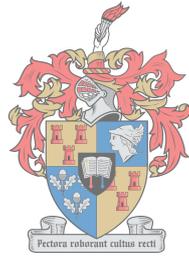


Teaching medication administration to nursing students – A scoping review with a decolonial lens

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**March 2018**

## **DECLARATION**

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

March 2018

Fadilah Haroun

## ABSTRACT

Medication errors are a worldwide phenomenon. Medication administration errors are one of the most prevalent types of medication errors occurring in the medical field today. Nurses are mainly responsible for the administration of medication, and the adequate preparation and competency of nurses is therefore vital to ensuring patient safety. Nursing and particularly nursing education can play an important role in preventing and reducing the incidence of this patient safety problem. Through a decolonial lens, the availability of African context studies were explored in this review. A scoping review was undertaken to attempt to summarise a body of work that could inform future context-specific information related to nursing education and medication management teaching strategies. Scoping reviews entail a systematic approach to the review of published literature and grey literature related to a specific topic. A framework developed by Arksey & O'Malley (2005), was used in the development of this review.

This study was interested in identifying teaching and learning strategies used in medication administration education in the African and specifically the South African context. Three studies met the inclusion criteria of this scoping review. An overview of the field of nursing education and medication management included the use of simulation and targeted teaching in the form of the formula method, to calculate medication doses and a review of a nursing curriculum. The gap identified in this study, is that a scarcity of research exists in the African and specifically, the South African context related to medication errors and educational strategies.

Competency training through the use of simulation, improving mathematical skills and using assessment for learning, could improve the confidence and competence of nursing students in preparation for medication management. The traditional "Five Rights" principle to teach medication administration could be insufficient as this linear approach does not take cognisance of the complexity of this task.

Although scoping reviews do not appraise the quality of studies, it does allow for a breadth of information. Another limitation of not exploring other types of grey literature, limited the findings of this review.

Future studies should include interventional studies, firstly to identify the learning needs of nursing students and secondly, to measure the effectiveness of teaching strategies in the preparation of nursing students for medication management.

**Key words:** Medication errors, medication administration errors, nursing education

**OPSOMMING:**

Medikasie foute is 'n wêreldwye verskynsel. Foute in die administrering van medikasie verteenwoordig een van die mees algemene medikasie foute in die hedendaagse mediese veld. Verpleegsters is hoofsaaklik verantwoordelik vir die administrering van medikasie. Voldoende opleiding en vaardigheid van verpleegsters is daarom uiters belangrik ten einde die veiligheid van pasiënte te kan verseker. Verpleeging en veral verpleegonderrig kan 'n belangrike rol speel in die voorkoming en vermindering van hierdie probleem rondom pasiënte veiligheid. In hierdie oorsig, word die beskikbaarheid van studies in die Afrika konteks deur 'n de-kolonisasie lens ondersoek. 'n Omvangsbepaling is onderneem ten einde die inligting wat toekomstige konteks-spesifieke inligting rakende verspleegonderrig en medikasie bestuur strategieë op te som. Omvangbepalings omvat 'n sistematiese benadering tot 'n oorsig van gepubliseerde literatuur en grys literatuur oor 'n spesifieke onderwerp. 'n Raamwerk deur Arskey & O'Malley (2005), is gebruik in die ontwikkeling van hierdie oorsig.

Hierdie studie het gefokus op die identifisering van onderrig en leerstrategieë wat in medikasie bestuur opleiding in die Afrika en spesifiek die Suid-Afrikaanse konteks toegepas word. Drie studies het aan die insluitings-kriteria van hierdie studie voldoen. Alhoewel omvangsbepalings nie die kwaliteit van studies beoordeel nie, laat dit wel toe vir omvangryke inligting. Die feit dat ander tipes grys literatuur nie ondersoek is nie, mag 'n verdere beperking van hierdie studie wees. Die oorsig oor die verpleegonderrig-veld en medikasie bestuur het die gebruik van simulاسie en doelgerigte onderrig (in die form van die formule metode om die dosis te bepaal); asook 'n oorsig van 'n verpleegkunde kurrikulum ingesluit..

Vaardigheids-opleiding deur die gebruik van simulاسie, die verbetering van wiskundige vaardighede en die gebruik van evaluering vir leer, kan die self-vertroue en vaardigheid van verpleegkunde studente verbeter ter voorbereiding vir medikasie bestuur. Die tradisionele 'Five Rights' beginsel vir onderrig in die administrering van medikasie mag ontoereikend wees omdat dit nie die kompleksiteit van hierdie taak in ag neem nie.

Toekomstige studies behoort intervensie-studies in te sluit, eerstens om die leer-behoeftes van verpleegstudente te kan identifiseer. Tweedens om die effektiwiteit van onderrig strategieë vir die voorbereiding van verpleegstudente vir medikasie bestuur te kan evalueer.

**Sleutelwoorde:** Medikasie foute, medikasie administrering, verpleegonderrig



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## LIST OF ACRONYMS AND ABBREVIATIONS

BDNM	Bachelor's Degree in Nursing and Midwifery
CHE	Council of Higher Education
ETD	Electronic Theses & Dissertations
ME	Medication Errors
ICN	International Council of Nurses
MAE	Medication Administration Errors
ME	Medication Errors
NCCMERP	National Coordinating Council for Medication Error Reporting & prevention
NEI	Nursing Education Institution
NETS	Nursing Education & Training Standards
NQF	National Qualifications Framework
OSCE	Objective Structured Clinical Examination
PBL	Problem-based learning
PRISMA	Preferred Reporting Items for Systematic Reviews
SANC	South African Nursing Council
SANETP	South African National Electronic Thesis & Dissertations Portal
SAQA	South African Qualifications Authority
WHO	World Health Organisation
WIL	Work integrated learning

## **CHAPTER 1**

### **BACKGROUND**

#### **1.1 INTRODUCTION**

The World Health Organisation (WHO 2017), has recently launched their third Global Patient Safety challenge – Medication Without Harm. This theme of medication safety encompasses that errors are inevitable and the WHO aims to reduce the frequency and impact of these errors by 50% over the next five years. This bold challenge highlights that medication errors is a global concern and that serious attention should be given to reducing its occurrence to the minimum.

#### **1.2 MEDICATION ERRORS – A WORLDWIDE PROBLEM**

Medication errors (ME), remain one of the foremost types of medical errors affecting patient safety in healthcare (Bush, Heuckel, Robinson, Seelinger & Molloy 2015), and are the third leading cause of deaths in America (Chu 2016). WHO (2017), estimates that 46 billion dollars is spent annually on ME across the world.

In the United Kingdom, during the period 2014 – 2016, a total of 112 recorded medication incidents that resulted in patient deaths, was recorded (National Reporting and Learning System (NLRs) medication errors 2016). This statistic highlights that ME are a problem. Not all ME will result in death, but will involve some degree of patient harm.

A systematic review on ME in South East Asian countries revealed that the error rates were between 15.2% - 88.6% (Salmasi, Khan, Hong, Ming, & Wong 2015). Similarly, Middle Eastern countries report an incidence rate of between 11% – 90% (Thomas, Rouf, Al Hail, El Kassem, Al saad, Sing, Paudyal, Maclure, McLay & Stewart 2017). Furthermore, Keers, Williams, Cooke & Ashcroft (2013), report that 19.1% of ME occur in the hospital setting. Although the National Coordinating Council for Medication Errors Reporting & Prevention in America, (NCCMERP 2017), asserts that there is no acceptable incidence rate for ME, these figures highlight the extent of ME as a patient safety issue.

Despite a focus on identifying the contributing factors related to ME, the incidence of ME has not decreased in past 10 years (Parry, Barriball & While 2015). Fifteen years after the “To Err is human” report (Kohn, Corrigan, Donaldson 2000), there has been no significant decrease in the

ME rates seen internationally. This is mainly due to the complexity of contributing variables such as systems, organisational, individual & educational factors (Schnipper & Rothschild 2012). The four domains of the WHO (2017) safety initiative includes health care professionals and systems and practices of medication. By doing so, WHO recognises the role that healthcare professionals and systems, can play in reducing ME.

Medication safety practices require a systematic approach. Contributing factors to ME include systemic, organisational and individual related issues (WHO 2011). Education and training has been identified as a contributory factor of medication management (Karavasiliadou & Athanasakis 2014), and will be the primary focus of what will be explored in this research assignment.

There is an array of definitions for ME (Keers, Williams, Cooke & Ashcroft 2013). This array of definitions, result in the variation of the incidence of ME internationally. Irrespective of the exact numerical extent of the problem, several systematic reviews addressing ME as a patient safety concern, was found in the literature search of this research assignment revealing the extent of the problem (Al-Jumaili & Douchette 2017; Berdot, Roudot, Schramm, Katsahian, Durieux & Sabatier 2016; Härkänen, Voutilainen, Turunen, & Vehviläinen-Julkunen 2016; Keers, William, Cooke & Ashcroft 2014; Lapkin, Levett-Jones, Chenoweth & Johnson 2016; Santesteban, Arenas & Campino 2015; Thomas, Rouf, Al Hail, El Kassem et al. 2017).

The National Coordinating Council for Medication Error Reporting & Prevention (NCCMERP), encompasses the multidisciplinary nature of the phenomenon (Svitlica, Simin & Milutinovic 2017), in the following definition for ME. This definition is been seen as the most appropriate description of the phenomenon described in this research assignment, and will therefore been used as the benchmark definition for ME:

"A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labeling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use."

The definition offered above alludes that ME can occur at any phase of medication management. Medication administration errors (MAE), are one of the main categories of ME, (Santesteban, Arenas & Campino 2015; Truter, Schellack & Meyer 2017). Up to a quarter to a

third of ME occur during the administration phase. In Iran, MAE are the most prevalent type of ME (Mansouri, Ahmadvand, Hadjibabaie, Kargar, Javadi & Gholami 2013).

MAE, include “any discrepancy between the medicine given to the patient and the prescriber's medication order as written on the patient's chart or manufacturers' preparation/administration instructions” (Keers, Williams, Cooke, Ashcroft 2013).

### **1.3 MEDICATION ERRORS IN AFRICA**

Following on the report on ME worldwide, the question arises on what the state of this phenomenon is in Africa? In Ghana, (Acheampong, Tetteh & Anto 2016), the medication administration incidence rate is reported to be at 27.2%. Feleke, Mulatu & Yesmaw (2015), reported the medication administration error incidence rate in Ethiopia is 56.4%. In Nigeria, nurses reported the administration of incorrect drugs, wrong dose medication administered and incorrect time of administration, as the most frequent MAE (Demehin, Babalola & Erhun 2008). The prevalence of ME in Nigeria is high with 47% of health professionals self-reporting ME (Ogunleye, Oreagba , Falade, Isah, Enwere, Olayemi, Ogundele, Obiako, Odesanya , Bassi , Obodo , Kilani & Ekoja 2016). It is thus evident that ME also occur on a large scale in Africa.

### **1.4 MEDICATION ERRORS IN SOUTH AFRICA**

Figure 1 on page 5, represents a graphical representation of medication related misconduct cases as reported by the South African Nursing Council (SANC 2012; 2013a & 2013b; 2014; 2015 & 2016a). This illustrates that the cases related to medication are steadily on the increase over a period of time (2012 - 2016). Although this mainly depends on the reporting of cases by the public and employers, the statistics do provide some account of how ME are experienced in the South African nursing context.

South Africa, like other developing countries does not have a national error reporting system. It is therefore difficult to quantify the extent of the problem. However, two studies published in 2017, related the rate of ME. Blignaut, Coetzee, Klopper & Ellis (2017), undertook a cross-sectional observational study in the Gauteng province of South Africa at public hospitals, and discovered

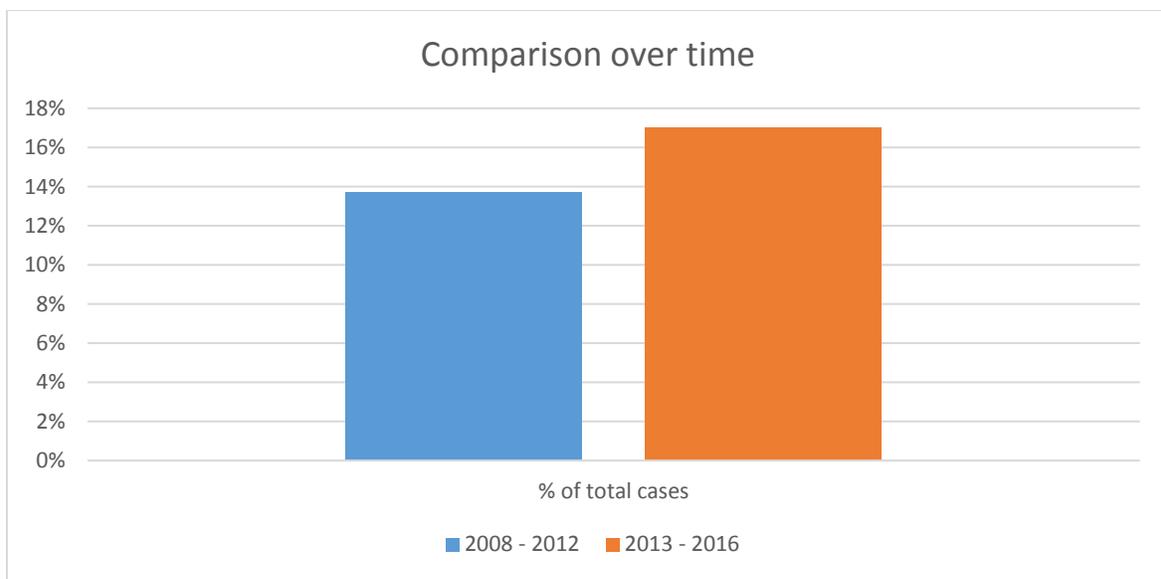
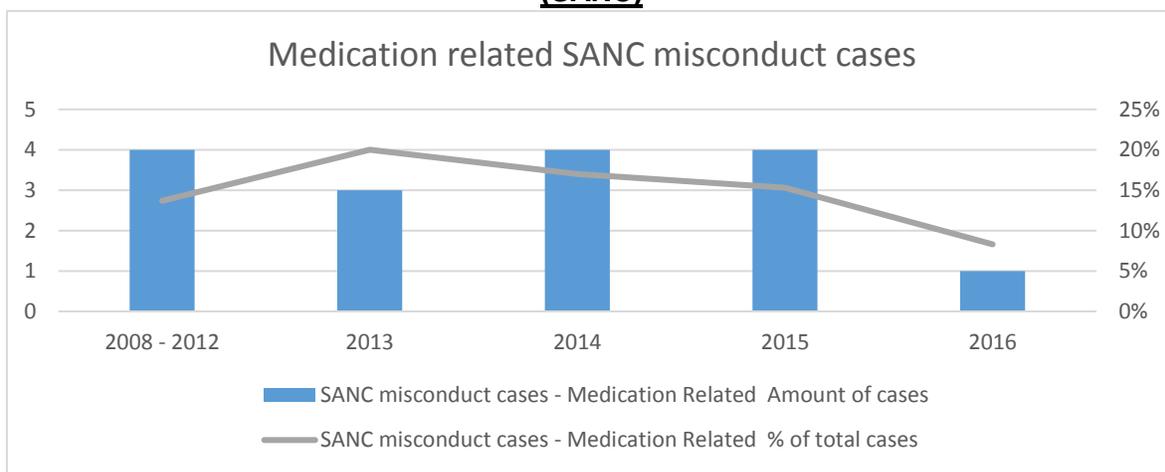
that MAE, specifically wrong-time errors and omissions were prevalent in up to 94% of patients observed.

Additionally, another prospective, quantitative descriptive study was undertaken at an academic hospital in the Gauteng Province of South Africa. It focused on neonatal intensive care & pediatric units and revealed that up to 78% of patients had one or more ME mainly in the administration and prescribing phases (Truter, Schellack & Meyer 2017).

Consequently, these two studies (in combination with the SANC misconduct cases), describe the high incidence of ME in the South African context. It also confirms that ME, specifically during the administration phase, presents a patient safety problem in this context.

Gokhul, Jeena & Gray (2016), highlighted the mathematical knowledge inadequacy of medical practitioners and nurses. Only 24% were able to complete the dosage calculations correctly. The alarming rate of 94.9% of children in this study, were exposed to at least one error. Additionally, Labuschagne, Robbertze, Rozmiarek, Strydom, Wentzel, Diedericks & Joubert (2011), report that 39.3% of anaesthetists were involved in at least one medication administration error. These statistics confirm the need for health professionals to be educated more rigorously in medication management in order to reduce ME.

**FIGURE 1 – GRAPHICAL STATISTICS OF MEDICATION RELATED MISCONDUCT CASES (SANC)**



Collated by F. Haroun August 2017

### 1.5 MEDICATION ADMINISTRATION

ME may occur at any of the three steps of the medication process. Medication management involves a multidisciplinary approach as various healthcare professionals play various roles in the process. This process includes *prescribing the medication* by the medical practitioner; *dispensing by the pharmacist* and *administration of the medication by the nurse*. This allows for a safety

mechanism of error interception at the prescription and dispensing phase. However, at the administration phase, there are no further safety mechanisms.

Nurses are responsible for the administration phase of medication (Medicines and Substances related Act 101 1965). Up to 45% of a nurse's daily tasks is medication related (Meechan, Mason & Catlin 2011; Karavasiliadou & Athanasakis 2014 & Chu 2016). Sixty three percent of ME were attributed to nursing during the administration phase at a private healthcare group in South Africa (Poovan 2007). Furthermore, The SANC reported in 2013 that 17% of professional misconduct cases were attributable to medication administration.

Since several issues around safety could result if the correct execution of the administration skill is not adhered to, consequences are severe and could possibly be fatal (Reid-Searle & Happel 2012). When safety issues have been compromised, it results in a medication administration error. One third of all ME occur during the preparation and administration phase, which nurses are primarily responsible for (Smeulers, Verweij, Maaskant, de Boer, Krediet, Nieveen van Dijkum & Vermeulen 2015). Nurses are often the last person in the cycle of medication management. Consequently, they are perfectly positioned to intercept and prevent ME from occurring.

Medication administration practices require the use of cognitive knowledge. This includes thinking simultaneously about dosage, timing, the right medication, patient assessment, interpretation of assessment data, anticipating risks, patient education and planning (Eisenhauer, Hurley & Dolan 2007). Furthermore, medication administration requires competency in the knowledge of medication, dosage and calculation, pharmacology, adverse drug reactions, different routes of medication, understanding policies and procedures and assessing for the legality of a prescription (Betts 2016). All these competencies also occur in a dynamic clinical environment plagued by distractions and interruptions.

In a systematic review by Karthikeyan, Balasubramanian, Mohammed, Muhammed & Rashifa (2015), MAE were classified into the following categories: *incorrect rate, incorrect time of administration, incorrect dose, medication omission, incorrect fluid, incorrect medication, incorrect medication, incorrect dose and incorrect patient*. It is thus evident that adequate training in this regard is crucial.

## 1.6 COMPETENCE OF NURSING STUDENTS

The International Council of Nurses (ICN 2009:6), defines competence as “the effective application of a combination of knowledge, skill and judgment demonstrated by an individual in daily practice or job performance”. This definition is supported by the Nursing Education and Training Standards (NETS 2013:3), as “the combination of knowledge, psychomotor, communication and decision-making skills that enable an individual to perform a specific task at a defined level of proficiency”.

However, student nurses have expressed that education programmes are leaving them vulnerable to ME (Vasimoradi, Jordan, Turunen & Bondas 2014). Subsequently, Reid-Searle & Happell (2011), call for an urgent need to prioritise medication administration as a priority in clinical education and call for contextualising these interventions into the clinical environment.

Inadequate knowledge regarding medication is a well-established causative factor of ME amongst nurses and student nurses. Education and training specifically pharmacology and dosage calculation was found to be inadequate by Zahara-Such (2013). Deficiencies in basic nursing education, inadequate knowledge about medication management and drug dose calculation are amongst the causative factors of MAE (Simonsen, Daehlin, Johannson & Farup 2014).

Persistent contributory factors to MAE include: “interruptions on medication rounds, poor mathematical skills, pharmacological knowledge and teaching and learning strategies used in nursing education,” (Cleary-Holdforth & Leufer 2013:218). Omissions, incorrect dosage, related to knowledge deficits, inexperience and distractions were leading causes of errors amongst nursing students (Wolf, Hicks & Serembus 2006).

Subsequently, Vaismoradi, Salsali & Marck (2011), state that at times, nursing students complete undergraduate training without gaining contextual knowledge about patient safety. Additionally, Burke (2014), claims that nursing education has struggled to enhance a patient safety culture due to the lack of empirical evidence of which teaching interventions affect student’s attitudes positively.

Furthermore, Aggar, Bloomfield, Frotjold, Thomas & Koo (2017), contextualised time management into simulated medication administration scenarios in order to improve nursing

students' preparedness for medication administration. This revealed that by contextualising medication administration through simulation, student preparedness and confidence can be enhanced.

## 1.7 THE ROLE OF NURSE EDUCATION IN MEDICATION ADMINISTRATION

As illustrated in the previous sections, ME is an international problem. As medication management involves a multidisciplinary approach, it is important that specific health science disciplines acknowledge and analyse their specific contribution to this process (Cleary-Holdforth & Leufer 2013).

Burke (2014), contends that the clinical skill of medication administration is an important and integral skill for nurses to acquire. He further argues that health professional students develop their attitudes to patient safety in the educational programmes that they interact with. The education of nurses therefore plays an integral role in patient safety. The strategic role of education in the prevention and management of ME in nursing cannot be underestimated and should begin at nursing student level and continue beyond obtaining the nursing qualification (Cleary-Holdforth & Leufer 2013). Through nursing education, students become aware of the importance of diligence and care required for the safe administration of medication (Koharchik & Flavin 2017).

Nursing education and training can play an important role in managing and controlling for ME (Keers, Williams, Cooke & Ashcroft 2013) and educational interventions that improve medication management practices will improve patient safety outcomes (Betts 2016). When clinical and educational interventions and strategies are combined, it has the potential to positively influence the safety of medication administration (Cleary-Holdforth, Leufer 2013).

Harding & Petrick (2008), explored the factors contributing to students' MAE and identified *rights violation*, *system factors*, *knowledge* and *understanding*, as the three categories. *System factors* include the work environment, individual, team, task and organisation (Latimer, Hewitt, Stanborough & McAndrew 2017). The complexity of this process needs to be included in teaching strategies to facilitate the competence of nursing students (Harding & Petrick 2008).

*System issues* that need to be included in educational interventions and strategies include: dealing with interruptions, team training, and communication (Sahay, Hutchinson & East 2015;

Leape & Berwick 2005). Despite this, patient safety education is generally under-prioritised in health professional educational programmes such as nursing and medicine (Wakefield, Attree, Braidman, Carlisle, Johnson & Cooke 2005). Furthermore, Hewitt, Tower & Latimer (2015), state that undergraduate curricula can improve knowledge about medication safety and influence future clinical practice. This can be done by teaching nursing students about the complexity of medication administration to prevent ME.

The key to understanding MAE is to understand how and why they occur (Gado, Ebeid & Axon 2016). Although improvement strategies include addressing the aforementioned variables, stand-alone educational interventions and strategies do not reduce ME. A combination of education and risk management strategies positively prevent ME from occurring (Lapkin, Levett-Jones, Chenoweth & Johnson 2016).

Understanding the reasons for these quality outcomes such as the prevention of ME, are vital in designing preventative strategies to improve patient safety. Medication safety practices require a systematic approach and contributing factors to ME include systemic, organisational and individual related issues (WHO 2011).

Härkänen, Voutilainen, Turunen & Vehviläinen-Julkunen (2016), explored the quality and effectiveness of educational interventions related to medication management. They revealed that all educational interventions had a positive effect with varying degrees of effectiveness - thus supporting the role education can play in medication management and the prevention of ME.

### **1.7.1 Educational strategies**

Developing students' understanding and recognition of factors related to ME is the first step in preventing ME (Latimer, Hewitt, Stanborough & McAndrew 2017). Educational strategies used during the training of students have included the use of the "rights" of medication and although this allows for a systematic check, it lacks standardisation internationally.

Ghamari-Zare & Hajbaghery (2016), state that nurses and nursing students need a high level of knowledge of pharmacology and medication management in order to care for patients. Insufficient knowledge was the main obstacle that nurses encountered during medication administration (Lan, Wang, Yu, Chen, Wu & Tang 2013). The calculation of correct doses is integral to medication administration, however, the numeracy skills of nurses was found to be inadequate (Stolic 2013).

Mechanisms relevant to real-world practice such as managing distractions and interruptions into training interventions, should be incorporated into educational strategies before students enter the clinical environment (Krautshaid, Orton, Chorpenning & Ryerson (2011)). Consequently, the authors hypothesise that effective education is grounded in behavioral learning theory, suggesting that students who learn and gain confidence with this psychomotor skill, are able to apply their knowledge in unfamiliar and varying contexts.

The view that realistic medication administration learning activities that closely mirror clinical practice settings, should initially occur in the safe, academic learning environment, is shared by Benner, Tanner & Chelsea (2009). These activities should be experiential, purposeful, and provide opportunities for formative feedback followed by summative evaluation to determine novice level competency.

The concept of competence developing over time, alludes to the need for medication management interventions and pharmacology to scaffold throughout an undergraduate course and continue into the professional life of the nurse (Cleary-Holdforth & Leufner 2013).

Simulation, medication dose calculation, e-learning, and the teaching of basic pharmacology are other methods of teaching medication administration. However, Miller, Haddad & Phillips (2016), advocates that although these strategies are invaluable, interventions that focus on incorporating a culture of patient safety has a greater effect in reducing ME. Alternative strategies to teaching medication safety are also advocated by Whitehair, Provost & Hurley (2014).

The current focus of “five rights” might not be sufficient to deal with medication administration practices effectively (Miller, Haddad & Phillips 2016), as it is a linear approach and the environment in which medication administration needs to be taken into account when teaching medication administration. Nurses’ knowledge related to medication administration especially pharmacological knowledge - appears to be insufficient from the findings of the literature.

## **1.8 NURSING EDUCATION IN SOUTH AFRICA**

Blaauw, Ditlopo and Rispel, (2014), describe the international need for educational programmes to produce health professions that are in alignment with the populations’ health needs. Subsequently, the nursing curriculum needs to be aligned with the National Qualifications Framework (NQF) in South Africa. Also, to respond to the changing health needs of South Africa,

nursing qualifications have been revised and new qualifications such as the Bachelor's Degree in Nursing and Midwifery (BDNM), were introduced, however is yet to be implemented.

Nursing qualifications needed to be in line with the Department of Higher Education (SAQA 2000), even though SANC, is the regulatory body of nursing in South Africa. Subsequently, nursing qualifications needed to be revised to meet these national requirements.

An aspect of SANC's mission is to set and maintain standards of nursing education, training and practice in South Africa. All Nursing Education Institution (NEI)'s in the country need to abide by these standards. In order for a curriculum to be accredited, it would need to meet the set criteria both by SANC and Council of Higher Education (CHE). The CHE is the Quality Council of Higher Education in South Africa.

Legacy qualifications in South Africa address three main categories of nurses, namely registered nurses, enrolled nurses and enrolled nursing assistants. These legacy qualifications such as the Bridging Course to Enrolment as a Registered General nurse are currently being phased out. The new NQF has resulted in a professional nurse qualification which requires that a four year bachelor's degree at a university needs to be obtained.

Similarly, the legacy qualification of the enrolled nurse has been replaced with a three year staff nurse diploma and also is yet to be implemented. As there is a recognised shortage of nurses in South Africa (South Africa Health Review 2015), the three year staff nurse qualification implies that there would be a broadening of the change of scope of practice that could possibly meet the nursing needs of the country (Blaauw, Ditlopo and Rispel 2014).

The Bachelor's Degree in Nursing and Midwifery (BDNM), in conjunction with the nursing education and training standards, has been designed by SANC to meet both national (Nursing Act 2005), and international standards (World Health Assembly 2001). In these documents, the authors claim to meet the growing and changing landscape of healthcare in South Africa.

Due to the transition phase of the curriculum of nursing in South Africa, it is the view of the researcher that this scoping review would be ideally positioned to assist nursing educators to inform curriculum development related to educational intervention and medication safety.

In South Africa, nursing students complete both a theoretical and practical component of their training. The Nursing Education and Training Standards document (NETS 2013: 33 - 34), requires

nursing education institutions to use recognised approaches of teaching & learning which include adult education, self-directed learning, e-learning and clinical simulations.

NETS (2013) specifically addresses the curriculum content to “show focus on pharmacology and therapeutic medication management across the course” (NETS 2013:10). The focus of this research assignment shall be on all undergraduate students either enrolled in a nursing diploma or a degree course.

In South Africa, the preparation of students with adequate knowledge and skills, requires critical thinking nurses. These students need to be prepared for the reality of staff shortages, lack of resources and ability to care for an increased number of patients due to the increasing burden of disease in South Africa (Subhan 2014).

Successful nursing education requires the blending of theory and practice that cannot exist separately. Theory and research must inform practice, and practice develops theory (Bruce, Klopper & Mellish 2011).

Theoretical facilitation is mainly classroom-based, whilst clinical learning occurs in any setting in a hospital or community (NETS 2013:3). Clinical learning is achieving knowledge, skills, and values in clinical practice settings or environments that encourage clinical practice (Bruce, Klopper & Mellish 2011).

The SANC stipulates the minimum number of clinical hours that nursing students in South Africa should achieve per year of training. This is achieved in the form of work-integrated learning where students are placed in the clinical environment to gain experiential learning. During clinical learning, students are exposed to learning opportunities for the application of theory into practice.

The future curriculum should require a 60:40 percent ratio of clinical placement and theory (NETS 2013:5). It follows that preparing and focusing on aspects related to the clinical environment is vital to adequately prepare nursing students for the medication administration process.

### **1.8.1 Clinical Practice**

The clinical environment is important for students to become competent in medication administration (Sulosaari, Huupponen, Torniaainen, Hupli, Puuka & Leino-Kilpi 2014). Clinical learning forms part of the “educational process that occurs in any practice setting in hospital or community” (Nursing Education Training & Standards 2013: 2). This clinical learning occurs in the

form of work-integrated learning which is described by NETS (2013:4) as “A component of a learning programme that focuses on the application of theory in an authentic, work-based context. It addresses specific competences identified for the acquisition of a qualification”.

As in the international arena, nursing students in South Africa are only allowed to administer medication under the supervision of a registered nurse. Clinical supervision of nursing students during their clinical placement is mandated by SANC R173 (SANC 2013:1), defines clinical supervision as “the assistance and support extended to the learner by the professional nurse, midwife or staff nurse in a clinical facility with the aim of developing a competent and independent practitioner.” Registered nurses assist with facilitating the student through the clinical supervision whilst in clinical practice.

## **1.9 EDUCATIONAL INTERVENTIONS TO PREVENT MEDICATION ERRORS – SYSTEMATIC REVIEWS**

Three systematic reviews about ME, (Berdot, Roudot, Schramm, Katsahian, Durieux & Sabatier 2016; Härkänen, Voutilainen, Turunen & Vehviläinen-Julkunen 2016; Lapkin, Levett-Jones, Chenoweth, & Johnson 2016), show that out of the 37 articles included, only one article was from an African country (see Figure 2).

There is overwhelming international evidence in the literature of understanding the contextual factors related to the prevention & management ME. The intention of this study was thus to explore the relevant literature in the context of Africa & South Africa. The rationale of taking the approach of a scoping review could amongst other aspects, address the need to explore grey literature.

## **1.11 A DECOLONIAL LENS**

Educational programs in African health systems were developed during the period of colonialism. This was mainly based on Western disease trends, educational systems and human resources as opposed to the actual reality of the African context (Seboni, Magewe, Uys, Su, Djeko & Moumoun 2013).

Furthermore, educational research in Africa has been described as marginalised from African values and researchers fail to acknowledge the cultural practice and preferences of African people. This has led to the belief that research ideology and methodologies of the Western world are superior in their approach (Higgs 2012). Furthermore, this author states that education in Africa is not reflective of the African context, but rather of a Eurocentric ideology.

Decolonialism thus allows for an alternative framework for knowledge that de-emphasises the Western knowledge framework (Oelofsen 2015). A decolonialist approach to research and practice is described by Chiumbu (2017:3), as having two aspects. Firstly, the “deconstruction of existing methodologies and methods that reproduce the coloniality of knowledge”, and secondly, a “reconstruction or reinvention of research practice”. This requires an intentional and planned advance towards “design methods that address African realities – methods that are participative, interactive and emancipatory whilst being ethical.”

Mubangizi (2017), argues that the decolonialisation of a curriculum needs to focus on discovering knowledge and practices that are contextually “relevant and responsive.”

Western philosophy has as its primary aim the search of truth, whereas African philosophy has a specific aim, namely the “quest for health” (Oelofsen 2015). Although African philosophy aims for truth as well, he argues further that the primary aim is to restore health.

Educators in Africa need to become aware of the impact that African philosophers can make on transforming educational theory and practice in Africa. It acknowledges diversity and has a practical approach to improve the quality of life for all (Higgs 2012).

It appeared that much of the literature related to medication management educational interventions, mainly existed in an international context. This posited me as the researcher to explore the local context of literature. One possibility could be that the research could be unpublished? Maybe it could exist in the form of theses and dissertations that were perhaps not published in an international or local journal or easily accessible by the available databases?

Strengthened by the premise of the decolonialism of the research, the ontological lens was adopted to discover if literature in the South African context existed and if so, to collate the context-specific information in an easily accessible format of a scoping review. Thus, the departure point of this research assignment was to attempt to find an epistemological balance

between what are the international educational best practices related to MAE, whilst being locally relevant to the needs of the current South African context.

This premise shall be the epistemological view of the researcher in order to provide a context-specific, decolonised body of work in order to inform future educational nursing interventions related to medication management.

This lens further suited the study as the overwhelming claim of the international literature was to contextualise the environment in which ME were occurring, in order to inform educational interventions and strategies to prevent, control and manage these errors. The approach of a scoping review provided a suitable alternative to the overall aim of the study to present a body of work that could inform future interventions.

The premise of decolonialism is used in this research assignment as a lens to find context-specific information related to the African and specifically the South African context. Through the lens of decolonialism, this research assignment attempts to identify research studies related to the African and South African context by attempting to answer the research question which will be addressed in chapter three.

## **1.12 GLOSSARY**

Terminology associated with teaching in nursing education and medication safety or management practices are defined below:

### **1.12.1 Clinical accompaniment**

Clinical accompaniment is referred to as “a structured process by a nursing education institution to facilitate assistance and support to the learner by the nurse educator at a clinical facility to ensure the achievement of the programme outcomes (SANC 2013c:1).”

### **1.12.2 Clinical nursing education practices**

Clinical nursing education practices refer to real life, hands-on or practice-based teaching and learning activities that take place within the clinical environment (Kpodu 2015).

### **1.12.3 Clinical practice**

Clinical practice is a learning opportunity that the student uses in the health service, under the supervision of the registered nurse and midwife and other experts in the health service (SANC

1995:7). It takes place in the real practice setting involving actual patients (Bruce, Klopper & Mellish 2011:255).

#### **1.12.4 Grey Literature**

Grey literature is referred to as the diverse and heterogeneous body of material that is made public outside and not subject to the traditional academic peer reviewed process (Adams, Smart & Sigismund Huff 2017). It has also been referred to a range of documents that is not controlled by commercial publishing organisations (Adams, Hillier-Brown, Moore, Lake, Araju-Soares, and White & Summerbell 2016). It is non-peer reviewed material and sources include dissertations, theses etc. Dissertations have been referred to as a sub-category of grey literature (Hartling, Featherstone, Nuspl, Shav, Dryden & Vandermeer 2017).

#### **1.12.5 Medication Administration**

Medication administration includes aspects such as understanding pharmacological information related to medication, calculation of medication, safety aspects, side-effects, nursing considerations, health education and supervision of medication related tasks. This is required to administer medication safely to patients (Schellack 2011).

#### **1.12.6 Teaching strategy**

In health professions education, teaching strategies are defined as “using methods of instruction combined with a specific approach or combination of approaches (problem-based learning, cooperative learning, experiential learning, outcomes based education etc.), to promote learning about health and disease” (Hugo, Fakude 2011:54).

### **1.13 CONCLUSION**

In this research assignment, a review of the phenomenon of ME was undertaken through the specific lens of decolonialism with emphasis on managing ME through nursing educational interventions and strategies. This approach was undertaken to attempt to identify the extensive international literature, African context and South African context, with a view to identify categories from the main body of knowledge known about ME and nursing educational interventions and strategies.

During the preliminary literature search, a plethora of research existed in the international arena. However, it appeared that limited research both published and unpublished existed in the African context and specifically in the South African context. Could the source of information lie in unpublished data? This perception could lead to the conclusion that more context specific research in the African and South African context is needed in order to diagnose these environments before designing educational interventional studies. The premise of decolonialism was adopted due the claim that in order to understand ME and design appropriate interventions, the local landscape needs to be surveyed.

The hypothesis that is postulated is that limited research exists regarding educational interventions and strategies in the South African nursing context. The next chapter focusses on literature related to issues in the regards of teaching of medication administration to nursing students.

## **CHAPTER 2**

### **LITERATURE PERSPECTIVES**

#### **2.1 INTRODUCTION**

This chapter will discuss current literature related to medication administration and educational strategies to teach this process to the relevant people. It will explore educational interventions and strategies used to decrease the incidence of ME including successes, lessons learnt and recommendations from previous authors.

As the global, continental and local contexts of ME were described in the previous chapter, it will not be discussed in this chapter.

#### **2.2 MEDICATION ADMINISTRATION PROCESS**

The role of the nurse in the medication administration process is multifaceted. It includes the role of primary caregiver, requiring the preparation and administration of medication to assessing patient response and compliance. This process also includes the ordering, receiving and storage of medication (Schellack 2011).

Complex critical thinking is required to apply knowledge during medication administration. Ten areas of thinking show the intellectual complexity and multi-tasking aspect of the process of medication administration. These areas were identified as communication, dose-time, checking medication, assessment, evaluation, teaching side effects, work around procedures, anticipatory problem solving and drug administration. However, only seven elements can be retained by the human brain at any given time (Eisenhauer, Hurley & Dolan 2007). Additionally, this process occurs in a dynamic clinical environment plagued by distractions and interruptions.

Traditionally, the medication administration process is taught by making use of the “five rights” principle (Eisenhauer, Hurley & Dolan 2007). This is a systematic check done by the nurse of the following items prior to medication administration: Right patient, Right route, Right dose, Right medication and Right time. Variations have existed to include in the list up to ten rights.

Bourbonnais & Caswell (2014), acknowledge this process, however, they recommend that students need to understand system factors such as the environment where medications are

prepared which include distractions and interruptions amongst others. Furthermore, nursing education needs to prepare students for the reality of the clinical environment and the array of factors that contribute to ME.

### **2.3 EDUCATION AS A CONTRIBUTING FACTOR**

Education and training has been identified as one of the contributing factors of medication management (Karavasiliadou & Athanasakis 2014), and will be the primary focus explored in this study. The researcher is of the opinion that by including system factors into educational interventions and strategies, that ME can be reduced.

A systematic review showed that stand-alone educational interventions do not reduce ME, but that a combination of education and risk management strategies positively contribute to reducing ME (Lapkin, Levett-jones, Chenoweth & Johnson 2016).

Educational interventions and strategies can provide a solution to reduce ME. Breikreuz, Dougal & Wright (2016), claim that by understanding factors that can effectively shape a programme of education for error prevention with a significant and lasting impact on attitudes and behaviors, will result in the decrease of errors. It is important to engage staff to collectively uncover an in-depth understanding of contextual issues and potential educational needs. Consequently, in order to design an educational intervention, it is important to survey the landscape to understand the environment in which these errors occur (Hesselgreaves, Watson, Crawford, Lough & Bowie 2013).

However, Vaismoradi, Salsali & Marck (2011), state that at times, nursing students complete undergraduate training without experiencing contextual knowledge about patient safety. The context in which medication administration (otherwise known as systems factors), were not fully considered when educating nursing students about medication administration. The complexity of this process needs to be included in teaching strategies.

Adult-based learning principles, experiential learning and a learner-centered approach, are the main concepts related to nursing education (NETS 2013). Strategies to facilitate critical thinking and integrate theory and practice are essential in order to develop a graduate that is fit for purpose.

## **2.4 NURSING EDUCATION**

Medication administration is included in any nursing curriculum, as a primary focus. This is mainly because ME are a major threat to patient safety (Zahara-Such 2013). Nursing students need to display competence in the execution of the skill to ensure patient safety. Approaches to learning that facilitate learner engagement include experiential learning, reflective learning, problem-based learning, community-based learning and cooperative learning (Mellish, Brink & Paton 1998). A learner-centered approach to nursing education fosters critical thinking by engaging students in active learning (Sinqotho 2015). Vaismoradi, Griffiths, Turunen & Jordan (2016), advocate for educational programmes and experiential learning that are fit for purpose and appropriate for clinical practice.

### **2.4.1 Experiential learning**

Experiential learning is learning by doing (Quinn 2001). In nursing education this learning occurs in work-based placements (Bruce, Klopper & Mellish 2011). In the context of nursing education these “placements” are in the form of achieving the required notional clinical hours as required by the SANC through experiential learning.

Experiential learning is an aspect of nursing education that is used as an approach to facilitate work-integrated learning (Mellish, Brink & Paton 1998). This constitutes a component of a learning programme that focuses on the application of theory in an authentic, work-based context. It addresses specific competences identified for the acquisition of a qualification (NETS 2013:4).

Experiential learning is concerned with meaning and the meaningful, it applies the minds and feelings of the person (Aliakbari, Parvin, Heidari & Haghani 2015). Learning has a constructivist component and is an active process, as during knowledge construction, meaning is obtained from real life experiences (Botma, Brysiewicz, Chipps, Mthembu & Phillips 2013).

Elements of experiential learning include: the experience, reflections, action and revisiting the experience. Through these elements, the student is able to embrace knowledge, reflect on this experience of learning, has an opportunity to put the knowledge into action and revisits the experience (Bruce, Klopper & Mellish 2011).

### **2.4.2 Reflective Learning**

Reflective learning is vital to experiential learning (Sand, Elison-Bowers, Thomas & Kendrick 2014), as it cements the experiential learning aspect through encouraging reflection on learning experiences.

Reflective learning is described as the logical analytical exercise used to facilitate knowledge from experiences (Maree & Van Rensburg 2013). It facilitates the ability of the learner to identify what they have learnt and what they should be able to do. It allows students to create meaning from their experiences and to formulate more questions that will facilitate their understanding of their learning. Learning will occur when there is reflection on an experience (Ramani & Leister 2008), and feedback facilitates this process.

### **2.4.3 Problem-based learning (PBL)**

This teaching strategy prompts active learning through self-directed learning, problem solving skills, teamwork and the ability to apply knowledge whilst working with a problem (Council for Higher Education 2011).

Problem-based learning is an active, student centered approach that assists students to use and apply their knowledge and skills in various situations. Students in small groups learn through solving problems and reflecting on current experiences and learnings. Philosophical underpinnings of problem-based learning are based on constructivism, self-directed learning and adult learning.

PBL not only focuses on content but also the process of learning. Undergraduate education needs to facilitate learner engagement through learning content. Problem based learning allows for interactive, student-centered instructional methods (Rakhudu, Davhana-Maselesele & Useh 2017), which in turn, facilitates problem solving and critical thinking skills.

### **2.4.4 Case-based Learning**

Case-based learning is an active teaching and learning strategy which uses guided inquiry in small group discussions. It is an approach similar to PBL learning and uses a particular case to engage students in the acquisition of knowledge, skills and attitudes (Sinqotho 2015).

### **2.4.5 Community-based education**

Community-based education uses the community as the learning environment. This is an approach that contextualises the community's needs where case studies and problem based learning occurs (Hosny, Kamel, El – Wazir & Gilbert 2013).

### **2.4.6 Cooperative learning**

Cooperative learning, is when a team or group learn together to achieve a common goal. It is helpful in the development of communication skills, confidence levels and self-esteem of the participants. This technique of peer teaching should be used over a period of time and not used occasionally (Bruce, Klopper & Mellish 2011).

## **2.5 NURSING STUDENTS COMPETENCE/PREPAREDNESS**

Graduate nurse's perceptions of their management of medication administration in the clinical setting were explored and this showed that the complexity of medication management was not actively incorporated into the curriculum (Manias, Aitken & Dunning 2004). Additionally, Powell (2012), reports that student nurses in their second year in selected private hospitals in South Africa, do not appear competent in the skill of oral medication administration.

In Australia, nursing students' perceptions of the effectiveness of educational interventions were explored (Hewitt, Tower & Latimer 2015). This study found that educational interventions which included short digital recordings, a problem-based strategy and the inclusion of systems factors, could play an important role to create awareness and encourage students to relate this knowledge into clinical practice. Students found this strategy useful in preparing them for medication management. Whilst emphasis on pharmacological knowledge in the nursing curriculum is not refuted, strategies to include systems factors that increase the risk of ME must be included.

An integrative review on nurses' medication competence revealed eleven competency areas: "(1) anatomy and physiology, (2) pharmacology, (3) communication, (4) interdisciplinary collaboration, (5) information seeking, (6) mathematical and medication calculation, (7) medication administration, (8) medication education, (9) assessment and evaluation, (10) documentation and (11) promoting medication safety as part of patient safety" (Sulosaari,

Suhonen & Leino-Kilpi (2011:464). From these themes, three major categories were identified, namely decision making, theoretical competence and practical competence.

Medication management competency demands a sound knowledge base and application of that knowledge in a practical clinical setting in dynamic, complex environments (Sulosaari, Suhonen & Leino-Kilpi 2011). A task orientated teaching approach refutes the complex nature of medication administration.

### **2.5.1 Pharmacological knowledge**

Manias & Bullock (2002), established that clinical nurses perceived student nurses' pharmacological knowledge as being insufficient. Nurses and nursing students need a high level of knowledge of pharmacology and medication management to care for patients (Ghamari-Zare & Hajbaghery 2016). Although practical educational interventions to improve patient safety such as nurse pharmacological knowledge and dose calculations exist, medication safety issues and inclusion of pharmacology into the curriculum need to occur (Adhikari, Tocher, Smith & Corcoran & MacArthur 2014).

Meechan, Mason & Catling (2011), suggest that an early integrated approach to pharmacology and medication management to nursing students were favourable for increasing students' medication knowledge. Furthermore, Latimer, Hewitt, Stanborough & McAndrew (2017), incorporated pharmacology into a medication safety course for undergraduate students. This showed an improvement in medication calculation competence and confidence and that it assisted students' understanding of system related aspects of ME.

Furthermore, nursing students who received simulation-enhanced pharmacology instruction, showed improvement in medication administration processes (Steiner Sanko & McKay 2017).

### **2.5.2 Mathematical Skills**

The calculation of correct doses is integral to medication administration. However, the numeracy skills of nurses were found to be inadequate (Stolic 2013). Similarly, in South Africa, Blignaut, Coetzee, Klopper & Ellis (2017), found that dose-calculation skills were inadequate in nursing staff who participated in a dosage calculation test. In an educational audit, Tanzanian nurses and nursing students also experienced difficulties with mathematically calculating medication dosages (Savage 2015).

Stolic (2014), investigated the effects of education strategies on nursing students' ability to perform medication dosage calculation. Four types of strategies are used to teach calculation skills to nursing students: traditional teaching methods, technology, psychomotor skills and blended learning. However, there was insufficient evidence as to which strategy proved to be most effective in teaching medication calculations, thus calling for more research on this topic.

Anxiety experienced regarding mathematics calculation is inversely proportional to performance of mathematical ability. Environments that are supported by flexible teaching approaches with individualised focus and smaller class sizes, and which assist with mathematics anxiety, are much more effective in teaching mathematic calculations (Williams & Davis 2016).

Remedial classes focusing on logical reasoning skills in combination with reflection has shown to increase students' confidence and awareness in order to facilitate their competence regarding medication calculations (Shelton 2016). An integrated approach including technology, problem solving and a hands-on approach will assist nursing students in mathematics competency (Hunter Revell & McCurry 2013).

Educational interventions and strategies that included various didactic methods such as lectures, projects, simulation, and medication calculation skills and distractions management were found to be more valuable (Karavasiliadou & Athanasakis 2014). Subsequently, a whole curriculum approach related to developing numeracy skills in undergraduate nursing students spanning the duration of their course has shown improvement in their numeracy skills (van de Mortel, Whitehair & Irwin 2014).

### **2.5.2.1 Calculation of medication dosages**

Nursing students experience arduousness when learning about mathematical dosage calculation of medications. This follows that teaching strategies need to change in the nursing curriculum (Zahara-Such 2013). This integrative review established that mathematical calculations should be incorporated early into a nursing programme. It was found that realistic, problem solving scenarios provide the best learning outcomes and that nursing students' confidence levels improve when mathematical skills improve.

Teaching mathematical skills in the simulation laboratory and allowing students to have repeated opportunities to practice may improve students' proficiency in dosage calculations (Schneidereith 2014).

Accuracy is vital in the calculation of medication dosages, as errors may result in disastrous consequences for the patient. The formula method of medication dose calculation, in addition to the use of tutorials and assessment of knowledge, were found to have positive results in the medication dosage calculation skills of nursing students (Coyne, Needham & Rands 2013).

## **2.6. TEACHING STRATEGIES**

Teaching strategies used in nursing education include but are not limited to lectures, demonstration, group discussions, problem-solving activities, assignments, projects, games, projects, workbooks, worksheets, tutorials, posters, peer learning, role play, audio visual such as audio recordings and videos, e-learning etc. (Bruce, Klopper & Mellish 2011).

In clinical teaching, strategies include clinical demonstration, clinical ward rounds, simulation, clinical case presentations, reflective journaling, critical incident techniques, case studies, roleplaying, problem-based learning, teachable moments, supervision, team teaching etc.

In the Sub Saharan African context, Kpodu (2015), asserts that clinical teaching should include peer group teaching, demonstrations, patient case studies and presentations, clinical conferences, ward rounds, reflective journals and a critical incidence technique.

These strategies attempt to integrate theory and practice to facilitate competence. However, nursing graduates currently display a lack of integration of theory and practice (Armstrong & Rispel 2015).

Predominant didactic teaching strategies used by South African nurse educators in Kwazulu Natal South Africa, were mainly lectures and demonstrations across all subject areas. Small group discussion, problem-based learning, case-based studies, role play, simulation, narratives styles, questioning, portfolios, reflective thinking, web based teaching and community-based were the other teaching strategies used (Subhan 2014). Lectures, small group discussions and problem-based teaching were the predominant teaching strategies.

Skills laboratory; simulation laboratory; online and web-based teaching strategies; collaborative teaching strategies; problem-based and reflective thinking, are teaching strategies described by Jeppesen, Christiansen & Fredericksen (2017).

Normally during clinical practice, training interventions attempt to create a positive learning environment, focus on effective communication strategies and critical thinking strategies. The practicing of skills is the most important teaching strategy used in nurse education (Jeppesen, Christiansen & Fredericksen 2017).

### **2.6.1 Teaching strategies to teach medication administration**

Clinical competency is defined as integration of an array of skills, knowledge and attitudes. The curriculum and the clinical environment can have an important effect on clinical competence amongst students (Hakimzadeh 2013).

Teaching the “five rights” and calculation competency, are the main focus of teaching undergraduate nursing students medication administration (Miller, Haddad & Phillips 2016).

Teaching strategies such as teaching in small groups, allowing students to concentrate during practice sessions, proficiency in mathematic calculation included in simulation and completion of medication error reporting forms, showed an improvement in students’ performance. Simulation in combination with problem solving appears to be an optimal method for teaching the medication administration process (Koharchick & Flavin 2017).

What follows is a description of the most common teaching strategies used in nursing education.

#### **2.6.1.1 Case studies**

Case-based learning is an active teaching and learning strategy that uses guided inquiry involving small group discussions. This method promotes critical thinking, problem solving and effective communication (Sinqotho 2015).

Case-based learning in combination with a lecture showed improvement in patient assessment skills, preparing students for clinical practice (Raurell-Torredà, Olivet-Pujol, Romero-Collado, Malagon-Aguilera, Patiño-Masó & Baltasar-Bagué 2015).

#### **2.6.1.2 Simulation**

Simulation has the potential to assist students in increasing their sense of awareness e.g. movie simulations made students more aware of the severe consequences of errors (Breitkreuz, Dougal and Wright 2016). Clinical simulation teaching environments with adaptive realistic scenarios

have the potential to enhance nurse preparedness for oral medication competence and may reduce ME amongst novice nurses (Sears, Goldsworthy & Goodman 2010).

Undergraduate nursing students often have limited experience in making informed clinical judgments. Simulation offers opportunities to be safely exposed to clinical experiences and results in positive learning experiences. Simulation technologies have a positive impact on student nurses in that deductive reasoning and analysis can be fostered by including interruptions (Hayes, Power, Davidson, Daly & Jackson 2015).

Nursing students at a South African University reflected that simulation allowed them to integrate theoretical knowledge with nursing practice in high-fidelity simulations. This exposure allowed them to develop their critical thinking skills and develop their self-confidence (Welman 2013).

At another South African university, Bekker (2015), explored nursing students' application of clinical judgement during simulation and found that simulation improves students' clinical judgement. Peer-learning was included in a simulation instruction study (Molloy 2017), where both senior and junior nursing students found the experience to be engaging and improved their confidence and competence. This was also a favourable example of cooperative learning. Students report that simulation allows them to identify knowledge gaps and increased confidence in a safe environment (Sears, Goldsworthy & Goodman 2010).

Interestingly, virtual reality simulation was used as an opportunity to bridge the gap between theory and practice. This improved the students understanding of the medication administration sequence, a vital step in preventing MAE (Dubovi, Levy & Dagan 2017).

### **2.6.1.3 e- Learning**

An e-learning programme has the benefit of reducing classroom teaching and can be an effective part of nursing education as it promotes self-directed learning. It also facilitates critical thinking. (Sung, Kwon & Ryu 2008).

A flipped classroom approach is a technology driven method that uses online resources to replace traditional lecture methods and allows for tasks completed outside the classroom to be discussed during classroom time. Students reported a greater understanding of pharmacology and enhanced critical thinking skills when exposed to a flipped teaching approach (Hanson 2016).

An online video to complement clinical teaching of medication administration has also shown to improve nursing students' satisfaction and performance (Holland, Smith, Mcgrossan, Adamson, Watt & Kay 2013).

### **2.6.1.3 Work integrated Learning (WIL)**

Work integrated learning is a component of a learning programme that focuses on the application of theory in an authentic, work-based context. It addresses specific competencies identified for the acquisition of a qualification (NETS 2013:4). It is currently a mandated requirement from SANC as students need to complete 1000 clinical hours per year in the form of WIL.

### **2.6.1.4. Supervision**

Nursing students develop competencies by rotating through clinical practice environments. Clinical environments that actively engage students, facilitate critical thinking and decision making skills, increase the students' level of competence (Bianchi, Bressan, Cadorni, Pagnucci, Tolotti, Valcarenghi, Watson, Bagnasco & Sasso 2016).

These clinical areas give students the opportunity to apply the principles of medication administration on actual patients whilst following the correct medication administration processes. Here they will read prescription charts, interpret medication orders, calculate medication doses, practice preparation of medication and be involved in direct patient care (Reid-Searle, Moxham, Walker & Happell 2010).

According to the Nursing Act 33 of 2005, student nurses in South Africa should be functioning under the supervision of registered nurses. However, poor supervision has been described by both unit managers and nursing students (Gerber 2016).

Clinical supervision is vital to the development of clinical skills in nursing students. However, clinical supervision and nursing students have been limited in the clinical environment. In South Africa, the supervision of nursing students are mainly undertaken by registered nurses who are also responsible for patient care (Jeggels, Traut & Africa 2013). Time for clinical supervision was found to be the main problem (Pillay & Mtshali 2008; Gerber 2016), as clinical learning was considered secondary to ward routine.

Effective supervision includes direct supervision and constructive feedback. Helpful behaviours include giving direct feedback, linking theory to practice, engaging in problem solving, reassurance and role modelling (Kilminster, Cottrell, Grant & Jolly (2007).

Teaching strategies employed during supervision are demonstrations, questioning, role modeling and coaching. Coaching allows clinical supervisors to give feedback and advise students during medication administration.

Social learning theory and situated learning theory are frameworks for understanding the importance of learning (Coté & Laughrea 2014). The challenge remains that, during bedside teaching, preceptors/ supervisors need to have skills in clinical teaching, role modelling and the socialisation of nursing students in order to facilitate the transition to clinical practice. In the clinical environment, role modelling is more difficult to maintain consistently.

#### **2.6.1.5 Contextual educational interventions**

Miller, Haddad & Phillips (2016), emphasises that interventions that are focused on instilling a culture of safety have a greater impact on reducing ME. Latimer, Hewitt, Stanbrough & McAndrew (2017), supports this view by introducing a module for nursing students that incorporate students' understanding of the systems approach to ME, and possible prevention strategies, mainly attempting to increase students' awareness of the complex nature of the healthcare system and medication administration.

One of the leading causes of ME is interruptions. Interruptions were contextualised during a simulation activity with nursing students. This was designed to help students understand the impact of interruptions and develop effective management strategies in order to deal with them. Role play and reflection were incorporated into the session. This resulted in a positive learning experience influencing the students' ability to make clinical judgement and stimulate critical thinking (Hayes, Power, Davidson, Daly & Jackson 2015).

Education and training is mainly focused on pharmacology and medication calculations. Limited evidence exists that stand-alone interventions are effective. Multifaceted approaches in combination with education and risk management strategies have been shown to be more effective in reducing ME (Lapkin, Levett-jones, Chenoweth & Johnson 2016).

### **2.6.1.6 Interprofessional Collaboration**

Inter-professional communication and teamwork are vital for medication safety (Omura, Levett-Jones, Stone, Maguire & Lapkin 2015). Multi-professional collaboration, effective communication, adequate skills, distraction-free working environments and more systematic processes regarding medication processes, should be included to increase medication administration safety in hospitals (Härkänen, Turunen & Vehviläinen-Julkunen (2016).

An inter-professional initiative to teach medication safety to health professional students highlighted that students have a better understanding of each other's roles and responsibilities regarding medication safety (Hardisty 2014). Additionally, a pharmacist was included in nursing simulation scenarios. This showed to be beneficial to teaching nursing students about medication safety (Marvanova 2017).

### **2.6.1.7 Clinical Assessment**

Clinical assessment is also a teaching strategy and includes methods of direct observation, Objective Structured Clinical Examination (OSCE) and progress reports etc. (Bruce, Klopper & Mellish, 2011). In nursing, competence has traditionally been determined through assessment by directly observing a student in the clinical setting (Garside & Nhemachena 2013).

Assessing clinical competencies is necessary to determine whether the learner possesses the required skills, knowledge and attitude to perform a clinical task within his/her scope of practice (Schub & Heering 2016).

As mentioned in Chapter 1, competence is defined by the ICN (2009), as “the effective application of a combination of knowledge, skill and judgment demonstrated by an individual in daily practice or job performance”. The outcome of assessing clinical skills is to determine whether a student nurse has the required skills and knowledge to consistently perform “competencies” or skills according to their scope of practice (SANC R2598, 1978).

Medication knowledge of pharmacology, (e.g. indications, contra-indications, mechanism of actions) as well as the application of legislation are integral to the safe administration of medication (Ghamari-Zare & Adib-Hajbaghery 2016). Students thus need to demonstrate that they possess the necessary knowledge, skill and behaviours required for the safe administration of medication.

Learning and assessment are closely interlinked and assessment stimulates and drives learning (Norcini, Anderson, Bollella, Burch, O Costa, Duviveier, Galbraith, Hays, Kent, Perrott & Roberts 2011). This is important when assigning weighted marks to a set of criteria in order to determine competence. Schuwirth & Van Der Vleuten (2010:198), states that there is a common understanding that assessment impacts on students' learning behaviour.

## **2.7 CONCLUSION**

The available evidence suggests that including a multi-factorial, holistic approach is needed when teaching medication administration. By considering those factors contributing to ME, health professionals may be better prepared for their role in medication management. Important methodologies to include in a medication safety educational programme are pharmacological knowledge; dosage calculations; communication skills; prioritisation skills; use of simulation laboratory; distraction and interruptions and communication.

This literature perspective attempted to discuss the role of nursing and nursing students and highlighted the areas that nursing students have difficulty with. The next chapter will focus on the methodology section of this scoping review.

## **CHAPTER 3**

### **STUDY RATIONALE, RESEARCH QUESTION, APPROACH AND PURPOSE**

#### **3.1 INTRODUCTION**

The purpose of this scoping review was to provide an overview of the African (and more specifically, the South African) literature regarding the educational interventions and strategies applied to address the phenomenon of MAE in the nursing context, in order to summarise and identify the gaps in the available body of literature.

This chapter will discuss the study rationale, research question, approach, limitations and purpose of the study.

#### **3.2 RATIONALE**

Medication safety practices require a systematic approach. Contributing factors to ME include systemic, organisational and individual related issues (World Health Organisation 2011). Since nurses are primarily responsible for medication administration in hospitals, and MAE are amongst the most prevalent types of ME, it follows that the education and training of nurses has been identified as one of these contributory factors which could play a role in the prevention of ME. Proper education and training of medication management (Karavasiliadou & Athanasakis 2014), will therefore be the primary focus explored in this research assignment.

It is therefore important to explore how training and education can prepare nurses to be leaders in medication monitoring and to address the potential gap between theory and practice regarding pharmacology education (Gabe, Davies, Murphy, Davies, and Johnstone & Jordan 2011). Futhermore, nursing curricula should be designed to ensure that graduates are prepared to contribute to safe, harm-free clinical environments (Usher, Woods, Parmenter, Hutchinson, Mannix, Power, Chaboyer, Latimer, Mills, Siegloff & Jackson 2017:90).

The alignment of a health professional e.g. a nurse, to a country's health needs is vital. If the recent statistics in South Africa are considered (Blignaut et al. 2017 & Truter et al. 2017), the medication error rate that patients will be exposed to, is as high as 97% and 78%. It follows that

employing appropriate educational interventions and strategies in nurse training is important and should be reflective of the environment that the student will soon be practicing in.

It is important that nurses have access to the best evidence available in order for research to be aligned with their country's health care priorities. However, culturally-sensitive and appropriate interventions are important aspects to consider in the African climate. Transferability of research projects from higher income countries could prove to be difficult in this context. Thus it is vital to assess and identify gaps in current literature to inform future nursing interventions (Sun et al. 2017).

With this in mind, the researcher wanted to explore the local context of literature. One possibility of the dearth of local literature in this field is that research done on ME could exist in the form of theses and dissertations that were perhaps not published in an international journal or readily accessible in the available databases.

For the researcher, it was therefore important to undertake an explorative study of the grey literature in this context. The sub-category of grey literature are theses and dissertations. This will include theses and dissertations from universities in South Africa specifically.

This study will also attempt to view the problem of ME through the lens of decolonialism. This concept was introduced in Chapter 1. This research assignment will attempt to provide a local context of Africa and South Africa in order to inform future educational interventions and strategies related to ME.

### **3.3. PURPOSE**

The objective of this research assignment is to conduct a scoping review of relevant literature related to the context of Africa and specifically South Africa. Using a decolonial principle could assist in creating a synopsis/summary of a body of work that could inform future educational interventions and strategies related to ME in the South African context and to synthesise this information into future educational programmes for nurses.

The purpose of this review was to provide a review of relevant literature regarding educational interventions and strategies related to MAE in the nursing context, with the view to summarise and identify gaps in the literature.

The view is that this scoping review will provide nurse educators, clinical practice and administrative functions with a map of research in order to identify evidence-based educational practices. More importantly, it will allow these stakeholders an access point of previously unpublished literature specifically to inform the South African educational bodies.

### **3.4 RESEARCH QUESTIONS**

Since ME remain a safety risk to patients in the international arena, what is the extent of the problem in the African and South African context? What is the value of educational interventions and strategies related to nursing education that exist in the continent of Africa and locally? Could a scoping review of information provide a summary of information in the South African context to guide future educational interventions and strategies?

The aim of this scoping review was to review the African continental and South African national literature and was guided by the following questions:

1. What is known in the African context about educational interventions and strategies related to nursing education and medication administration?
2. What is known in South Africa about educational interventions and strategies related to nursing education and medication administration?
3. What are the educational interventions and strategies used in nursing education in relation to the above?

Educational interventions and strategies related both to undergraduate nursing curriculum and educational interventions and strategies in clinical practice were explored in the literature.

What African and South African literature exist in nursing education specifically related to educational interventions and strategies and medication administration?

### **3.5 APPROACH**

Previous research methods used to answer the research question stated above has revealed that many qualitative and quantitative research including systematic reviews were undertaken in the international arena.

Thus it was regarded as appropriate to do research of a more theoretical nature in the local context, in order to provide a collection of information that can be used for future educational interventions and strategies. This research will not contribute empirically nor will it develop any theoretical development of models or new concepts. It will however, attempt to focus on the literature of the African context through a decolonial lens.

### **3.6 SCOPING REVIEW**

A scoping review is defined by Arksey & O'Malley (2005), as a review that can map and identify existing literature and also to identify any gaps in the literature. It is a systematic approach to reviewing published literature and grey literature related to a specific topic (Peterson, Pearce, Ferguson, Langford 2017).

Although no universal definition exists, it refers to mapping during a process of summarising a range of evidence to reveal evidence of a specific field or topic (Levac, Colquhoun & O'Brien 2010). It is becoming a popular option for synthesising health evidence (Levac, Colquhoun & O'Brien 2010) and allows for a descriptive, narrative account of available research (Arksey & O'Malley 2005).

A scoping review has also been described as a robust method of identifying primary and secondary sources (Davis, Drey & Gould 2009:1387), by addressing the “what” and “why” of a research topic.

Due to the complexity and nature of ME, a scoping review would allow a broader body of literature to be investigated. This type of review was deemed appropriate as ME have been described as complex in nature (Manias, Aitken & Dunning 2004). A scoping review addresses this complex and broad nature by reviewing the wider body of literature to be investigated to provide an answer to the research question.

A scoping review does not present any new findings on a specific topic. For this reason, this methodology suits the aims and objectives of this research assignment, as it will provide a summary of continental and local studies related to ME and educational interventions and strategies in the nursing context.

A systematic review is guided by a highly focused question, whereas a scoping review is more iterative in nature. It allows for more flexibility than a systematic review by looking at different methodologies which is not ideal for a systematic review (Peterson, Pearce, Ferguson & Langford

2017). In comparison to other review methods, a scoping review is considered at a higher level than a straightforward review of literature or integrative review, but not as in-depth as a Cochrane or Johanna Briggs model of systematic reviews (Levac, Colquhoun & O'Brien 2010; & Arksey & O'Malley 2005).

The methods used throughout various stages of a scoping review should be documented in detail to enable others to replicate the study (Arksey & O'Malley 2005). (This process is discussed in further detail in chapter 4). This explicit approach increases the reliability and findings and addresses methodological rigour.

During a preliminary literature search, there seemed to be a vast amount of international literature on this topic, but minimal published literature in the African context was found. Furthermore, scoping reviews allow for all types of literature to be identified, including grey literature. The aim of this study was then to explore all theses and dissertations of universities in South Africa.

This type of review was selected as a methodology as it was a faster and less costly to undertake than a systematic review. An extended literature review was initially pursued, but the rigour of the methodology was not as well established as with the scoping review.

Different methodologies were explored as the researcher was interested in identifying teaching and learning strategies or interventions used in medication administration education. A scoping review could provide a synthesis of literature, specifically for nurse educators (such as myself), who wish to be informed by relevant literature prior to designing an educational intervention or strategy related to medication administration. It also allowed for the use of grey literature as a source of information to be explored.

### **3.7 LIMITATIONS**

Scoping reviews do not appraise the quality of evidence in primary research studies as is the case with systematic reviews. Thus the amount of data found can be considerable leading to decisions regarding the depth and breadth of the research topic.

There is a lack of consistency in terminology and methods relating to scoping reviews (Levac, Colquhoun & O'Brien 2010). A need exists for a standardised guideline to standardise the reporting of scoping reviews. This lack of standardisation was evident in that only 13% of scoping

reviews used a protocol; only 36% used two reviewers for citations and inclusion; 29% used two reviewers for full text screening and 43% used a predefined data charting form (Tricco, Lillie, Zarin, O'Brien, Colquhoun, Kastner, Levac, Ng, Pearson Sharpe, Wilson, Kenny, Warren, Wilson, Stelfox & Straus 2016).

A scoping protocol was developed prior to undertaking the review to guide the methodology. In this protocol, a secondary reviewer was consulted to confirm the search results. However, during the actual search phase of the scoping review the search was not confirmed by a second reviewer.

### **3.8 CONCLUSION**

This chapter discussed the research questions, aims and purpose of this research. It also briefly discussed the rationale for the use of a scoping review methodology. The next chapter will address the methodology (scoping review) that was used in this study.

## **CHAPTER 4**

### **METHODOLOGY**

In this chapter, a definition and rationale for the use of a scoping review as a research methodology will be provided. The methodology describing the search strategy and steps involved a scoping review will be discussed. A description of the search strategy and databases used will be undertaken. Subsequently, the inclusion and exclusion criteria will be defined in this chapter.

#### **4.1 DEFINITION OF SCOPING REVIEW**

A scoping review allows for all types of literature to be identified, including grey literature (as described in Chapter 1 under point 1.10 and in the terminology section of this research assignment under point 1.12.8).

Scoping reviews have been described as a robust method of identifying primary and secondary sources (Davis, Drey & Gould 2009: 1387) by addressing the “what” and “why” of a research topic. The congruence of these questions is related to the research questions as described in Chapter 3 under point 3.4.

Scoping reviews are undertaken for four reasons (Arksey & O'Malley 2005): firstly, to provide a quick overview of a specific field; secondly, to determine the feasibility of conducting a systematic review; thirdly, to provide a focused synthesis in a shorter space of time and fourthly, to draw conclusions and identify gaps in the literature.

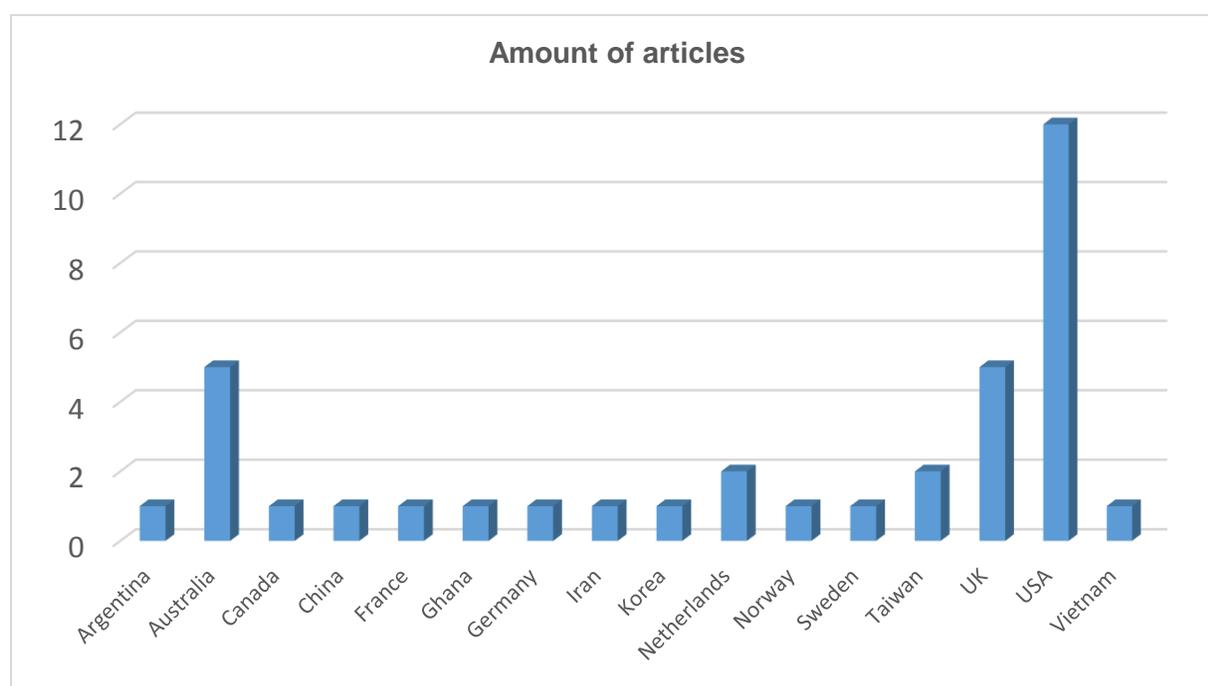
Reasons one and four provided the rationale for using a scoping review as a methodology for this study. It suited the aim of the study as described in Chapter 3.

#### **4.2 RATIONALE**

A myriad of available international studies existed regarding educational interventions and strategies associated with medication administration in nursing education. However, there appeared to be a limited amount of published studies in the African and South African context. This premise was determined when the systematic reviews were explored in order to establish a background for the study. A summary of the geographical location of studies of systematic reviews is tabulated in Figure 2.

This reveals that there were only one article from the African or South African context that were included in the systematic reviews. Due to the available amount of systematic reviews, international studies were not included as part of this scoping review. Instead the international literature was used in Chapter 2 to synthesise the available literature into a broader overview on which to base this study.

**Figure 2. Geographical representation of articles included in systematic reviews**



Collated by F. Haroun November 2017

Additionally, the consensus view of researchers such as Tshiamo, Kgositau, Ntsayagae, Sabone & Motshedisi (2015), is that international literature could guide educators with general insights to ME. More importantly, locally generated findings will reveal information relevant to the context and implement effective teaching strategies for safe medication management in undergraduate nursing programmes. This view is supported by Sun, Dohrn, Omoni, Malata, Klopper & Larson. (2016), who state that culturally sensitive and appropriate interventions are important aspects to

consider in the African context. Transferability of research projects from higher income countries could prove to be difficult in this context, and it is therefore vital to assess and identify gaps in current literature to inform future nursing interventions in Africa and specifically, in South Africa.

Through the premise of decolonialism, the literature search was expanded to include articles from an African database. South African unpublished dissertations relevant to the research topic were also included as grey literature.

### **4.3 STAGES OF A SCOPING REVIEW**

Arksey & O' Malley's (2005), scoping review methodology framework, guided the conduct of this review. The framework includes the following six stages:

1. Identify the research question
2. Identify relevant studies
3. Study selection
4. Charting the data
5. Collating, summarising and reporting the results
6. Consulting (optional)

This framework was chosen as it was the most frequent framework used for guiding scoping reviews (Tricco, Lillie, Zarin, O'Brien, Colquhoun, Kastner, Levac, Ng, Pearson Sharpe, Wilson, Kenny, Warren, Wilson, Stelfox & Straus 2016). Pham, Rajic, Geri, Sargeant, Papadopoulos, & McEwen (2014) also stated in their report that the majority of researchers making use of scoping reviews, used this framework.

### 4.3.1 Identifying the Research question

The Research questions that guided this scoping review were:

- What African and South African literature exist in nursing education specifically related to educational interventions and strategies and medication administration?
- What are the educational interventions and strategies related to the above?

If ME remain a risk to patients safety in the international arena, what is the extent of the problem in the African and South African context? A scoping review of information that can provide a summary of information in the South African context to guide future educational interventions and strategies was developed to attempt to address these questions.

### 4.3.2 Identify relevant studies

In the process of identifying relevant studies, it is of outmost importance to follow a specific method or strategy. The chosen strategy needs to be followed precisely to avoid confusion during the search process. The search strategy which was used will be described in the section that follows.

#### 4.3.2.1 Search strategy

##### 4.3.2.1.1 Search Sources

A search review of the following research databases was included: Africawide, Scopus, Cinahl, Cochrane library, Pubmed and South African National Theses & Dissertations Portal (SANETP). The results of this search are found in Appendix 1: Databases Spreadsheet and Appendix 2: Scopus database – results by country pdf.

A description of these databases (which were retrieved from information provided by the Stellenbosch University Library) will be described in the following paragraphs:

*A. Africa-Wide Information* is a unique, multidisciplinary index to research and publications by Africans and about Africa. An essential resource for those interested in African studies and research, *Africa-Wide Information* covers millions of news articles, scholarly articles, books, reports, theses and grey literature. Millions of citations and abstracts include pertinent information from all 56 African countries as well as the surrounding islands. Databases in this collection derive from major African Studies and international specialist African organisations worldwide. Databases include *Index to South African Periodicals*, *IBISCUS*, the *Africa Institute Database*,

*African Journal Online, Media Africa, and NAMLIT*, which is compiled by the National Library of Namibia (Africawide 2017).

B. *Cinahl* is a database that includes nursing, the allied health disciplines, biomedicine, and healthcare. It includes seventeen allied health disciplines, plus biomedicine, health management, behavioural sciences, health sciences librarianship, education, and consumer health (Sunlearn library 2017).

C. *Scopus* is the largest abstract citation database of peer reviewed literature, research journals, books and conference proceedings.

D. Cochrane library is a collection of six databases that contain various high-quality independent evidence to inform healthcare decision making and includes a seventh database that provides information about Cochrane groups (Cochrane 2017).

E. *South African National Electronic Thesis & Dissertations (SANETP)*, is described by Webley, Chipeperekwa & Suleman (2011), as, “A national Electronic Theses and Dissertations (ETD) portal (which) has been developed in South Africa to provide access to a country-specific collection of ETDs and, more importantly, to coordinate, manage, monitor and support the development of ETD programmes at the various universities”

F. *Pubmed*: Pubmed-Medline is a bibliographic database of international biomedical literature.

However, due to the limited number of studies found in the SANETP, a further literature search was executed. All higher education institutions that are accredited with SANC to offer postgraduate courses to nurses, was retrieved (SANC 2016b). This list guided the researcher in identifying which universities' electronic theses and databases for perusal. This search strategy was used in order to answer the research question by including an extensive range of literature. Each listed university repository was searched for studies that met the inclusion criteria. This is tabulated in Appendix 1, spreadsheet “University repositories”. For the purposes of this study grey literature, will be in the form of unpublished studies. This was done to identify theses and dissertations from all universities.

The assistance of a professional librarian was sought to refine the search strategy and to formulate keywords for the search.

A timeline was developed and a date where no further articles would be included – as suggested by Arksey & O' Malley (2005).

#### **4.3.2.2.2 Search steps**

The steps taken once articles were found were divided into two levels. Firstly, screening and secondly, identifying potential relevant studies.

Level 1 screening – Each database revealed varying amounts of results. Most of the databases did not reveal the geographical location of the studies automatically. I then exported the results of each database into an excel spreadsheet and hand searched the geographical location of the studies. Thereafter, I tabulated the articles into an Excel spreadsheet. The results of this are tabulated in Appendix 1. The Excel spreadsheet is arranged as per each database, search strategy and results. If the geographical location was within Africa, the article title and abstract was then screened. The main criterion of geographical location in Africa needed to be met in order to be included in the study. Additionally, the search and results were captured with screenshots of the searches. This served as evidence of the number of articles found per database and date and time of the search. This evidence can be found in Appendix 5: Screenshots of database search.

Level 2 screening - Potentially relevant articles were identified. Articles with titles that met the inclusion criteria were saved. Thereafter the abstracts were read. If an article met the inclusion criteria, the full article was read and reviewed for inclusion in the study.

Only the Scopus database had an option for automatic retrieval of studies from a specified location. The other articles were individually searched to identify the location of the study. The copies of the Scopus search are tabulated in Appendix 2. This appendix described the Scopus search by country. This was the only database that offered this level of analysis of the search.

Thereafter, the results were exported to the Mendeley programme. This is a “reference management software produced by Elsevier for managing and sharing research papers, discovering research data and collaborating online,” Mendeley (2017). This system assisted the researcher with eliminating duplicates in the literature.

The title and abstract of each thesis was then reviewed for its applicability to the research question. If the abstract met the inclusion criteria, the whole thesis was reviewed. A preliminary

PRISMA diagram was completed iteratively as the search was performed. The results are summarised in Appendix 3 labelled “Preliminary PRISMA Diagram.”

The search proceeded with Arksey & O’ Malley’s (2005), framework and the results were tabulated (see Appendix 4 – Data Extraction Spreadsheet).

#### **4.3.2.2.3 Search terms**

A number of search terms were used in the search process. A table of search terms will be provided in Table 3. A homogenous set of terms was used on the six databases including the SANETP database. I enlisted the assistance of a professional librarian to assist with appropriate terms to use in the Boolean phrases selected. The following terms were used:

“Educational interventions OR Educational strategies”

“Teaching AND/OR Learning strategies”

“Medication Administration OR medication management”

“Nursing Education”

“Nursing students/student nurses”

“Medication safety”

#### **4.4 STUDY SELECTION**

The following set of inclusion criteria were designed in relation to the research question. These inclusion criteria were defined to provide clarity regarding the criteria for included studies in this scoping review. Even though Arksey & O’ Malley’s (2005), framework is not as explicit about inclusion criteria, the following categories should be considered when defining inclusion criteria: Types of participant, Concept, Outcomes and Context (Peters, Godfrey, McInerney, Baldini Soares, Khalil & Parker 2015).

The time period from 2000 – 2018, was included in the study search as the first to “Err is human” report was published in 2000 (Kohn 2000). This report highlighted the awareness of the extent of ME as a problem (Balas, Scott & Rogers 2004).

Up to 56% of scoping reviews included scanning the reference lists of included studies (Tricco et al. 2016). Thus the reference lists of the included articles were perused in this study to find more articles. The geographical location of each item in the reference list was hand searched. If the geographical location was in Africa, the article was further screened. See Appendix 4 for reference search per included study. No further studies from the reference list search met the inclusion criteria.

#### **4.4.1 Inclusion Criteria**

- Studies that included participants as either Undergraduate/ pre-licensure nursing students. This inclusion criteria meets the Type of participant criterion as listed above.
- Articles or studies that address medication administration in nursing context. This criterion meets the Context category of inclusion criteria.
- Studies or articles in the English Language.
- The article or study explored educational interventions or strategies related to nursing education. This criterion meets the category of “Concept” as an inclusion criteria.
- The term or related terms to “medication” needed to be present in the title or article i.e. Medicine, drug. This criterion also meets the “Concept” as an inclusion criterion
- Articles in African or South African context. This criterion addresses the “context” aspect as mentioned above.
- Educational interventions or strategies related to theoretical or clinical practice as nursing education has two main components of teaching and learning i.e. theory and practice. This inclusion criterion meets the “Concept” category as mentioned above.

#### **4.4.2 Exclusion criteria**

Similarly, the exclusion criteria were formulated with the same premise as above. The following exclusion criteria were designed in relation to the research question:

- Non-English articles – Language restriction of researcher
- Peer reviewed articles in all databases except Electronic Thesis & Dissertation (ETD) database (this criteria allowed for grey literature in the form of dissertations and thesis’s to be considered).
- Articles that included other healthcare professions were excluded – to ensure that context of nursing is adhered to as guided by research question.
- Non-African based articles

#### **4.5 CHARTING THE DATA**

A Preferred Reporting Items for Systematic Reviews (PRISMA) diagram is a flowchart of the study selection process that describes the search strategy. Although there is no standard methodology for reporting the results of a search in a scoping review, Pham et al. (2015), recommends that the PRISMA flow diagram be utilised. The results of the search are presented in a PRISMA flow diagram, (see Figure 3: PRISMA flow Diagram).

A narrative review can be used to chart the data (Arksey & O'Malley 2005). This will be discussed in Chapter 5.

The information was tabulated according to the specific criteria as seen in Appendix 1. The geographical location of the study and type of intervention was described. This information was tabulated into an Excel spreadsheet in the form of a chart, as suggested by the framework of Arksey & O' Malley (2005). It entails the following aspects: Author, Intervention type, Duration of intervention, Study population, Aims of the study, Methodology, Outcome measures and important results. The methodology of reporting it in such a way ensures that a record of all the articles of the studies and sources of evidence are kept.

#### **4.6 COLLATING, SUMMARISING & REPORTING THE DATA**

As Arksey & O' Malley (2005), stated in their framework that the results can be presented in the form of tables, diagrams, tables or in a narrative review to present results in a meaningful manner. Thus the use of an excel spreadsheet as illustrated in Appendix 1 was designed to give a concise view of the search strategy and results. This spreadsheet is categorised into the names of the databases used in this scoping review i.e. Africawide, Cochrane, Pubmed, Scopus, SANETDP and Universities Repositories. Findings are discussed in a narrative form in Chapter five.

#### **4.7 LIMITATIONS**

The main limitation of this scoping review was the scarcity of available literature as evidenced by the limited amount of included studies. This restricted the compilation of a comprehensive review to inform future educational interventions and strategies.

Another limitation could be the exclusion of other forms of grey literature e.g. from government agencies, other universities in Africa, companies, research centers, professional organisations, associations and societies. This was also not explored due to the limited nature of the search strategy, but could have revealed more results.

Timelines and second reviewer's availability to assess the studies were limiting factors in this scoping review. Although a protocol and timeline were drawn up and agreed on, the second reviewer was not able to review the hand-searched articles in the agreed upon timeline. This resulted in the primary researcher being the only reviewer to confirm the search independently in order to meet the agreed timeline of submission of this study. This limitation could have resulted in studies being omitted.

This chapter attempted to explain the research approach and methodology used to answer the research questions. The next chapter will report on the results that were found with the scoping review.

## **CHAPTER 5**

### **RESULTS**

In this section, a summary of the relevant research studies included in this scoping review are discussed. The PRISMA flow diagram (Figure 3) provides a breakdown of the steps used during the process of the scoping review which resulted in the inclusion of relevant studies (results), which will be discussed in this chapter.

It is necessary to be reminded that the purpose of this study was to establish a review of relevant literature regarding educational interventions and strategies related to MAE in the nursing context – specifically in Africa. Also, this scoping review was undertaken with the view to provide an overview of literature on this matter and to identify possible gaps in the literature.

#### **5.1 SEARCH RESULTS AND DESCRIPTION OF STUDIES**

The findings below are based on an analysis of the three education intervention studies that met the inclusion criteria. The analysis is based on the data extraction sheet (see Appendix 4).

##### **5.1.1 PRISMA diagram**

A preliminary PRISMA flow diagram was iteratively completed during the search (see Appendix 3). The results of the search strategy were then tabulated into the final PRISMA diagram as seen in Figure 3 - PRISMA Flow Diagram.

##### **5.1.2 Included studies**

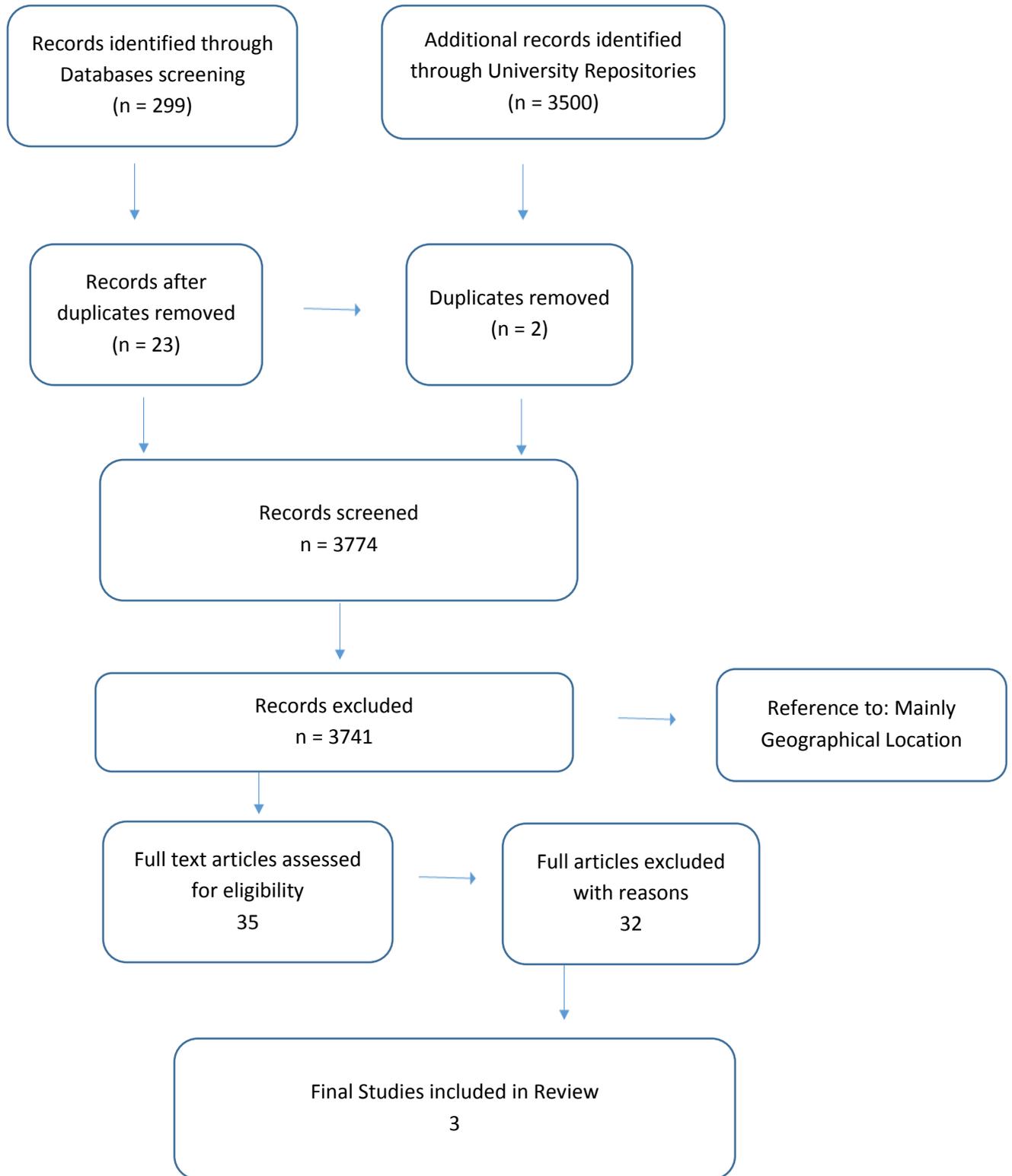
The following studies were included as these articles met the inclusion criteria described in Chapter 4. A summary of the findings is presented in Appendix 4 in a sheet labelled: Data Extraction sheet – Descriptive data of included studies.

Study 1: Powell (2012). Thesis

Study 2: Savage (2015). Published in African Health Sciences

Study 3: Tshiamo et al. (2015). Published in International Journal of Africa Nursing Sciences

**Figure 3. PRISMA Flow Diagram**



## **5.2 DESCRIPTION OF ARTICLES**

The following section will describe each included article under the following headings: Setting, Study design, Focus of educational intervention, Main findings, Limitations, and Recommendations. A discussion of each included article will be found in Chapter 6.

### **5.2.1 Study 1: Powell (2012). Effectiveness of Simulation training to improve pupil nurses' clinical competence.**

This study was undertaken in South Africa and the participants were nursing students enrolled for the Enrolled Nursing Course at a nursing school. This study was submitted in the form of a Master's thesis at a South African university. Two clinical skills were included in this study. The one skill was the administration of oral medication and the other skill was the performance of neurological observations.

#### **5.2.1.1 Setting**

The setting was a learning centre for nurses at a private hospital group in South Africa, and the period of the study was from 2011-2012.

#### **5.2.1.2 Study Design**

This research design was a quasi-experimental quantitative design. It followed a non-randomised trial design and participants were either assigned to a control group or to the experimental group. Forty three enrolled nursing students from seven participating hospitals constituted the sample group of the study.

The data collection method was direct observation. Evaluation instruments were used as a pre-test, post-test and post-post-test. Evaluation instruments used were the same assessment instruments used in the students' clinical assessments.

#### **5.2.1.3 Focus of educational intervention**

The researcher states that second year enrolled pupil nurses had not been found competent in the procedures mentioned above. During discussions with educators and students, the researcher found that second year students were not given sufficient opportunity in the clinical area to gain clinical experience in the aforesaid procedures. Simulation training was used as the educational intervention to determine whether the students' competency levels could be improved. The clinical

skill of administration of oral medication was assessed using direct observation as an assessment strategy.

#### **5.2.1.4 Teaching strategies used to teach medication administration**

Teaching strategies used by this nursing learning centre, included that students complete a theoretical component on pharmacology and a pharmacology assignment, before being able to administer oral medication. This included an explanation from the student regarding effect, side-effects and-contraindications of prospective medication that would be administered.

Furthermore, students received demonstrations and practices under the supervision of nurse educators. These practice sessions included small group sessions in a simulated environment and clinical evaluation of the skill.

Additionally, students received a demonstration of the skill in a simulation laboratory. In the second month of training, they were exposed to a pretest done in the clinical facility on actual patients.

The experimental group were involved in a six-hour simulation setting to practice skills on oral medication administration and neurological observations which was facilitated by the nurse educator. Teaching strategies of role-play, simulation and on-the-spot guidance was given to students.

Three months later, a post-test was done on both groups and the results showed no statistical difference. At nine months, a post-post test was done on both groups.

#### **5.2.1.5 Data Analysis**

Data were quantified into numerical data and analysed statistically. Descriptive statistics were used to describe and summarise information collected. Descriptive and inferential statistics were used to analyse the data. The t-test was used to compare the two groups.

#### **5.2.1.6 Main findings of study**

The experimental group had more opportunity to practice the skill in the simulation lab, but yet they did not score significantly higher than the control group in the post-test. A post post -test was then conducted nine months after the initial pretest, which showed statistical differences between the control group and intervention group. The practice session in the simulation lab benefitted the

intervention group as this group scored higher marks than the control group. The researcher linked this to the intervention of facilitated simulation as described under point 5.2.1.3.

The use of simulation allows students to develop clinical skills needed for nursing practice and assist them to integrate theory into practice (Powell 2012). Powell (2012) further demonstrated that the use of simulation and role play improved the pupil nurses' competency levels in the administration of oral medication. The summation that experiential learning augmented the competency level was also acknowledged.

The main conclusion of this study is that simulation training may improve nursing students' level of competence with regards to administration of oral medication.

#### **5.2.1.7 Limitations**

The study was limited to the participants of pupil enrolled nurses registered at a particular time and cannot be generalised to other nursing institutions. The assessment tools were not externally validated for reliability & validity criteria, thus could have affected the results.

One of the inferences made by the researcher is that students practiced the skill in a controlled setting in the form of a simulation lab. The limitation of not providing a realistic as possible simulated experience influenced the students negatively during the actual assessment of the skill in the real setting.

The assumption that I can make is that possibly the contextual factors of real life situations was not factored into the simulated skill. Possibly the premise that training needs to be contextualised would have improved students' performance. As alluded to earlier in Chapter 2, the importance of contextualising medication administration to include systems factors would better prepare students for clinical practice.

#### **5.2.1.8 Recommendations**

Recommendations were made in relation to nursing education. Amongst these, nurse educators should use clinical simulation as an orientation teaching strategy. Also, compulsory practice sessions for students to practice skills in simulation should be introduced. This will assist with reinforcement of skills after the initial demonstration of skill is performed. Allocating a mark for attendance can motivate students to attend the simulation practice sessions.

Clinical simulation as a clinical teaching strategy should be pursued to improve the competency levels of nursing students related to their clinical procedures. Furthermore, a simulation programme needs to be developed that will include different simulation teaching strategies including scenarios and case studies. This will stimulate critical thinking and problem solving amongst students.

## **5.2.2 Study 2: Savage (2015). Educational audit on drug dose calculation learning in a Tanzanian school of nursing**

### **5.2.2.1 Setting**

The setting of this study was at a nursing school in Tanzania. The article was published in a peer reviewed journal, African Health Sciences. This is an international journal with free access and publishes original articles on research, clinical practice, public health policy, planning, implementation and evaluation (Africa Health Sciences 2017).

This research assignment is written with patient safety as a background as nurses need to be able to calculate medication doses correctly to reduce ME. The aim of the study was to perform an educational audit on medication dose calculation learning at a Tanzanian School of Nursing.

### **5.2.2.2 Study design**

This was not explicitly stated in the article. Based on the description of methods used, the research approach was a quantitative approach. This included a pre and post-test experimental design with no control group. The researcher did not describe her sample group in detail other than that it consisted of 204 registered nurses who had completed the said nursing programme. No reference is made to when these registered nurses received their qualifications or how they were selected. The 26 registered nurses participating in this study received four year nurse education training prior to entering the current degree programme and were registered with the nursing school at the time of the study. The study was included in this review as it involved nursing students as participants. Twenty six second year nursing students who were enrolled in the nursing course at the time of the study were also included.

### **5.2.2.3 Focus of educational intervention**

The teaching strategy was not clearly defined. However, the author mentions that she wanted to assess learning that had occurred through targeted teaching. The definition of targeted teaching is not provided.

Four hours of teaching was conducted after a pretest was given to participants. This pretest included questions formulated by the researcher. These questions were based on her own clinical teaching experience and the national curriculum requirements in Tanzania.

### **5.2.2.4 Teaching strategies used to teach medication administration**

The formula method was used to teach the calculation of medication dosages. The teaching strategy included using the drug calculation formula; showing worked out examples and allowing students to practice examples. I am assuming that these teaching strategies represent the “targeted learning” that the researcher is referring to. Handouts were given to students and they were instructed to work through given examples in preparation for the post-test two weeks later. After the post-test, the papers were marked and returned to students informing them of another similar test eight weeks later.

### **5.2.2.5 Data Analysis**

Data were subjected to a t-test for analysis. Results showed that both registered nurses and nursing students had difficulty with drug dose calculations.

### **5.2.2.6 Main findings**

The researcher concluded that targeted teaching has the potential to be highly effective in improving test performance. The scores in the pretest improved in the post test. Possible reasons include that students were motivated to learn as they knew that there would be a follow up test as part of the compulsory evaluations. This alludes to the principle that assessment drives learning (Norcini, Anderson, Bollela et al. 2011).

Both nursing students and registered nurses produced similar results. Student nurses had not practiced in the clinical area at the time of testing; however the registered nurses had achieved a basic nursing qualification and had been practicing in the clinical area since qualification.

Tanzanian nurses experienced similar problems to the rest of the world with calculations, i.e. mathematical calculations, decimal places, ratios and computational skills as stated by Stolic 2014.

The nurses' self-reported performance and observed performance of arithmetic skills were not congruent. The participants underestimated their lack of arithmetic skills when compared to the observations of the teacher.

Targeted teaching has the potential to increase classroom test performance. Probably it is the most effective when test marks are weighted towards overall marks. However, the effects of targeted teaching on reducing and preventing ME still needs to be established.

#### **5.2.2.7 Limitations**

The study was performed at one institution and results cannot be generalised. Only the formula method of calculation was taught in the classroom setting, and the use of alternative methods in the clinical setting might produce varied results. The audits were conducted by one person only, so the reliability of the results obtained is questionable.

#### **5.2.2.8 Recommendations**

The author suggests that the study should be reproduced in different settings in Tanzania to address the generalisability of the findings. Various other methods for the teaching of medication calculation such as proportional and dimensional analysis could be used to teach medication calculations.

Nurse educators should be active in addressing patient safety issues and be aware of the reality of limitations of clinical practice settings. Incorporating a systems approach with a non-punitive approach to reporting of errors is recommended.

All students require a basic mathematics course to practice in a safe manner. An individualistic, context-specific analysis is important to identify individual needs and areas of improvement. e-Learning packages could allow students to complete activities at own speed until they feel confident enough. An essential pre-requisite to the pharmacology course should be a foundational course in mathematics.

Pass marks of pharmacology courses should be reviewed. A percentage mark of fifty is inadequate and pass marks that promote safe practice should be established.

### **5.2.3 Study 3. Tshiamo, Kgositau, Ntsayagae & Sabone (2015). The role of nursing education in preventing medication errors in Botswana**

This article was published in the International Journal of Africa Nursing Studies (an international journal published by Elsevier). This broad-based journal was founded to publish research related to nursing and midwifery. It is a fully refereed journal (International Journal of Africa Nursing Sciences 2017).

The curricula of the basic nursing diploma and basic degree diploma were reviewed to determine the medication-related teaching content of the nursing curriculum. Strengths and weaknesses were then tabulated.

Although this study does not include a specific educational intervention, the following definition of a curriculum was used to ascertain the suitability for inclusion in the review. According to the Nursing Education Training standard (NETS 2013) formulated by SANC, a curriculum is defined as “A systematic process that defines the theoretical and practical content of an education programme and its teaching and evaluation methods”. Thus the conclusion can be drawn that a curriculum in its entirety can be seen as an educational intervention itself as it consists of amongst other things, teaching strategies.

#### **5.2.3.1 Study setting**

The study was undertaken in Botswana.

#### **5.2.3.2 Study design**

The exact magnitude of ME was not known in Botswana and provided the rationale for this study. However, the authors suggest that the contributory factor for the shortage of nurses and resource constrained environments in Botswana, could mean that the issue of ME was higher than in developing countries.

Furthermore, the researchers mention that the nursing curriculum in Botswana does not reflect sufficient depth in the teaching of medication management to assist nurses to become competent in the skill of managing medication. Additionally, limitations in the clinical practice environment pose a risk to ME occurring. The authors wanted to establish the scope of the basic diploma and basic degree nursing curricula used in Botswana with regards to the prevention of ME.

### **5.2.3.3 Main findings - Teaching strategies described**

A stand-alone pharmacology course that includes pharmacokinetics and pharmacodynamics is taught by pharmacist and clinical pharmacologists. A theory and a skills- based course is offered in the classroom, skills laboratory and clinical areas by nurse educators. This includes oral and parenteral medication using the five rights principle, dose calculation and precautionary measures.

Stand-alone pharmacology courses do not offer access to real-life situations. There is no deliberate effort to address issues of prescription, transcription, administration and dispensing of medication in the course content of the curricula.

Students are provided with hands-on experience during allocated clinical placements in medical surgical wards. Thereafter students are placed in specialty areas including orthopedic, gynecological and pediatric units. During the final level of training, students are exposed to complex patient conditions in adult health, critical care, obstetric, psychiatric and community nursing areas.

Nurse educators provide an application of the above by including the five rights of medication administration, dose calculation and specific safety aspects. These aspects are not fully described in the literature review.

Also, no preceptorship programme exists where students are assigned to dedicated staff in the units that they are working in. The curriculum does present assessment tools for assessing medication administration however, it does not make provision for testing medication calculation competency.

The authors point out that there is no intentional focus on ME in the nursing curriculum. Although competency assessment tools exist, medication dose calculation does not form part of this competency. This could result in a nursing student being successful in the skill of medication administration without establishing their proficiency in dosage calculation.

Furthermore, the workload of nurse educators and nursing clinicians does not facilitate the required supervision of students to assist with proficiency of medication management.

The authors conclude that nursing curricula require a holistic approach to the healthcare system in order to address ME. Also the curricula needs to be improved to ensure that graduates are better equipped with the competencies required to prevent ME.

#### **5.2.3.4 Data analysis**

The findings of the literature were tabulated into themes of strengths & weaknesses of the nursing curriculum.

#### **5.2.3.5 Limitations**

No limitations were explicitly mentioned in the literature review.

#### **5.2.3.6 Recommendations**

Recommendations made by the authors included “implications for nursing curricula, clinical practice and research”.

Implications for nursing curricula include that medication dosage calculation needs to be incorporated into the classroom using a constructivist approach and experimentation with ampoules, syringes, manikin and use of manikins.

Additionally, continuous learning regarding medication management should be undertaken post-graduation in the form of continuous professional development programmes.

Implications for clinical practice include the need for students to be up to date with their knowledge of medications. Communication amongst the multidisciplinary team can prevent and reduce ME. This can be done through reviewing ME in case studies so that the medication management of doctors and nurses may improve.

Implications for research include the need for research in Botswana regarding the severity of ME. The authors speculate that this will allow patients as well as healthcare providers to find solutions. Furthermore, their stance is that qualitative studies would facilitate this process. Research related specifically to nursing education, should include the learning needs of students related to pharmacology and the prevention of ME. Nursing graduates could provide an understanding of how the nursing curriculum prepares them for the prevention of errors.

### **5.3 CONCLUSION**

This chapter described the three studies included in this scoping review. In the next chapter, a discussion regarding the related findings and recommendations of these three studies will be undertaken. Recommendations for nursing education and further research will also be made in Chapter 6.

## **CHAPTER 6**

### **DISCUSSION & RECOMMENDATIONS**

#### **6.1 INTRODUCTION**

As mentioned in chapter four, a scoping review is undertaken for four main reasons. Firstly to provide a quick overview of the field, secondly, to determine the feasibility of a systematic review thirdly, to provide a focused synthesis of information and fourthly, to draw conclusions and identify gaps (Arksey & O' Malley 2005).

This scoping review study addresses the first and fourth reasons for undertaking a scoping review namely to provide a quick overview of the field (see 6.2.1) and to draw conclusions and identify gaps (see 6.2.2). The aforementioned aspects will provide a framework for the discussion section in this chapter.

#### **6.2 DISCUSSION**

##### **6.2.1 Overview of the field**

The discussion of the findings will attempt to provide an overview of the field of research about ME specifically in Africa. This shall take place in the form of revisiting the original research questions:

1. What is known in the African context about educational interventions and strategies related to nursing education and medication administration?

Three studies were included in this scoping review. This small number is in itself evident that there is a dearth of studies related to ME and associated educational interventions and strategies in the African context. Based on the findings of the search in this scoping review, the initial hypothesis that limited literature exists in the South African context was found to be supported. Of the three studies, only one is South African, compounded by the fact that it is an unpublished thesis.

The three studies discussed teaching strategies such as simulation to improve the clinical skill of the administration of oral medication to patients (Powell 2012), mathematical drug calculation (Savage 2015), and the strengths and weaknesses of teaching and learning methods in a particular nursing curriculum (Tshiamo 2015 et al).

Two of the studies met the inclusion criteria of the study, however the third study did not highlight a specific educational intervention. The synthesised information of literature related to the nursing curriculum, was viewed in its entirety as an educational intervention.

2. What is known in South Africa about educational interventions and strategies related to nursing education and medication administration?

As stated, only one of the included studies originated in South Africa in the form of a thesis. In the South African context there is scarcity of literature associated with medication errors and educational interventions and strategies. The South African study discussed the impact of simulation on the clinical skill of medication administration amongst enrolled nurse pupils. This study discussed teaching strategies such as the use of the five right method, clinical demonstrations, practicing the clinical skill and the assessment of the students' competence level in clinical practice.

3. What are the educational interventions and strategies used in nursing education in relation to the above?

The educational interventions and strategies illustrated by the included articles are: the use of simulation to assess administration of oral medication, the importance of dose calculation and review of nursing curricula. These educational interventions and strategies will be further discussed under section 6.2.2.

## **6.2.2 Identify gaps & draw conclusions**

### **6.2.2.1 Identify Gaps**

This scoping review has met the requirement of identifying a gap in the literature. The identified gap is the scarcity of available literature on this topic in the African and South African context.

Multiple teaching strategies related to medication administration were discussed in Chapter 2 point 2.6. Only three teaching strategies are described in this scoping review, i.e. medication dose calculation, simulation and nursing curricula review which further highlights limited number of teaching strategies alluded to in the three articles selected for this scoping review.

### 6.2.2.2 Draw conclusions

The theme of safety resounds in all three of the studies, and emphasises the rationale for undertaking the respective studies. The interventions are related to similar identified issues in the international literature and will be discussed in further detail under the following headings: Competency through simulation, Medication dose calculation and Nursing curricula.

#### 6.2.2.2.1 Competency through simulation

Two studies allude to the importance using simulation to teach medication administration. Tshiamo et al. (2015), state that medication dose calculation should be included in what is taught in the classroom to provide a more realistic view of actual events experienced in clinical practice. This can be done through the use of simulation as it allows for a more “real-life experience”. This may assist students to calculate dosages accurately. Powell (2012) affirms the conclusion that simulation has the capacity to improve students’ oral medication administration competency.

The above finding is coherent with international literature as for example Aggar, Bloomfield, Frotjold, Thomas & Koo (2017), who contextualised medication administration during simulation in order to enhance student preparedness and confidence. The use of simulation is further supported by other international literature such as that of Latimer, Hewitt, Stanborough & McAndrew (2017), and Steiner Sanko & McKay (2017), as it was found that simulation as a teaching strategy improved students’ medication calculation competence and confidence and assisted students to understand the system-related aspects with regards to ME.

#### 6.2.2.2.2 Medication dosage calculation

The calculation of medication dosages needs to be prioritised into the curriculum with specific assessment tools addressing medication calculation. An integrated approach including technology, problem solving and a hands-on approach will assist nursing students in mathematics competency (Hunter Revell & McCurry 2013). Savage (2015), deduces that Tanzanian student nurses’ mathematical skills required for dosage calculation were inadequate.

In the South African study, Powell (2012), attached the assessment instrument used to determine the competence of nursing students in the skill of oral medication administration. This assessment instrument allocates only one mark out of a possible total of fifty-five marks to the dose criterion. This finding exacerbates the undermining of the importance of the calculation of medication dosage as alluded to by Savage (2015). Similarly in Botswana, competency assessment tools

exist, however medication dose calculation does not form part of this competency (Tshiamo 2015). This could result in a nursing student being successful in the skill of medication administration without the proficiency for dosage calculation. Based on these findings, the researcher concludes that similar practices regarding competency tools related to medication dose calculations exist in all three contexts of Botswana, South Africa and Tanzania.

#### 6.2.2.2.3 Nursing Curricula

According to the Nursing Education Training standards (NETS 2013), which were formulated by the South African Nursing Council (SANC), a curriculum is defined as “A systematic process that defines the theoretical and practical content of an education programme and its teaching and evaluation methods.” The theoretical aspect of including the “five rights” method will be further discussed here together with assessment (evaluation) methods.

##### 6.2.2.3.1 “Five Rights” Method

Both Powell (2012), and Tshiamo et al. (2015), state that the “five rights” method is used in their respective contexts of teaching medication management. However, the current focus of “five rights” might not be sufficient to deal with medication administration practices effectively (Miller, Haddad & Phillips 2016), as it is a linear approach and the environment in which medication administration is executed needs to be taken into account when teaching medication administration.

A multifactorial, holistic, ongoing approach (including various didactic methods) which is content related and contextualised within the system, needs to be followed. This has to include all the contributing factors such as pharmacological knowledge, dosage calculations and the use of the simulation laboratories, amongst others. These factors are regarded as vital methodologies to include into a medication safety educational programme.

##### 6.2.2.3.2 Assessment

Learning and assessment are closely interlinked as assessment stimulates and drives learning (Norcini, Anderson, Bollella et al. 2011). Both Savage (2015) and Powell (2012), implied that assessment drives learning. By using pre-test and post-tests as an interventional strategy, they concluded that assessment motivated students to perform better in the post-tests, as the students were aware that their knowledge or skill was going to be assessed.

Learning needs should be assessed, as recommended by Tshiamo et al. (2015). This should be done to determine whether students are being prepared adequately for their required role of medication managers. Congruently, Savage (2015), undertook such an assessment in the form of an audit of medication dose calculations.

She continues to state that targeted teaching in the form of the formula method to teach medication dosage calculations, may be effective in increasing nursing students' ability to become proficient in this skill.

Recommendations by Savage (2015) & Powell (2012), addressed the fact that future assessments of medication administration should include an assessment specifically related to the competency of calculation of dosages. Savage (2015), also states that this proficiency level should be regularly assessed, even after qualification. Tshiamo et al. (2015), allude to the importance of determining an identified proficiency level of medication dose calculation that signifies competency. This is supported by Savage (2015), who proposes that a pass mark higher than fifty percent in medication dosage calculation should be introduced and that each student should be assessed in the clinical filed as well.

The fact that assessment stimulates and drives learning is important when assigning weighted marks to a set of criteria for assessing competence. The studies included in this scoping review acknowledge this deduction and relay the importance of an appropriate weighting of marks to assessing the skill of medication administration.

### **6.3 RECOMMENDATIONS**

The purpose of the recommendations is to suggest certain areas of potential improvement with the training and education of nursing students based on the abovementioned findings of this scoping review.

- Although the teaching of the “five rights” method appears to be a standard, a more holistic approach to teaching medication management may prove to be useful in preparing nursing students to more effectively fulfil their role in medication management. This should include systems factors that contribute to ME.
- There is an urgent need for the assessment of learning needs of nursing students' readiness to perform the skill of medication management in the African context. This assessment should be carried out by nurse educators and may take the form of reviewing the nursing curriculum

and assessing the effectiveness of current teaching strategies. This needs to be done with the aim of identifying students' specific needs, and also to improve their competence in medication management. As South Africa is undergoing a curriculum change of nursing undergraduate courses, this would be an ideal time to incorporate context specific teaching strategies into the new curriculum.

- As mentioned in Chapter 3, it is important that nurses have access to the best evidence available in order for research to be aligned with their country's health care priorities. However, culturally-sensitive and appropriate interventions are important aspects to consider in the African climate. As transferability of research projects from higher income countries could prove to be difficult in this context. Thus it is vital to assess and identify gaps in current literature to inform future nursing interventions (Sun et al. 2017). It is with this in mind, that context specific research regarding the extent of ME as a problem, specifically in the African and South African context, needs to be undertaken.
- Interventional studies in the African and South African contexts are needed to identify strategies that may prove to be successful in preventing and reducing ME. By using the lens of decolonialism, this may be achieved as the use of unpublished studies and grey literature can be used.
- Emphasis on assessment strategies and appropriate weighting of medication dose calculation with established proficiency levels should be incorporated into the assessment of medication administration.

## **CHAPTER 7**

### **CONCLUSION**

#### **7.1 INTRODUCTION**

The research question that guided this scoping review was whether a scoping review could provide information as a summary of information in the African and South African contexts to guide future educational interventions and strategies. This conclusion chapter will summarise the findings of the scoping review as well as the conclusions drawn from this study. Specific suggestions for future research will also be put forward.

#### **7.2 SUMMARY OF FINDINGS**

As mentioned in Chapter 4, this study addresses the first and fourth reason for undertaking a scoping review. Firstly, to provide a quick overview of the field (see 6.2.1) and then to draw conclusions and identify gaps (see 6.2.2).

The first reason, to provide a quick overview of the field was not sufficiently addressed due the scarcity of studies to include. However, it does provide a basis for future research as to what is known about educational interventions in nursing education.

The fourth reason of developing a scoping review (Arksey & O'Malley 2005) is, identifying a gap in the literature. This was addressed during this scoping review. This gap is defined as insufficient literature related to educational interventions and strategies regarding medication management in nursing education, specifically in the African context.

In South Africa, the use of simulation was explored as a teaching strategy and showed to improve the clinical skill of medication administration amongst nursing students. The educational interventions and strategies in the African context were identified to include the formula method of calculating medication dosages and the review of a nursing curriculum.

Furthermore, this scoping review highlights that whilst education is identified as a factor that can reduce ME, that in the African context, much needs to be done in order to firstly; identify the extent of the problem and secondly; to find appropriate methods of educational teaching strategies to address ME. As mentioned in Chapter 3, these appropriate methods could be explored through the decolonialisation of e.g., a curriculum that needs to focus on discovering knowledge and practices that are contextually “relevant and responsive” Mubangizi (2017).

### **7.3 CONCLUSIONS**

African and South African literature in nursing education related to educational interventions and strategies and medication administration include the use of simulation, medication dose calculation and review of nursing curricula.

Simulation may provide a solution to provide students with realistic experiences. The contextualising of this teaching strategy to mimic the actual clinical practice area, will assist in the competence levels of students in medication management. It was found to be important that when teaching dosage calculation to students, real life-examples from clinical practice should be included. This will enhance nursing students' readiness for medication dosage calculation. It is further proposed that even medication dosage calculation should be assessed in clinical practice and not only in the classroom. Contextualising teaching and assessment strategies to include real life scenarios that students will face in clinical practice, can be achieved through the use of simulation.

The extent of the problem of ME is not known in either of the included studies i.e. Botswana, South Africa and Tanzania. This is due to the fact that no formal reporting system of ME exists in any of these three countries.

Although international studies address educational interventions and strategies related to ME (which could provide a guide for developing countries), context specific research is required to identify appropriate teaching strategies that are aligned with the needs of that particular country. This information can be contextualised to the African and South African context by assessing the learning needs of nursing students regarding their preparedness for medication administration.

### **7.4 SUGGESTIONS FOR FUTURE RESEARCH**

A suggestion for future research is to further explore the effectiveness of simulation as a teaching strategy to teach and assess medication management skills. It should include context specific issues such as systems factors which could improve student readiness for medication management in clinical practice.

Although this scoping review set out to provide an overview of the existing literature, the depth of this review was limited due to the scarcity of related studies. A suggestion for future scoping

reviews could possibly be to include unpublished studies of universities in the African context to establish if any other unpublished data exist that may inform future educational interventions and strategies.

## **7.5 CONCLUSION**

Effective nurse training in medication administration has the potential to minimise medication errors. To reach this goal, nursing education will need to include appropriate teaching strategies that incorporate a systems approach to prepare future practicing nurses for medication management.

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## APPENDICES

### Appendix 1 – 5 (Separate Excel Files in attached USB flashdrive)

#### APPENDIX 1

#### Search databases - spreadsheet results



Appendix 1\_Search  
Databases -Spreadsl

#### APPENDIX 2

#### Scopus Database - results by country



Appendix 2  
Scopus-Analyze-Cou

#### APPENDIX 3

#### Preliminary PRISMA diagram



Appendix  
3\_Preliminary PRISM

#### APPENDIX 4

#### Data Extraction Spreadsheet - Descriptive data of included studies



Appendix 4\_Data  
Extraction Sheet-De:

## APPENDIX 5                      Screenshots of databases search

