly effects and commonly effects – if you are then going to use this measure as the outcome (per domain and overall) then we can estimate a sample size for one of these measures. For example, if you think 20% of the participants will respond with commonly effects (3) then we can estimate with what precision you would like to estimate that outcome in the population (ie the 95% Confidence interval: eg. 5-10%% around the 20% you estimate).

It would be more useful to calculate it for overall, thus overall (across all domains) you think that 20% of participants will respond to commonly effects (thus you are making the outcome binary). Just a note that the data analysis section should describe how you will analyse the outcomes and how it will be calculated. Think of what exactly you are going to put into your excel spreadsheet and how you are going to summarise that. I.e. 1 = rarely effects, 2=... 3=commonly effects. Then you will tabulate the proportion of responses for each statement and take the median response per domain.

For example if you suspect 20% of the participants will select commonly effects (overall) and you want to be 95% certain that that value lies within 5% either side then the sample size would be 246. Quite obtainable. I used this site to calculate it. <http://www.openepi.com/SampleSize/SSPropor.htm>

If you are uncertain of what the estimate might be , then use your best clinical judgement or refer to a similar studies results that have used this tool.

Kind regards,

Michael

Sent: 28 September 2015 07:44 AM

To: Mccaul, MG, Mnr <mmccaul@sun.ac.za> <mmccaul@sun.ac.za>

Cc: Damons, A, Mrs <damonsa@sun.ac.za> <damonsa@sun.ac.za>

Subject: RE: Research proposal

Importance: High

Good morning Michael,

We have now remodelled my population and sampling and I am soon to present to the MTut.

Would it be possible for you to have a look at the population and assist me with identifying how many I should target to ensure I have sufficient for the study?

Kind regards,

Karen

[Esterhuizen, ME, Mev <lesterhuizen@sun.ac.za>](mailto:lesterhuizen@sun.ac.za)

Dear Liesel

As below, could you please provide Karen with the requested letter. Karen, well done, and I hope to see the final product in a publication!

Kind regards,

Michael

From: Karen Hill

Sent: 10 August 2016 08:17 AM

To: Mccaal, MG, Mnr <mmccaal@sun.ac.za> <mmccaal@sun.ac.za>

Subject: Confirmation report request

Importance: High

Hello Michael,

I hope you are well and enjoyed a day of sunshine and rest yesterday.

I am pleased to be able to say that my writing is done ☺ and I am busy putting together the final product.

On that note, would it be possible for you to provide me with a note that has your department letterhead and confirms that you conducted the statistical analysis for my research.

I would be most appreciative (I know you are extremely busy).

Thank you and kind regards,

Karen

Appendix 15: Confirmation of post marking editing

To whom it may concern.

This is to certify that the thesis document has been examined for technical and grammatical accuracy as of this date.

24th October, 2016.

A handwritten signature in black ink, appearing to read 'R. Webster', with a long horizontal stroke extending to the right.

Robert Wayne Webster - 9 Castleview Rd., Constantia. 7806. RSA.