

Assessment of bridging students' access to and utilisation of resources to ensure safe medication administration in a private hospital group in Southern Africa.

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Master of Nursing Science in the Faculty of Medicine and Health Sciences at
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DECLARATION

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ABSTRACT

Medication-related errors are a global concern, leading to unnecessary and avoidable harm to patients, families, healthcare workers and healthcare facilities. Errors can occur during the prescription, dispensing, preparation and administration of medication as well as during observation after administration of medication. The nurse responsible for administration of medication is the last person in this chain of events (prescription, dispensing and administration) to prevent any medication errors from reaching the patient, and the first person to detect any unwanted effects of administered medications.

The purpose of this study was to determine 2nd year bridging students' access to and utilisation of available information sources to ensure safe medication administration in a private hospital group in Southern Africa.

Knowles' assumptions of adult learners being self-directed and motivated to learn new information relevant to their personal lives or jobs were utilised in the conceptual framework for this study.

A quantitative approach with a descriptive design in the format of a survey was applied to this study. The target population was initially (N=190) second year students. However, (n=87) participants were excluded as they were not available at the time of data collection. Therefore, an all-inclusive sample of (n=103) participants was included for this study. A self-administered questionnaire with Likert items and one open-ended question were utilised. This instrument was tested during a pilot test involving (n=15) participants. The results of the pilot test was excluded from the main study

Data was entered into a Statistical Package for Social Sciences (SPSS) spreadsheet and was analysed by an experienced biostatistician from the University of Stellenbosch. Descriptive and inferential tests were applied for the data analysis.

Results revealed that medication information resources are available in all selected settings. However, these resources were under-utilised in the clinical settings and also during training on pharmacology and medication.

Some participants acknowledged that they had never consulted the pharmacist n=19 (18.4%), Monthly Index of Medical Specialities (MIMS) or South African Medicines Formulary (SAMF) n=5 (4.9%), other sources e.g. articles n=18 (17.8%), prescribing physician n=19 (18.6%) and medication package inserts n=8 (8%). Due to a growing number of medications available under different brand names, pharmacists frequently dispense a more economic generic equivalent of the prescribed medication. Nurses therefore need to consult medication information sources on a regular basis, to ensure that medication dispensed is the generic equivalent of medication prescribed.

Results regarding the utilisation of different study methods and information sources for studies on pharmacology and medications also revealed that the majority n=65 (63.1%) of participants were not self-directed and preferred lectures for studies on these subjects.

To conclude, the results of the final section referring to the knowledge of frequently administered medications showed that the majority of participants n=30 (88.24%), n=30 (88.24%) and n=32 (91.42%) respectively, had adequate knowledge of the classification of the following medications: Enoxaparin sodium (Clexane), Paracetamol intravenous infusion, (Perfalgen) and Tramadol (Tramazac).

The researcher recommends that further studies with a qualitative design to explore the reasons behind the under-utilisation of available resources, should be conducted.

OPSOMMING

Medikasie-verwante foute is 'n wêreldwye probleem wat kan lei tot onnodige en voorkombare leed en skade aan pasiënte, families, gesondheidsorgwerkers en instansies waar hierdie foute plaasvind. Medikasie foute sluit in foute tydens die voorskryf, uitreik, voorbereiding en toedien van medikasie, asook tydens waarneming na toediening van medikasie. Die verpleegkundige is die laaste persoon in hierdie reeks van opeenvolgende gebeure (voorskryf, uitreik, voorbereiding en toediening) wat kan voorkom dat medikasie foutief toegedien word, asook die eerste persoon wat ongewenste medikasie-effekte kan waarneem.

Die doel van hierdie studie was om te bepaal of 2de jaar oorbruggingstudente toegang het tot inligtingsbronne oor medikasie, en hoe gereeld beskikbare bronne benut word om veilige medikasie toediening te verseker in 'n privaat hospital grope in Suidelike Afrika/

Knowles se teorie oor volwasse onderrig in sy aanname dat volwasse leerders selfgerig en gemotiveerd is om inligting wat betrekking het op hul daaglikse lewe en werk self te ondersoek en te implementeer, is aangewend in die konseptuele raamwerk van hierdie studie.

'n Kwantitatiewe benadering met 'n beskrywende ontwerp is deur middel van 'n meningsopname gekies vir hierdie studie. Die totale populasie tweedejaar studente was aanvanklik (N=190). Aangesien (n=87) studente nie beskikbaar was tydens die data-insamelingsperiode nie, was hulle uitgesluit van die studie. Gevolglik is 'n alomvattende steekproef (n=103) gebruik vir hierdie studie, waarin 'n selfgeadministreerde vraelys met Likert- items en een oopvraag aangewend is. Hierdie vraelys is gedurende 'n loodsondersoek met (n=15) studente beproef. Resultate van die loodsondersoek is uitgesluit van die hoof studie.

Data van hierdie studie is in 'n 'Statistical Package for Social Sciences (SPSS)' sigbladprogram gevoer, en 'n ervare biostatistikus aan die Universiteit van

Stellenbosch is geraadpleeg tydens data-analise waartydens beskrywende en inferensiële ontledings toegepas is.

Resultate het aangedui dat medikasie inligtingsbronne beskikbaar was in al die areas wat ingesluit is in die studie, maar dat hierdie bronne onderbenut word in die kliniese areas, sowel as tydens opleiding in farmakologie en medikasie.

Sommige deelnemers het aangedui that hulle nooit 'n apteker n=19 (18.4%), 'Monthly Index of Medical Specialities' (MIMS) of 'South African Medicines Formulary' (SAMF) n= 5(4.9%), ander bronne bv. artikels n=18 (17.8%), dokter n=19 (18.6%) of medikasie voubiljet n=8 (8%) raadpleeg met navrae oor medikasie nie. As gevolg van 'n stygende aantal medikasies beskikbaar onder verskillende handelsname, word voorgeskrewe medikasie gereeld deur aptekers vervang met goedkoper generiese medikasie met gelykstaande werking. Verpleegkundiges moet dus gereeld medikasie inligtingsbronne raadpleeg om te verseker dat beskikbare generiese medikasie wat toegedien word, die ekwivalent van voorgeskrewe medikasie is.

Resultate met betrekking tot die benutting van verskillende studie-metodes en inligtingsbronne tydens farmakologie en medikasie studies, het voorts aangedui dat die meerderheid deelnemers n=65 (63.1%) nie selfgerig is nie, en dat hulle formele lesings oor farmakologie en medikasie verkies bo ander studie-metodes.

Laastens het die afdeling oor kennis van medikasie wat daaglik toegedien word, aangedui dat die meeste deelnemers n=30 (88.24%), n=30 (88.24%) en n=32 (91.42%) onderskeidelik voldoende kennis het oor die klassifikasie van die volgende medikasies: Enoxaparin natrium (Clexane), Paracetamol binnearse infusie, (Perfalgen) en Tramadol (Tramazac).

Verdere studies met 'n kwalitatiewe benadering waarin die redes vir die onderbenutting van beskikbare inligtingsbronne ondersoek word, word deur die navorser aanbeveel.

DEDICATION

This thesis is dedicated to my husband, Peet, who urged me to start this journey. My children, Nico, Jaco, Carlene, Odie and Angelique who encouraged me and never doubted my ability to complete this journey and my granddaughter, Emma, whose frequent visits always were a welcome interruption.

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TABLE OF CONTENTS

DECLARATION	i
ABSTRACT	ii
OPSOMMING	iv
DEDICATION	vi
ACKNOWLEDGEMENTS	vii
TABLE OF CONTENTS.....	viii
LIST OF TABLES	xiii
LIST OF FIGURES.....	xiv
LIST OF APPENDICES	xv
LIST OF ABBREVIATIONS	xvi
CHAPTER 1 FOUNDATION OF THE STUDY	1
1.1 Introduction	1
1.2 Rationale	1
1.3 Problem statement	3
1.4 Research question	4
1.5 Research aim	5
1.6 Research objectives	5
1.7 Research methodology	5
1.7.1 Research design	5
1.7.2 Population and sampling	6
1.7.2.1 Inclusion criteria	6
1.7.2.2 Exclusion criteria	6
1.7.3 Instrumentation	7
1.7.4 Pilot test	7
1.7.5 Reliability and validity	7
1.7.6 Data collection	7
1.7.7 Data analysis	8
1.7.8 Ethical considerations	8
1.7.8.1 Respect for persons	8
1.7.8.2 Beneficence	9
1.7.8.3 Justice	10
1.7.9 Limitations	11
1.7.9.1 Pilot test	11
1.7.9.2 Study sample size	11

1.8 Conceptual framework	11
1.9 Operational definitions	12
1.10 Duration of the study	12
1.11 Chapter outline	13
1.12 Summary	14
1.13 Conclusion	14
CHAPTER 2 LITERATURE REVIEW	15
2.1 Introduction	15
2.2 Reviewing and presenting the literature.....	16
2.3 Findings from the literature	16
2.3.1 Frequency of medication errors	17
2.3.2 Factors influencing medication administration errors.....	18
2.3.2.1 Underdeveloped skills	18
2.3.2.2 Look alike, sound alike medications	19
2.3.2.3 Generic substitution	19
2.3.2.4 System errors.....	19
2.3.3 Nurse education	19
2.3.3.1 Theoretical preparation	20
2.3.3.2 Simulation	22
2.3.3.3 Practical exposure in the Clinical setting	22
2.3.3.4 Registered nurses as role models for students	25
2.3.3.5 Continuous education to ensure medication safety.....	27
2.3.4 Generic substitution.....	27
2.3.5 Information sources.....	28
2.3.6 State of affairs in South Africa.....	29
2.4 Conceptual framework	30
2.4.1 Contribution of focus areas in conceptual framework	31
2.4.1.1 Demographic data of the enrolled nurse.....	31
2.4.1.2 Clinical setting	32
2.4.1.3 Academic setting.....	32
2.5 Conclusion	33
CHAPTER 3 RESEARCH METHODOLOGY.....	34
3.1 Introduction	34
3.2 Study setting	34
3.3 Research design	35
3.4 Population and sampling.....	35
3.4.1 Inclusion criteria	36
3.4.2 Exclusion criteria	37
3.5 Instrumentation	37

3.5.1 Section A: Demographic data	39
3.5.2 Section B: Resources available and utilised in the clinical setting.....	39
3.5.3 Section C: Utilisation of medication information resources in the academic setting.....	39
3.5.4 Section D: Knowledge of medication	39
3.6 Pilot test	40
3.7 Reliability and validity.....	42
3.7.1 Reliability	42
3.7.2 Validity.....	43
3.8 Data collection process	43
3.9 Data preparation	44
3.10 Data analysis.....	45
3.11 Response rate to questionnaires	46
3.12 Summary.....	46
CHAPTER 4 DATA ANALYSIS, INTERPRETATION AND DISCUSSION	48
4.1 Introduction	48
4.2 Presenting the study findings	48
4.3 Section A: Biographical data.....	49
4.3.1 Question 1: Your gender (n=103).....	49
4.3.2 Question 2: Your age (n=103).....	49
4.3.3 Question 3: Access to internet at home (n=103).....	50
4.3.4 Question 4: Duration of employment as enrolled nurse (n= 103)	51
4.3.5 Question 5: Areas where students spent the longest time (n=103).....	51
4.4 Section B: Clinical setting	52
4.4.1 Question 6: Internet access at work (n=103)	52
4.4.2 Question 7: Average amount of hours spent on medication administration (n=103).....	53
4.4.3 Question 8: Access to a pharmacist after hours and over weekends (n=102)	54
4.4.4 Question 9: Availability of medication resources in the ward (n=103)	55
4.4.5 Question 10 - 15: Utilisation of medication information resources.....	56
4.4.5.1 Question 10: Consulting a registered nurse with queries about prescribed medication during medication administration rounds (n=102).....	57
4.4.5.2 Question 11: Consulting a pharmacist with queries about prescribed medication during medication administration rounds (n=103).....	57
4.4.5.3 Question 12: Consulting resources, e.g. MIMS or SAMF during medication administration rounds (n=103)	57
4.4.5.4 Question 13: Consulting other sources for information about new medications (n=103)	58
4.4.5.5 Question 14: Consulting the prescribing physician with queries about prescribed medication during medication administration rounds (n=103).....	58
4.4.5.6 Question 15: Consulting package insert of patients' home medication during medication administration rounds (n=100).....	59

4.4.6 Question 16: Providing health education to patients about medication during medication administration rounds (n=103)	60
4.5 Section C: Academic setting (Learning centre)	61
4.5.1 Questions 17 - 20: Preferred study methods for pharmacology and medication studies ...	61
4.5.1.1 Question 17: Formal lectures on pharmacology and medications (n=103)	61
4.5.1.2 Question 18: Group work on pharmacology and medications (n=101)	61
4.5.1.3 Question 19: Self-study for pharmacology and medication (n=102)	62
4.5.1.4 Question 20: Discussions on pharmacology and medication (n=103)	62
4.5.2 Questions 21 – 24: Information sources used for studies on pharmacology and medication	63
4.5.2.1 Question 21: Preference for textbooks (n=101).....	63
4.5.2.2 Question 22: Preference for lecturer’s notes (n=102).....	63
4.5.2.3 Question 23: Preference for Internet sources (n=102)	64
4.5.2.4 Question 24: Using package inserts for studies on medication (n=101)	64
4.5.3 Question 25: Clarification is asked if content of lectures is unclear (n=103)	65
4.6 Section D: Medication knowledge	66
4.6.1 Questions 25 – 28: Knowledge of Enoxaparin sodium (Clexane) (n=34)	67
4.6.2 Questions 29 – 32: Knowledge of Paracetamol intravenous (Perfalgan) (n=34).....	68
4.6.3 Questions 33 – 36: Knowledge of Tramadol (Tramazac) (n=35)	68
4.6.4 Percentages of correct answers across three medications	69
4.6.5 Additional tests performed on available data	69
4.6.5.1 Difference in knowledge score between males and females.....	69
4.6.5.2 Difference in knowledge score across age groups	70
4.6.5.3 Difference in knowledge scores and access to internet	70
4.6.5.4 Difference in knowledge scores across length of employment as enrolled nurse	70
4.6.5.5 Difference in knowledge scores across groups with different nursing area experience	70
4.7 Conclusion	70
CHAPTER 5 DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS.....	72
5.1 Introduction	72
5.2 Discussions	72
5.2.1 Objective 1: To determine final year bridging students’ access to medication information sources in the clinical setting.....	73
5.2.1.1 Internet access at work	73
5.2.1.2 Access to a pharmacist after hours and over weekends	73
5.2.1.3 Availability of MIMS, SAMF, pharmacology textbooks and other sources in the wards	73
5.2.1.4 Conclusion	74
5.2.2 Objective 2: To determine final year bridging students’ utilisation of medication information sources in the clinical setting.....	75

5.2.2.1 Consulting a RN	75
5.2.2.2 Consulting a pharmacist	75
5.2.2.3 Consulting resources	75
5.2.2.4 Consulting other sources	75
5.2.2.5 Consulting the prescribing physician	76
5.2.2.6 Consulting package inserts	76
5.2.2.7 Providing health education to patients about medication during medication administration rounds	77
5.2.2.8 Conclusion	77
5.2.3 Objective 3: To determine final year bridging students' utilisation of medication information sources in the academic setting	78
5.2.3.1 Preference for formal lectures on pharmacology and medication	78
5.2.3.2 Group work, self-study or discussions as preferred study strategy for pharmacology and medication studies	78
5.2.3.3 Utilisation of textbooks, lecturer's notes, internet sources or package inserts for studies on pharmacology	79
5.2.3.4 Clarification is asked if content of lectures is unclear	79
5.2.3.5 Conclusion	79
5.2.4 Objective 4: To assess the knowledge of final year bridging students regarding frequently administered medication	80
5.2.4.1 Knowledge of Enoxaparin sodium (Clexane).....	80
5.2.4.2 Knowledge of Paracetamol intravenous (Perfalgen)	80
5.2.4.3 Knowledge of Tramadol (Tramazac)	80
5.2.4.4 Conclusion	81
5.3 Recommendations	82
5.3.1 Recommendations for practice	82
5.3.1.1 Clinical settings	82
5.3.1.2 Academic settings	82
5.3.2 Recommendations for future research	83
5.3.2.1 Research on utilisation of information resources	83
5.3.2.2 Research on preferred study methods and information resources	83
5.4 Limitations of the study	83
5.5 Conclusion	84
LIST OF REFERENCES	86
APPENDICES	97

LIST OF TABLES

Table 1.1: Target population (N) for this study.....	6
Table 3.1: Target population for this study.....	36
Table 4.1: Average time spent on medication administration	54
Table 4.2: Availability of medication resources in the ward	56
Table 4.3: Utilisation of medication information resources in clinical setting	60
Table 4.4: Providing health education to patients	61
Table 4.5: Preferences on study methods for pharmacology and medication studies	63
Table 4.6: Preferences on information sources for pharmacology and medication studies	65
Table 4.7: Clarification is asked when content of lectures is unclear	66
Table 4.8: Clexane knowledge.....	67
Table 4.9: Perfalgen knowledge	68
Table 4.10: Tramazac knowledge	68
Table 4.11: Percentage of correct answers	69

LIST OF FIGURES

Figure 2.1: Framework for the study designed by the researcher	31
Figure 4.1: Gender	49
Figure 4.2: Age in years	50
Figure 4.3: Access to internet at home	50
Figure 4.4: Duration of employment as enrolled nurse	51
Figure 4.5: Areas of nursing experience	52
Figure 4.6: Internet access at work	53
Figure 4.7: Average time spent on medication administration	54
Figure 4.8: Availability of pharmacist after hours and over weekends.....	55

LIST OF APPENDICES

ANNEXURE A: ETHICS APPROVAL	97
ANNEXURE B: APPROVAL FROM HOSPITAL GROUP	99
ANNEXURE C: APPROVAL FROM NDOSI AND NEWELL'S PHARMACOLOGY	100
ANNEXURE D: PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM.....	101
ANNEXURE E: INSTRUMENT	105
ANNEXURE F: PROOF OF CONSULTATION AT BIOSTATS UNIT (1)	115
ANNEXURE G: PROOF OF CONSULTATION AT BIOSTATS UNIT (2).....	116
ANNEXURE H: DECLARATION BY LANGUAGE EDITOR	117

LIST OF ABBREVIATIONS

BNF	British National Formulary
MAE	Medication administration errors
MIMS	Monthly Index of Medical Specialities
RN	Registered nurse
SAMF	South African Medicines Formulary

CHAPTER 1

FOUNDATION OF THE STUDY

1.1 Introduction

Regulation 2598, Regulations relating to the Scope of Practice of persons who are registered or enrolled under the Nursing Act, 2005, as amended by Regulation 260 (Republic of South Africa, 1991) determines that the registered nurse is responsible for the execution of medication instruction as prescribed by a registered person. Medication administration also comprises the monitoring of the patients' vital signs and reaction to medication. However, in order to prevent errors, this responsibility requires specific knowledge and skills.

Student nurses as well as registered nurses are often responsible for medication administration errors. Medication administration errors were confirmed by several studies, namely: in France (Berdot, Sabatier, Gillaizeau, Caruba, Prognon & Durieux, 2012:6), Norway (Simonsen, Johansen, Daehlin, Osvik & Farup, 2011: 8) and Singapore (Choo, Hutchinson & Bucknall, 2010:856). According to a news release by the World Health Organization (WHO), at least one person dies every day following a medication error and about 1.3 million people are harmed by medication errors in the United States of America every year (WHO, 2017:n.p.)

This study focuses on final year bridging students' access and utilisation of resources in the academic and clinical setting of a private hospital group in Southern Africa to ensure safe medication administration.

1.2 Rationale

According to various studies, medication errors seemed to be a worldwide phenomenon (Simones, Neal, Schug, Blazovich, Pivec, Daniels, Becker, Schulenberg, Lehman, Ohman, Swiggum & Keller, 2014:137; Reid-Searl & Happel, 2012:1998; Honey & Lim, 2008:12). Furthermore, medication errors have escalated

globally (Lewellyn, Gordon & Reed, 2011:1; Kulstad, Sikka, Sweis, Kelley & Rzechula (2010: 304).

Medication administration errors have far-reaching effects on the patients and families affected by the error, the healthcare professionals involved in the incident, as well as the healthcare facility where these incidents occur. According to Choi, Lee, Flynn, Kim, Lee, Kim and Suh (2016:429) 7 000 deaths per year can be attributed to medication errors. In addition, Choi *et al.* (2016:429) also indicated that even if these errors do not lead to serious effects on the patients, the healthcare facility has to carry the costs of prolonged treatment, because incorrect medication administration leads to unnecessary waste of medication, extra laboratory tests and time wasted on investigating and addressing the problem.

International studies reported further that nurses do not always have the required medication or pharmacology knowledge for practising safe medication administration (Ndotsi & Newell, 2008:576; Simonsen *et al.*, 2011:8; Pazokian, Zagheri Tafreshi & Rassouli, 2014:249). Moreover, nurses do not always follow safety precautionary measures, unless the drug is classified high risk (Smeulers, Onderwater, Van Zwieten & Vermeulen, 2014:282; Reid-Searl, Moxham, Walker & Happel, 2008:2755). In addition, Tsiamo, Kgositau, Ntsayagae and Sabone's (2015:21) literature review accentuated that an increase in pharmacology and medication knowledge of nurses can reduce nurse-related medication administration errors.

Another risk factor which contributes to medication errors is the continuous approval and marketing of new and generic substitutes for medications already in use. In the United States of America, 118 new medications were approved by the Food and Drug Administration in 2015 (CenterWatch, 2016:n.p.). Similarly, the Cape Business News (2017:1) reported that the use of generic medications in South Africa have increased from 35% to 60% during the last decade. The continuous approval and marketing of new medications could result in a lack of knowledge, which could influence all nurses responsible for medication administration.

In order to administer medications safely, it is imperative that all nurses responsible for medication administration, must have the knowledge of all the different generic substitutes, or must have access to and make use of medication information

sources. This is necessary to finally verify whether the dispensed medication is the generic equivalent of what was initially prescribed.

In South Africa, Truter, Shellack and Meyer (2017:5) highlighted that the rate of medication errors in the paediatric wards and neonatal intensive care unit of a teaching hospital in Gauteng were even higher than those reported globally. These results were also confirmed in a paediatric intensive care unit in Durban (Gokhul, Geena & Gray, 2016:1226). Furthermore, Blignaut, Coetzee, Klopper and Ellis (2015:260) emphasised that the incidence of observed medication errors in public hospitals in Gauteng were higher than the rate of reported errors.

In addition, according to the Medicines and Related Substances Act 101 of 1965, as amended (Republic of South Africa, 2003), pharmacists are encouraged to dispense generic medications as far as possible. A private healthcare institution, in the Western Cape, South Africa reported a 20% medication error rate increase during 2013 and 2014. This error rate increased, to an alarming 41% during 2014 and 2015 (Hill & Damons, 2016:2). Participants in this study indicated that identification of look-a-like sound-a-like medications presented a challenge in administering medication safely (Hill & Damons, 2016:116).

The researcher was unable to retrieve any studies relevant to bridging student nurses, and their medication knowledge. These students have previously completed a two-year course according to Regulation 2175, Regulations Relating to the Course Leading to Enrolment as a Nurse (Republic of South Africa, 1993:1), and have been found competent in the administration of oral medications and intramuscular injections in the second year of the above-mentioned course. One of the key performance areas of enrolled nurses in private healthcare settings is the safe administration of medication timeously (Mediclinic, 2016:2). During their course as bridging students, they are responsible for medication administration on a daily basis.

1.3 Problem statement

During 2015, the healthcare group under investigation reported a medication error rate of 0.86 out of a 1 000 bed days (Mediclinic, 2016:61). This rate is calculated as

follows: $\frac{\text{Medication Errors}}{\text{Patient Days}} \times 1000$ and includes all medication related events such as: ordering, dispensing, delivery, administration and monitoring of effects and side-effects of administered medication. These numbers are lower than the 1.6 per 1 000 bed days reported in South Korea by Choi *et al.* (2016:429). However, the error rate for 2016 had escalated to 1.18 out of a 1 000 bed days (Mediclinic, 2017:38). These escalating error rates are a concern, and one of the future objectives stated in this 2017 report is the development of quality improvement plans to improve medication safety for all patients.

A private healthcare institution is profit driven, and annually reports to shareholders on the financial growth of the institution. In order to grow financially, the institution must minimize preventable medication errors. However, the researcher experienced a lack of knowledge on classification, as well as mode of action of medications amongst bridging students at the higher education facility where she is employed as a lecturer. Furthermore, these students also displayed a lack of motivation to utilise information sources during medication administration duties, which could lead to potential medication administration errors. Therefore, it is imperative to conduct this study in order to determine bridging students' access to and use of medication information sources during their training and clinical practice. These study findings can add value to future training of bridging students, and will also be utilised for assisting this hospital group in the development of quality improvement plans to improve medication safety.

1.4 Research question

The research questions which guided this study was

- “What access to medication information sources do final year bridging students at higher education and training centres of a private hospital group in South Africa have” and
- “How do final year bridging students at higher education and training centres of a private hospital group in South Africa utilise these medication information sources to ensure safe medication administration?”

1.5 Research aim

The aim of this study was to determine:

- what access to medication information sources do final year bridging students at the higher education and training centres of a private hospital group in South Africa have and
- how do they utilise these medication information sources to ensure safe medication administration.

1.6 Research objectives

The objectives of the study were to:

- determine final year bridging students' access to medication information sources in the *clinical* setting
- determine final year bridging students' utilisation of medication information sources in the *clinical* setting
- determine final year bridging students' utilisation of medication information sources in the *academic* setting
- assess the knowledge of final year bridging students regarding frequently administered medication.

1.7 Research methodology

This chapter provides a short overview of the applied research methodology, with more detailed description in chapter three.

1.7.1 Research design

A quantitative approach with a descriptive design in the format of a survey was applied to determine final year bridging students' access to and utilisation of medication information sources at the higher education and training centres of a private hospital group in South Africa to ensure safe medication administration.

1.7.2 Population and sampling

The target population (N=190) for this study included all second-year bridging (Regulation 683) nursing students.

1.7.2.1 Inclusion criteria

According to table 1.1, the target population consisted of students whose studies commenced on 1 June 2015 (n=62) and 1 January 2016 (n=100), as well as those whose study was extended (n=28) during the first year. The total population (N) for this study was (N=190).

1.7.2.2 Exclusion criteria

However, three groups of students, comprising (n=57) students, did not attend classes during the data collection period, and data could therefore not be obtained from them. Furthermore, another class of (n=28) students was excluded from the main study, since that group was utilised for the pilot test. Therefore, due to the small population, an all-inclusive sample (n=105) was utilised. All students from these identified groups were invited to participate in the study. Two students arrived late for classes on data collection dates, and did not participate in the study. Therefore (n=103).

Table 1.1: Target Population (N) for this study

Inclusion criteria		Exclusion criteria	
Students commenced June 2015	62	Students excluded as they did not have class during the data collection period	57
Students commenced Jan 2016	100	Students excluded, as they were utilised for the pilot test	28
Students whose study was extended	28	Students excluded as they arrived late	2
Total population (N)	190	Total students excluded	87
Final population (N)			103

1.7.3 Instrumentation

A self-administered questionnaire based on the objectives of the study was utilised for data collection (Annexure E). The questionnaire is an adapted version of the questionnaire used by Ndosi and Newell (2008 & 2010). Consent to use and adapt this questionnaire was obtained and is attached to this thesis. (Annexure C).

1.7.4 Pilot test

The students of the Cape Learning Centre (n=28) were selected for the pilot test. The pilot test was done to improve the reliability and validity of the testing methodology used for the questionnaire. The results of the pilot test were excluded from the actual study.

1.7.5 Reliability and validity

A pilot test, similar to the actual study was conducted to ensure reliability. The researcher collected all the data by means of a self-administered questionnaire. Training was given to all four fieldworkers by means of electronic and telephonic conversations to ensure reliability and uniformity of the data-collection process. In addition to the above training, all data collectors were registered nurses with previous experience of the research process.

Validity was ensured by applying content and face validity. The content of the questionnaire was validated by a colleague of the researcher with experience of the research process, as well as medication content of the curriculum. In addition, a pilot test was conducted and the inputs were gained from the following experts, namely: the study supervisor and academic staff members at the Stellenbosch University Master's tutorial, as well as the biostatistician at Stellenbosch University, who ensured the face validity of the instrument.

1.7.6 Data collection

Data was collected by trained data collectors during May 2017. Structured self-reported data was collected at four different venues from six groups of students, using self-administered questionnaires.

1.7.7 Data analysis

Data analysis was done with the support of a biostatistician at the University of Stellenbosch, utilising Stata version 14, which is a computer software program with advanced statistical techniques. Data analysis included descriptive, as well as inferential analysis techniques.

1.7.8 Ethical considerations

Ethical approval was obtained from the Ethics Committee of Stellenbosch University on 23 March 2017 (Protocol number S17/01/005, Annexure A) and written approval from the private healthcare group was granted on 3 April 2017. (See Annexure B).

According to the Belmont report (Federal Register, 1979:1), ethical research should be based on the following three principles: Respect for persons, beneficence and justice.

1.7.8.1 Respect for persons

This principle can also be referred to as “respect for human dignity” (Polit & Beck, 2014:84), which can be divided into the following three requirements (Federal Register, 1979:1): Right to self-determination, informed consent and the treatment of vulnerable groups.

- Right to self-determination

Participants had the right to freely decide whether to participate in the study or not (Polit & Beck, 2008:172), and this right was clearly stipulated in the ‘Participant information leaflet’. This leaflet was printed in English, since English is the language utilised for all written record-keeping purposes in this private hospital group, as well as for facilitation of contact sessions at the learning centres. Potential participants could decide whether they wanted to participate or not, after reading through the leaflets. Only after signing the consent on the leaflet and handing it in, were the questionnaires handed to them for completion. It was also clearly stated that if they decided not to participate, it would not have any negative effect on them. No coercion took place, since the leaflet also made it clear that participants would not be paid for participation.

- Informed consent

Providing adequate information about the study to potential participants, in order to make an informed decision on whether or not to participate in the study, is another measure to demonstrate respect for persons (Federal Register. 1979:1). As mentioned before, all potential participants received an information leaflet, clearly explaining the aim of the study, as well as potential risks and benefits to participants and society. They were allowed time to read through the leaflet, and encouraged to ask for clarification from the data collectors if they were unsure about anything. Only after following all these steps, did they sign a declaration.

- Treatment of vulnerable groups

Students at the learning centre where the researcher is currently employed were treated as a vulnerable group, due to the fact that they might have feared negative consequences by not participating in the study (Polit & Beck, 2014:90). Several measures were utilised to ensure the voluntariness of their participation. Firstly, data was collected by a fieldworker not employed at the hospital group. Secondly, data collection took place at the end of their course, during a theory revision block, after all tests and assignments had been written and marked, and practical examinations had been performed and assessed. Thirdly, data was collected during a period when the researcher was not at the facility for an extended period.

1.7.8.2 Beneficence

The principle of beneficence refers to the duty of the researcher to ensure minimal harm to the participants, and maximum benefit to the participants or society (Polit & Beck, 2014:83). Due to the nature of this study, no physical harm could be foreseen, but psychological harm and discomfort were minimised through maintaining the following measures: Confidentiality and anonymity, and protection from discomfort and harm.

- Confidentiality and anonymity

Confidentiality procedures should be utilised to protect study participants' right to privacy (Polit & Beck, 2014:88). Privacy refers to the right of the participant, to expect that information disclosed during the study, will be kept confidential, and if

information has to be disclosed, it cannot be linked or traced to the participant (Polit & Beck, 2014:85 & 89).

Signed consent forms, the only documents providing a link between participants and the data collected, are currently locked away in a safe place, to which only the researcher and her supervisor have access. This fact was clearly stated in the information leaflet. Furthermore, anonymity was ensured when the field-workers reminded participants before handing out the questionnaires, to not put their names on the questionnaire. Each participant was also provided with a blank envelope and instructions to fold the questionnaire, seal it in the envelope, and drop it in the box provided. After all the participants had left, the box was emptied and all the instruments, as well as signed consent forms were sent to the researcher via courier, to ensure safe transit.

- Protection from discomfort and harm

Participants to this study were not subjected to any physical harm, but could have been subjected to emotional harm caused by stress induced by the last question, which tested knowledge on one specific medication (Polit & Beck, 2014:83). Fortunately, since all participants are employed by a private hospital group, they have access to free counselling services through the employee health and wellness programmes at the various hospitals. Counselling can be done by social workers permanently employed by the private hospital group. In smaller hospitals, counselling can be done by social workers who perform these duties and are remunerated by the hospital group on a contractual basis.

1.7.8.3 Justice

Ethical research should also be based on the principle of justice, which can be translated as fair treatment of all potential participants (Polit & Beck, 2014:85). Participation in this study did not benefit any participant directly, as was clearly stated in the information leaflet, and all potential participants were treated fairly, since every member of the identified population could participate, if they so wished.

1.7.9 Limitations

Limitations in a study are those factors which may negatively impact on the generalisability and credibility of the findings (Burns & Grove, 2009:707). The following limitations were identified during the pilot test, as well as the data collection period:

1.7.9.1 Pilot test

One class of 28 students were selected for the pilot test. Of these students, only 15 were willing to do the pilot test, and only students with English, Afrikaans and isiZulu as their first language were willing to participate. None of the students with isiXhosa as first language volunteered for the pilot test. These limitations might have influenced the generalisability of the study findings.

1.7.9.2 Study sample size

During the planning phase, it was estimated that (N=190) students would be available for the pilot test and main study. Due to unforeseen delays in data collection, (n=57) students were not available for data collection since they did not attend classes on those days.

1.8 Conceptual framework

A conceptual framework is a graphic or schematic representation of the concepts to be included in a study and the relationships between these concepts (Polit & Beck, 2008:749). This study incorporated Knowles' adult learning theory.

According to Knowles' adult learning theory, it can be assumed that adult learners are self-directed, have previous experiences and knowledge, are outcome orientated and need to be able to apply new knowledge to real life (Australian Catholic University, 2016:1; Keesee, 2009:1). These assumptions were incorporated into the conceptual framework for this study, which will be discussed in depth in chapter 2.

1.9 Operational definitions

- **Enrolled nurse:** someone who completed a two-year course according to Regulation 2175, Regulations Relating to the Course Leading to Enrolment as a Nurse (Republic of South Africa, 1993:1).
- **Registered nurse:** For the content of this study, it refers to someone who is registered as a nurse after completion of the bridging course according to Regulation 683, Regulations relating to the minimum requirements for a bridging course for Enrolled Nurses leading to registration as a General Nurse or a Psychiatric Nurse (Republic of South Africa, 1991:1), or after completion of a four year course according to Regulation 425, Regulations relating to the approval of and the minimum requirements for the education and training of a Nurse (General, Psychiatric and Community) and Midwife leading to registration (Republic of South Africa, 1985:1).
- **Bridging student:** An enrolled nurse who has registered for the bridging course according to Regulation 683 (Republic of South Africa, 1991:1)
- **Medication:** the term used for “substances used in the diagnosis, treatment or prevention of diseases” (Farlex, 2017: online).
- **Medication administration:** The preparation and handing out of drugs, as well as the evaluation of the effect of these drugs.
- **Medication error:** any error that occurs during the prescribing, dispensing or administration of medication (Feleke, Mulatu & Yesmaw, 2015:2).
- **Medication administration error:** any difference between the medication prescribed for the patient and the actual medication received by the patient (Feleke, 2015:2).
- **Rights of safe medication administration:** right patient, right drug, right dose, right time, right route (Edwards & Axe, 2015:399)

1.10 Duration of the study

Approval from Health Research Ethics Committee of the Stellenbosch University was granted on 23 March 2017, and the research application was approved by the private hospital group on 3 April 2017. The pilot study was conducted on 18 April

2017 and data collection for the main study between 4 May 2017 and 22 May 2017. The completed thesis will be submitted on 27 November 2017.

1.11 Chapter outline

Chapter 1: Foundation of the study

This chapter describes the background and rationale, problem statement, research questions, aims and objectives, conceptual framework and research methodology, ethical considerations, operational definitions, duration of the study and chapter outlines, as well as the significance of the study.

Chapter 2: Literature review

This chapter will focus on the literature reviewed in preparation for this study, and sources utilised during the study, will be reviewed and presented in this chapter. The aim of this chapter is to identify previous research done on the phenomena to be studied, as well as to identify any gaps in available literature.

Chapter 3: Research methodology

The research methodology followed for this study will be discussed comprehensively, and the application of the methodology to the study will be clearly described.

Chapter 4: Data analysis, interpretation and discussion

This chapter will consist of the analysis of the data, the interpretation thereof, as well as a discussion on these findings.

Chapter 5: Discussions, conclusions and recommendations

The limitations of the study will be discussed, and conclusions will be reached. Recommendations for future studies or nursing practice, based on the findings of this specific study, will also be included in chapter 5.

1.12 Summary

In this chapter, the rationale, research problem and significance of the problem, objectives, research methodology, conceptual framework, operational definitions as well as the chapter layout was described.

1.13 Conclusion

Medication administration errors are a reality, as described in studies done globally (Simones *et al.*, 2014:137; Reid-Searl & Happel, 2012:1998 and Honey & Lim, 2008:12). In addition, numbers of medication errors are escalating worldwide (Lewellyn *et al.*, 2011:1 & Kulstad *et al.*, 2010: 304), as well as in South Africa (Truter, *et al.*, 2017:5; Gokhul, *et al.*, 2016:1226 & Blignaut, 2015:260).

Medication administration errors can be fatal; with far-reaching effects on families, but they can also have devastating effects on healthcare workers involved in these errors, as well as financial implications for healthcare institutions where these errors occur (Choi, *et al.*, 2016:429; Bernard, 2013:4).

According to the reviewed literature, professional nurses as well as nursing students do not always have the required levels of knowledge about medication and pharmacology to administer medication safely. Enrolled nurses following the bridging course (Regulation 683) to become registered nurses must be appropriately prepared for the task of unsupervised medication administration, as well as fulfilling the role of supervisor to students. Teaching and encouraging future professional nurses to identify and utilise available medication information sources, may lead to a decline in the number of medication administration errors and all its accompanying results. The literature review will be discussed in chapter two.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a structured overview of the written sources of information about the subject or the proposed study (Burns & Grove, 2009:92). Literature included in this review may consist of a variety of written materials, e.g. articles published in scholarly journals, newspapers and magazines, statistical information published by trustworthy sources, and various sources of evidence-based information about previous research on the topic of interest (Burns & Grove, 2009:92).

The purpose of a literature review is to inform the reader about what is already known about the subject to be studied, as well as to identify areas where little or no research has been conducted. In quantitative research, the literature review plays a major role in determining the progress of the study. Previous study results and conclusions are cited throughout the research report, in an effort to demonstrate the relevance of new information, and how it correlates with what is already known (Burns & Grove, 2009:91).

Medication errors seem to be a global phenomenon, having far-reaching effects on the patients and families affected by the error, the healthcare professionals involved in the incidents, as well as the healthcare facilities where these incidents occur (Choi *et al.*,2016:429).

In conducting the literature review for this study, the researcher's aim was to gather written information about nursing students' access to and utilisation of information sources to enhance safe medication administration, since this information was essential in identifying whether this aspect of medication administration errors has previously been examined thoroughly.

2.2 Reviewing and presenting the literature

Different aspects of patient safety, including medication errors, have been researched since the release in 1999 of the report “To Err is Human: Building a Safer Health System” by the Committee on Quality of Health Care in America (Kohn & Donaldson, 2000:1).

An electronic search for relevant literature was done via EBSCOhost, selecting CINAHL, Health Source: Nursing/Academic Edition and MEDLINE, as well as PubMed and Science Direct. The following key words were applied, namely: “enrolled nurse, bridging course, conversion to registered nurse, medication administration competence, medication administration errors, medication administration training, pharmacology education, medication information sources and clinical supervision”. Sources cited in relevant articles were utilised as further sources of relevant literature. Furthermore, Stellenbosch University’s Library was browsed for electronic copies of research theses relevant to the concepts being studied.

The researcher aimed to only include articles and sources published between 2007 and the current date. However, in some instances literature from before 2007 was included, due to the information still being applicable.

2.3 Findings from the literature

The findings from the literature will be presented under the following headings:

- Frequency of medication errors
- Factors influencing medication errors
- Nurse education
- Generic substitution
- Information sources
- State of affairs in South Africa

2.3.1 Frequency of medication errors

A medication administration error (MAE) occurs when the patient does not get the medication as intended by the prescriber. Feleke *et al.* (2015:3), differentiate between the following types of medication administration errors:

- Missed drug error: medication was not administered as prescribed, even though available,
- Unauthorized drug error: medication which was not prescribed and was given to the patient,
- Technique error: the nurse did not follow the correct procedure in administering medication,
- Wrong dose error: patient received a different quantity or dose than what was prescribed,
- Wrong time error: medication was administered more than 30 minutes earlier or later than the intended administration time,
- Wrong route error: medication was administered via a route different from the intended route and
- Documentation error: medication was administered, but no documentation of administration took place.

Medication errors appear to be a global problem, as reported by various studies in the United States of America (Simones, *et al.*, 2014:137; Choi *et al.* 2016: 432). Choi *et al.* (2016:432) confirmed that medication errors in the United States of America lead to a spending of \$3, 5 billion on health care per year.

In Norway, Simonsen *et al.* (2011:1) pointed out that 27% of all adverse events, were medication related. Edwards and Axe (2015:400) emphasised that 38% of medication errors in the United Kingdom seemed to be nurse related. Berdot, *et al.* (2012:6) concluded that drug administration errors frequently occurred in the teaching hospitals.

Not much literature was available on African studies. Feleke *et al.* (2015:7) confirmed that medication errors were indicated as the main cause of preventable adverse events in Ethiopia. Whereas Tshiamo *et al.* (2014:23) recommended that

nurses' training curricula should be revised in Botswana to provide nurses with the skills and knowledge needed to prevent medication errors.

2.3.2 Factors influencing medication administration errors

According to the literature, medication errors could be influenced by the following factors, namely: underdeveloped skills, look alike, sound alike medications, generic substitution and system errors. These factors are discussed underneath.

2.3.2.1 Underdeveloped skills

Iranian focus groups identified “underdeveloped caring skills in medication management” and “unfinished learning of safe medication management” as contributing causes of medication administration errors (Vaismoradi, Jordan, Turunen & Bondas, 2013:435). In another study in Iran, qualified nurses indicated the perceived lack of knowledge of pharmacology and underdeveloped skills in medication administration, as well as factors regarding medication, e.g. similarities between commercial names, shapes and packaging of medication, as causes for medication administration errors (Pazokian *et al.* 2014:249).

Edwards and Axe (2015:400) identified the lack of continuous training and the unclear marking and labelling of medication as system errors, and sub-optimal medication knowledge of responsible personnel, as human errors contributing to medication errors in Britain. Simonsen, Daehlin, Johansson and Farup (2014:4) also indicated that Norwegian nursing students' medication knowledge was below the expected standard, which can contribute to medication administration errors.

Besides these, poor mathematical skills of student nurses, as well as registered nurses have been identified as a major factor involved in medication errors. These skills are of paramount importance when calculating medication dosages and infusion rates of intravenously administered medications. In Flanders, Belgium, it was reported that nursing students' calculation skills prior to graduation were limited (Dilles, Stichele, Van Bortel & Elseviers, 2011:499). Dilles *et al.*, (2011:499) reported that diploma students scored 53% on the calculation test in the study, and bachelor's degree students obtained 66%. These calculating scores could result in fatal medication administration errors, due to too large dosages. These findings were in line with findings of studies done in Dublin, Ireland (Fleming, Brady & Malone,

2014:57), where over dosages of medication in tablet form, were the most frequent occurring errors.

2.3.2.2 Look alike, sound alike medications

In line with the aforementioned studies, the study results of Valdez, De Guzman and Escolar-Chua (2013:225) showed that junior and senior Philippine student nurses were also concerned that the different medications which sometimes look the same, and have similar packaging used for more than one medication could result in medication administration errors.

2.3.2.3 Generic substitution

Håkonsen, Hopen, Abelsen Ek and Toverud (2010:1) pointed out that generic substitution of medications was identified as a potential factor contributing to medication administration errors. Nurses do not receive training on all the different generic medications, and thus feel at risk for causing medication administration errors.

2.3.2.4 System errors

In addition, Feleke *et al.* (2015:4), highlighted that the age of the student, as well as the age of the patient, the working experience of the specific nurse, interruptions during medication administration shifts, the time when medication administration takes place, and the number of patients allocated to each nurse, were the factors contributing to medication administration errors in Ethiopia.

In order to determine whether student nurses are adequately prepared to prevent medication administration errors during their training, as well as when practising as Registered Nurses, student nurses' training were further explored by searching the literature for appropriate information.

2.3.3 Nurse education

In order to fully understand the unique theoretical and practical training student nurses have to complete in order to become registered nurses, the following topics were explored: theoretical preparation in different academic institutions, practical preparation taking place in simulation, as well as the clinical setting, and medication knowledge of registered nurses responsible for supervising students.

2.3.3.1 Theoretical preparation

The training of novice nurses usually consists of a theoretical component, taking place at University Colleges (Simonsen *et al.*, 2014:2), or Schools of Nursing (Honey & Lim, 2008:13), as well as a practical component. The practical training takes place in simulation at the college or nursing schools, followed by exposure to the clinical setting, e.g. a teaching hospital (Fleming *et al.*, 2014:56; Berdot *et al.*, 2012:2) or tertiary hospitals (Valdez *et al.* 2013:224). In the academic settings, students are prepared for the theoretical component of medication administration during lectures on pharmacology, and by practising of medication calculation skills (McMullan, Jones & Lea, 2010:893), as well as learning about correct procedures to follow (Edwards & Axe 2015:399) during administration of medication in order to prevent MAEs.

In South Africa, pupil enrolled nurses complete a two year course to become enrolled nurses according to Regulation 2175, Regulations Relating to the Course Leading to Enrolment as a Nurse (Republic of South Africa, 1993:1). During the first year of this course, pupil enrolled nurses receive training in anatomy and physiology, and during the second year more in-depth teaching on anatomy and physiology takes place. Pharmacology is taught at the start of this second year, and safe medication administration practices are demonstrated in simulation. These students then practice these skills in simulation, as well as in clinical practice under direct supervision of a registered nurse. Towards the completion of the second year, students are assessed on medication administration skills, and must be competent in these skills before they are admitted to final examinations, set by the South African nursing council (Republic of South Africa, 1993:5).

Studies have found that student nurses (Vaismoradi, *et al.*, 2013:435–436), lecturers (Adhikari, Tocher, Smith, Corcoran & MacArthur, 2014:189), as well as registered nurses (Honey & Lim 2008:15), consider the amount of time spent on pharmacology lectures to be insufficient, when compared to the actual time spent on the administering of medication in the clinical setting. One of the reasons most frequently stated for these findings is that not enough time is available in the curriculum for more pharmacology lectures and practising of medication calculation skills (Latter *et al.*, 2000:1287). Some students also reported feelings of being ‘overwhelmed’ (Honey & Lim, 2008:16) by the amount of knowledge they perceived to be necessary

for safe practice, once they approached the end of their studies. In an attempt to overcome this problem, it was recommended that lecturers should focus on the application of pharmacology in lectures, rather than on specific medications (Adhikari, *et al.*, 2013:189).

Nursing is a science, and as such, the nursing practice should keep up with technological advances, and include technology in nursing education where applicable. Hewitt, Tower and Latimer (2015:17) recognized that medication administration is becoming more complicated, due to the wide variety of medications available. They utilized short video recordings depicting situations that may lead to medication errors, as well as the interactions between applicable members of the multi-disciplinary team, e.g. the prescribing physician, dispensing pharmacist and nurse administering medication during these situations. The aim of these recordings were to demonstrate how potential medication errors can be prevented through effective team work and the result of this intervention was reported to be beneficial in nurse education on medication safety (Hewitt *et al.*, 2015:19).

The study of Falk, Falk and Ung (2015: 16) aimed to determine whether this sequence of events will positively influence Swedish students' responsibilities for their own learning. First year student nurses were placed in the clinical setting after just three weeks of theory. However, study findings revealed that theoretical studies should be completed before the placement of students in the clinical setting.

In addition, Hanson (2016:80) evaluated the flipped classroom approach. This approach refers to the process where lesson content is made available to students in electronic format, and after working through this content, students come to class to discuss the content.

Feedback from students revealed that this approach does have benefits, because they could replay these sessions if needed, and do the learning when it suited them. Unfortunately, when students were faced with time constraints, they would neglect to attend the classroom sessions where discussions took place, and preferred to just do the electronic learning component. Therefore, it was concluded that this approach should be considered for the future, but students must be really committed, in order to fully benefit from this approach (Hanson, 2016:84).

2.3.3.2 Simulation

According to various authors (Simones, *et al.*, 2014:137; Andrew & Mansour, 2013:313; Reid-Searl, Moxham & Happel, 2010:226), nursing students could practise theory and practice integration in simulation (e.g. using mannequins and simulated medications), before being allowed to practise acquired skills on patients in clinical settings. Students reported that they valued the opportunity to practise medication administration skills, without any possibility of causing harm to patients. In addition, students indicated that simulation also highlighted where they lacked knowledge as required to be safe practitioners (Sears, Goldworthy & Goodman, 2010:55). Likewise, Dubovi, Levy and Dagan (2016:26) showed that Israeli nursing students also found it beneficial to rehearse medication administration procedures in a computer assisted virtual reality environment, before practising in the clinical setting.

2.3.3.3 Practical exposure in the Clinical setting

Student nurses have to practise their knowledge of pharmacology and administration of medicine under the direct supervision of a registered nurse in order to become competent (Honey & Lim, 2008:14; Simonsen *et al.*, 2014:2). Facilities providing nurse education are usually affiliated to clinical settings where nursing students can practise their medication administration skills, under supervision of the ward registered nurses to accompany and supervise them (Sundler, Bjork, Bisholt, Ohlsson, Kullen Engstrom & Gustafsson, 2014:663). However, Reid-Searl *et al.* (2010:229) pointed out that nursing students reported that supervision by registered nurses during medication administration rounds did not always comply with the expected standards. Students experienced that the registered nurse assigned to them, did not always perform all the necessary checks or shared all the information about the medication being administered (Reid-Searl *et al.*, 2008:2753). Notwithstanding, students described these infrequent experiences as excellent learning opportunities. Likewise, Iranian nursing students also confirmed that clinical practice situations provided them with opportunities to observe clinical instructors at the patient's bedside (Baraz, Memarian & Vanaki, 2014:527).

Moreover, instances were also reported where the registered nurses would be with the student, but in a hurry for the student to complete the task, with the result that

students did not take the necessary time to consult resource manuals when they were unsure about the medication (Reid-Searl, *et al.*, 2008:2753). This type of supervision resulted in a few near-miss events, and was not deemed a positive experience by the students. Similarly, Honey and Lim (2008:14) also reported that nursing students participating in a study done in New Zealand were not granted sufficient time to consult resources in busy clinical settings. Lack of time for supervisors to get to know students and establish a relationship, was also cited as having a negative influence on how student nurses experienced their clinical training periods (Sundler, *et al.*, 2013:665).

In Australia, Carrigan (2012:22) reported that due to the increased number of nursing students being trained, these students are accompanied by preceptors, and not clinical educators. A preceptor is the description given to a registered nurse taking care of a number of patients, as well as supervising students (Carrigan, 2012:23). The majority of these preceptors work only part-time, with the effect that students are continuously supervised by and assessed by registered nurses with whom they have no relationship.

In addition, students also reported on clinical personnel not supporting them and engaging with them about learning outcomes (Luanaigh, 2015:455). Students wanted to actively participate in their studies, but felt they were not accepted as part of the clinical team. Students recognised contact with other healthcare providers, especially registered nurses, as learning opportunities, and valued feedback from respected registered nurses (Luanaigh, 2015:455).

Finally, students described another type of supervision which occurred when the registered nurse was not with the student during administration of medication (Reid-Searl *et al.*, 2008:2754). This usually happened when the registered nurse had to take care of an emergency, but it also occurred when the registered nurse expected the student to know what he/she was doing, e.g. towards the end of the student's training. According to Baraz *et al.* (2014:528), some students viewed this as a positive experience, since it motivated them to study about the medications to be administered, in order not to commit any mistakes. The consequences of this were increased self-confidence and competence.

Reid-Searl and Happel (2012:1998) subsequently did another study, to 'explore the attitudes, experiences and opinions' of the registered nurses who had to frequently supervise nursing students during medication administration procedures. Contrary to the findings of Reid-Searl *et al.* (2008:2752-2754), the majority of the registered nurses participating in this study, were of the opinion that university required standards for supervision were met in the clinical settings (Reid-Searl & Happel, 2012:2002). Since these candidates volunteered to participate in the study, it might be argued that these registered nurses actually followed protocol in their daily practice, and registered nurses who knew that they did not adhere to prescribed standards, did not volunteer for the study.

Clinical educators in Japan, admitted that at academic settings students were taught to nurse patients holistically, but in the clinical settings they concentrated on the disease, rather than on holistic care (Taniyama, Kai, & Takahashi, 2012:6). They admitted that they could not really monitor students effectively, due to time restraints and numbers of students allocated to each facilitator (Taniyama *et al.*, 2012:4). Sundler *et al.* (2014:665) also concluded that preceptors reported time available for student accompaniment was insufficient for building relationships with students.

Registered nurses regarded supervision of students during medication administration as a learning opportunity where they could share their own knowledge and experience with the students (Baraz, 2014:528), as well as an incentive to ensure that they themselves would keep up to date with the changes regarding medication. Some of the registered nurses even admitted that they could learn from students, since students might have knowledge about new inventions or ways to do procedures (Reid-Searl & Happel, 2012:2002).

Because registered nurses also have other duties to fulfil, and supervision of students are time-consuming, *preparation* for student supervision was identified as very important to ensure adherence to required standards, as well as to provide an environment conducive to learning (Pillay & Mtshali, 2008:55). Communication between clinical staff supervising and accompanying students and members of educational institutions should form a partnership to ensure that theory and practice are integrated (Pillay & Mtshali, 2008:55).

When final year students were asked about their experiences of supervision in the clinical setting (Reid-Searl *et al.*, 2010:227), nine students from a group of 28, reported instances where medication administration errors were prevented by timely intervention by the registered nurse supervising him/her. These numbers illustrate the risk of medication administration errors when students administer medication, and also emphasise the importance of supervision by registered nurses, in order to prevent students from committing medication administration errors.

According to Baraz *et al.* (2014:528), student nurses involved in clinical rounds reported question-and-answer sessions concerning medications as learning opportunities. Repetitive emphasis on critical points to consider during medication administration became established in their brains, assisting these students to become safe medication administration practitioners. These findings correlate with student nurses reporting that they do not really like being tested by clinical supervisors on their medication knowledge, but they recognise the benefit of these practices (Luanaigh, 2015:454).

2.3.3.4 Registered nurses as role models for students

Due to the amount of time registered nurses spend accompanying students in the clinical setting, it can be expected from students to regard registered nurses as role models, since that is the qualification they (students) aspire to. It can then also be expected of registered nurses to have adequate levels of knowledge and skills concerning medication administration, in order to be able to supervise students, and to be able to prevent students from making medication administration errors.

In order to establish whether registered nurses' knowledge about medication is sufficient to prevent medication errors, Simonsen *et al.* (2011:2) performed a study in Norway to establish medication knowledge, as well as certainty and risk of error, amongst registered nurses. Findings of this study indicated that registered nurses do not have sufficient knowledge about medication, especially drug management (Simonsen *et al.*, 2011:4), to prevent medication errors. Drug management in this study referred to the regulations related to medications, correct and safe storage of medications, preparation and administration of medications (Simonsen *et al.*, 2011:2). Even more important was the finding that only 12% (N= 25) of registered

nurses obtained full marks for the component on drug dose calculations (Simonsen *et al.*, 2011:4). Choo *et al.* (2010:857) also indicated that nurses frequently administer medication, without adequate knowledge about medications being administered. Fleming *et al.* (2014:60) also concluded that registered nurses do not always have adequate drug calculation skills, which can lead to incorrect dosages being administered.

Another study done in Britain to determine the pharmacology knowledge of registered nurses also revealed that pharmacology knowledge was inadequate (Ndosi & Newell, 2008:578).

Although the results of above-mentioned studies indicated that registered nurses did not have the desired level of medication knowledge, it was reassuring to note that registered nurses who worked in specialised areas, displayed a high medication knowledge (Simonsen *et al.*, 2011:87), since the administration of medication with the biggest potential to cause harm, took place in these settings. Engels and Ciarowski (2015:287) also concluded that nurses, pharmacists and prescribing physicians could identify high-alert medications and could correctly treat patients who were exposed to incorrect dosage of these medications. The term 'high-alert medication' refers to any medication with the potential to cause extreme harm to a patient when administered incorrectly (Engels & Ciarowski, 2015:287).

Simonsen *et al.* (2014:3) conducted another study, using the same tool as in 2010, to compare the medication knowledge of graduating nurses with the findings of the study done in 2010. In this study it was established that registered nurses did have increased knowledge of pharmacology than students. The results of this study also indicated that medication knowledge only increased during the first year after graduation (Simonsen *et al.*, 2014:9). Therefore, it can be assumed that newly-graduated registered nurses recognised their need for improvement, and took some action to acquire new knowledge, but after one year of being registered, they considered their medication knowledge to be adequate. This finding is alarming, because registered nurses are responsible for the safe and effective administration of medication (Sulosaari, Suhonen & Leino-Kilpi, 2010:476).

2.3.3.5 Continuous education to ensure medication safety

In examining the medication administration process, it is clear that the nurse administering the medication is the last person in the chain of events leading to medication administration who can prevent medication administration errors from occurring (Leufer & Cleary-Holdforth, 2013:215). In addition to administration of medication, the nurse is also the person who is continuously in contact with the patient, and is responsible to continuously monitor the effect of medications on the patient, according to Regulation 2598, chapter 2 (c) (Republic of South Africa, (1984:1). It is therefore crucial that nurses should have adequate knowledge of the mode of actions of medications, as well as the effects and potential side-effects in order to be safe practitioners.

However Håkonsen *et al.* (2010:1) indicated that Norwegian nurses reported that generic substitution of medications could be a major risk factor for medication administration errors. Cadarin, Suter, Dante, Williamson, Devetti and Palese (2012:157), as well as Cleary-Holdforth and Leufer (2013:219) also emphasised the need for continuous professional development of nurses due to frequent changes in their working environment, to maintain their skills and knowledge, as well as to breed a culture of continuous education in the students they accompany.

Continuous education in an effort to remain competent in a changing work environment relates to three of Knowles' principles for adult education: self-directed learning where learners decide on what and how they need to learn, readiness for learning where they can relate what they are learning to their immediate needs, and learning orientation, which in this case is problem orientated (Australian Catholic University, 2016:1).

2.3.4 Generic substitution

As noted in paragraph 2.3.2, nurses have highlighted that generic substitution of medications showed a potential risk for medication errors, due to similar sounding commercial names (Pazokian, *et al.*, 2014:249; Håkonsen, *et al.*, 2010:1).

In 2014 Hewitt, *et al.*, (2015:17) reported that more than 8 000 different medications already existed, and 17,000 different commercial names, also referred to as brand names, were available. Generic medications consist of the same ingredients as

original medications, and original medications can thus be safely substituted with generic medications. The difference between original and generic medications is that generic medications are much cheaper than original medications. The use of generic medications are promoted in many countries, in order to decrease medication expenses (Hassali, Alrasheedy, McLachlan, Nguyen, Al-Tamimi, Ibrahim & Aljadhey, 2014:491; Keenum, DeVoe, Chisholm & Wallace, 2012:574; Zerbini, Luceri & Vergura, 2016:397).

In South Africa, according to the Medicines and Related Substances Control Act 101 as amended in 1997, chapter 22(f) (Republic of South Africa, 1965:20) clearly states that it is expected of pharmacists to inform patients presenting a prescription, of substitutions available. It further states that a pharmacist shall dispense a generic substitution unless forbidden to do so by the patient, or the prescribing practitioner, or in cases where the price of the prescribed medication is lower than that of the substitution. Implementation of these instructions, leads to hospital pharmacists dispensing substitutions for medications prescribed by treating physicians, unless clearly instructed not to substitute, with the result that nurses responsible for administration of medications, are continuously confronted with new brand names.

On 9 May 2017, it was reported that 20 new drugs have already been approved for 2017 in America by the Food and Drug Administration (Mukherjee, 2017:1). In the same report it was stated that 22 drugs have been approved in 2016, 41 in 2015 and 45 in 2014. These numbers clearly illustrate that the numbers of new medications are continuously increasing and that training institutions will never be able to provide student nurses with all the information necessary to be able to safely administer medication. As stated by Cadarin, *et al.* (2011:1570), healthcare workers need to develop a habit of lifelong learning, and therefore, students must be encouraged to utilise information resources when confronted with unfamiliar medications.

2.3.5 Information sources

Buckley, Stasa, Cashin, Stuart and Dunn (2015:87) conducted a study in Australia during 2007 and again in 2010 to investigate which medication information sources registered nurses preferred to utilise for safe medication administration. It was concluded that eighty percent of the participants mostly utilised professional

literature, which consisted of academic reports and journal articles, as well as unconventional publications. In 2010 it was established that nurses rely less on representatives from pharmaceutical companies for information on drugs and that they actually preferred to access information sources electronically, rather than in printed format. It was furthermore reported that nurses rated colleagues as the second most frequently utilised source of medication information (Buckley, *et al.*, 2015:90).

In Britain it was also reported that 95% of nurses regarded the British National Formulary (BNF) as the source most frequently consulted for medication information (Ndosi & Newell, 2010:2660). Pharmacists, doctors and nursing colleagues were again stated as the second most frequently used sources of medication information while administering drugs. While the BNF can be regarded as a reliable source of information, information from human sources cannot always be substantiated. Even though pharmacists can be relied upon for medication information, they are not on duty at all hours, giving rise to situations where nurses rely on other nurses and doctors for information.

Contrary to above findings, Ozsoy and Ardahan (2008:606) reported that nurses in Turkey more frequently relied on information gained from colleagues, as well as previous experience to guide them in decision making. However, even though these findings were reported in 2007, this study was done from 2003 till 2004, which may account for the contradictory findings, since Buckley, *et al.*, (2015:90) also reported a change in the results on frequently used information sources between 2007 and 2010. It can thus be assumed that results from the study done by Ozsoy and Ardahan (2007:606) can no longer be applicable to a younger generation of nurses.

2.3.6 State of affairs in South Africa

Wilson, Michel, Olsen, Gibberd, Vincent, El-Assady, Rasslan, Qsous, Macharis, Sahel, Whittaker, Abdo-Ali, Letaief. Ahmed, Abdellatif, Larizgoitia, WHO Patient Safety EMRO/AFRO Working Group (2012:1) reported an estimated 8.2% of patients admitted to healthcare facilities in developing countries (including South Africa) suffer adverse events

According to Truter *et al.* (2017:1) the numbers of medication errors in a neonatal intensive care unit as well as paediatric wards of an academic hospital in Gauteng were higher than elsewhere in the world. Incorrect dosages accounted for the largest number of errors, while omission of prescribed medication as well medication administered at incorrect times accounted for a considerable number of errors. Blignaut *et al.* (2015:145) reported similar results in surgical and medical wards in public hospitals in Gauteng, where medication errors occurred in 90% of patients. Incorrect administration times and medication omissions were again reported to be the most prevalent types of errors.

Hill & Damons (2016:125) identified generic substitution as a potential risk factor for medication administration errors in a private healthcare institution in South Africa. Study participants expressed an urgent need for information resources on generic substitution, in order to reduce the risk of medication administration errors.

2.4 Conceptual framework

A conceptual framework can be described as a construction of theories or concepts utilised as a map or framework for the study (LoBiondo & Haber, 2010:575) Concepts are represented by boxes, and arrows are used to illustrate linkages or relationships between different concepts (Polit & Beck, 2014:135).

According to Knowles' adult learning theory, it can be assumed that adult learners display the following four characteristics towards learning (Australian Catholic University, 2016:1). Firstly, adult learners utilise self-directed learning, secondly they have previous experiences and knowledge, which can be applied to new learning situations, while the third and fourth principles state that adult learners are outcome orientated and need to know whether they will be able to apply what they have studied to real life. These characteristics were incorporated into the conceptual framework for this study.

Figure 2.1 illustrates the conceptual framework utilised for this study, namely:

- The bridging course (Regulation 683) student's demographic data (i.e. age, duration of employment as enrolled nurse and exposure to specialised areas),

- Pharmacology and medication administration education in the academic setting (i.e. preferred method of learning and resources used for learning),
- Support and resources in the clinical setting with regard to medication administration (i.e. availability of pharmacists, registered nurses and literature on medications, as well as utilisation of sources),
- Knowledge of the most frequently used medications (i.e. Paracetamol intravenous (Perfalgen), Enoxaparin sodium (Clexane) and Tramadol (Tramazac).

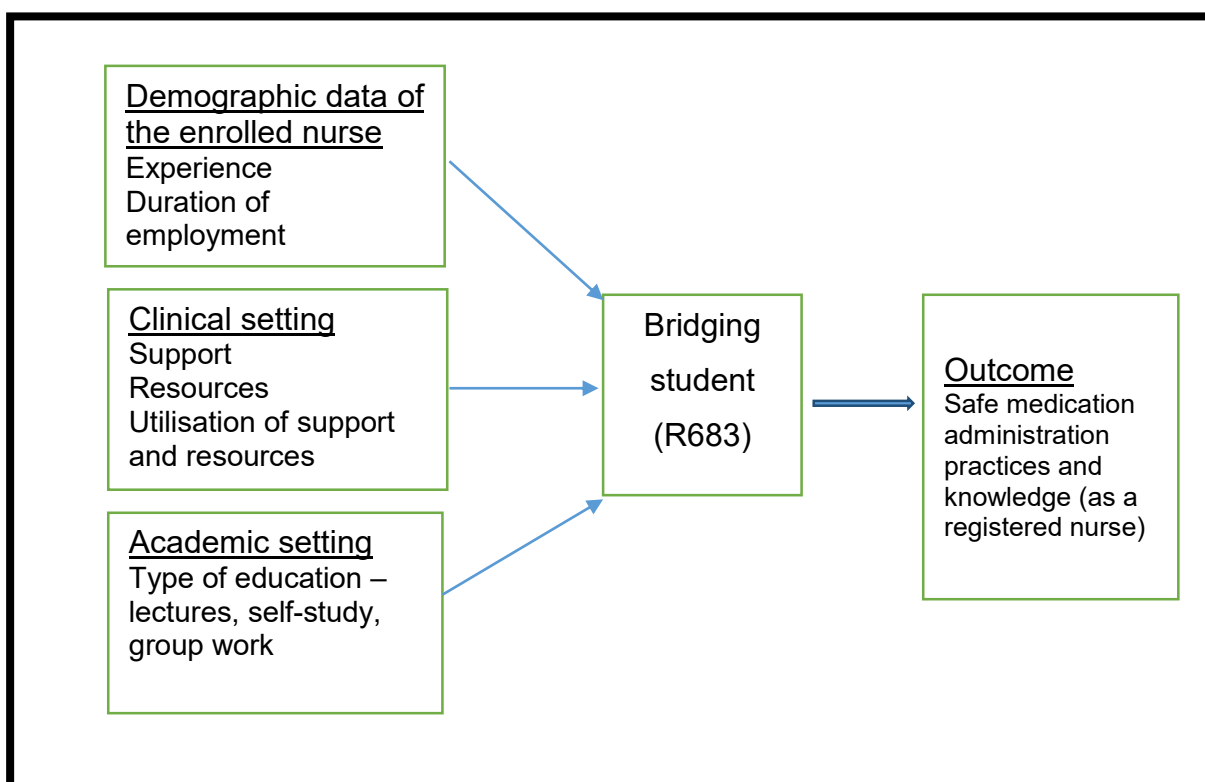


Figure 2.1: Framework for the study designed by the researcher

2.4.1 Contribution of focus areas in conceptual framework

2.4.1.1 Demographic data of the enrolled nurse

- Experience: Participants to this study had previous exposure to different areas of nursing, including specialised areas (critical care units, emergency centres and theatres etc.) Chronic medications are administered less frequently in

these areas, and participants from these areas may therefore need to utilise medication information resources more frequently than participants from general areas (medical and surgical wards) who administer a wide range of chronic medications daily.

- Duration of employment as enrolled nurse: Medication administration is one of the key functions of the enrolled nurse in the study setting, and it can thus be assumed that knowledge of different medications will increase with duration of employment.

2.4.1.2 Clinical setting

- Support & Resources: Availability and awareness of support by members of the multidisciplinary team (pharmacists) as well as other medication information resources need to be explored, since support systems and resources will only be utilised if participants are aware of these resources.
- Utilisation of support and resources: Utilisation of available support systems and resources to gather information about new and unfamiliar medications will lead to safe medication administration practices.

2.4.1.3 Academic setting

- Type of education: Preferences for group discussions or self-study methods for theoretical component of pharmacology and medication content will indicate a measure of responsibility and self-reliance, whereas preference for formal lectures will indicate participants' reluctance to assume responsibility for their own development.

In this study, all participants had pre-existing knowledge and a background in nursing, as stated in Knowles' learning theory. One of the aims of this study was to determine whether these students could take responsibility for their own learning needs and identify and utilise available resources. The outcomes to the last question on the instrument demonstrated whether the participants will be able to recall and utilise information on medication included in their studies, in real life.

The questionnaire integrated Knowles's self-directedness by including questions about preferences regarding study methods and resources, while previous experience and knowledge were integrated through the exploration of students' previous exposure to different areas of nursing and duration of exposure.

2.5 Conclusion

All the literature reviewed for this study, indicated that medication administration errors are a reality, causing harm to not only patients, but also to the healthcare practitioners, including registered nurses as well as nursing students involved in these incidents.

Every year more medications are approved for distribution and administration to patients, and the same type of medication can be marketed under more than one brand name. For nurses to safely administer medications, some form of information resource should be available and utilised continuously.

In the next chapter the research methodology utilised for this study will be discussed. Aims and objectives will be clearly stated and the process of data collection will be described in chronological order.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Chapters one and two provide an overview and the literature review for this study respectively. Chapter three describes the research methodology in depth to determine whether final year bridging students had access to, and utilised medication information sources in the clinical and academic settings of a private hospital group in Southern Africa. Research methodology is defined as the strategies, steps and procedures utilised to gather and analyse data during a study (Polit & Beck, 2014:385).

In this chapter the researcher provides a detailed discussion regarding the following:

- Study setting
- Research design
- Population and sampling
- Instrumentation
- Pilot test
- Reliability and validity
- Data collection
- Data preparation
- Data analysis
- Study limitations

3.2 Study setting

The study setting refers to the physical address or location where the data is collected (Polit & Beck, 2008:766). The setting for this study comprised the following

four learning centres of a private healthcare setting, namely: in the Cape, Bellville, Limpopo in Polokwane, Northern in Bryanston, Gauteng, and Tshwane in Pretoria.

3.3 Research design

According to Rubin and Babbie (2015:612) the research design involves all the decisions made (regarding the topic, population, methods and purpose) in planning and conducting the research. Selection of the appropriate research design will assist the researcher in controlling components which may threaten the validity of the study (Burns & Grove, 2009:237). A quantitative approach with a descriptive design was applied for this study.

- ***Quantitative research***

For the purpose of this study, quantitative research is defined as a process which is systematic, formal and objective (Burns & Grove, 2009:22). Information for this study was derived from numerical data utilised to describe the variables under investigation. Statistical analysis was applied to the data in order to ascertain whether the findings were significant (Terre Blanche, Durrheim & Painter, 2012:563).

- ***Descriptive design***

A descriptive design was applied to gain more information about the availability of medication information resources, as well as the utilisation of these resources by second-year bridging students in the clinical, as well as academic settings. A descriptive design was utilised for this study, since information about this topic is limited (Burns & Grove, 2009:25). Furthermore, this design enabled the researcher to describe the availability of medication information resources in the clinical setting, as well as report the frequencies with which second-year bridging students utilised these information resources in the clinical, as well as academic settings, to ensure safe medication administration.

3.4 Population and sampling

The population for any study consists of all the individuals that met the inclusion criteria for the specific study (Burns & Grove, 2009:42). The total population for this study (N= 190) consisted of all enrolled nurses employed by the private hospital

group who were in the second year of their bridging course according to R683 (Republic of South Africa, 1991:1). Table 3.1 presented the target population for this study.

Table 3.1 Target population for this study

Inclusion criteria	
Students commenced June 2015	62
Students commenced Jan 2016	100
Students whose study was extended	28
Total population (N)	190

A sample consists of a smaller portion of the entire population initially identified for the study (Grove, Gray & Burns, 2015:511). Due to the limited size of the population, an all-inclusive sampling method was employed. All-inclusive sampling refers to a method where all members of the population who meet the inclusion criteria are invited to participate in the study (Merriam-Webster, 2017). Thus, for the purpose of this study the sample size consisted of all second-year bridging students who were available and willing to participate in this study. However, a total of 57 participants were not available for data collection on the pre-determined dates, and another class of 28 students was utilised for the pilot test, thus the final number of the all-inclusive sample came to (n=105). Two more students (n=2) arrived late for classes on the days of data collections, and were therefore excluded from the study. Therefore, the final sample size was (n=103).

3.4.1 Inclusion criteria

Inclusion sampling criteria refers to the qualities subjects must possess to form part of the population targeted for the study (Grove *et al.*, 2015:505). For this study, all second-year bridging students attending class on data collection dates, who were willing and signed informed consent forms to participate in the study, were included in the study.

3.4.2 Exclusion criteria

Exclusion sampling criteria refers to qualities or circumstances that may lead to subjects being excluded from the larger population (Grove *et al.*, 2015:504). Students whose second year was extended due to failure of second year practical or theoretical examination were excluded from the study. These students were excluded because they did not attend any classes, and were therefore not available for participation.

Another three classes of students, comprising (n=57) students, had to be excluded from this study, due to them not attending classes and thus not being available for data collection during the data collection period. A further class of (n=28) students were excluded from the study, since this class was utilised for the pilot study. (Please refer to paragraph 1.7.1.1 Table 1.1)

3.5 Instrumentation

Instrumentation can be defined as the adherence to specific standards during the development of the measurement device to be utilised during data collection for a study (Burns & Grove, 2009:43). The researcher adapted a questionnaire developed by Ndosu and Newell for a study to determine pharmacology knowledge of nurses (2009:570). This same instrument was subsequently utilised in a second study by Ndosu and Newell (2010:2660) to identify medication information sources utilised by nurses during medication administration. Permission to adapt this instrument was granted by M Ndosu on 18 June 2016 (Annexure C).

A questionnaire is frequently utilised for data collection in social studies (Terre Blanche *et al.*, 2012: 484). This type of data-collection tool consists of different questions to measure the different concepts being studied (LoBiondo-Wood & Haber, 2010:275). The questionnaire can consist of open-ended or close-ended questions. Open-ended questions are usually included in structured interviews, when the researcher cannot precipitate the participants' reactions to questions, while closed-ended questions can only be answered with fixed responses (LoBiondo-Wood & Haber, 2010:275).

For this study, a self-administered questionnaire (Annexure E), with close-ended questions was utilised for data collection. One open-ended question was included to give respondents the opportunity to describe any medication information resources utilised in their clinical surrounding, which was not included in the study.

The term self-administered refers to a data-collection method, where participants directly respond to structured questionnaires (LoBiondo-Wood & Haber, 2010:274). A self-administered questionnaire was beneficial for use in this study, as the questionnaire allowed for effective utilisation of time, as a class of thirty students could complete these questionnaires simultaneously. During the pilot study it was established that time to complete the questionnaire ranged between fifteen and twenty minutes, and these same numbers were reported by the data collectors at the different venues.

Furthermore, the printed version of the questionnaire consisted of only two pages, which was very cost-effective, since two pages were printed on one page, and each page was then folded in half (Polit & Beck, 2014:186). This method leads to a 50% saving on printing costs.

Another advantage of this type of questionnaire with closed-ended questions was demonstrated in the ease with which respondents could complete these questionnaires, as well as the simplicity of data analysis afterwards (LoBiondo-Wood & Haber, 2010:274).

The language selected for the questionnaire was English. Since all classes at these facilities are presented in English, and tests and examinations are written in English, it was assumed that all participants will understand English. Furthermore, one of the aims of the pilot test was to establish readability of the questionnaire. Readability refers to whether all participants will be able to read and understand the printed questionnaire (Grove *et al.*, 2015:510).

The questionnaire was divided into the following four (4) sections:

3.5.1 Section A: Demographic data

Section A consisted of five closed questions (A - E) and included data about sex, age, duration of employment as enrolled nurse, as well as information about exposure to different types of nursing environments. This data was included to provide complete details about the composition of the sample, in order to determine transferability to the broader population (LoBiondo-Wood & Haber, 2010:277; Terre Blanche *et al.*, 2012:91).

3.5.2 Section B: Resources available and utilised in the clinical setting

Section B included 11 questions (F – P) on the support and resources available in the clinical setting, as well as the student's utilisation of these resources. Questions F to I explored the availability of different resources at ward level, while questions J to P were Likert type questions, or Likert items. A Likert item is a declarative statement followed by a scale of responses, from which the respondents must choose the most appropriate response (Terre Blanche *et al.*, 2012:488). A Likert scale consists of a number of statements about a topic, and respondents are required to indicate whether they agree or disagree with these statements (Rubin & Babbie, 2015:554). Responses to these include: "1=Never, 2=Sometimes, 3=Frequently and 4=Always" (LoBiondo-Wood & Haber, 2010:276).

3.5.3 Section C: Utilisation of medication information resources in the academic setting

Section C (Q – Y) comprised another set of Likert type questions, ranging from "1=Strongly disagree, 2=Disagree, 3=Agree and 4=Strongly agree", to measure the student's preferences for resources utilised during studies and lectures on pharmacology and medication (LoBiondo-Wood & Haber, 2010:276).

3.5.4 Section D: Knowledge of medication

Section D consisted of multiple-choice questions (Z - CC) to assess students' knowledge of three medications which are most frequently used in the private hospital group. A multiple-choice question consists of a question followed by two or more possible answers from which the respondents must choose the correct one

(Terre Blanche *et al.*, 2012:489). In this questionnaire, each question was followed by three possible questions, of which only one could be correct.

Three versions of this section were developed, each containing a different medication in Section D. Two different versions of the questionnaire were supplied to learning centres where data were collected from two different groups of students on different dates. This was done to ensure that even if students from the first group participated in the study they would share the content of the questionnaire with students from the second group, the data collected from the second group would still be valid. If students had to be tested on knowledge of medication, and had time to prepare for this question, the internal validity of the questionnaire would be threatened (Terre Blanche *et al.*, 2012:90).

In order to identify medication administered on a daily basis by these students, pharmacists of two large hospitals in the private healthcare group were requested to provide a list of the ten medications most frequently prescribed and administered in the general wards of these hospitals. The two lists were compared, and three medications which were listed on both, and which were included in the curriculum of the first year of study for the bridging course, were selected for inclusion in the questionnaire. The selected medications were: Enoxaparin sodium (Clexane), Paracetamol intravenous (Perfalgen) and Tramadol (Tramazac).

Questions pertaining to these three medications included the mode of action, indications, contra-indications and side-effects or adverse effects. Three possible options were provided from which the student could select the correct one. Only one option was correct. An answer guide was developed for this section utilising two of the most frequently used medication information sources, MIMS (Snyman, 2015: 75, 88 & 182), and SAMF (Gibbons, 2008: 101, 416 & 418). This answer guide is attached to Annexure A.

3.6 Pilot test

A pilot test is the trial run in preparation for the major study, to assess the practicalities and to allow for adjustments to the instrument should there be any shortcomings (Polit & Beck, 2008:761). Furthermore, the pilot test also provides an

indication of the time required to complete the questionnaire (Brink, van der Walt, & van Rensburg, 2012: 57).

Hertzog (2008:180) considered a 10% sample of the intended population as sufficient for a pilot test. Therefore, the researcher aimed to include fifteen to twenty students in the pilot test. One class consisting of (n=28) students was selected for the pilot study. Unfortunately, only (n=15) students chose to participate in the pilot test.

The researcher selected the Cape Learning Centre for the pilot test. This learning centre was accessible and convenient for the researcher. The pilot test was conducted on 18 April 2017. Data generated from the pilot study was not included in the major study. Furthermore, to protect the validity of the final data, and to prevent bias, Section D (knowledge component of the questionnaire) in the pilot study, was not the same as in the final instrument used at this centre. This was done in order to prevent students from the pilot test group sharing information with other students, thus enabling them to prepare for the knowledge component of the instrument. Preparation for this component would have resulted in distorted findings, which is a type of bias the researcher tried to minimise (Grove *et al.*, 2015:500).

One of the aims of the pilot test was to establish readability of the questionnaire (Polit & Beck, 2014:51). Therefore, students from all the different language groups were requested to participate in the pilot test. Students with Afrikaans, English and isiZulu as a first language participated. Unfortunately, none of the isiXhosa speaking learners chose to participate.

Participants to the pilot study were requested to thoroughly read the information leaflet and informed consent form, and to ask for clarification if anything was unclear. They were also encouraged to bring any grammar or spelling errors under the researcher's attention. After the informed consent form was signed, they were handed a questionnaire with a blank envelope, and they were again requested to thoroughly read and assess every question for ease of understanding, and to ask for clarification where needed (Terre Blanche *et al.*, 2012:94). During this phase, it was established that the instruction to the question about the availability of the MIMS, SAMF (2008), Internet or other sources in the clinical setting, were not clear and had

to be changed. On the final instrument the instruction to this question clearly stated that participants could select more than one of the available resources.

After completion of the questionnaire, participants were instructed to fold the questionnaire, seal it in the unmarked envelope, and drop it in the empty box provided at the exit from the room. Participants were provided with a small bag of snacks on their exit, as a token of appreciation from the researcher.

Instructions on the single item identified as unclear on the questionnaire, were corrected after the pilot test. It was also established that time needed to read and complete the informed consent form as well as the questionnaire, ranged from fifteen minutes to twenty five minutes. It was important to establish the time needed, in order to properly plan for data collection sessions.

3.7 Reliability and validity

3.7.1 Reliability

Reliability refers to the instrument's ability to consistently and accurately measure the specific attribute under investigation (Grove *et al.*, 2015:510). The aim of this study was to identify different sources of medication information available to bridging students, and to determine whether these sources were utilised during medication administration in the clinical setting, as well as during studies of medication. The questions included in the instrument were found to be reliable in the study done by Ndosu and Newell (2008:574). During this study in the United Kingdom, the original instrument was utilised in structured interviews, and intra-class correlation was 0.726 ($p = 0.0001$). This is an indication that scores given by different assessors corresponded. The adapted version of this instrument had been piloted in the South African context to ensure that all participants clearly understood the questions, as aforementioned, and data was collected by trained fieldworkers.

Due to the fact that multiple variables were investigated that could not be grouped into scales, traditional methods of determining reliability, such as Cronbach's alpha could not be applied (Polit & Beck, 2014:203). Test-retest reliability was not suitable either, since completion of the first instrument could have influenced the responses

to the second instrument, especially the questions related to knowledge of medications (Polit & Beck, 2014:202).

3.7.2 Validity

The validity of an instrument refers to the ability of the instrument to accurately measure the construct being studied (Grove *et al.*, 2015:514). Validity was supported by the pilot study and by applying content and face validity. Content validity is determined by assessing whether all the constructs under investigation, are equally represented in the instrument (Brink *et al.*, 2012:166), while face validity is established when it looks like the instrument is measuring the construct it is supposed to measure (Polit & Beck, 2014:380).

The content of the questionnaire was validated by a colleague of the researcher with experience of the research process, as well as medication content of the curriculum. Furthermore, the supervisor and the academic staff members at the Stellenbosch Master's tutorial provided valuable input into the face validity of the instrument.

3.8 Data collection process

The concept data refers to all information or materials gathered during a research study (Terre Blanche *et al.*, 2012:51; Grove *et al.*, 2015:502). Data collection is the systematic process of identifying the questions or subjects to be studied, as well as the collection of information in numerical or language format (Terre Blanche *et al.*, 2012:51)

Data for this study was collected between 4 May 2017 and 22 May 2017 at the following learning centres: Tshwane, Northern, Cape and Limpopo. Dates for data collection were arranged in advance between the researcher and data collectors at the different data collection venues via electronic mail. These dates were arranged to coincide with dates when students who met the inclusion criteria, would be attending classes at the different venues.

Four data collectors at the different learning centres received written training via electronic mail, as well as telephonic conversations well in advance of data collection dates. Information leaflets, blank envelopes and questionnaires were sent to these

data collectors via a private courier company frequently utilised by the private hospital group to ensure safe transport of documents.

On the pre-determined dates, trained data collectors explained the purpose of the study to potential participants, and were available to answer any questions. Students who chose to participate in the study then signed the informed consent forms, which were returned to the data collector. Questionnaires and blank envelopes were then handed to all who wished to participate, and the data collector remained in the venue, to be available for any queries. The duration of time needed to complete these questionnaires, ranged from ten to fifteen minutes.

After completion of the questionnaire, each participant folded the questionnaire and placed it in the blank envelope received with the questionnaire. An empty box was placed in the vicinity of the door, and participants were requested to put their envelopes in the box, as they exited the venue. Completed questionnaires and signed informed consent forms were returned to the researcher by the same courier company who delivered the documents before data collection.

Feedback between the researcher and data collectors on the data collection process at the different venues took place by telephone conversations, as well as electronic mail. According to all data collectors, no difficulties on comprehension or readability of the instrument were reported, and no participants required assistance on completing the questionnaire. A total number of (n=103), i.e. a (100%) response rate, completed the questionnaires. Only two (n=2) students from the identified sample were excluded, due to the fact that they were late for class on the date when data collection took place.

3.9 Data preparation

The first step in organising the data was to assign a reference number to each completed instrument, which was written onto the instrument in a space provided. All data was subsequently entered into a SPSS (Statistical Package for the Social Sciences, version 24 of 2017) spreadsheet.

To ensure the accuracy of data entered into the spreadsheet, three different methods were utilised by the researcher. Firstly, the spreadsheet was opened in the “Data” view, and all entries were analysed for any answers outside the possible range of values. Secondly, all rows with missing values were compared against the original data collection instrument to ensure no collected data was missed. Thirdly, 10% of the original instruments were compared to the entered data, with the assistance of a second person. When all of these measures only produced one item of data incorrectly captured, the researcher concluded that data was correctly entered.

3.10 Data analysis

Quantitative data are analysed according to various statistical methods. The results of the variables measured are compiled to assist the researcher in the description of the data collected, as well as in drawing conclusions about the population from which the sample was derived (Terre Blanche *et al.*, 2012:188).

Data analysis included descriptive as well as inferential analysis techniques. Descriptive statistics consists of procedures to assist the researcher in the description and comprehension of data sets, by summarising the data collected for the study (LoBiondo-Wood & Haber, 2010:310). Descriptive statistics are further utilised to condense and organise the data, in order for the results to be understood by those who read the research report (Brink *et al.*, 2012:179).

Numerical data, (age, gender, internet access at home and duration of employment) were summarised by measures of central tendency; mean, median and mode to indicate the average scores obtained from the data. Categorical data, consisting of nominal and ordinal categories, were calculated and reflected in tables. Categorical data refers to data organised into groups (LoBiondo-Wood & Haber, 2010:312). Each group can consist of more than one mutually exclusive group.

Inferential statistics were utilised to draw conclusions about the population being researched (Polit & Beck, 2014:225). Inferential statistics utilises a combination of logic and mathematical calculations to make predictions or generalisations about the larger population from which the sample was selected (LoBiondo-Wood & Haber,

2010:318). The Mann-Whitney U test is a non-parametric test utilised to compare data from two different groups, e.g. between male and female participants without assuming that values obtained are normally distributed (Pallant, 2016:230). The Kruskal-Wallis test is another non-parametric test utilised when data are not assumed to be normally distributed, e.g. work experience in different areas of nursing, but data from three or more groups can be compared (Pallant, 2016:236).

A qualified statistician of Stellenbosch University assisted the researcher with the data analysis. A computerised software program, Stata version 14 was utilised for the data analysis.

3.11 Response rate to questionnaires

The total amount of questionnaires handed out for this study, was (n=103), and 100% completed questionnaires were received back. However, some participants chose not to respond to the questions related to medication knowledge. These omissions will be further discussed in the next chapter.

According to Grove *et al.* (2015:37) a sample can be accepted to be representative of the bigger population if it adheres to the following characteristics: the sample should be representative with regard to the variables under inquiry and the demographic background, and the available sample population should portray the larger population. The sample selected and utilised for this study, adhered to all these principles. All participants were second-year bridging students; their demographic characteristics represented the characteristics of the larger population of second-year bridging students, and the students available to participate in the study, were representative of the larger population. Therefore, it can be concluded that the findings of this study can be generalised to the larger population of second-year bridging students.

3.12 Summary

This chapter provided an in-depth description of the research methodology utilised during this study, to determine whether final year bridging students had access to, and utilised medication information sources in the clinical and academic settings of a

private hospital group in Southern Africa. Terminology applied in this study was defined and described, and all the steps of the research process were described in detail.

In the next chapter, the research findings will be discussed, and supported with the appropriate graphical representations.

CHAPTER 4

DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

In this chapter, the study findings will be presented, interpreted and discussed by relating it with possible findings from the literature. The data are presented according to the questionnaire, namely: biographical data, clinical setting, academic setting and medication knowledge.

4.2 Presenting the study findings

Study findings will be presented as follow:

Section A: Biographical data

The biographical profile of the participants will be described in this section.

Section B: Clinical setting

Availability of different sources of medication information in the clinical setting as well as utilisation of these resources will be presented.

Section C: Academic setting (Learning centre)

Preferred study methods as well as medication information sources consulted for pharmacology studies will be presented.

Section D: Medication knowledge

Knowledge on mode of action, indications and contra-indications as well as side-effects and adverse effects of three regularly prescribed medications will be presented.

Study findings are presented and interpreted in tables, histograms and pie charts. Various tests were done during the data analysis, as described in chapter three, Section 3.10.

4.3 Section A: Biographical data

This section includes the biographical profile of the participants. Five questions (Question one to five) collected data about gender, age, internet access at home, duration of employment as enrolled nurse and area of nursing where they spent the majority of time as an enrolled nurse.

4.3.1 Question 1: Your gender (n=103)

Figure 4.1, showed that the majority of participants were female n=88 (85.4%) with only a few males n=15(14.6%). These findings correlate with other nursing studies also indicating that females were found to be in the majority (Fleming *et al.*, 2014:57; Cadorin *et al.*, 2012:155).

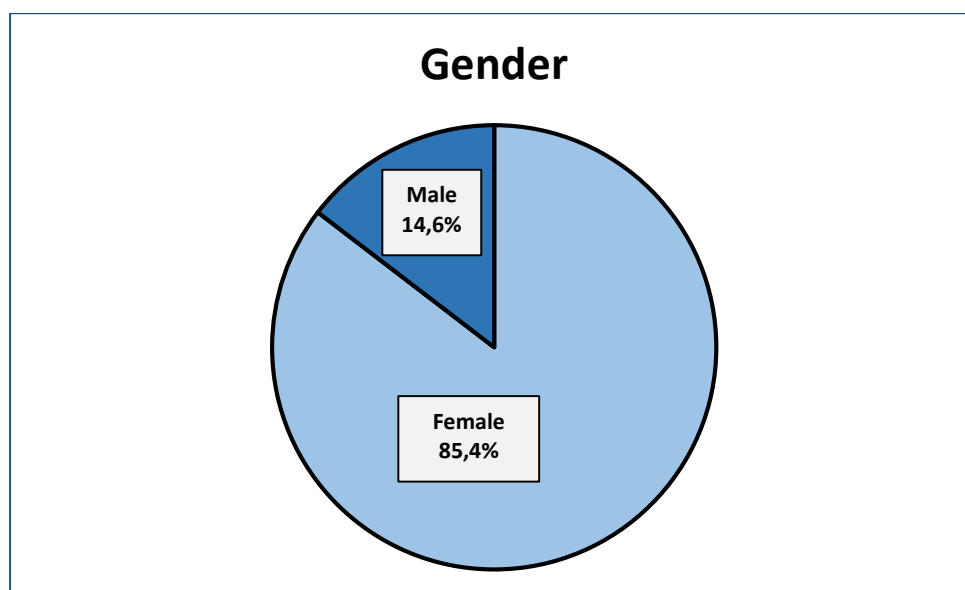


Figure 4.1: Gender

4.3.2 Question 2: Your age (n=103)

As illustrated by Figure 4.2, just over fifty percent of participants n=53(51.5%) were in the age group 20 – 29 years of age, followed by 39 participants (39.7%) in the age group 30 – 39. Only 11 participants (10.7%) were 40 years and older. These results

mirror the findings from a study done in Ireland, where the majority of participants were in the age group between 21 and 30 years (Fleming *et al.*, 2014:57).

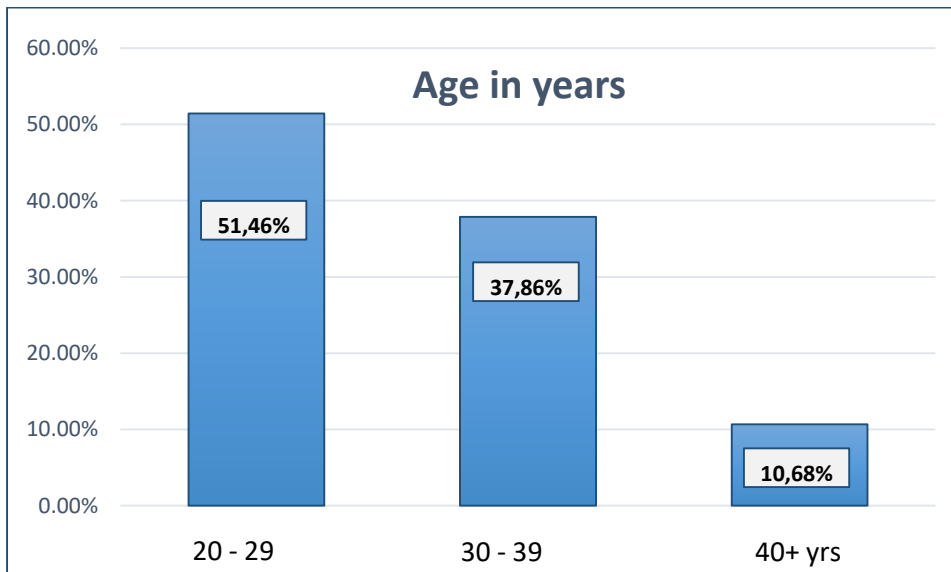


Figure 4.2: Age in years

4.3.3 Question 3: Access to internet at home (n=103)

According to Figure 4.3, only a few participants n=19 (18.4%) did not have access to internet at home, while most of the participants n=84 (81.6%) reported that they had internet access at home. It was important to explore this question, since Section C of the questionnaire dealt with the utilisation of different information sources, including use of the internet on studies of pharmacology.

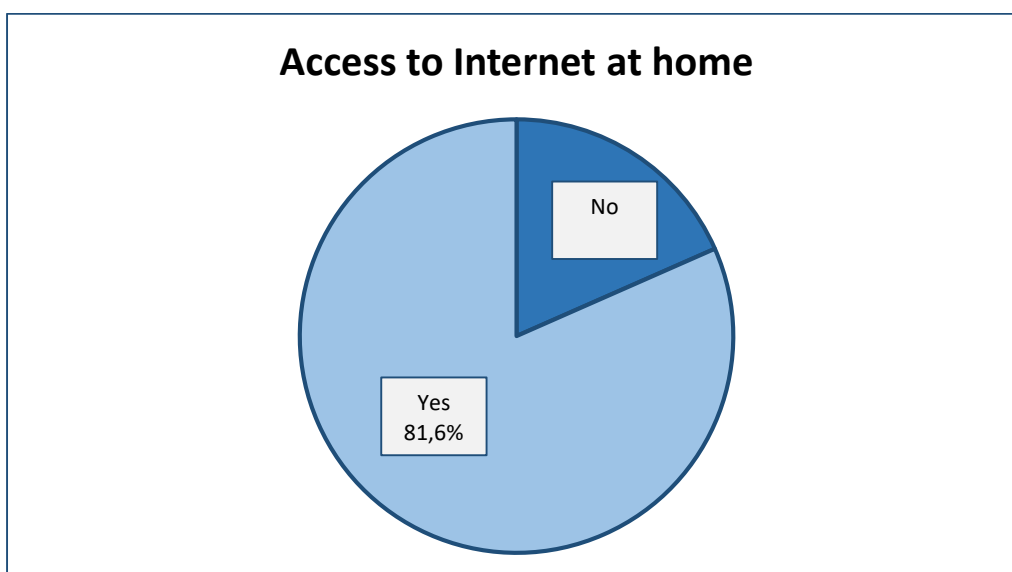


Figure 4.3: Access to Internet at home

4.3.4 Question 4: Duration of employment as enrolled nurse (n=103)

The results in Figure 4.4 illustrate that the majority of participants n=45 (43.67%) have been working as enrolled nurses for one to three years before commencing with the bridging course. The remainder of the participants n=24 (23.30%) had worked between four and five years, six n=6 (5.83%) worked between eleven and twenty years, while some n=3 (2.91%) had more than 20 years of experience working as an enrolled nurse. These numbers indicated that the majority of participants had very limited experience as enrolled nurses.

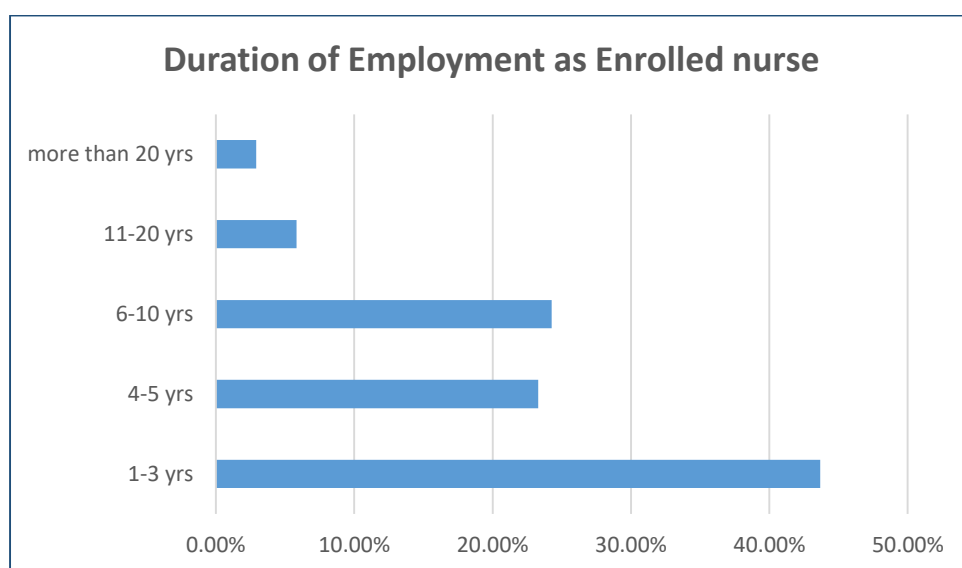


Figure 4.4: Duration of Employment as Enrolled Nurse

4.3.5 Question 5: Areas where students spent the longest time (n=103)

According to Figure 4.5, more than fifty percent of participants n=64 (63.1%) had worked as enrolled nurses in either surgical wards n=23 (22.33%), medical wards n=21 (20.39%), or intensive/high care units n=21 (20.39%). Of the remainder, 12 participants n=12 (11.65%) had emergency centre experience, while nine n=9 (8.74%) had worked in theatre. Only a few n=17 (16.51%) participants had worked in paediatric wards n=7 (5.83%), obstetric wards n=6 (5.83%) and other areas of nursing n=4 (3.88%).

The significance of this information lies in the fact that enrolled nurses working in specialised areas, e.g. obstetrical or paediatric wards, are only administering a limited number of specific medications applicable to that speciality. Whereas enrolled nurses working permanently in theatre become familiarised with anaesthetic medications and analgesics. Likewise, enrolled nurses working in the emergency departments will be familiar with emergency drugs, but they might not necessarily have knowledge about all the chronic medications used by patients admitted for long-term stay in hospital due to a medical condition or surgery.

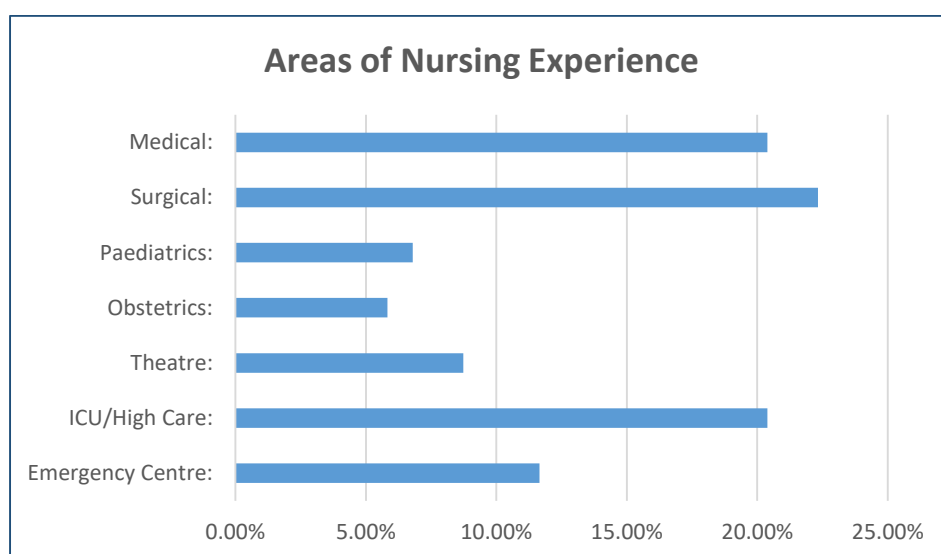


Figure 4.5: Areas of Nursing Experience

4.4 Section B: Clinical setting

The aim of the questions (6 to 16) in this section was to determine which medication information resources were available in the clinical setting, the amount of time the participants spent on medication administration each day, their utilisation of various medication information sources, and how frequently they gave health information to patients.

4.4.1 Question 6: Internet access at work (n=103)

Figure 4.6 shows that the great majority of participants n=83 (80.6%) indicated that they had internet access at work, while only a few participants n=20 (19.4%) reported no internet access at work. It was important to establish whether participants had access to the internet at work, since this is one of the information

sources explored in this study. According to Ndosu and Newell (2010:2660), 11.9% of participants in the United Kingdom reported utilisation of this information source to ensure safe medication administration.

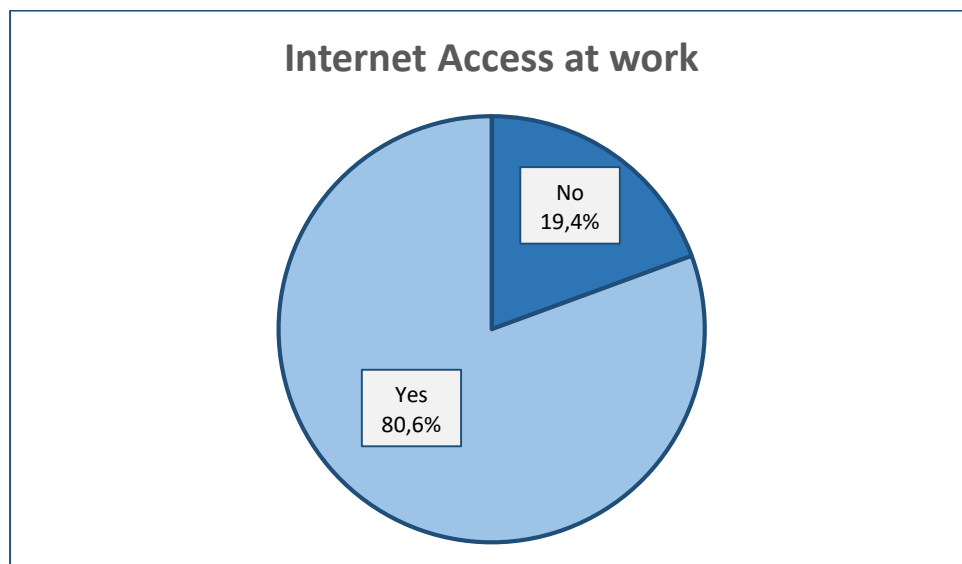


Figure 4.6: Internet access at work

4.4.2 Question 7: Average amount of hours spent on medication administration (n=103)

As illustrated by Table 4.1, as well as Figure 4.7, a significant amount of time is spent on medication administration per 12-hour shift. The majority of participants n=39 (37.9%) reported that medication administration took up between three and four hours per shift, while a smaller number of participants n=15 (14.6%) reported four to five hours, and the same number n=15 (14.6%) reported more than five hours. Only two participants n=2 (1.9%) reported less than an hour and the remainder of participants n=32 (37.9%) reported between one to two hours spent on medication administration per shift. These numbers exceeded times reported by Dilles *et al.* (2010:499) where it was estimated that in Belgium 62 to 90 minutes are needed to administer medication for 20 patients. Likewise, Ndosu and Newell (2010:2660) reported that medication administration for 15 patients took up 10 to 75 minutes in the United Kingdom.

However, it should be noted that participants of this study were questioned about time spent on medication administration per 12-hour shift. During this shift, more

than one medication administration round took place, and some medications were administered between rounds, for example analgesics which were administered as needed. Thus, findings by Hanson (2016:79) where it was estimated that one third of a nurse's day could be spent on activities related to medication, correlates with these current results.

Table 4.1: Average time spent on medication administration

Less than 1 hr	1 to 2 hrs	3 to 4 hrs	4 to 5 hrs	More than 5 hours	Total
n=2 (1.9%)	n=32 (33.1%)	n=39 (37.9%)	n=15 (14.6%)	n=15 (14.6%)	n=103 (100%)

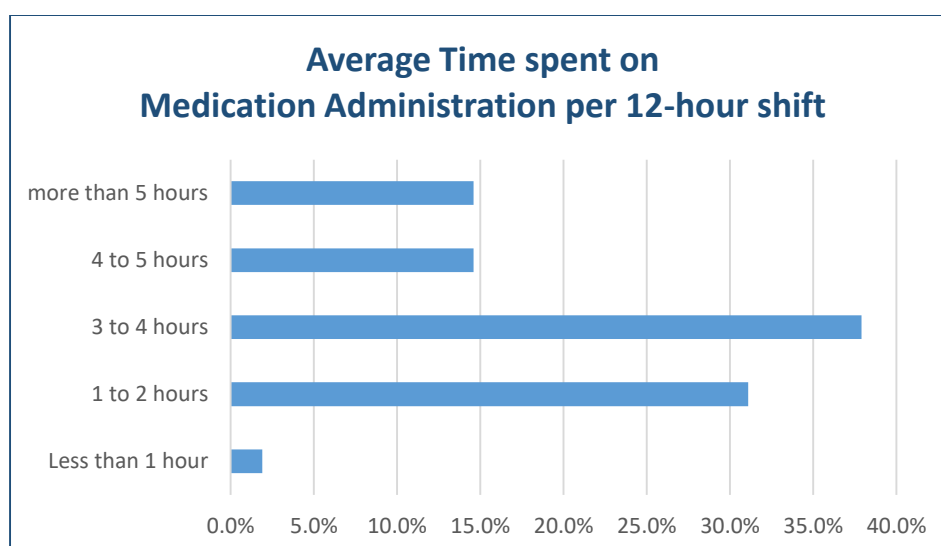


Figure 4.7: Average time spent on medication administration

4.4.3 Question 8: Access to a pharmacist after hours and over weekends (n=102)

One participant (n=1) did not complete this question and the response was therefore excluded from this calculation. Just over fifty percent of participants n=58 (56.3%) indicated that they had access to a pharmacist after hours and over weekends, while a third n=35 (34%) reported that they did not have access to a pharmacist after hours. The fact that nine participants, n=9 (8.7%) did not know whether they had access to a pharmacist over weekends and after hours, is a cause for concern. These participants will be registered nurses within the next year, and then they will

have to make decisions about medications after hours and over weekends. However, these study findings revealed that they had no knowledge about the availability of this important source of medication information. Furthermore, it can be assumed that these nine participants $n=9$ (8.7%) do not utilise pharmacists as a source of information, since they were not aware of the availability or not, of these members of the healthcare team.

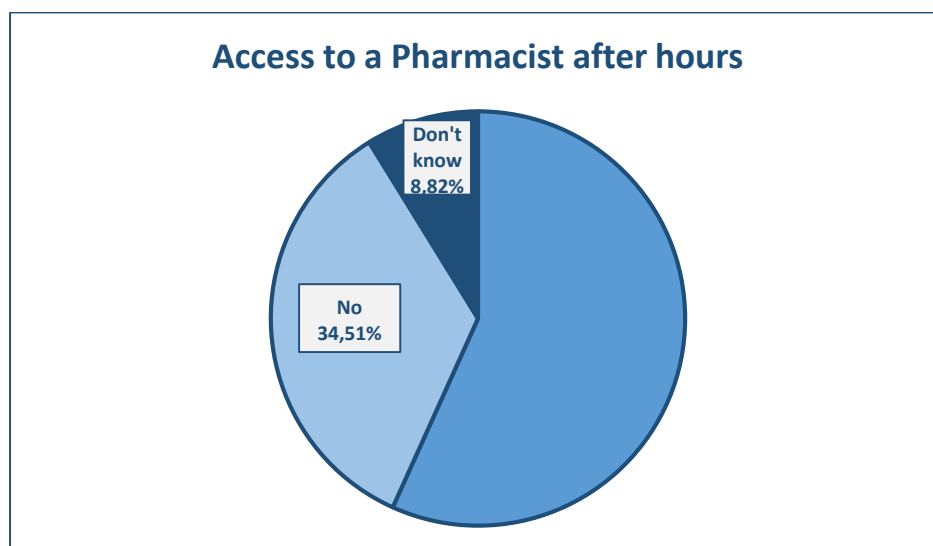


Figure 4.8: Availability of pharmacist after hours and over weekends

4.4.4 Question 9: Availability of medication resources in the ward (n=103)

For this question participants could choose more than one option, since the aim was to identify all resources available in the clinical setting.

According to Table 4.2, the majority of participants $n=100$ (97.1%) indicated that the MIMS is available in the clinical setting, with only a few participants $n=3$ (2.9%) who reported the unavailability of this resource. A third of participants $n=36$ (34.95%) indicated that the SAMF (2008) was available, while the majority $n=67$ (65.05%) reported the absence of this resource in the clinical setting. The three participants $n=3$ (2.9%) who reported about the unavailability of a MIMS did report that a SAMF (2008) was available in the clinical setting. Medication textbooks availability was only reported by some participants $n=5$ (4.85%), whilst an overwhelming number of

participants n=98 (95.1%) revealed that no medication textbooks were available in the clinical setting.

The availability of any other medication resources in the clinical setting was also included. A few n=7 (6.80%) participants answered positively, while the great majority n=96 (95.15%) replied negatively. Participants who replied positively were requested to provide more details regarding the “other” resources. The following information was provided: Google, a file printed by the unit manager with information, internet (mentioned twice), and pamphlets in the medication boxes. Unfortunately two participants did not provide details of these “other” resources.

These numbers indicate that at least one type of medication information resource is available in all the clinical settings where participants in this study were placed for the practical component of their studies. Data on availability of these resources was important, since utilisation of these resources was further explored in the next section, where findings will be compared to results from previous studies.

Table 4.2: Availability of medication resources in the ward

	Yes	No	Total
Availability of MIMS	n=100 (97.1%)	n=3 (2.9%)	n=103 (100%)
Availability of SAMF	n=36 (35.0%)	n=67 (65.0%)	n=103 100%
Availability of pharmacology text books	n=5 (4.9%)	n=97 (95.1%)	n=102 (100%)
Availability of other resources	n=7 (6.8%)	n=96 (93.2%)	n=103 (100%)

4.4.5 Question 10 - 15: Utilisation of medication information resources

The aim of this section was to establish whether the participants consulted the various medication information resources available to them during medication administration rounds, as well as to learn about new medications. The results from this section are illustrated in table 4.3.

4.4.5.1 Question 10: Consulting a registered nurse with queries about prescribed medication during medication administration rounds (n=102)

One participant did not answer this question and the response was therefore excluded from the analysis. Just a bit more than half of the participants n=56 (54.9%) reported that they “sometimes” consult a registered nurse with queries about prescribed medication during medication administration rounds, while thirty-two n=32 (31.4%) participants reported that they “frequently” consulted a registered nurse and n=14 (12.7%) participants showed that they “always” consulted a registered nurse with questions. None of the participants (0%) selected the “never” option. These findings correlate with findings from Buckley *et al.* (2015:90), where professional colleagues were stated as the second-most frequently utilised source of information during medication administration rounds in Australia.

4.4.5.2 Question 11: Consulting a pharmacist with queries about prescribed medication during medication administration rounds (n=103)

All participants answered this question. Most participants n=80 (77.7%) stated that they “sometimes” consulted a pharmacist with queries about prescribed medication during a medication round. Only n=4 (9%) participants “frequently” consulted a pharmacist, while n=19 (18.4%) participants reported that they “never” consulted a pharmacist with queries about medication during a medication administration round. These results are not in line with findings by Ndosu and Newell (2010:2660), where 57.1% of nurses in the United Kingdom reported that pharmacists were the second most frequently consulted source of information on medication information.

4.4.5.3 Question 12: Consulting resources, e.g. MIMS or SAMF during medication administration rounds (n=103)

This question was answered by all participants, and as illustrated in Table 4.3 just over fifty percent of participants n=58, 56.3%) reported that they “sometimes” consulted resources, e.g. MIMS or SAMF (2008) during medication administration rounds, while a third n=34 (33%) reported “frequently” and six participants n=6 (5.8%) selected “always”. A few participants (n=5 (4.9%)) reported that they “never” consulted these resources during a medication administration round.

These results do not correlate with findings from Ndosi and Newell (2010:2660) where the British National Formulary (BNF) were reported to be the most frequently consulted source of information in the United Kingdom. However, Buckley *et al.* (2015:91) reported the MIMS to be fifth most frequently utilised source of information on medication in Australia, which is more in line with findings from this current study.

4.4.5.4 Question 13: Consulting other sources for information about new medications (n=103)

All participants answered this question. Thirteen n=13 (12.9%) participants reported that they “always” consult other sources, e.g. articles, brochures and the internet for information about new medications. Of the remainder of participants, n=28 (27.7%) participants reported “frequent” use of other information sources, n=42 (41.6%) participants reported that they “sometimes” consult other sources and n=18 (17.8%) participants reported that they “never” consult other sources of information. This wide range of answers correlates with previous results from Turkey, published by Ozsoy and Ardahan (2008:605), Buckley *et al.* (2015:91) and Ndosi and Newell (2010:2660), who respectively reported on the use of internet, professional literature and journals as sources of information on new medications.

4.4.5.5 Question 14: Consulting the prescribing physician with queries about prescribed medication during medication administration rounds (n=103)

All participants answered this question. The majority n=66 (64.7%) of participants reported that they “sometimes” consulted the prescribing physician with queries about medication, eleven n=11 (10.8%) participants indicated that they “frequently” consulted the prescribing physician and a few n=6 (5.9%) participants revealed that they “always” consulted the prescribing physician with queries about medication. A considerable percentage n=19 (18.6%) of participants reported that they “never” consulted the prescribing physician with medication queries. This wide range of answers is inconclusive about the utilisation of prescribing physicians as a source of medication information, and correlates with findings of Ndosi and Newell (2010:2660), who reported that only 23.8% of nurses frequently consulted doctors for information about medications.

4.4.5.6 Question 15: Consulting package insert of patients' home medication during medication administration rounds (n=100)

Three participants did not answer this question, and were therefore excluded from the analysis. Slightly more than half of the participants n=52 (52%) showed that they “sometimes” consulted the package insert of patients' home medication, while n=29 (29%) participants reported that they “frequently” consulted package inserts of patients' home medication. Only n=11 (11%) participants reported that they “always” consulted package inserts of patients' home medication and n=8 (8%) participants reported that they “never” consulted package inserts of patients' home medication. In contrast with these results, Buckley *et al.* (2015: 91) reported professional literature as the most frequently utilised source of information about medications in Australia.

The few participants n=8 (8%) who reported never consulting package inserts is a matter of concern, since patients are admitted to these private hospitals with medications prescribed by a wide variety of physicians and dispensed by various pharmacies not connected to these hospitals. Patients are therefore admitted with a wide variety of differently branded medications. Nurses are taught not to administer any medication without knowledge of the actions, effects and potential side-effects of the medication, and if they do not consult any information source, they will inadvertently administer medication without the necessary knowledge of actions, effects and side-effects. These actions can lead to serious adverse events, e.g. if a prescribed anti-hypertensive drug is administered to a dehydrated patient, it can lead to severe hypotension.

Table 4.3 clearly illustrates that the highest score (77.7%) for utilisation of resources were reported for question 11: “*How often do you consult a pharmacist with queries about prescribed medication during medication administration rounds*”, with the majority of participants who indicated that they sometimes consulted a pharmacist. This is in contrary to the findings of Ndosu and Newell (2010:2660) where the British National Formulary was indicated as the most frequently utilised source of information, as well as findings by Buckley *et al.* (2012:90) who reported that nurses rated professional literature as the most important source of information. In both these studies, human information sources, e.g. pharmacists and nursing colleagues were rated as second most frequently utilised information sources.

Table 4.3: Utilisation of medication information resources in clinical setting

	Never	Sometimes	Frequently	Always	Total Response
10. How often do you consult a RN	n=0 (0.0%)	n=56 (54.9%)	n=32 (31.4%)	n=14 (13.7%)	n=102 (100.0%)
11. How often do you consult a pharmacist	n=19 (18.4%)	n=80 (77.7%)	n=4 (3.9%)	n=0 (0.0%)	n=103 (100.0%)
12. How often do you consult resources, e.g. MIMS, SAMF	n=5 (4.9%)	n=58 (56.3%)	n=34 (33.0%)	n=6 (5.8%)	n=103 (100.0%)
13. How often do you consult other sources	n=18 (17.8%)	n=42 (41.6%)	n=28 (27.7%)	n=13 (12.9%)	n=101 (100.0%)
14. How often do you consult prescribing physician	n=9 (8.8%)	n=66 (64.7%)	n=11 (10.8%)	n=6 (5.9%)	n=102 (100.0%)
15. How often do you consult package inserts	n=8 (8.0%)	n=52 (52.0%)	n=29 (29.0%)	n=11 (11.0%)	n=100 (100.0%)

4.4.6 Question 16: Providing health education to patients about medication during medication administration rounds (n=103)

Table 4.4 revealed that almost half of the participants n=47 (45.6%) reported that they “frequently” provided health education to patients about medication during medication rounds. Only a third n=33 (32%) of participants reported that they “always” provided health education, while some n=22 (21.4%) reported that they only “sometimes” provided health education. This question was not explored during the review of previous studies, therefore the results obtained here could not be compared with results from the literature.

However, it is a concern that one (1%) of the respondents admitted to “never” providing patients with health education. The reasons behind this answer might be the fact that this student does not understand the importance of health education about medication, or that he/she does not have the necessary knowledge about the medication to be able to provide health education.

Table 4.4: Providing health education to patients

Never	Sometimes	Frequently	Always	Total
N=1 (1.0%)	n=22 (21.4%)	n=47 (45.6%)	n=33 (32.0%)	n=103 (100%)

4.5 Section C: Academic setting (Learning centre)

This section consisted of another set of Likert type questions, where participants had to respond to the statement with responses varying from “strongly disagree”, “disagree” to “agree”, and “strongly agree” The aim of these questions was to explore which resources and study methods students preferred for their studies about pharmacology and medications, as well as whether students understood the content of lectures on these subjects. Results from this section are illustrated in Table 4.5, Table 4.6 and Table 4.7.

4.5.1 Questions 17 - 20: Preferred study methods for pharmacology and medication studies

In this section, the students were asked to indicate which study methods they preferred for studying pharmacology and medication. Study methods included formal lectures, group work, and self-study and class discussions on medication. Findings from previous studies relating to these subjects will be discussed after reporting findings from question 20.

4.5.1.1 Question 17: Formal lectures on pharmacology and medications (n=103)

As illustrated in Table 4.5, the majority of participants n=65 (63.1%) reported that they prefer formal lectures on pharmacology, while n=23 (22.3%) and n=10 (9.7%) participants, respectively reported “disagree” and “strongly agree” Only a few participants n=5 (4.9%) reported “strongly disagree”.

4.5.1.2 Question 18: Group work on pharmacology and medications (n=101)

Two participants did not respond to this question, and the responses were therefore excluded from the analysis. The remaining responses to this question were similar to those of the previous question, where just over fifty percent n=53 (52.5%) of participants “agreed” while one third n=32 (31.7%) of participants “disagreed” about

a preference for group work on study methods and materials pertaining to pharmacology and medications. Ten participants $n=10$ (9.9%) “strongly agreed” while a few $n=6$ (5.9%) participants “strongly disagreed”.

4.5.1.3 Question 19: Self-study for pharmacology and medication (n=102)

One participant did not respond to this question and that response was thus excluded from the analysis. The responses revealed the same trend as responses from the previous two questions. More than half of the participants $n=58$ (56.9%) “agreed” with preference for self-study for pharmacology and medication, while $n=22$ (21.6%) participants “disagreed”. Sixteen participants $n=16$ (15.7%) “disagreed” and another $n=16$ (15.7%) “strongly agreed”.

4.5.1.4 Question 20: Discussions on pharmacology and medication (n=103)

All participants responded to this question, with similar results as for the three previous questions. The majority of participants ($n=62$ (60.2%)) “agreed”, one quarter $n=25$ (24.3%) “disagreed”, while a few $n=15$ (14.6%) “strongly agreed” and one $n=1$ (1%) participant “strongly disagreed” about preference for discussions on pharmacology and medications.

Responses to the aforementioned questions did not really yield any definitive information about study methods preference, since the results indicate that participants reported to prefer all four study methods. These results can be an indication of any of the following: participants did not have any preference for one specific study method; participants did not understand that it was expected to indicate a preference; or participants did not want to spend too much time on decision making and opted for a safe answer in the middle. According to Knowles’ theory of adult education (Australian Catholic University, 2016:1), adult learners are self-directed and not dependent upon others for their learning, but the above results do not support this theory.

Previous studies on this subject revealed a variety of results. Baraz *et al.* (2014:529) motivated nurse educators to encourage students to develop their own learning styles and strategies in order for students to develop independence in learning. However, Hanson (2016:83) reported that undergraduate nursing students preferred

lectures provided by teachers rather than group work and discussions with other students.

Table 4.5: Preferences on study methods for pharmacology and medication studies

	Strongly disagree	Disagree	Agree	Strongly agree	Total responses
17. Preference is given to formal lectures on pharmacology	n=5 (4.9%)	n=23 (22.3%)	n=65 (63.1%)	n=10 (9.7%)	n=103 (100.0%)
18. Preference is given to group work on pharmacology	n=6 (5.9%)	n=32 (31.7%)	n=53 (52.5%)	n=10 (9.9%)	n=101 (100.0%)
19. Preference is given to self-study for pharmacology	n=6 (5.9%)	n=22 (21.6%)	n=58 (56.9%)	n=16 (15.7%)	n=102 (100.0%)
20. Preference is given to discussions on pharmacology	n=1 (1.0%)	n=25 (24.3%)	n=62 (60.2%)	n=15 (14.6%)	n=103 (100.0%)

4.5.2 Questions 21 – 24: Information sources used for studies on pharmacology and medication

In this section of the questionnaire, the aim was to determine which information sources the participants utilised for studies on pharmacology and medication. Information sources consisted of textbooks, lecturer's notes, internet sources and medication package inserts. Results of these four questions are illustrated in table 4.6. Findings from previous studies relating to information sources preferred for studies on medication and pharmacology will be included after discussion of question 24.

4.5.2.1 Question 21: Preference for textbooks (n=101)

Two participants did not respond to this question and their responses were thus excluded from the analysis. Just more than half of the participants n=56 (55.4%) indicated a preference for textbooks, and a third n=32 (31.7%) "strongly agreed". A small percentage of participants n=13 (12.9%) indicated that they prefer sources other than textbooks, by responding with "disagree" and "strongly disagree"

4.5.2.2 Question 22: Preference for lecturer's notes (n=102)

One participant did not respond to this statement and the response was excluded from the data analysis. From the remaining participants, more than fifty percent n=57

(55.9%) of participants preferred the use of lecturer's notes on medication, while almost a third $n=30$ (29.4%) did not prefer to use lecturer's notes. Only a small group $n=9$ (8.8%) and a few $n=6$ (5.9%) respectively indicated "strongly agree" and "strongly disagree" about preference for the lecturer's notes.

4.5.2.3 Question 23: Preference for Internet sources (n=102)

One participant refrained from responding to this statement and the response was excluded from the analysis. Just less than half of participants $n = 50$ (49%) "agreed" while $n=23$ (22.5%) "disagreed" and the same number $n = 23$ (22.5%) "strongly agreed". A few participants $n = 6$ (5.9%) "strongly disagreed" regarding preference for internet sources.

4.5.2.4 Question 24: Using package inserts for studies on medication (n=101)

Two participants did not respond to this statement and these responses were excluded from the analysis. Just under fifty percent $n=51$ (49.5%) of participants "agreed" with utilising package inserts for studies on medication, while a quarter $n=27$ (26.2%) "strongly agreed". Fifteen $n=15$ (14.6%) participants "disagreed", and $n=8$ (7.8%) "strongly disagreed".

Results from this section showed the same trend as the previous four questions, where the majority of participants indicated that they agreed with all four statements. These results may indicate that students utilise a variety of resources during studies of pharmacology and medications, but it can also indicate that these participants had no real preference and decided to report a safe middle option. As with the previous four questions, self-directed learning as proposed by Knowles (Australian Catholic University, 2016:1) is not supported by these results.

Scott, Gilmour and Fielden (2008:996) reported that 61% ($n=105$) of participants in New Zealand utilised the internet successfully for medication information, but some participants reported technical difficulties in accessing reputable sources, which eventually prevented them from utilising this source. Chuang and Tsao (2013:174) concluded that medication learning materials sent via mobile phone to Taiwanese students were proved to enhance nursing students' knowledge about medications, but it can be argued that this method was another example of educator instigated

learning, and that it was not expected from students to seek any information. They only needed to read the daily message with medication information.

Table 4.6: Preferences on information sources used for pharmacology and medication studies

	Strongly disagree	Disagree	Agree	Strongly agree	Total responses
21. Preference is given to textbooks to study for pharmacology	1 (1.0%)	12 (11.9%)	56 (55.4%)	32 (31.7%)	101 (100.0%)
22. Preference is given to lecturer's notes on pharmacology	6 (5.9%)	30 (29.4%)	57 (55.9%)	9 (8.8%)	102 (100.0%)
23. Preference is given to internet sources for pharmacology studies	6 (5.9%)	23 (22.5%)	50 (49.0%)	23 (22.5%)	102 (100.0%)
24. I keep available package insert and use it for pharmacology and medication studies	8 (7.8%)	15 (14.6%)	51 (49.5%)	27 (26.2%)	101 (100.0%)

4.5.3 Question 25: Clarification is asked if content of lectures is unclear (n=103)

All participants responded to this question and the results are illustrated in Table 4.7. The majority of participants n=62 (60.2%) “agreed” that clarification is asked if content of lectures is unclear, while one third n=34 (33.0%) “strongly agreed”. No participants have indicated that they “strongly disagreed”, but the fact that n=7 (6.8%) participants indicated that they “disagree” with this question is a cause for concern. It indicates that students do not always ask for clarification when content of lectures is unclear, with the effect that they leave the classroom without gaining the acquired knowledge. Therefore, lecturers can assume that all students have clear knowledge of the content discussed, while the opposite is true.

Motivation to learn is a characteristic of adult learners, according to Knowles (Australian Catholic University, 2016:1) but the aforementioned responses illustrate that students are not motivated to such a degree that they will speak up when they do not understand the content, which can lead to them being unsafe medication administration practitioners.

Table 4.7: Clarification is asked when content of lectures is unclear

Strongly disagree	Disagree	Agree	Strongly agree	Total
n=0 (0.00%)	n=7 (6.8)	n=62 (60.2%)	n=34 (33.0%)	n=103 (100.0%)

4.6 Section D: Medication knowledge

The aim of the questions in this section was to assess participants' knowledge on three medications which are administered more than once on a daily basis. According to Knowles' theory of adult education (Australian Catholic University, 2016:1) adult learners accumulate experience due to maturity. By administering the medications included in this instrument frequently, participants should therefore have accumulated knowledge about these medications. The process of identifying which medications to include in the instrument was discussed in detail in chapter three (Paragraph 3.5.4).

Participants had to indicate the classification, indication for use, contra-indication to use, and adverse effects or side-effects of the specific medications. Three possible answers were provided for each question of which only one answer was correct. For this portion of the results, missing responses were included in the analysis. The rationale behind this action was that participants, who preferred not to answer this portion, did not believe they had the required knowledge to answer correctly, and could thus not be calculated as correct or incorrect, but excluding these responses from the analysis could have produced an incorrect result.

In an effort to ensure that these results reflect participants' knowledge of medications, and to prevent them from studying before participating in the study, three different medications were utilised in three different versions of the questionnaire. At learning centres where more than one group of students participated in the study, care was taken to ensure that two different versions of questionnaires were utilised for the different groups.

The results of these questions on knowledge of medications will be presented in Table 4.8, Table 4.9 and Table 4.10. Findings from previous studies on nursing

students' medication knowledge will be reported after results for all three medications included in this study are discussed.

4.6.1 Questions 25 – 28: Knowledge of Enoxaparin sodium

(Clexane) (n=34)

Thirty-four participants (n=34) received an instrument with regard to Enoxaparin sodium. One participant n=1 (2.94%) did not answer all four questions related to this medication, but as stated in section 4.5, missing responses were also included in this analysis.

The majority of participants n=30 (88.24%) could classify this medication correctly as an anti-coagulant, and most n=32 (94.11%) knew the indication for use, which is prevention of post-operative venous thrombosis. Only two-thirds n=21 (61.76%) were correct in identifying the contra-indication to this medication as known hypersensitivity and most n=32 (94.11%) were correct in identifying the risk of bleeding as an adverse effect.

These results indicate that participants to this study have adequate knowledge of this medication's classification, action and adverse effect. Lack of knowledge was displayed in the component of contra-indication, but since these participants were not studying towards a qualification where they would be required to prescribe medications, the risk of medication administration error could be interpreted as minimal in this instance.

Table 4.8: Clexane knowledge

	Correct	Incorrect	Not answered	Total
25. Classification	n=30 (88.24%)	n=3 (8.82%)	n=1 (2.94%)	n=34 (100%)
26. Indication	n=32 (94.11%)	n=1 (2.94%)	n=1 (2.94%)	n=34 (100%)
27. Contra-indication	n=21 (61.76%)	n=10 (29.41%)	n=2 (5.88%)	n=34 (100%)
28. Adverse effect	n=32 (94.11%)	n=1 (2.94%)	n=1 (2.94%)	n=34 (100%)

4.6.2 Questions 29 – 32: Knowledge of Paracetamol intravenous (Perfalgan) (n=34)

Thirty-four participants (n=34) had to respond to questions on Paracetamol intravenous. The majority of participants n=30 (88.24%) chose the correct answer for classification (analgesic and anti-pyretic) and a large portion n=29 (85.29%) were correct in their answers on contra-indication (severe hepatic disease), while a slightly smaller portion n=27 (79.41%) knew that hypotension is a side effect and two-thirds n=24 (70.59%) were aware that this medication is indicated for pyrexia (temperature above 38 °C).

Table 4.9: Perfalgan knowledge

	Correct	Incorrect	Not answered	Total
29. Classification	n=30 (88.24%)	n=0 (0.00%)	n=4 (11.76%)	n=34 (100%)
30. Indication	n=24 (70.59%)	n=6 (17.65%)	n=4 (11.76%)	n=34 (100%)
31. Contra-indication	n=29 (85.29%)	n=1 (2.94%)	n=4 (11.76%)	n=34 (100%)
32. Side effect	n=27 (79.41%)	n=3 (8.82%)	n=4 (11.76%)	n=34 (100%)

4.6.3 Questions 33 – 36: Knowledge of Tramadol (Tramazac) (n=35)

Thirty-five (n=35) participants received instruments with questions about Tramadol. The majority of participants n=32 (91.42%) correctly identified the classification of this medication, while many n=24 (68.57%) had knowledge of the adverse effect, and just more than half of the participants n=18 (51.43%) could correctly identify the indication, as well as the contra-indication for this medication.

Table 4.10: Tramazac knowledge

	Correct	Incorrect	Not answered	Total
33. Classification	n=32 (91.42%)	n=2 (5.71%)	n=1 (2.86%)	n=35 (100%)
34. Indication	n=18 (51.43%)	n=16 (2.94%)	n=1 (2.86%)	n=35 (100%)
35. Contra-indication	n=18 (51.43%)	n=16 (45.71%)	n=1 (2.86%)	n=35 (100%)
36. Adverse effect	n=24 (68.57%)	n=10 (28.57%)	n=1 (2.86%)	n=35 (100%)

4.6.4 Percentages of correct answers across three medications

As illustrated in Table 4.11, knowledge scores on the three medications included in this study varied widely. Knowledge scores on classification of the different medications ranged between 88.24% for both Clexane and Perfalgen and 91.42% for Tramazac. while knowledge on indications and contra-indications for the administration of Tramazac rated poorly with 51.43% for both questions. Knowledge scores on side-effects of Clexane were rated at 94.11%, with 79.41% and 68.57% respectively for Perfalgen and Tramazac.

Table 4.11: Percentage correct answers

	Clexane	Perfalgen	Tramazac
Classification	88.24%	88.24%	91.42%
Indication	94.11%	70.59%	51.43%
Contra-indication	61.76%	85.29%	51.43%
Side effect/adverse effect	94.11%	79.41%	68.57%

These results illustrate that participants had knowledge of the classifications of these frequently-used medications, but that they lacked knowledge on the indications for Tramazac, as well as contra-indications for the use of Clexane and Tramazac.

4.6.5 Additional tests performed on available data

A biostatistician employed by the Stellenbosch University furthermore utilised non-parametric tests to establish correlations between total knowledge scores of participants and demographic data from Section A of the questionnaire. Non-parametric tests are utilised when test scores are not normally distributed (LoBiondo-Wood & Haber, 2010:323). For these tests, missing values were not included in the data analysis.

4.6.5.1 Difference in knowledge score between males and females

The Mann-Whitney U test was utilised to compare data from two different groups (males and females) of the population (LoBiondo-Wood & Haber, 2010:326). The Mann-Whitney U test revealed no significant differences in the knowledge score of males (n=12) and females (n=85) ($z=-0.902$, $p=0.367$).

4.6.5.2 Difference in knowledge score across age groups

The Kruskal-Wallis test allows for comparison of scores from three or more groups (Palant, 2016:236). The Kruskal-Wallis test revealed no significant differences in knowledge scores across the three age groups (20 – 29 years, 30 – 39 years, 40 years or older) ($\chi^2(z) = 3.178, p=0.2041$).

4.6.5.3 Difference in knowledge scores and access to internet

The Kruskal-Wallis test revealed no significant difference in knowledge scores between those participants with access to internet and those without internet access ($\chi^2(z) = 0.315, p=0.5745$).

4.6.5.4 Difference in knowledge scores across length of employment as enrolled nurse

The Kruskal-Wallis test revealed no significant differences in knowledge scores across the five groups (1 – 3 years, 4 – 5 years, 6 – 10 years, 11 – 20 years and more than 20 years) ($\chi^2(z) = 3.201, p=0.5247$).

4.6.5.5 Difference in knowledge scores across groups with different nursing area experience

The Kruskal-Wallis test revealed no significant differences in knowledge scores across the different groups (experience in medical wards, surgical wards, paediatric wards, obstetric wards, operating theatre, intensive care units and high care units, emergency centres and any other areas) ($\chi^2(z) = 3.845, p=0.7974$).

All the above non-parametric tests revealed that no definite relationship consists between knowledge scores and any of the demographic data obtained in Section A of the questionnaire.

4.7 Conclusion

In this chapter, the data collected for this study was examined, condensed, interpreted and explored. The researcher explored the research questions, i.e.:

“What access and utilisation of medication information sources are available to final year bridging students at higher education and training centres of a private hospital group in South Africa to ensure safe medication administration?”

Data collected was examined and interpreted, and the following objectives were achieved during this process:

- Determination of final year bridging students’ access to medication information sources in the *clinical* setting
- Determination of final year bridging students’ utilisation of medication information sources in the *clinical* setting
- Determination of final year bridging students’ utilisation of medication information sources in the *academic* setting
- Assessment of the knowledge of final year bridging students regarding frequently administered medication.

In the next chapter, findings of this study will be discussed and compared with findings of previous studies, as explored in chapter 2. Limitations of this study will be explored and recommendations for future studies, as well as nursing practice will be discussed.

CHAPTER 5

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study was conducted to determine the availability and utilisation of medication resources in the clinical and academic setting and also to assess bridging students' knowledge on frequently administered medications. Chapter five summarises the conclusions of the findings based on the study results as reported in chapter four. Recommendations are made, limitations are outlined and overall conclusions of the study are described.

5.2 Discussions

The aim of this study was to identify which medication information resources were available to second year bridging students, and to explore how frequently these resources were utilised in clinical practice, as well as in the academic setting of a private hospital group in South Africa. Findings will be discussed in relation to the following objectives to:

- determine final year bridging students' access to medication information sources in the *clinical* setting
- determine final year bridging students' utilisation of medication information sources in the *clinical* setting
- determine final year bridging students' utilisation of medication information sources in the *academic* setting
- assess the *knowledge* of final year bridging students regarding frequently administered medication.

Each of these objectives will be discussed separately.

5.2.1 Objective 1: To determine final year bridging students' access to medication information sources in the clinical setting

The first objective was to identify which medication information resources were available to second year bridging students in the clinical setting. Section B: questions six, eight and nine covered this objective (Table 4.2, Figures 4.6 & 4.8).

5.2.1.1 Internet access at work

The first question on information resources available at work was to establish whether participants had access to the internet at work. From the responses to this question, it was clear that the majority of participants $n=83$ (80.6%) had access to the internet at work (Figure 4.6). Buckley et al (2015;93) reported that registered nurses are becoming more reliant on electronic information sources about medications, and for nurses to learn how to utilise these resources, it should be available at all times.

5.2.1.2 Access to a pharmacist after hours and over weekends

This second question on the availability of medication information resources was included since pharmacists are regarded as reliable human sources of medication information (Ndosi & Newell, 2010: 2660). As illustrated in Figure 4.8, more than half $n=58$ (56.3%) indicated that they had access to a pharmacist after hours and over weekends, and a third $n=35$ (34%) did not have access to a pharmacist during these times. Furthermore, $n=9$ (8.7%) participants did not know whether a pharmacist was available for consultation after hours, which indicated that these participants had never attempted to consult a pharmacist after hours.

5.2.1.3 Availability of MIMS, SAMF, pharmacology textbooks and other sources in the wards

This second question on the availability of medication information resources was included since pharmacists are regarded as reliable human sources of medication information (Ndosi & Newell, 2010: 2660). As illustrated in Figure 4.8, more than half $n=58$ (56.3%) indicated that they had access to a pharmacist after hours and over weekends, and a third $n=35$ (34%) did not have access to a pharmacist during these times. Furthermore, $n=9$ (8.7%) participants did not know whether a pharmacist was

available for consultation after hours, which indicated that these participants had never attempted to consult a pharmacist after hours.

After these results were analysed, they were examined for a second time to establish whether participants who reported no MIMS being available in the wards, had access to a SAMF (2008), and it was found that all these participants did indeed have access to a SAMF (2008). It was important to establish whether all participants had access to a reliable written source of medication information which they could access at all times during medication administration rounds, since these resources could enhance safe medication administration, if utilised properly.

Participants who selected 'other' were then requested to provide information on these 'other' resources. Amongst these resources were: a file containing medication information printed by the unit manager, medication pamphlets in boxes for medications and the internet.

5.2.1.4 Conclusion

As illustrated in chapter 4, the majority n=83 (80.6%) reported having internet access at work, more than half n=58 (56.3%) had access to a pharmacist after hours and over weekends, most n=100 (97.1%) had access to a (MIMS) and a third n=36 (35%) had access to a (SAMF, 2008). From the literature reviewed Buckley *et al.* (2015:91) and Ozsoy and Ardahan (2008:605-606) reported all these resources are available in international settings, as well as journal articles on medications (Ndosi and Newell, 2010:2660).

It can thus be concluded that participants had access to a variety of reliable medication information resources: pharmacists and professional literature. As discussed in chapter 2, it is essential for healthcare workers involved in medication administration to have access to reliable and current information resources, due to the constant supply of newly-approved medications.

5.2.2 Objective 2: To determine final year bridging students' utilisation of medication information sources in the clinical setting

The second objective focused on the utilisation of medication information sources available to participants and according to Table 4.3, questions 10 to 15 covered the second objective.

5.2.2.1 Consulting a RN

More than half the participants $n=56$ (54.9%) reported that they “sometimes” consulted a registered nurse with queries about medications and $n=32$ (31.4%) “frequently” consulted a registered nurse. These results correlate with results published by Ozsoy and Ardahan (2008:606) where nurses indicated that fellow nurses were their most important source of information for daily practice.

5.2.2.2 Consulting a pharmacist

An overwhelming majority of participants $n=80$ (77.7%) reported that they “sometimes” consulted a pharmacist, while a small group $n=19$ (18.4%) admitted to “never” consulting a pharmacist with queries about medication. These findings are a concern, since pharmacists are regarded as the most trustworthy human source of medication information. In contrast to these current findings, Ndosì and Newell (2010:2660) reported that 51% of participants consulted pharmacists, compared to 31% who consulted nursing colleagues for medication information.

5.2.2.3 Consulting resources

More than half of all participants $n=58$ (56.3%) indicated that they “sometimes” consulted resources, e.g. MIMS, SAMF (2008), while a few $n=5$ (4.9%) admitted to “never” having consulted resources. Since data was collected by self-administered questionnaires, it can be assumed that participants would not have reported these omissions if it was not the truth. The implication of these admissions is that medication will be administered without consulting available information sources, with the potential to cause serious medication administration errors.

5.2.2.4 Consulting other sources

In this question participants were asked about how often they consulted any other sources for information about new medications, e.g. articles, internet and brochures.

Answers to this question varied from a minimum of n=13 (12.9%) participants who reported that they “always” consulted resources to a maximum of n=42 (41.6%) participants who reported that they “sometimes” consulted resources, and a small group n=18 (17.8%) reported that they “never” consulted sources about new medications. In contrast to these findings, Buckley *et al.* (2015) reported that more than 80% of participants considered professional literature, e.g. journal articles and reports as the most important sources of information on new medications. The implication of these findings is that nurses will be exposed to and administer new medications, without any knowledge of the classification, action, effects and side-effects of these medications, if they do not make a conscious effort to gain information about new medications.

5.2.2.5 Consulting the prescribing physician

For this question participants were asked to describe how often they consulted the prescribing physician with queries about a patient’s medication, and the majority of participants n=66 (64.7%) reported that they “sometimes” consulted the physician, while n=19 (18.6%) reported that they “never” consulted the prescribing physician with queries. The indication may be that these participants never had queries about patients’ medications, and thus never had to consult the physician, or they may have consulted other resources, e.g. a registered nurse. Ndosi and Newell (2010:2660) also concluded that only 23.8% of nurses frequently consult doctors with queries about medications.

5.2.2.6 Consulting package inserts

Finally, participants were requested to indicate how often they consulted package inserts of patients’ home medication during medication administration rounds. More than half n=52 (52%) of the participants indicated that they “sometimes” consulted package inserts during medication rounds, while a few n=8 (8%) participants admitted that they “never” consulted package inserts of patients’ home medication. These results are a concern, since patients are admitted to hospital with medications prescribed and dispensed by different doctors and pharmacists. As described in chapter 1, (section 1.2), pharmacists are encouraged to dispense generic medications where possible, resulting in patients admitted to hospitals with a variety of chronic medications with different brand names. When these medications are

prescribed to be administered while the patient is treated in hospital, nurses are confronted with unfamiliar medicines. Package inserts are a valuable information sources about the specific medications and can help prevent medication administration errors.

5.2.2.7 Providing health education to patients about medication during medication administration rounds

According to the Regulation 2598, chapters 2(d) and 5(c) (Republic of South Africa, 1984:1&3) it falls within the scope of practice registered nurses and enrolled nurses to provide information to patients. Results from this question indicated that less than half $n=47$ (45.6%) of the participants and a third $n=33$ (32.0%) of the participants reported to provide health education to patients “frequently” and “always,” respectively. A single participant $n=1$ (1%) admitted to “never” having provided health education, and this is a concern, since most patients admitted to hospital are prescribed medications they do not take as part of a chronic medication regimen, e.g. analgesics or antibiotic treatment. Patients need information about these newly-prescribed medications, as well as health education about potential side-effects, e.g. not to drive after taking some analgesics which cause drowsiness.

5.2.2.8 Conclusion

These findings revealed an under-utilisation of resources, where a small group $n=19$ (18.4%) of participants indicated that they “never” consulted a pharmacist,. Furthermore, a few $n=5$ (4.9%) participants have “never” consulted a source of information, e.g. MIMS or SAMF (2008) and $n=19$ (18.6%) participants have “never” consulted a prescribing physician. A few $n=8$ (8%) participants also reported that they have “never” consulted package inserts of patients’ own medicines which they bring with them on admission to hospital.

At the same time, a third $n=32$ (31.4%) of participants reported that they “frequently” consulted a registered nurse and another third $n=34$ (33%) reported information sources, e.g. MIMS and SAMF (2008). Almost a third $n=29$ (29%) of participants “frequently” consulted package inserts, while a large group $n=80$ (77.7%) reported that they “sometimes” consulted a pharmacist. These results indicate that some

second year bridging course students do follow safe practices during medication administration.

Above findings correlate with results from studies done by Ndosi & Newel (2010: 2660), where it was concluded that nurses preferred utilising the British National Formulary, followed by human sources of information (colleagues, pharmacists and physicians). In the South African context, the MIMS and SAMF were reported to be the information sources frequently consulted, with registered nurses as the second most frequently utilised source.

5.2.3 Objective 3: To determine final year bridging students' utilisation of medication information sources in the academic setting

The third objective focused on different study methods and information sources utilised for studies on pharmacology and medication. Questions 17 - 20 (Table 4.5) and questions 21 – 24 (Table 4.6) answered this objective.

5.2.3.1 Preference for formal lectures on pharmacology and medication

Two thirds $n=65$ (63.1%) of participants “agreed” with this statement, which correlates with findings by Hanson (2016:83). These numbers indicate that participants to this study did not display self-directedness, as described by Knowles (Keese, 2009:1).

5.2.3.2 Group work, self-study or discussions as preferred study strategy for pharmacology and medication studies

As discussed in chapter 4, section 4.5.1.2 – 4.5.1.4, results from this section of the questionnaire yielded no evidence of preference for any study method. Table 4.5 clearly illustrates that more than half $n=53$ (52%) of participants consistently reported to “agree” with all statements, thus giving the impression that they had no preference for any specific study method to be utilised for studies about pharmacology and medication. Moreover, these results are in contrast to findings published by Hanson (2016:83), wherein participants clearly indicated that they do not prefer workshops or discussions, but preferred lectures presented by teachers for studies on medication.

5.2.3.3 Utilisation of textbooks, lecturer's notes, internet sources or package inserts for studies on pharmacology

Data collected from questions 21 – 24 on preference of different information sources during studies of pharmacology and medication, did not identify any information source as a preferred source to be utilised during studies of pharmacology and medication. As illustrated in table 4.6, participants “agreed” that they prefer all four information sources (textbooks, lecturer's notes, internet sources and package inserts) for these studies.

5.2.3.4 Clarification is asked if content of lectures is unclear

The aim of this question was to determine whether participants were comfortable asking for clarification during classes, and the findings were encouraging, with a vast majority (n=96 993.2%) of participants indicating to “agree” and “strongly agree”. These findings indicate that the majority of students will understand the content of lectures on pharmacology and medication, and if not, they will ask for clarification, indicating a degree of self-directedness in taking responsibility for their own learning.

5.2.3.5 Conclusion

As stated in chapter 4, these findings do not fully support Knowles' theory of adult education, which proposes that adult learners are self-directed and take responsibility for their own learning (Australian Catholic University, 2016:1). According to results from this study, almost two thirds (n=65 (63.1%)) of participants preferred formal lectures on pharmacology and medication, and more than half (n=57 (55.9%)) preferred to use lecturers' notes for studies. These findings do not correlate with previous study results. Buckley *et al.* (2015:90) reported that registered nurses in Australia indicated a preference for professional literature for information about medications, while Scott *et al.* (2008:996) reported that 61% of respondents utilised the internet for medication and health information. However, the majority of participants in this study reported a willingness to ask for clarification if unclear about content of lectures on pharmacology and medications, which is an indication of a degree of self-directedness.

5.2.4 Objective 4: To assess the knowledge of final year bridging students regarding frequently administered medication

The final objective explored participants' knowledge on medications frequently administered in the hospitals where they completed the clinical portion of their studies towards becoming registered nurses. It was expected from participants to indicate the classification, indication for use, contra-indications for use, and side-effects or adverse effects of three medications administered daily in general wards. Participants had to choose one correct answer from three possible options. The process of deciding which medications to include in this objective was discussed in chapter 3, section 3.5.4.

5.2.4.1 Knowledge of Enoxaparin sodium (Clexane)

Answers to these questions indicated that a large proportion $n=30$ (88.24%) of participants knew the classification and the majority $n=32$ (94.11%) knew the indication for use, as well as the adverse effects of this drug. However, only $N=21$ (61.76%) knew the contra-indication for use of this drug (hypersensitivity). Omission to check for hypersensitivity before administering Clexane, may lead to a preventable anaphylactic reaction.

5.2.4.2 Knowledge of Paracetamol intravenous (Perfalgen)

Correct answers to questions on this medication indicated that the majority of participants $n=30$ (88.24%) had adequate knowledge about the classification, indication for use $n=24$ (70.59%), contra-indication to use $n=29$ (85.29%) as well as side-effects $n=27$ (79.31%) of this medication. Since this medication is one of the preferred post-operative analgesics, it is reassuring to report that second year bridging course students have adequate knowledge about this medication, in order to prevent medication administration errors.

5.2.4.3 Knowledge of Tramadol (Tramazac)

The results obtained from questions about this medication, were the lowest of all three medications included in this study, The majority $n=91$ (42%) of participants knew the classification, but correct answer scores for indications, contra-indications and adverse effects were lower than for Clexane and Perfalgen. The implication for these low scores is that participants may administer this medication without

knowledge about adverse effects, e.g. head injury, and then not monitor the patient after administration of this medication.

5.2.4.4 Conclusion

As summarised and illustrated in Table 4.11, the majority of participants $n=32$ (91.42%) knew the classification of Tramazac and a large portion $n=30$ (88.24%) knew the classification of Clexane and Perfalgen. Knowledge scores on side-effects and adverse effects ranged from $n=32$ (94.11%) for Clexane to $n=27$ (79.41%) for Perfalgen and $n=24$ (68.57%) for Tramazac, indicating that more than two-thirds $n=83$ (80.5%) of the participants would be able to detect unwanted effects after administration of medication. These findings correlate with results published by Ndosì and Newell (2008:576) where it was concluded that registered nurses in the North of England had adequate knowledge about indications and side-effects of medications, without understanding the action of medication and the drug interactions between medications.

Additional non-parametric tests were performed on collected data to establish whether any relationships exist between the different demographic data of participants and total knowledge scores obtained on medication knowledge of participants.

The Mann-Whitney U test was performed to determine if there was a difference between the knowledge scores of males and females, but no significant differences in the knowledge score of males ($n=12$) and females ($n=85$) ($z=-0.902$, $p=0.367$) were revealed.

The Kruskal-Wallis test was performed to compare the total knowledge scores across the different age groups: 20 – 29 years, 30 – 39 years, 40 years and older, and no significant differences in knowledge scores across the age groups were revealed ($\chi^2(z) = 3.178$, $p=0.2041$). The Kruskal-Wallis test was again performed to determine any difference in the knowledge scores between participants with internet access and those who do not have access to internet and it was determined that there was no significant difference in the knowledge scores between these two groups ($\chi^2(z) = 0.315$, $p=0.5745$). The Kruskal-Wallis test was also performed to determine a difference in the knowledge scores across the five different groupings

according to length of employment as enrolled nurse: 1 – 3 years, 4 – 5 years, 6 – 10 years, 11 – 20 years and more than 20 years. This test revealed no significant differences in knowledge scores across the five groups ($\chi^2(z) = 3.201$, $p=0.5247$). The Kruskal-Wallis test was finally performed to determine any differences between the knowledge scores of participants with nursing experience in the following areas: medical wards, surgical wards, paediatric wards, obstetric wards, operating theatre, intensive care units and high care units, emergency centres and any other areas. This test revealed no significant differences in knowledge scores across these different groups ($\chi^2(z) = 3.845$, $p=0.7974$).

5.3 Recommendations

Recommendations based upon the results of this study are summarised into two main sections: nursing practice and future studies.

5.3.1 Recommendations for practice

5.3.1.1 Clinical settings

Based on the results gained in this study, it is clear that medication information resources were available in all the clinical settings under investigation, either in written format, e.g. MIMS) and (SAMF, 2008) or human resources, e.g. pharmacists. However, these resources were not utilised to their full extent in the clinical setting nor the academic setting.

Results from this study will be communicated to the Research and Publication Committee of the private healthcare institution where data was collected, in order for these results to be implemented as a foundation for potential in-service training programmes on the utilisation of medication information resources to prevent medication administration errors.

5.3.1.2 Academic settings

Furthermore, as a nurse educator, the researcher will utilise these results during the facilitation of classes on pharmacology and medications to introduce nursing students to various medication information resources, and to assist them in becoming familiar with all types of written information sources, e.g. package inserts,

medication formularies, research articles, etc. Students should be encouraged to become self-directed in choosing learning strategies and identifying resources, as described by Knowles (Australian Catholic University, 2016:1).

5.3.2 Recommendations for future research

5.3.2.1 Research on utilisation of information resources

Due to the restricted nature of close-ended questions in the instrument utilised for this study, future studies with a qualitative approach may yield more in-depth information on participants' reasons for not utilising information resources. Through focus group discussions, as well as individual interviews rich and meaningful data can be obtained on potential barriers to utilisation of resources. Elimination of barriers to utilisation of resources may lead to a decrease in the numbers of medication administration errors.

5.3.2.2 Research on preferred study methods and information resources

Due to inconclusive findings about preferred resources and study methods utilised for studies about pharmacology and medication, further research is also required to establish students' preferences for study methods and resources. More convincing results may be obtained by requesting students to rate different study methods and information sources on a scale from most preferred to least preferred. This format will ensure that participants have to consciously consider their preferences, and not just 'agree' with every statement. Informal research can also be conducted by means of group discussions on study methods, where students can describe their preferred study methods to colleagues, followed by discussions on advantages and disadvantages of different study methods.

5.4 Limitations of the study

Study limitations refer to flaws or defects in the methodology and theory of a study, which may prevent study findings from being generalised to a larger population (Grove, Gray & Burns, 2015:48).

The study population for this study was smaller than envisioned, due to some students (n= 57) who had met the inclusion criteria but were unavailable for data

collection on the pre-arranged dates. Another limitation was experienced when only 15 participants from a class of 28 and none of the isiXhosa speaking students volunteered to participate in the pilot test. Furthermore, students could only select pre-determined answers to questions, and more valuable information might have been obtained by including a section in the questionnaire for students to reflect and explain their responses.

These limitations influence the generalisability of the findings in the sense that study findings may differ if this same instrument is to be utilised in a larger population with a majority of isiXhosa speaking participants.

5.5 Conclusion

The study investigated final year bridging students' access to medication information sources, the utilisation of these sources in the clinical and academic setting, as well as these students' knowledge regarding medications frequently administered. In chapter five the conclusions and recommendations are discussed and compared with literature of previous studies.

Findings from this study revealed that medication information resources are available in clinical settings where second year bridging students of this private hospital group complete the practical component of their studies. However, these findings also indicate that resources are not fully utilised during medication administration rounds, putting patients at risk for medication administration errors. On the other hand, findings about preferred information sources and study methods utilised for studies on pharmacology and medication, were inconclusive, with the majority of participants indicating that they agreed with all statements and not indicating any clear preferences.

The conceptual framework applied for this study is based on Knowles' theory of adult education, where it is assumed that adult learners move from dependent to independent and self-motivated learners (Australian Catholic University, 2016:1). It is assumed that these learners have gathered experiences through life, and new learning is added to what is already known. Furthermore, Knowles also assumed

that adult learners will be motivated to learn if new knowledge is relevant to their jobs and they can utilise it immediately.

Even though these findings do not support Knowles' theory of adult students being self-directed (Australian Catholic University, 2016:1), findings from the last section of the instrument reflected that participants to this study did retain knowledge on frequently administered medications. They will therefore be able to safely identify side effects and adverse effects after administration of these familiar medications, but unless information resources are utilised for new and unfamiliar medications, medication administration errors might continue escalating, due to the rising number of new medications available to healthcare systems worldwide.

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APPENDICES

ANNEXURE A ETHICS APPROVAL



UNIVERSITEIT-STELENBOSCH/UNIVERSITY
of Health Research and Knowledge Partners

Approval Notice New Application

23-Mar-2017
Blanckenberg, Martha MM

Ethics Reference #: S17/01/005

Title: Assessment of bridging student's access to and utilisation of resources to ensure safe medication administration in a private hospital group in Southern Africa

Dear Mrs Martha Blanckenberg,

The **New Application** received on **11-Jan-2017**, was reviewed by members of **Health Research Ethics Committee 1** via Expedited review procedures on **16-Mar-2017** and was approved.

Please note the following information about your approved research protocol:

Protocol Approval Period: **23-Mar-2017 -15-Mar-2018**

Please remember to use your **protocol number** (**S17/01/005**) 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 (healthires@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/frds

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

Included Documents:

M Blanckenberg Supervisor declaration.pdf
M Blanckenberg Checklist.xls
M Blanckenberg Application form signed_2.pdf
M Blanckenberg Protocol summary.xls
M Blanckenberg Participant Information and Consent Form.xls
CV MRS JE EYGELAAR.pdf
M Blanckenberg CV.xls
M Blanckenberg Investigator declaration.pdf
M Blanckenberg Proposal.xls

Sincerely,

Franklin Weber
HREC Coordinator
Health Research Ethics Committee I

ANNEXURE B

APPROVAL FROM HOSPITAL GROUP



RESEARCH APPLICATION – M BLANCKENBERG

Date: 3 April 2017

FOR APPROVAL

A handwritten signature in black ink, appearing to read "G Van Wyk", written over a horizontal line. Below the line, the text "Chief Human Resources Officer" is printed.

G VAN WYK

Chief Human Resources Officer

NOTES

- | | |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Locality | • Mediclinic Learning Centre Cape Region |
| Value of Study | • Yes |
| Employee | • Mediclinic |
| Topic/Title | • Assessment of bridging student's access to and utilisation of resources to ensure safe medication administration in a private hospital group in Southern Africa |
| Impact | • Mediclinic Learning centres |
| Supported by hospital | • Supported by: Head Nurse Educators, Ann van Zyl |

ANNEXURE C

APPROVAL FROM NDOSI AND NEWELL'S PHARMACOLOGY

Blanckenberg, Marthie

From: Mwidimi Ndosi <Mwidimi.Ndos@uwe.ac.uk>
Sent: Sunday, 19 June 2016 02:01
To: Marthie Blanckenberg
Subject: Re: Research on pharmacology
Attachments: Ndos and Newell's Pharmacology knowledge questionnaire and answer guide.docx

Dear Marthie,

Thank you for your interest in our study and I grant you the permission to use the questionnaire and modify it to suit your needs.

The questionnaire or its style can be referenced using our original article: Ndos ME, Newell R. (2009) Nurses' knowledge of pharmacology behind drugs they commonly administer. *Journal of Clinical Nursing*. **18**(4):570-80; discussion 620. doi: 10.1111/j.1365-2702.2008.02290.x.

Best wishes for your studies

Mwidimi

Dr Mwidimi Ndos
Senior Lecturer in Rheumatology Nursing
BHPR Deputy Research and Conference Officer

Faculty of Health and Applied Sciences
University of the West of England

Glenside Campus, Bristol BS16 1DD
Tel: 0117 328 5636 mwidimi.ndosi@uwe.ac.uk

On 18 Jun 2016, at 12:12, Marthie Blanckenberg wrote:

Dear Mwidini

I have read your article on Nurses' knowledge of pharmacology behind drugs they commonly administer in *Journal of Clinical Nursing* online, and have found it very enlightening.

I am a nurse educator at a private nurse training institution in the Western Cape, South Africa. I am currently busy with my Masters degree in Nursing, and my area of interest is the competency of final year Bridging students (Enrolled nurses following a two-year course to be registered as professional nurses) in medication management and pharmacology knowledge of the medications they administer.

Can I request a copy of the questionnaire and answer guide used in your study? I will credit you if I find it suitable, but I might have to make some changes to allow for medications commonly used in South Africa.

I hope you are able to help me and I am thanking you in advance.

ANNEXURE D

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT: Assessment of bridging studentst' access to and utilisation of resources to ensure safe medication administration in a private hospital group in Southern Africa.

REFERENCE NUMBER: S17/01/005

PRINCIPAL INVESTIGATOR: Mrs. M Blanckenberg

ADDRESS: Medicine and Health Sciences department

CONTACT NUMBER: 0769136913

Dear Student

You are being invited to take part in a research study conducted by Marthie Blanckenberg. The results will contribute to the researcher's dissertation presented for the Master's degree in Nursing. You were selected as a potential participant in this study because of your current studies.

Please take some time to read the information presented here, which will explain the details of this project and ask the study staff any questions about any part of this project that you do not fully understand. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

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

What is this research study all about?

- This study will be conducted at five Mediclinic Learning Centres: The number of participants at this centre will be 25 – 30 and the total number of participants will be 180 – 200.
- The aim of this project is to find out which resources to ensure safe medication administration are available in the hospitals, and to find out which of these resources do you use during medication administration and studies about medication, in order to help future students to make better use of all available resources.

Why have you been invited to participate?

- You have been invited to participate because medication administration is one of the key responsibilities of enrolled nurses and as a bridging course student, you fit this profile.

What will your responsibilities be?

- Your only responsibility will be to complete the questionnaire anonymously and honestly. This should take no longer than 30 minutes.

Will you benefit from taking part in this research?

- There will be no direct benefits to you personally, but future students, nurses, as well as patients will benefit when resources to ensure safe medication administration are used effectively.

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

- There are no risks involved in your participation of this study.

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

- If you do not agree to take part in this project, you do not have to sign the accompanying consent, and not complete the questionnaire.

Who will have access to your consent records?

- Only the researcher and her supervisor will have access to your consent forms, and these will be locked away in a safe location, away from the learning centre.

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

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

Is there anything else that you should know or do?

- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study doctor.

- You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I (print name and surname)

..... agree to take part in a research study entitled: Assessment of bridging student's access to and utilisation of resources to ensure safe medication administration in a private hospital group in Southern Africa.

I declare that:

- I have read this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) on (*date*)
2017.

Signature of participant

Signature of witness

Declaration by investigator

I (*name*) declare that:

- I explained the information in this document to
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did not use an interpreter.

Signed at (*place*) on (*date*)
2017.

Signature of investigator

Signature of witness

ANNEXURE E

INSTRUMENT

Questionnaire

Case number _____

(For researcher's use only)

Assessment of bridging student's access to and utilisation of resources to ensure safe medication administration in a private hospital group in Southern Africa.

In this questionnaire you are asked to assess your use of medication information sources used during medication administration rounds and studies about medication and pharmacology during your bridging course studies to date, as well as knowledge of frequently-used medications.

The questionnaire is divided into the following sections:

- A. General background information
- B. Clinical setting (hospital/clinic)
- C. Academic setting (learning centre/college)
- D. Medication knowledge

Please answer the following questions by selecting only **ONE** option for each question. Mark your choice with an X in the box next to the most applicable option.

SECTION A: General Background information

A. Gender

0	Male	<input type="checkbox"/>
1	Female	<input type="checkbox"/>

B. Age in years

0	20 to 29	<input type="checkbox"/>
1	30 to 39	<input type="checkbox"/>
2	40 or older	<input type="checkbox"/>

C. Do you have access to the internet at home?

0	Yes	<input type="checkbox"/>
1	No	<input type="checkbox"/>

D. How long (in years) have you been employed as an enrolled nurse?

0	1 to 3	<input type="checkbox"/>
1	4 to 5	<input type="checkbox"/>
2	6 to 10	<input type="checkbox"/>
3	11 to 20	<input type="checkbox"/>
4	More than 20	<input type="checkbox"/>

E. In which area of nursing did you spend the major portion of your time as enrolled nurse?

Select only ONE area.

0	Medical	<input type="checkbox"/>
1	Surgical	<input type="checkbox"/>
2	Paediatrics	<input type="checkbox"/>
3	Obstetrics	<input type="checkbox"/>
4	Theatre	<input type="checkbox"/>
5	ICU / High care	<input type="checkbox"/>
6	Emergency centre	<input type="checkbox"/>
7	Other	<input type="checkbox"/>

SECTION B: Clinical setting (Hospital)

F. Do you have access to the internet at work?

0	Yes	<input type="checkbox"/>
1	No	<input type="checkbox"/>

G. How many hours do you spend on average on medication administration during a 12 hour shift?

0	Less than 1	<input type="checkbox"/>
1	1 to 2	<input type="checkbox"/>
2	3 to 4	<input type="checkbox"/>
3	4 to 5	<input type="checkbox"/>
4	More than 5	<input type="checkbox"/>

H. Do you have access to a pharmacist in the hospital after hours and over weekends?

0	Yes	<input type="checkbox"/>
1	No	<input type="checkbox"/>
2	Do not know	<input type="checkbox"/>

I. Which of the following medication resources are available in the ward?

Note: More than one option can be selected.

0	Monthly index of medical specialities (MIMS)	<input type="checkbox"/>
1	South African medicines formulary (SAMF)	<input type="checkbox"/>
2	Pharmacology Textbook	<input type="checkbox"/>
3	Other	<input type="checkbox"/>

If "other" was marked in above question, please provide details:

	1	2	3	4
	Never	Sometimes	Frequently	Always
J. How often do you consult a registered nurse with regards to queries about prescribed medication during medication administration rounds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K. How often do you consult the pharmacist with queries about prescribed medication during medication administration rounds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L. How often do you consult resources (e.g. MIMS or SAMF) during medication administration rounds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M. How often do you consult any other sources about information about new medication, e.g. articles, internet, brochure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
N. How often do you consult the prescribing physician with queries about a patient's medication during medication administration rounds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
O. How often do you consult the package insert of patients' home medication during medication administration rounds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P. How often do you provide health education to the patient about his/her medication during medication administration rounds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION C: Academic setting (Learning Centre)

	1	2	3	4
	Strongly disagree	Disagree	Agree	Strongly agree
Q. Preference is given to formal lectures on pharmacology and medication as opposed to other learning methods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
R. Preference is given to group work on pharmacology and medication as opposed to other methods of learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S. Preference is given to self-study for pharmacology and medication objectives as opposed to other methods of learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T. Preference is given to discussions on pharmacology and medication as opposed to other methods of learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
U. Preference is given to the use textbooks for pharmacology and medication studies as opposed to other methods of learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
V. Preference is given to the use of lecturer's notes on pharmacology and medication studies as opposed to other methods of learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
W. Preference is given to the use of <i>internet sources</i> for pharmacology and medication studies as opposed to other methods of learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X. I keep available package inserts and use it for pharmacology and medication studies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Y. Clarification is asked when content of lectures is unclear.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION D: Medication knowledge Version 1

Choose the correct answer under each of the following questions by marking the correct block with a X.

Clexane (Enoxaparin sodium)**Z. Classification**

0	Platelet aggregation inhibitor	<input type="checkbox"/>
1	Anti-coagulant	<input type="checkbox"/>
2	Haemostatic	<input type="checkbox"/>

AA. Indication

0	Cerebral aneurism	<input type="checkbox"/>
1	Thrombocytopenia	<input type="checkbox"/>
2	Prevention of post-operative venous thrombosis	<input type="checkbox"/>

BB. Contra-indication

0	Known hypersensitivity	<input type="checkbox"/>
1	Pregnancy	<input type="checkbox"/>
2	Lactation	<input type="checkbox"/>

CC. Adverse effects

0	Risk of bleeding	<input type="checkbox"/>
1	Dyspnoea	<input type="checkbox"/>
2	Tachycardia	<input type="checkbox"/>

End of Questionnaire.

Thank you for your time and cooperation.

SECTION D: Medication knowledge Version 2

Choose the correct answer under each of the following questions by marking the correct block with a X.

Perfalgan (Paracetamol intravenous)**Z. Classification**

0	Analgesic and antipyretic	<input type="checkbox"/>
1	Opioid analgesic	<input type="checkbox"/>
2	Non-steroidal anti-inflammatory	<input type="checkbox"/>

AA. Indication

0	Pyrexia	<input type="checkbox"/>
1	Severe pain	<input type="checkbox"/>
2	Anxiety	<input type="checkbox"/>

BB. Contra-indication

0	Pregnancy	<input type="checkbox"/>
1	Severe hepatic disease	<input type="checkbox"/>
2	Post-operative	<input type="checkbox"/>

CC. Side effects

0	Bradycardia	<input type="checkbox"/>
1	Respiratory depression	<input type="checkbox"/>
2	Hypotension	<input type="checkbox"/>

End of Questionnaire.

Thank you for your time and cooperation.

SECTION D: Medication knowledge Version 3

Choose the correct answer under each of the following questions by marking the correct block with a X.

Tramazac (Tramadol)**Z. Classification**

0	Antipyretic	<input type="checkbox"/>
1	Non-steroidal anti inflammatory	<input type="checkbox"/>
2	Opioid analgesic	<input type="checkbox"/>

AA. Indication

0	Moderate to severe pain	<input type="checkbox"/>
1	Mild to moderate pain	<input type="checkbox"/>
2	Pyrexia	<input type="checkbox"/>

BB. Contra-indication

0	Bleeding disorders	<input type="checkbox"/>
1	Post-operatively	<input type="checkbox"/>
2	Head injury	<input type="checkbox"/>

CC. Adverse effects

0	Cardiac dysrhythmias	<input type="checkbox"/>
1	Hypertension	<input type="checkbox"/>
2	Constipation	<input type="checkbox"/>

End of Questionnaire.

Thank you for your time and cooperation.

Answer Guide

SECTION D: Medication knowledge

Choose the correct answer under each of the following questions by marking the corresponding block with a X.

Enoxaparin sodium (Clexane)

SAMF (Gibbons, 2008: 101)

MIMS (Snyman, 2015: 182)

Classification

A	Platelet aggregation inhibitor	<input type="checkbox"/>
B	Anti-coagulant	<input checked="" type="checkbox"/>
C	Haemostatic	<input type="checkbox"/>

Indication

A	Cerebral aneurism	<input type="checkbox"/>
B	Thrombocytopenia	<input type="checkbox"/>
C	Prevention of post-operative venous thrombosis	<input checked="" type="checkbox"/>

Contra-indication

A	Known hypersensitivity	<input checked="" type="checkbox"/>
B	Pregnancy	<input type="checkbox"/>
C	Lactation	<input type="checkbox"/>

Adverse effects

A	Risk of bleeding	<input checked="" type="checkbox"/>
B	Dyspnea	<input type="checkbox"/>
C	Tachycardia	<input type="checkbox"/>

Paracetamol intravenous (Perfalgen)

SAMF (Gibbons, 2008: 418)

MIMS (Snyman, 2015: 75)

Classification

A	Analgesic and antipyretic	<input checked="" type="checkbox"/>
B	Opioid analgesic	<input type="checkbox"/>
C	Non-steroidal anti-inflammatory	<input type="checkbox"/>

Indication

A	Pyrexia	<input checked="" type="checkbox"/>
B	Severe pain	<input type="checkbox"/>
C	Anxiety	<input type="checkbox"/>

Contra-indication

A	Pregnancy	<input type="checkbox"/>
B	Severe hepatic disease	<input checked="" type="checkbox"/>
C	Post-operative	<input type="checkbox"/>

Side effects

A	Bradycardia	<input type="checkbox"/>
B	Respiratory depression	<input type="checkbox"/>
C	Hypotension	<input checked="" type="checkbox"/>

Tramadol (Tramazac)

SAMF (Gibbons, 2008: 416)

MIMS (Snyman, 2015: 88)

Classification

A	Antipyretic	<input type="checkbox"/>
B	Non-steroidal anti inflammatory	<input type="checkbox"/>
C	Opioid analgesic	<input checked="" type="checkbox"/>

Indication

A	Moderate to severe pain	<input checked="" type="checkbox"/>
B	Mild pain	<input type="checkbox"/>
C	Dyspnea	<input type="checkbox"/>

Contra-indication

A	Bleeding disorders	<input type="checkbox"/>
B	Post-operatively	<input type="checkbox"/>
C	Head injury	<input checked="" type="checkbox"/>

Adverse effects

A	Cardiac dysrhythmias	<input type="checkbox"/>
B	Hypertension	<input type="checkbox"/>
C	Constipation	<input checked="" type="checkbox"/>

ANNEXURE F

PROOF OF CONSULTATION AT BIOSTATS UNIT (1)



21.09.2016

To whom it may concern

This is to confirm that Ms Marthie Blanckenberg, attended a consultation at the Biostatistics Unit in the Centre for Evidence Based Health Care of the University of Stellenbosch on the 14th of September 2016.

I hope you find the above information in order.

Yours sincerely

Tawanda Chivese
Biostatistician: Biostatistics Unit



UNIVERSITEIT STELLENBOSCH
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ANNEXURE G

PROOF OF CONSULTATION AT BIOSTATS UNIT (2)



UNIVERSITEIT-STELLENBOSCH UNIVERSITY
pro bono verum est: your knowledge partner

Biostatistics Unit, Centre for Evidence Based Health Care
Faculty of Medicine and Health Sciences, Stellenbosch University
P.O. Box 19063
Tygerberg
7505
Cape Town
South Africa
18 November 2017

To Whom It May Concern

Ref: Proof of consultation at the Biostats Unit

This letter serves to confirm that Mrs Marthie Blanckenberg attended two contact sessions at the Biostats Unit for data analysis on 12 and 18 July 2017.

Thank you and kind regards

Tawanda Chivese
Biostats Unit, CEBHC



Fakulteit Gesondheidswetenskappe • Faculty of Health Sciences



Biostatistics Unit, Centre for Evidence Based Health Care • Verbind tot Optimale Gesondheid • Committed to Optimal Health
Community Health

Postbus/PO Box 19063 • Tygerberg, 7505 • Suid-Afrika/South Africa
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ANNEXURE H

DECLARATION BY LANGUAGE EDITOR



English/Afrikaans
Afrikaans/English

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* Translations * Editing * Proofreading
* Transcription of Historical Docs
* Transcription of Qualitative Research
* Preparation of Website Articles

TO WHOM IT MAY CONCERN

This letter serves to confirm that the undersigned

ILLONA ALTHAEA MEYER

has proofread and edited the document contained herein for language correctness.

Signed

Ms IA Meyer

19 November 2017

FOR: MARTHIE BLANCKENBERG

**TITLE: ASSESSMENT OF BRIDGING STUDENTS' ACCESS TO AND
UTILISATION OF RESOURCES TO ENSURE SAFE MEDICATION
ADMINISTRATION IN A PRIVATE HOSPITAL GROUP IN SOUTHERN AFRICA**