UNIVERSITY OF CAPE COAST

NURSES VIEW ON DRUG ADMINISTRATION ERROR AND PATIENT SAFETY IN HEALTH FACILITIES IN THE CENTRAL REGION OF GHANA

BY

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DECLARATION

Candidate's Declaration

I hereby, declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: ..... Date .....

Name: Thywill Amenuveve Degley

Supervisors' Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: ..... Date .....

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ABSTRACT

Drug administration is a core responsibility of nurses. Medication error occurring during the drug administration process can be attributed to varied effects on patients' safety, ranging from the errors going undetected to prolonged hospital stays, discomfort and death. It is relevant to identify the extent of drug administration error in the district hospitals in the Central region of Ghana. A quantitative, cross-sectional study was conducted among nurses nursing patients admitted to selected district hospital in the Central Region of Ghana. Primary data was gathered from 168 nurses using a pre-tested questionnaire and a review of incident books on the wards. Logistic regression was done to assess possible factors contributing to drug administration error. The majority of the respondents (61.9%) were below 29 years and had worked between one and four years (72.2%). Most common types of error committed include pre-administration error (mean=2.67) and administration technique error (mean=2.67).The majority of these errors occur during the night shift (65%). Lack of understanding of medication jargons (mean = 3.89), "feeling uncomfortable to wake patient up' (mean = 3.78) and nurses eagerness to go home (mean = 3.67) were the most predisposing factors to drug administration error. Increasing internal environment constraints corresponds with increasing drug administration error commitment by a factor of 0.228. Lack of emphasis placed on medication error as a measure of quality of care and non-existence of channels for reporting drug administration error were the main barriers to reporting drug administration error.

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DEDICATION

I dedicate this work to my children and all nurses.

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LIST OF ABBREVIATIONS

ADE	Adverse drug events
ADR	Adverse Drug Reaction
AHRQ	Agency for Healthcare Research and Quality
CHPS	Community-based health's planning and services
CIHI	Canadian Institute for Health Information
CMIRPS	Canadian Medication Incident Reporting and Prevention System
CRAR	Central Regional Annual Report
DAE	Drug Administration Error
FDA	Food and Drug Administration
GFFR	Ghana Fact and Figure Report
GHS	Ghana Health Service
GSS	Ghana Statistical Service
HCP	Health Care Provider
HRD-GHS	Human Resource Division –Ghana Health Service Report
IOM	Institute of Medication
ISMP	Institute for Safe Medication Practices
KQI	Key Quality Indicator
MAE	Medication Administration Error
ME	Medication Error
MIR	Medical Incident Report
NCCMERP	National Coordinating Council for Medication Error Reporting and Prevention
NHIS	National Health Insurance Scheme

NMC	Nursing and Midwifery Council
PS	Patient Safety
US	United States
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

Background to the Study

The effect of medical errors on the safety and quality of patient care in health facilities cannot be overemphasized. Studies shows that, patient safety is one of the most pressing health care challenges in the world (Institute of Medicine (IOM), 1999). Patient's safety is freedom from accidental injury while a patient is receiving care in the health facility (IOM, 1999). Patient safety encompasses a variety of patient care processes and outcomes, including the safe use of surgical equipment during procedures, medications, physical restraints, and prevention of harmful events, such as patient falls and suicide (Wakefield, Uden-Holman & Wakefield, 2005). Emmanuel, et al (2009) stated that the level of a patients' safety in health facilities affects the recovery rate of clients. The Patient Safety Curriculum Guide Report (2011), explains that it is the responsibility of every healthcare provider to render the best medical services with minimal or no medical errors to patients.

Medications are therapeutic interventions envisioned to reduce patient suffering, promote healing and improve health and quality of life; however, all medications have potential adverse effects (Metsala & Vaherkoski, 2014). Among patient safety issues, medication safety has been considered a major indicator of health-care quality (Joint Commission on Accreditation of Healthcare Organizations, 2006). The use of medicines to address the health challenges of patients in the world has increased considerably(Avian, 2009). However, the increase in the use of medication is accompanied by medication error. 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 healthcare professional, patient, or consumer (Williams, 2007).

Medication errors may occur in any phase of the medication use process (Mrayyan, Shishani, & Al-Faouri, 2007). The medication use process extends from procuring the medication by the procurement officers; selecting, transcribing and ordering of the medication by the doctors, preparing, dispensing and educating on the medication regimen by the pharmacy attendants; administering and monitoring on the effect of the medication by the nurse and the patient or the consumer who is receiving the medication. Some stages of errors comprise manufacturing, prescribing, transcribing, dispensing, administration of a medication and monitoring of its effects (Dabaghzadeha, et al, 2013).

Empirical evidence shows that medication error continues to place the patient in serious danger (Rozich, Haraden, & Resar, 2008). According to estimates by the IOM, patients who are admitted into hospitals experience approximately one medication error per day of their stay (Institute of Medicine, 2006). It has been estimated that between 10% and 18% of all reported medical errors can be attributed to unsafe medication use with varied effects, ranging from the errors going unnoticed to causing death and other disabilities to patient (Choo, Hutchinson & Bucknall, 2010).

The increase in the incidence of medication error may be due to the complex nature of the medication use process which extends from medication prescription, transcription, dispensing and the administration stage. It could also result from lack of professional competence or system failures (Ndosi &

Newell, 2008). Increases in new products as well as advances in technology also increase the risk of medication error.

Globally, empirical evidence shows that researchers are concerned by the increased rate of medication error. A report from the IOM, (1999) stated that 7,000 deaths could be associated with medication errors annually in the United States. Similarly, Ammenwerth, et al (2008) estimated that nearly 100,000 individuals per year in the United States (US) die of preventable medication errors. Aside from death, poor patient safety practices are responsible for the increasing hospital admissions and cost, prolonged hospital stays, use of additional resources, extra cost of litigation, lowering patient satisfaction and undue discomfort (Montesi & Lechi, 2009). It is therefore important to promote safety in the medication process because of the significant consequences associated with medication error.

Medication error is particularly common in hospitalized patients, especially elderly people, critically ill, pediatric patients and those that require multiple forms of pharmacological therapies (Mirkuzie, Tesfahun and Zeleke ,2014). The above categorization places adult clients on admission at risk of medication error. A study by the US Food and Drug Administration (FDA) evaluated reports of fatal medication errors over five years' records that almost half of the fatal medication errors occurred in people at the age of 60 years and above (Stoppler,2006). This indicates that older people are at greatest risk for medication errors because they often take multiple prescription medications (Stoppler, 2006).

In health facilities, the drug administration process is the last stage of the medication use process. The process involves: obtaining medication in a

ready-to-use form, counting or calculating, labelling, storing and preparing in some way. It also involves checking for allergies; giving the right medication to the right patient, in the right dose, via the right route, at the right time; and documenting and monitoring of patient for effects of the drug (World Health Organisation (WHO), 2011). In the same vein, the Nursing and Midwifery Council (NMC) in the UK argues that the drug administration process is not a robotic task that should be performed by strictly following the prescriber's orders but demands that the nurse thinks through and exercises professional judgement as well (NMC, 2007). There is potential for a drug administration error to occur with each dose of medication due to the complex nature of the medication administration process. It is therefore imperative that drug administration errors are detected and reported by nurses (Ferner, Ferner, & McDowell, 2009). A study by Anderson and Townsen, 2010 (as cited in Jo, Marquard, Clarke, & Henneman,2013) expounds that approximately 38% of medication errors occur during medication administration process and are termed drug administration error.

Drug administration error is any discrepancy between the drug therapy received by the patient and that intended by the prescriber (Chua, Tea & Rahman, 2009). About 71.5% of medication errors are due to nurse administration and 16.4% result from the prescribing stages (Westbrook and Woods, (2009) & Redley and Botti, 2012). A recent systematic review of drug administration error prevalence in healthcare settings found that nursing administration error is the most common type of medication error in health facilities, reporting an estimated median of 19.1 % of total opportunities for error in hospitals (Keers, Williams, & Cooke, 2013).

Many policies and guidelines have been devised to help prevent drug administration error from occurring. Most nurses are familiar with the five rights of medication administration: the right patient, drug, dose, route and time (Eisenhauer, Hurley, and Dolan, 2007).These medication rights are designed to ensure patient safety and prevent harm (Malcolm, Yisi, 2010). However, quality in medication administration is not simply a matter of adhering to these five rights (Cox, 2000).

Just like medication error classification, different types of drug administration error can occur owing to the stage of the drug administration process at which an error occurs. For instance, Seki & Yamazaki (2009) describe that error of omission can occur when a drug is prescribed but was not administered by the nurse to the patient. Wrong patient error occurs when a different medication is administered to the patient other than the one prescribed. Drug administration error can also occur during any shift (morning, afternoon and night shifts). Likewise, various classifications of medication like antibiotics, intravenous infusions, diuretics, anti-diabetes, anti-hypertensive medications and analgesics can be involved in drug administration error (Ferner et al., 2009).

A study by Clifton-Koppel (2008) shows that nurses can reduce drug administration error and improve patient safety by implementing important changes to their individual practice. These changes include reporting medication errors, reducing distractions, independent implementation of safe medication double checks before medication administration, and promoting a safety culture (Handler et al., 2008). It appears that nurses are not reporting drug administration error when they occur. Meanwhile, error reporting is

important in reducing drug administration error. Informal reporting and documentation of drug administration errors can prevent healthcare authorities from knowing the rates of specific types of medication errors that occur (Garner, 2012). It will also prevent the authorities from understanding the underlying cause of drug administration error and from appropriately prioritizing the opportunities to correct and prevent the errors, both within and across facilities.

Drug administration errors are less likely to be prevented than prescription and dispensing errors because it occurs in the last stage of the medication use process and result in direct harm to the patient (Van den Bemt, Robertz, De Jong, Van Roon, & Leufkens, 2007).

Statement of the Problem

The increase in the use of drugs has also brought about an increase in associated medication errors (Avian,2009). A study of anonymous errors reported via a national, confidential medication error-reporting program in the US across 496 emergency departments recorded a total of 13,932 medication errors over a 4-year time span (Pham, et al, 2011). This value translates to an error rate of 78 reports per 100,000 patient visits. The groups most frequently responsible for these errors were nurses (54%) and the most common errors that occurred were in the drug administration phase (36%) (Pham, et al., 2011).

Likewise, Dabaghzadeh, et al (2013), in a study on medication errors in a large teaching hospital in Tehran (US) showed that 19% of drug administrations contained at least one error. The most recorded errors were made by nurses (44.5%), most commonly during the drug administrating stage

(63.6%). Most of these drug administration errors were responsible for one-third of medication errors leading to poor patient recovery, death, decreased client satisfaction, and other forms of harm to patients (Westbrook & Woods 2009; Redley & Botti, 2012). Similarly, Alsulami et al. (2013) in systematic review study on medication errors in the Middle East countries revealed that the most frequent types of reported medication incidents errors were drug administration related errors.

The case is not different in Africa. A prospective observational study carried out in Ethiopia revealed that a total of 196 (89.9 %) administration errors were identified from 218 observations made over a period of 13 days (Feleke & Girma, 2010). This indicated that at least 15 administrative errors were committed each day in the hospital.

Studies by Ahado, (2007) and Degley (2013) in Ghana using questionnaires and an observational method recorded 32.9% and 49% administration errors respectively. These findings suggested that drug administration error also occurs in Ghanaian hospitals but little is known about the frequency of these drug administration errors. WHO (2009) also estimated that the risk of patient harm as a result of medication error may be greater in Ghana, due to inadequate infrastructure facilities, technological advancement, and skilled human resources in hospitals.

According to Barker, et al, (2002), identifying errors is fundamental to error prevention. Thus, for a hospital to be able to minimize drug administration error, it is important to explore the various factors that contribute to drug administration error in the facility. The questions that remain unanswered are what types of drug administration error occur in health

facilities in Ghana, what contributes to those errors and how do these medication errors compromise in-patient safety? These questions remain unanswered in the two empirical studies on medication errors carried out in Ghana.

Likewise, it was revealed that some studies were done on drug administration error in specialty wards (theatre, emergency department, psychiatric and intensive care unit), but little has been done among the general adult, medical and surgical ward which was the focus of the researcher. To address this gap in literature, the study aimed to profile drug administration errors and explore nurses' perception on the effects of drug administration error on patient safety in the health facilities in Central Ghana.

Purpose of the Study

The study purposes to describe drug administration errors and explore nurses' perception on the effects of drug administration error on patient safety in the Central Region of Ghana.

Specific objectives

The study sought to:

1. profile drug administration errors;
2. examine the relationship between demographic factors and committing drug administration errors;
3. determine the factors contributing to drug administration errors;
4. assess nurses' perception on the effects of drug administration error on patient safety;
5. identify the channels of reporting drug administration errors in the health facilities; and

6. assess the barriers to reporting drug administration error.

Research Questions

1. What drug administration errors occur in the hospitals and which groups of people are more likely to commit drug administration errors?
2. What is the relationship between demographic factors and drug administration error?
3. What factors contribute to drug administration errors?
4. What are nurses' perceptions of the effects of drug administration error on patient safety?
5. How are drug administration errors reported?
6. What are the barriers to nurses reporting drug administration errors?

Significance of the Study

The findings from the study are of invaluable benefit to knowledge and nursing practice. Firstly, this study contributed to knowledge by improving the understanding of causes of drug administration error and how they affect patient safety in health facilities in Central Ghana. It also serves as a reference point for analysing drug administration error and patient safety in Ghana to influence error prevention policies in the healthcare system.

Among nurses, the study has created awareness on occurrence of drug administration error and how errors affect the quality and safety of care rendered to patients. The study also influences nurses to develop a positive attitude and improve practice towards safe drug administration process in order to minimise drug administration error. The study further helps to provide information on policy development and planning towards reducing drug administration error among adult hospitalised patients.

Finally, the study stimulates the interest of other researchers to conduct research into this area to add to the existing body of knowledge. It also provides an empirical work on drug administration error and patient safety in Central Ghana.

Delimitations

Medication error is a broad term that is used to describe any medication related error. For the purpose of this study, drug administration error is the medication related error that occurs when nurses are administering drugs to patients entrusted in their care. The study was delimited to profiling the drug administration errors that occur in the medical, surgical and general adult ward setting only. The study also explored the nurses' perception on the effect of drug administration error on patients.

Extensive literature review shows that some work was done on drug administration error in the specialty wards (theatre, emergency department, psychiatric and intensive care unit) but little was done among the adult medical and surgical patients which the researcher sought to address. Two studies done in Ghana used trigger tools, medical charts and descriptive statistics for data analysis; however, this study aimed to employing both descriptive and inferential methods to analyse the data.

Limitations

Firstly, the research sought nurses' view on drug administration error, rather than evaluating the magnitude of drug administration error that occurs on the ward at a point in time. Secondly, only 84% retrieval rate was achieved, since it was difficult to assemble all the nurses within the study period, due to the shift system which resulted in some of them not being available for three

(3) days or more. Lastly, due to time constrains, the researcher could not do a comparative analysis of results among the hospitals.

Definition of Terms

Diploma registered nurse- A nurse who had general nursing training for three years and awarded a diploma certificate to practice nursing as a professional staff nurse.

Drug administration error- Discrepancy in drug served to patient on admission from the one intended by the prescriber.

Enrolled nurse – Nurses who had general nursing training for two years and awarded basic certificate to practice nursing as auxiliary nurses.

First degree nurse- A nurse who had a four years training in general nursing or a diploma nurse who had undergone further studies to attain a bachelor's degree in nursing.

Internal environmental factors- Conditions arising from the ward and the nursing care process.

Organizational /System factors- Conditions arising from administrative decisions and other health care providers.

Personal Factor- Conditions pertaining to the nurse as an individual.

Post-diploma nurse- Either an enrolled nurse or a diploma registered nurses who have undergone further studies to attain a basic certificate/diploma in any specialty area in nursing.

Organisation of the Study

The study comprised five chapters. Chapter One presents the background, statement of the problem, purpose of the study and the research questions, significance of the study, delimitation of the study and limitation of

the study. The limitations of the study as well as suggestions of possible areas for further research are also presented in this chapter. Chapter Two focuses on the review of relevant literature concerning the theoretical, empirical and conceptual framework for the study. Chapter Three describes the methodology of the study. This includes the description of the study area, research design and data analysis techniques. The chapter also captures the population, sample and the sampling procedure, research instrument, and validity and reliability of the research instrument. Chapter Four captures the analysis and discussion of data. Lastly, Chapter Five presents the summary, conclusion of findings of the study and makes recommendations based on the study.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews both theoretical and empirical literature relevant to the study. The review sought studies published in English from 2008 to 2015. Research study reports, news reports were reviewed from databases including peer –review articles. Literature search was done using key words like medication error, drug administration error and patient safety. Major emphasis was placed on medication error, concept of patient safety, types of medication error, types and frequency of drug administration error and nurses view on factors contributing to drug administration errors. The chapter further reviews literature on nurses' perception of the effects of drug administration error on patient safety, drug administration error reporting and barriers. The theoretical framework reviews Reason's model of accident causation and Anderson's Behavioural Healthcare Model, which were adapted to form the conceptual framework of the study.

Empirical Review

Medication error

A conscious human action can be performed correctly as intended. However, an error may arise when one plans an action but it is not performed well (Ferner, Ferner & McDowell, 2009). Simpson and Weiner (2009) explains that an error is something that is incorrectly done through ignorance or inadvertence. Errors are also considered as facts of the human condition. Psychologists outlined that errors are unintentional but are inevitable in human actions (Reason, 1990). Humans sometimes take wrong pathways, make slips of the tongue and dial wrong numbers although they know those numbers.

This phenomenon can be adopted to understand how medication errors can occur in the hospital settings. Likewise, Mach (1975) stated that knowledge and error flow from the same mental sources; only success can tell the one from the other. Although an error is an unintentional act, it can occur while formulating the plan for action or whilst executing it (Ferner et al, 2009).

Ferner et al, (2009) affirm that some tasks are naturally prone to error, especially tasks that are not familiar to the worker or performed under pressure. They explained that tasks that require the calculation of a dosage or dilution are especially susceptible to error. The drug administration procedure extends from obtaining medication in a ready-to-use form; counting/ calculating; labelling; storing; and preparing in some way. It also involves checking for allergies; giving the right medication to the right patient, in the right dose, via the right route, at the right time; and documenting and monitoring of patient for effects of the drug (WHO, 2011). These tasks of preparing and administration of medicines is complex, and are carried out within a complex system hence errors can occur at any stage.

The psychologist James Reason called attention to latent errors, i.e. errors that arise because of systems that have the potential to be unsafe (McDowell, Ferner &Ferner,2009).The hospital medication systems are very complex, and the entities involved include: a medicine, a patient, one or several healthcare professionals, pharmacy and pharmacy staff, the manufacturers and suppliers of the medicines and the medication (William, 2007). Similarly, Vincent, Ennis and Audley (1999) noted that tasks that require a high reasoning burden are susceptible to mistakes. Mistakes are errors that arise in formulating a plan. Errors that arise from incorrect

execution of well-formulated plans are called slips; whereas the errors that arise when one or more steps of a planned action are omitted are called a lapse (McDowell, Ferner &Ferner,2009). All these mistakes or errors can occur during drug administration.

Norman (1981) and Shallice (1982) explained that an error can occur when the execution follows a laid down procedure or follows a well-worn path until there is a distraction or failure of attention. Reason's Accident Causation Model (Reason, 1999) has been widely used in the study of human errors. More than 200 years ago, Florence Nightingale warned that *"the very first requirement in a hospital is that it should do the sick no harm"* (Nightingale, 1863, hospital notes 22). This concern was echoed in *crossing the Quality Chasm: A New Health System for the 21st Century*, where the IOM called for safety in the delivery of healthcare indicating that patients should always be safe from injury caused by the care system (IOM, 2001). Today, the increasing complexity of healthcare has contributed to the growing problem of medical error (Wachter, 2011). According to the Committee on Quality of Healthcare in America, the majority of quality problems and medical errors occur because of fundamental short comings in the ways care is systematized (IOM, 2001), and not individual error or negligence (Kohn, Corrigan & Donaldson, 2009).

The occurrence of medical errors garnered widespread attention after the IOM published its seminal report, *To Err is Human: Building a Safer Health System* (Kohn, et al., 2009). This report was a spark in focusing America's attention on the need for patient safety improvement and higher quality healthcare. The report found that medical error does not only impede the quality of care but are responsible for 44,000 to 98,000 patient deaths per

year. The costs of errors are estimated at $17 to $29 billion (Kohn et al., 2009) and have devastating effects and emotional costs for patients and their families (Gibson & Singh, 2013). The United State Senate Appropriations Committee directed the Agency for Healthcare Research and Quality (AHRQ) to also lead the national effort to combat medical errors and improve patient safety (AHRQ, 2004). Since that time, AHRQ has taken the lead in advancing the patient safety agenda by funding health services research in this area.

The three terms most frequently used in literature to denote drug related mishaps are medication error (ME), adverse drug reactions (ADRs), and adverse drug events (ADEs). ME is the broadest concept among the three and it is defined in different ways. The dimension in terminology is the possible reason for the variations in the definition of medication errors. The AHRQ defines medication error as any mistakes made in the process of care that result in or have the potential to do harm to patients (AHRQ, 2004). Although ADEs and ADRs have different meanings, researchers have used them interchangeably (Classen, et al 2008).

National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) (2015) also defined a medication error as any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional or patient. Such events may be related to professional practice, healthcare products, procedures, and systems, including prescribing; order communication; product labelling, packaging, and nomenclature; compounding; dispensing; administration; education; monitoring; and use. Bates, et al 1995 (as cited in Al-Faouri, Hayajneh, Habboush, (2014) also

defined ME as an error in the process of ordering or delivering a medication, regardless of whether an injury occurred or the potential for injury was present.

Although Bates' definition encompasses all stages of medication errors occurring from prescribing to administration, some researchers do not distinguish these stages and use the term medication error when they actually mean medication administration error (Barker, Flynn, Pepper et al., 2002). In 2007, William in a study on medication error defined ME as an error in prescribing, dispensing or administering of a drug, irrespective of whether such errors lead to adverse consequences or not (Williams, 2007). Similarly, Grou-Volpe, et al (2014) describe ME as an error that occurs in the process of drug use, or as a result of a system error that can be avoided.

One can say that ME is any preventable failure in the mistake made at any stage in the provision of a drug to a patient while the medication is in the possession of the healthcare provider notwithstanding whether an injury occurred or the potential for injury was present. From this perspective, it can be deduced that ME may be recorded by doctors during medication prescription or ordering; by pharmacy personnel during medication dispensing; and by nurses during medication administration to patients. Therefore, early identification and prevention of ME at each stage of the medication use process is an important strategy towards improving patient safety.

In addition to these definitions, some have further classified ME according to the stage of the medication use cycle in which they occur (prescribing, transcribing/ordering, dispensing, or administration). Yet other

classification of ME that divides them into mistakes, slips, or lapses have been suggested (Karthikeyan & Lalitha, 2013).

Concept of patient safety

The issue of patient safety (PS) has become a global concern necessitating the need to define PS. Some researchers came up with the assumption that, patient safety is a philosophy with its own explanatory framework, ethical principles, and methods; a discipline with a body of expertise. Some also assume that it is a state of being safe that emerges from a system. This explains the varying definitions of patient safety. The IOM (cited in the National Healthcare Disparities Report, 2010) defines safety as freedom from accidental injury, but patient safety remains undefined even among the organizations that force its existence. In 1998, the IOM at a National Roundtable Conference On Health Care Quality came up with a universally accepted definition of quality as: "*Quality of care is the degree to which health care services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge*" (Chassin & Galvin, 1998, p.189). At the same time, health care quality problems were classified into three categories as underuse, overuse, and misuse. Misuse was defined as the preventable complications of treatment. The IOM Roundtable further distinguishes misuse from error where they concluded that errors may or may not cause complications. This misuse category became a common reference point for conceptualizing patient safety as a component of quality.

Fogarty and McKeon (2006) noted that safety emerges from the good interaction of components of the health care system, thereby leading the way

to a defined focus for patient safety (Cooper, Gaba & Liang, 2000).Beyea, Hicks and Becker, (2006) observed that as attention to patient safety has deepened, the distinction between the overuse, underuse, and misuse categories have become indistinct. "It seems logical," they wrote, *"that patients who fail to receive needed treatments, or who are subjected to the risks of unneeded care, are also placed at risk for injury every bit as objectionable as direct harm from a surgical mishap"* (Leape & Berwick, 2006, p.8).

Emmanuel et al. (2009) defined PS as an attribute of health care systems that minimizes the incidence and impact of, and maximizes recovery from adverse events. This description includes: why patient safety exists; its nature; it's essential focus of action; how patient safety works (e.g., high-reliability design, use of safety sciences, methods for causing change, including cultural change); and who its practitioners are (i.e., all health care workers, patients, and advocates). This definition identified essential features of patient safety. The WHO (2011) also defined PS as the prevention of adverse events to patients associated with health care.

Types of medication errors

In various hospital settings, three general types of ME can occur. They include those related to the prescribing process; those that occur when the medication is dispensed at the pharmacy; and those related to the use of the medication. Each of these tasks is complex, involving series of tasks, thereby increasing the frequency of error occurrence. Bates (2009) found that most MEs (49% to 56%) occur when physicians prescribe or order medications. Nurses and pharmacists are responsible for medication errors involving

administration (26% to 34%), dispensing (14%), and transcription (11%). Patients themselves are sometimes the cause of a ME especially when they fail to take a medication as prescribed or take too much or too little medication or when they are unable to purchase medication as prescribed.

However, a study by Westbrook and Woods (2009) showed that 71.5% of the ME are due to nurse administration and 16.4% result from the prescribing stages. A recent systematic review of drug administration error prevalence in healthcare settings found that nursing administration error is the most common type of ME in health facilities, reporting an estimated median of 19.1% of total opportunities for error in hospitals (Keers, Williams, & Cooke, 2013).

Similarly, a retrospective study carried out in Kuopio University Hospital in Finland recorded 671 ME most of which (82.6 %) came from registered nurses, while pharmacists reported 5.4 % and physicians only 2.5% (Härkäne, et al 2013). A quantitative study by Dabaghzadeha, Torkamandic and Farsaeia (2013) in a large teaching hospital in Tehran affirms that out of the 275 patients observed, 203 medication errors were recorded during 180 hours. Almost 64% of the errors occurred during drug administration, 67 (33.0%) occurred during prescribing stage and 7 (3.4%) occurred during the monitoring stage which was also committed by nurses. These findings indicate that at least one medication error (irrespective of the type) is committed every hour, of which drug administration error is more common in the hospital settings.

Prescribing errors

The first step in obtaining a prescription medication occurs when a patient visits a physician, or other health care professional with prescribing authority, and receives a prescription. Medication prescription process involves good history taking, making suitable diagnoses, selecting the right type of medicine and transcribing those orders for dispensers and nurses to follow. Each of these steps require a lot of thinking and calculations which makes the process prone to error (Ferner, et al, 2009).

Prescribing errors may be defined as an incorrect drug selection for a patient, be it the dose, strength, route, quantity, indication and contraindications, and may include failure to comply with legal requirements for prescription writing (Drug Safety, 2000). The prescriber must specify the information which the pharmacist needs to dispense the drug in the correct dosage and form and the directions the patient needs to take it safely (Dean et al, 2009). During the drug prescription process, the prescription error can be in the form of wrong selection of drug error, illegible handwriting error, drug allergy error, wrong dose error, wrong unit of measurement and use of abbreviation errors.

According to Garfield, Reynolds, et al (2013), prescribing errors remain very common among hospitalized patients. Although most of these errors are under-reported in clinical practice, some research studies have found much higher rates of prescription errors. A systematic review of studies in the Us and UK on the prevalence, incidence, and nature of prescribing errors in hospital inpatients showed the median prescription error rate in 65 eligible studies as 7% of medication orders of which 52 prescription errors occurs per

100 admissions, and 24 errors per 1,000 patient days (Lewis, et al. 2009). Prescription errors that do not result in harm caused extra stress on both healthcare provider and patient and can adversely affect patients' confidence in their care provided (Lewis, et al. 2009).

Similarly, a study undertaken in a hospital setting by Lesar et al. (2009) found an error rate of 4 errors per 1000 medication orders. The study also identified other prescription errors as drug allergies error (12.1%); wrong drug name, wrong dosage form or abbreviation error (11.4%), incorrect dosage calculations1(1.1%) and incorrect dosage frequency errors (10.8%) (Drug Safety, 2000). Contributing factors to prescribing error occurrence include: illegible handwriting, inaccurate drug history taking, inappropriate use of decimal points, use of abbreviations, use of verbal orders and drug name confusion (Lesar, Briceland, & Stein,1997)**.** Although there is a high prevalence of prescribing errors, some are intercepted by pharmacists, nurses, or other staff during the medication use process (Lesar et al., 2009).

Dispensing errors

The dispensing process is another step in medication use process. The process requires selecting the right drug at the recommended dose, storing and preparation of the medicine in a way, labelling/packaging of the medicine and educating other staff or client on the use of the medicines. Dispensing errors occur when a patient is given a medication other than the one intended by the prescriber (WHO, 2007).

Studies in the United States have estimated that dispensing errors occur at a rate of 1-24% and include selection of the wrong strength or product. According to Williams (2007), other potential types of dispensing errors

include wrong dose, wrong drug or wrong patient, wrong dosage form error, omission error which is mostly due to drug being out of stock, and dispensing of expired drug error. Others include poor labelling error which is as a result of the use of computerized labelling, which is among the most common causes of dispensing error.

Dispensing error occurs primarily with drugs that have a similar name or appearance. Lasix® (frusemide) and Losec® (omeprazole) and amiloride 5mg and amlodipine 5 mg tablets are examples of proprietary names which, when handwritten, look similar and therefore need to be prescribed generically (Williams, 2007).

Barber, et al (2009) stated that one of the most important influences on dispensing errors has to do with confusing the name of one drug with another. Others include lack of knowledge on new medicines and the use of out-dated and/or incorrect references, poor dispensing procedures with inadequate checking, unreasonable workloads and poor housekeeping standards. Studies have also supported an association between dispensing errors and lighting levels, prescription workload and noise. It is also suspected that distractions or interruptions, not challenging unusual doses, dispensing unfamiliar products, and dispensing before seeing a written order may lead to dispensing errors (Avian, 2009). Bates, Kaushal and Landrigan (2011) in a prospective study conducted in the infant, child and adolescent unit of the Johns Hopkins clinic also noted other factors including, lack of quality control or independent verification systems; missing patient information as allergies, age, weight, pregnancy; and missing drug information thus out-dated references and inadequate computer screening.

Nevertheless, some dispensing errors can be identified and intercepted by the nurses, doctors, care assistants, patient or family member during the drug administration process. Unfortunately, most drug administration errors are not intercepted perhaps because that is the last stage of the medication use process in hospital settings (Vincent et al., 2009).

Drug Administration Error

Drug administration error is the third most common classification of ME. Drug administration is the sole responsibility of the nurse, although other healthcare providers including the pharmacist, doctors, healthcare assistants, patients and patients' caregivers assist with administering medicines to client (Macdonald, 2010). The drug administration process involves: collecting the medicine in a ready-to-use form from the pharmacy; counting and calculating the dose to administer; labelling and storing the medicine for further use; and preparing (crushing or diluting the medicine) in some way. It also involves checking for allergies; giving the right medication to the right patient, in the right dose, via the right route, at the right time; and documenting and monitoring of patient for effects of the drug and educating client on the expected effects of the medicine (WHO, 2011). The NMC, UK argues that the drug administration process is not a robotic task that should be performed by strictly following the prescribers orders but demands that the nurse thinks through and exercises professional judgement (NMC, 2008; NHS Professionals, 2010).

Generally, nurses are said to be responsible for 26 to 38% of medication errors in hospitalized patients (Leape et al., 2002; Bates, 2007), and have an important role in ensuring safety in the medication administration

process. The nurse is the last person who can check if the medication is correctly prescribed or dispensed right before it is administered (Davey et al., 2008) allowing nurses to intercept approximately 85% of the potential errors from other practitioners who are involved in patient care. As medication administration is probably the highest risk task a nurse can perform (Anderson & Webster, 2001), many policies and guidelines have been devised to help prevent medication administration errors.

Most nurses are familiar with the five rights of medication administration: the right patient, drug, dose, route and time (Eisenhauer et al., 2007). These rights are taught to nurses in the diploma and first degree programs to enable nurses to evaluate the outcome of the drug administration process and prevent latent or concealed errors (Reason, 1995). It focuses on the nurses' behavior during the drug administration process. These have been increased from five to nine rights. These nine rights include: right medicine, patient, dosage form, dose, route, reason, after a right assessment, and the nurse completes the right documentation (Cohen, 2007). However, these 'rights' are not able to evaluate the organizational and environmental factors that contribute to error (Cox, 2000; Pepper, 2006; Cohen, 2007).

Drug administration activity is prone to errors, due to the rapid development in medical technology, leading to a tremendous increase in types and complexity of medical devices as well as the number of medications being introduced. In addition, there are various routes of administration, different dosages, dosage forms and dosing regimens which are often changed according to the patient's clinical condition and diagnostic test results available (Chua, et al, 2009).

Empirical studies reveal that the drug administration error is the most common type of medication error that occurs in the health facilities (Westbrook and Woods, (2009); Redley and Botti (2012) and Keers, Williams, & Cooke, 2013).

Other Classifications of Medication Error

The California HealthCare Foundation (CHCF) guidelines, classified medication errors as administration errors, prescribing errors, dispensing errors, compliance errors, monitoring errors, potential errors, and other medication errors (Karthikeyan & Lalitha, 2013). Although this classification embraces the three major categories of medication error as proposed by several studies, it also included other stages of medication use process. However, the US NCCMERP in 1996, classified medication error as: no error medication error; error, no harm medication error; error, harm medication error; and, error, death medication error.

This classification was based on the extent of harm or the severity of effect of error to patients. A prospective observational study conducted among in-patients in the general medicine department of a hospital in South India shows that no error occurs in about 25% of medication use. Nonetheless, 56% of errors occurred without any harm to patient, 19% of errors occurred with an effect on patient and no error occurred with effect on patient safety (Karthikeyan & Lalitha, 2013). These findings suggested that the majority of medication errors that occur in the hospital settings have an effect on the patient and care must be taken to correct those effects.

Medication errors were also categorized as serious (capable of producing permanent organ damage or death) or not serious, and outcome was

graded according to the classification described by Hartwig, Denger and Schneider (1991). The levels described were: Level 0: error prevented by staff surveillance; Level 1: error occurred, but no patient harm; Level 2: error occurred; increased monitoring required but no change in clinical status; Level 3: error occurred; change in clinical status, or need for increased laboratory monitoring, but no ultimate harm; Level 4: error occurred; extra treatment required, or increased length of stay resulted; Level 5: error occurred; permanent patient harm resulted; and Level 6: error occurred resulting in death of patient. In conclusion, medication error can be classified based on the stage of the medication use process such as prescription, transcription, dispensing, administration, or based on the extent of harm to patient.

Drug Administration Error Reporting

Nurses, nurse managers and physicians indicated that medication errors were underreported by nurses (Osborne, Blais & Hayes, 2009) . Mayo and Duncan (2004) in a study conducted among 5000 registered nurses in California, USA, noted that nurses themselves said only 25% of all drug administration errors were reported using incident reports. Mayo and Duncan also reported that their study recorded a higher rate of medication error reporting, as compared to that of Osborne, Blais and Hayes (2009) where only 3.5% of the nurses in the study said that all medication errors were reported. Mayo and Duncan (2004) stated that failure to administer a medication is the most underreported error because nurses perceive that patients will not be harmed in such a situation. Conversely, errors resulting in overmedication were the most frequently reported.

Penalties for errors can lead to underreporting and contribute little to the development of effective risk-management strategies. Hospital institutions should prevent medication errors through the elaboration and implementation of safety mechanisms directed at the medication system, putting aside the prosecution and punishment of professionals for the error. This would open the error up to discussion, thereby converting it into an educational process, and thus improving the system. In other words, it would be more effective to use the error to analyse the potential weaknesses of the system and the conditions under which it happened (Reason, 2000). Error events need to be monitored and reported and treated as important in the elaboration of risk management strategies and the development of safety measures (Cohen & Shastay, 2008).

Only 45.6% (983) nurses in the study by Mayo and Duncan (2004) indicated that all drug administration errors were reported. Reasons for not reporting include fear of manager and peer reactions. Evidence from medication error reporting systems suggest that many medication errors are not reported for different individual and contextual reasons, and go undetected (Evans, 2009). The resultant underreporting reduces the possibility of analysing natures of drug administration errors and developing quality improvement initiatives (Mansouria et al., 2014).

Types and Frequency of Drug Administration Error

The Food and Drug Authority that evaluated reports of fatal medication errors from 1993 to 1998 outlined that the most common error involving medications was related to administration of an improper dose of medicine, accounting for 41% of fatal medication errors. Giving the wrong

drug and using the wrong route of administration each accounted for 16% of the errors (US FDA, 2000, cited in Stoppler, 2010)

Among 328 administration errors which were found in a study by Armitage and Knapman (2008), 79% affected patients and 21% were intercepted (near misses). Among the 259 actual errors, over 60% involved wrong dose or drug; others included 12.4% of wrong time of administration, 11.6% wrong patient, 8.5% wrong delivery route and 3.1% classified as 'other' involved wrong IV set, or wrong blood transfusion, etc. Fifteen of 81 (18.5%) wrong drugs were due to giving medicines when order was discontinued and 68% wrong times involved forgetting the administration time (Armitage & Knapman, 2008). Near misses had similar results.

Sheu et al, (2008) used snowball sampling method to collect data on drug administration errors from nurses; and identified types of drug administration error as wrong patient, wrong medicine, wrong dose, wrong route, wrong timing, drug omission, discontinued medicine, wrong documentation, wrong technique, wrong duration of medication, and wrong form of medicine errors.

The rates of drug administration errors vary depending on the method used to detect the error (Härkänen et al, 2013). For example, among hospitalized patients, errors may be occurring as frequently as one per patient per day. In pediatric intensive care unit (ICU) studies, reported medication error rates have ranged from 5.7 and 14.6 per 100 orders to as high as 26 per 100 orders (Cowley, 2000; Walsh, Kaushal, & Chessare, 2005).

Using chart reviews, Grasso, Genest and Jordan (2013) found that 4.7% of doses were administered incorrectly. Direct observation studies

placed the estimate of total incorrect doses between 19 and 27% and when an extra review was done to separate the errors into stages of the medication process, between 6 and 8% of doses were in error because of administration. The majority of types of drug administration errors reported were wrong dose, wrong rate, wrong time, and omission. All of the studies reviewed here reported wrong drug and dose, but varied across the other types of drug administration error categories (Grasso, Genest & Jordan, 2013).

A study has evaluated self-reported drug administration errors, involving incident reports and informal reports (Wolf, Hicks, & Serembus, 2006). The most common types of reported errors were wrong dose, omission, and wrong time. Four of these studies assessed a large secondary, nationally representative database containing drug administration errors reported to the MEDMARX database over five years and found in the error reports submitted by nursing students that the majority of drug administration errors were associated with omission, wrong dose, wrong time, and extra dose (Wolf, Hicks, & Serembus, 2006).

A study looking at errors associated with the operating room, same-day surgery, and post anaesthesia unit found the majority of errors recorded were attributable to administration but they did not classify them by error type Beyea and Hicks (2008). Majority of drug administration errors were associated with errors involving interpreting or updating the medication administration record, delayed dose, wrong dose, or wrong drug (Dabaghzadeh et al, 2013). A separate component of the study by Dabaghzadeh et al (2013) surveyed administrative and clinical nurses and

found that they believed the majority of medication errors occurred at either the administration or dispensing stage.

Another study by Balas, Scott and Rogers (2006), assessed the type of drug administration errors reported by nurses in nationwide surveys. Whilst majority (57%) of errors reported by critical care nurses involved drug administration errors, an additional 28% of reported errors involved near misses. Drug administration errors involving wrong time, omission, and wrong dose accounted for 77.3% of errors, while wrong drug and wrong patient accounted for 77.8% of near misses. The most frequent types of medication errors were wrong time (33.6%), wrong dose (24.1%), and wrong drug (17.2%), and the three most frequent types of near misses were wrong drug (29.3%), wrong dose (21.6%), and wrong patient (19%). Many of the reported drug administration errors in ICUs involved intravenous medications and fluids. In Balas' survey, the nurses who reported making errors described between two and five errors during a 14-day period.

Conversely, Grou et al., (2014) categorized the frequency of drug administration error based on the shift in which the error occurred. A cross-sectional, descriptive and exploratory study carried out in a clinical medicine unit of the Regional Hospital in Brazil outlined that majority 121(100%) of drug administration errors occurs during the night shift (Grou et al., 2014).

Dabaghzadeha, Torkamandic and Farsaeia (2013) in a study on drug administration errors classified drug administration error into 11 categories. These comprised incorrect time, incorrect administration technique, unauthorized or unordered drug, incorrect drug preparation, incorrect dose, omission, incorrect rate, incorrect drug, deteriorated drug, extra dose and other

errors which were not specified. An incorrect time error was defined as the administration of drugs an hour or more before or after the scheduled time. Incorrect dose was defined as the administration of doses ±10% or more of the originally prescribed dose. Unauthorized or unordered drug error was the administration of a dose of medication that was not ordered by the doctor for the patient. This included the administration of a drug to the wrong patient but not the administration of a wrong medication (that is incorrect drug). Some drug administration errors would lead to subsequent errors. For example, incorrect drug preparation would result in incorrect dose but only incorrect preparation technique was considered as an error and not the incorrect dose (Dabaghzadeha, Torkamandic & Farsaeia, 2013).

Another study conducted in a Malaysian hospital recorded 203 medication errors during 180 hours (Chua, Tea and Rahman, 2009). The incidence of medication errors was 50.5% at various levels in the emergency department. Significant difference in age means was seen between the patients with and without medication errors. Seventy-five percent of errors were recorded as definitely an error. Most recorded errors were made by nurses (44.5%) and occurred in administrating stage (63.6%). Another study from 36 hospitals in the United States showed that 19% of administrations contained at least one error. Each error can result in an estimated cost of $5000, excluding legal expenses (Fahimi et al., 2009).

Similarly, a retrospective study carried out in Kuopio University Hospital in Finland indicated that, most errors were related to administration (39.9%) errors, and the most common types of incidents involved wrong doses (26.0%) or omissions (24.0%) (Härkäne et al, 2013). Approximately two

thirds (69.2%) of the incidents reached the patients, while one third were near misses. the majority of the incidents (65.7%) caused no harm to patients, and only 0.3% were estimated to have caused severe harm (Härkäne et al, 2013).

Factors Contributing to Drug Administration Errors

Drug administration is an activity that is prone to errors, partly attributed to the rapid development in medical technology, leading to a tremendous increase in types and complexity of medical devices (Macdonald, 2010). In addition, there are various routes of administration, different dosages, dosage forms and dosing regimens which are often changed according to the patient's clinical condition and diagnostic test results available (Chua, et al, 2009). In a systematic review report on drug administration personal factors were regarded as accountable in 27.7 to 79.9% of DAs by nurses. Inadequate knowledge of medications (75% of studies) had an estimated prevalence between 11.4 and 18.9%, and was reported as the most frequent contributing factor. In studies on nurses' views, shortage of workforce was indicated as one of the most reported sources (4 out of 5 studies; 80%) with regard to organization and management. It had one of the highest prevalence in all contributing factors (12.8 to 100.0%) (Udge et al., 2009).

Heavy workload had a projected prevalence between 10.6% and 70.0% in different settings, as reported in 80% of previous studies by Mansouria et al, (2014). Another most frequent source of medication errors at individual level as reported by nurses was physical and mental health which, ranged from 48.7 to 79.9% in prevalence, Illegible handwritings (15.0 to 70.0%) and inadequate

knowledge of medications (27.6 to 55.8%) was also reported by nurses as the next most frequent individual factor (Mansouria et al, 2014).

In general, the most commonly reported contributory factor to medication error was individual factors (10 of 12 studies), in which the inadequate knowledge of medication (7 of 12 studies) was the most frequently reported. The three most commonly reported individuals contributing factors to medication errors in all studies were personal problems (48.7 to 79.9% in different studies), inadequate knowledge of medication (11.4 to 55.8%), and dose miscalculations (13.5 to 20.0%) (Mansouria, et al., 2014).

A study by Cheraghi et al, (2012) using a cross-sectional, self-report survey (questionnaire) among 64 nurses in an Iranian hospital revealed that some organization and management factors contribute to drug administration error. The factors include shortage of workforce (accounted for 12.76% of errors) and lack of training for staff (accounted for 4.2%). Work environmental factors such as heavy workload leading to fatigue accounted for 10.6% of errors. Team factors such as miscommunication of drug orders from prescribers accounted for 14.89%, whilst individual's factors such as inadequate knowledge of medication accounted for about 27.7% and 48.93% of the error was as a result of using abbreviations for drug names (Cheraghi et al., 2012).

A cross-sectional, self-report survey among 86 nurses recorded that 100% of drug administration error occurred as a result of shortage of workforce which is an organization and management factor (Ghasemi, Valizadeh, & Moumennasab, 2009). A total of 83.7% of drug administration error was as a result of working overtime, as well as illegible handwriting by

prescribers accounted for 69.8%; inadequate supervision on wards contributed to 38.6% of drug administration error. About 35% of drug administration errors occurred as a result of lack of guidelines or medication protocols; personal stress/ill-heath resulted in 79.9% of drug administration error; lack of experience contributed to 64.0% of error; and 55.8 % were as a result of inadequate knowledge of medication by the nurse (Ghasemi et al., 2009).

Fatigue and exhaustion, as well as inadequate equipment resulted in 59% and 50% of drug administration error respectively (Nikpeyma and Gholamnejad,2009). In a large prospective Australian study of anaesthetists, one or more of the following factors was thought to be present when medication errors occurred: inattention (37% of medication errors); haste (39%); distraction (27%); and fatigue (11%) (Nikpeyma & Gholamnejad (2009). An analysis of 1305 errors made by nursing students, reported to the American MEDMARX Patient Safety program, identified inexperience (78%) and distractions (20%) as the principal factors contributing to the errors (Wolf, Hicks, & Serembus, 2006).

The mental state of the nurse might influence susceptibility to error. In a study that sampled of 123 paediatric residents, the 17 who were depressed were 6 times as likely to describe making a medication error as those who were not, whereas the 77 described as burnt out had average error rates (Fahrenkopf et., 2008). The risk of harm from medications in a hospital depends on the type of ward. Rates, expressed as adverse events per 1000 patient-days per drug used, were twice as high on medical care units as on surgical units (Ridley, Booth, & Thompson, 2004). Other studies have shown high rates of medication errors in intensive care units (Chappell & Newman,

2004). Part of the explanation may lie in the higher rate of prescribing errors in critical care units, where the prescriber may not have immediate access to critical information such as drug allergies, drug–drug interactions, or concomitant medical conditions.

Wright et al. (2006) examined a surgical database of 130,912 operating room cases over a 4-year period. Operating cases that began in the late afternoon were significantly more likely to experience adverse events than cases begun at other times. The authors suggested that this may have been a result of several factors such as patient characteristics, fatigue, and case workload (Wright, et al., 2006).

Several error-producing conditions were identified with intravenous medication errors in a study by Taxis and Barber (2008). Lack of knowledge of the preparation procedure and inadequate use of technology were the most common failures. The authors also highlighted the role of the technology, poorly designed equipment or unsuitable preparation procedures in producing errors, and lack of appropriate training and failure to involve pharmacists as important latent errors (Taxis & Barber, 2008).

In Dean, Schachter, Vincent and Barber's (2012) prospective analysis of prescribing errors in hospital, the following were all identified as error-producing: working conditions (insufficient staffing levels, heavy workload); the team (lack of communication); the individual (fatigue, hunger, lack of skills or knowledge); and task factors. Errors are also significantly more likely in children. An inpatient study using a prospective chart review showed that the rate of near-miss errors in children was three times the rate in adult patients (Kaushal et al., 2011). Raju et al. (1989) (cited in McDowell, Ferner,

& Ferner, 2009) undertook a prospective analysis of incident reports over 4 years from a paediatric and neonatal intensive care unit. During the study period, 2147 patients were admitted and 315 medication error incident reports were submitted. Wrong time was the most common type of error. Errors were most frequent during the day shift, although this was most probably due to the large number of prescriptions issued during the day McDowell, Ferner, & Ferner, 2009).

In a retrospective review of medication errors reported over a 4-year period in a large hospital, antibiotics were the commonest drugs and the intravenous route was the commonest (56%) route involved in medication errors (Ross, Wallace, & Paton, 2009). In a large 9-year study of prescribing errors in a teaching hospital, antimicrobials (34%), cardiovascular agents (16%) and gastrointestinal agents (7%) were identified as the three drug classes most commonly involved in prescription errors (Lesar, Lomaestro, & Pohl, 1997, cited in McDowell et al., 2009).

In a systematic review, three drug classes most commonly associated with preventable drug-related hospital admissions were identified: antiplatelet drugs (including aspirin when used as an antiplatelet drug), diuretics, and non-steroidal anti-inflammatory drugs (Howard et al., 2006). Findings of another review shows that, errors were more likely with medications used in the eyes (OR 11; 95% CI 4.3,29) or for inhalation (OR 4;95% CI 2.6,6.6) (Fijn et al, 2012). A prospective study of intravenous fluid administration errors in a surgical ward over a 4-week period outlined that, the lack of permanent staff contributed to administration errors (Han, Coombes and Green, 2005); the

level of nurse experience, the time of drug administration and the patient's sex were not associated with an increased risk of errors.

Nurses' Perception on the Effects of Drug Administration Error on Patient Safety

Everyone concerned about patient safety equates medication errors with serious risks to patients (European Medicines Agency, 2013). About 10 to 18% of all reported hospital injuries have been attributed to drug administration errors. Five percent of all medication errors reported to the US Food and Drug Administration (FDA) in 2001 were fatal (Mayo & Duncan,2004). United States data for 2008 for instance indicated that 7391 patients died from medication errors, and patient stays associated with medication errors increased by 4.6 days, with a resulting cost increase of $4685 per patient (EMA, 2013). In the state of California alone, over 700 patients die each year because of drug administration errors. Drug administration errors also cause a large number of adverse drug reactions (ADR) among patients with negative patient health outcomes each year and are a major public health burden representing 18.7–56% of all adverse drug events among hospital patients (Mayo and Duncan,2004).

The impact of drug administration errors on the safety of patients were assessed in a case-control analysis of ADEs in hospitalized patients during a 3-year period (Patterson, Woods, Cook, & Render, 2009). The researchers found that nurses generally perceived post-discharge disability among patients due to drug administration error. The perceived impact was however considered by the nurses as less in male patients, younger patients, and patients with less severe illnesses and in certain diagnosis-related groups.

One main factors that contribute to low patient safety at health care settings is the failure to perceive the prevalence and seriousness of drug administration errors (Millenson, 2003). This infers that medication administration, which is one core nursing action, if not performed in accordance to standards of care, may increase the unnecessary risks among patients.

Aboshaiqah (2014) on the perceived effects of drug administration error on the safety of patients showed that 13% of drug administration errors committed by nurses are perceived as not having any adverse effects on patient safety. Aboshaiqah, again stated that 41% of the administration error were with minimal risk (no clinical sign and symptoms), 27% with mild side effects of drugs, 17% moderate side effects, whilst less than 2% were perceived as severe and required immediate intervention related to allergy or adverse effect of the drug.

Channels of Reporting Drug Administration Errors

Tariq, Georgiou and Westbrook (2012) undertook a study in three large residential aged care facilities in Australia with a total of 23 semi-structured interviews and 62 hours of observation sessions. The qualitative data was iteratively analysed using a grounded theory approach. The authors described the channel of the drug administration error reporting across the study sites. Triangulated qualitative data facilitated the identification of the channel of activities during the process of drug administration error reporting at the sites and headquarters. The drug administration error process in the study sites relied on staff or care managers to identify incidents and submit a drug administration error form.

Drug administration error can be committed during regular shifts and if a nurse identifies a drug administration error, he/she has to inform the manager as explained by deputy manager site A that *"If there's an issue that was identified, the nurse has to fill in the form, but before that they will have to let nursing manager know, every incident, whether it is a medication or regarding medications, is informed to the manager"* (p. 5). Depending on the seriousness of the incident, the manager may decide to inform the doctor or nurse consultant. For the evening and night shifts, the team leader contacts the manager by telephone to seek guidance on the actions to be taken. At other times, the nurses will intervene by themselves without informing the nurse manager the next day. Managers who may not be on the site sometimes contact doctors directly to report the error. Nurses or manager(s) complete initial sections of the drug administration error form after taking actions to deal with the incident (Tariq et al. 2012).

As explained by one of the nurses at site C, *"We have to write down the dates, the time, what happened, how it happened"* (Tariq et al., 2012, p. 6). The partially filled report is then forwarded to the manager or team leader. They then document details of how the error was managed and which stakeholders were consulted in response to the error. As explained by a nurse at site A "*The manager will document the follow up like what has been done for this mistake. What action we have been taken, like [for example] staff education"* (p. 6) Communication with the pharmacy is done only when incident is related to them (such as a drug packing error). As informed by deputy manager site B *"We do not need to communicate with pharmacy for*

incidents all the time, only if there is a need, if there is a query about a medication, or there is a medication missing" (p. 6) (Tariq et al. 2012).

The nurse manager or team leader needs to fax the partially filled Medical Incident Report (MIR) form to the pharmacy to get their comments on the incident. The manager or staff member also needs to update the resident's electronic progress notes to ensure that incoming staff are aware of the incident. The organisation has a pre-established set of rules which help the manager identify when a medication incident involves a quality assurance issue. The last part of the report focuses on documenting information when the incident led to a quality assurance issue. This requires free text description of what actions were taken to manage the issue and how the actions were followed up. The MIR report is completed only after the quality assurance actions have been executed (Tariq et al., 2012).

The completed MIR forms are held in temporary storage files by the manager, who then prepares monthly summary reports which document the type of incidents which have occurred (Tariq et al,2012). The managers are also required to complete a monthly key quality indicator (KQI) form, which includes the number of administration of different types. The monthly summary reports and KQI forms are either faxed or emailed to headquarters. At headquarters the quality management team utilises the monthly summary error reports from sites and the KQI forms to generate organisational level error summary reports. The files received are managed by the administrator who also prepares an Excel file which is analysed with support of Excel experts (part-time). The quality team manager then writes a narrative quarterly report to explain the trends in the collated data. The report prepared by

headquarters is shared with the organisational board's quality committee and the individual nurses (Tariq et al., 2012).

According to the Institute for Safe Medication Practices of Canada (2006), with a variety of reporting channels including telephone, electronic submission through a web portal, and mail, the Canadian Medication Incident Reporting and Prevention System (CMIRPS) offers nurses the opportunity to present error reports through the Institute for Safe Medication Practices (ISMP) of Canada voluntary practitioner reporting program component. This service, according to the ISMP of Canada, offers confidential (or anonymous,) reporting of incidents and does not collect identifying information about individual patients. Reports are accepted, not only from nurses but also, other health professionals working within the health care system, including physicians, pharmacists, technicians, and paramedics, as well as risk managers and staff of regulatory colleges, coroners' offices, and insurance providers. Garnerin et al, (2009) also noted that drug administration errors are typically reported through institutional reporting systems such as incident reports.

Barriers to Drug Administration Error Reporting

Barriers exist and hinder drug administration error reporting because of the various factors that are attributed to operational, institutional and individual intricacies involved (Hartnell et al,2012). Studies indicate that the most cited reason why drug administration errors were not reported was fear, which is expressed in various contexts; fear in general (Chiang, Lin, Hsu & Ma, 2009; Petrova, Baldacchino, & Camilleri, 2009); fear of punishment/ reprimand/disciplinary action (Chiang & Pepper, 2009; Kim, Kwon, Kim, & Cho, 2011); fear from being blamed; fear from press or media, licensing

board/Nursing Board; fear of losing job; fear of reaction from leadership, peer, patients and their families; and fear from being considered as troublemaker (Covell & Ritchie, 2009; Moumtzoglou, 2010; Kwon et al., 2011).

The blame and shame culture associated with drug administration error strongly contributes to under-reporting of errors (Butt, 2010). Fear of being singled out, punished, and facing lawsuits and other punitive measures discourages professionals from openly reporting errors. While blame and shame certainly reduces reporting, there are other cultural issues as well. For instance, Waring (2008) argued that many doctors believe that errors are an inevitable and unmanageable feature of work and hence error reporting is unnecessary. Furthermore, in some cases reporting is discouraged by administration, and doctors are concerned about the increased potential for managers to interfere in the regulation of quality of care. These beliefs have a strong influence on rates of error reporting.

Lack of coordination and consistency, as noted by Baker and Norton (2012) is another major barrier to the effective reporting of drug administration error by nurses. Baker and Norton argued that there are few coordinated, standardized, and comprehensive mechanisms to collect and analyze information on patient safety and medical errors in Canada. While the health care industry recognizes the importance of standardization as an indicator of quality and safety, variations exist across the board (Canadian Institute for Health Information, 2009). A possible explanation for such inconsistencies is that organizations may be unsure of what information on error and safety is pertinent to gather and disclose. Thus, greater coordination and communication is required to have systematic, simplified, and

standardized reporting mechanisms in place. Information systems and information technology can be utilized to assist in this process.

Research has also shown that lack of time, workload, competing priorities, and shortage of human, monetary, and technological resources are barriers to the reporting of errors (Baker & Norton, 2012). Reporting is also affected by institutional size and complexity (Waring, 2008). In smaller health facilities, for example, it may be easier to report errors whereas in larger institutions, it is perhaps more difficult to discover and discuss errors. Staff may also not think about identifying errors or they may not know how to properly report errors (Edmondson, 2004; Butt, 2010).

In a study conducted by Elder et al, (2007) among 139 physicians, nurse practitioners, physician assistants, nurses, and staff who took part in 18 focus groups discussion, the most frequently reported barriers were those related to burden of effort, specifically a lack of time to make the report and forgetfulness. Participants noted that, "*Sure it's only 5 minutes of your time, but who's got 5 minutes?"* or *"It's just one more added thing when we're already pushed to the limit."* (Elder et al., 2007). Participants also noted that they both forgot about making reports at all *("To be honest, I pretty much have forgotten about it")* (Elder et al., 2007) or they would plan on making a report later, but, *"I think I'll wait until I get a few minutes and then I'll do that and then at the end of the day you've already forgot the incident"* (Elder et al., 2007). Some participants mentioned that information required of the reporting tool (like patient demographics) was not always readily available. In addition, local computer problems and access made making online reports difficult for some participants (Elder et al., 2007).

Confusions about what to report and who to report to were also noted by Elder et al. (2007). These included lack of clarity about what constituted an error, the specific information requested in the report, and whether error identification and reporting applied to those in the back office. For example, "Working in medical records "*None of it applies to what I do, but it does apply to others."* Repetitive errors that seem to happen again and again, as well as rare ones related to the frequent errors noted the "*fatigue*" factor leading to *"detracting from wanting to report it"* (Elder et al.,2007).

Another barrier to reporting was related to the severity of the error, where less serious errors were less likely to be reported. For example, this participant noted that *"I think for me, the level of it (the error) was just not that big a deal. I haven't reported any but that doesn't mean I haven't seen them."* Feeling personally responsible for an error was a barrier for some participants. For example, *"I never thought of reporting something that I did," and "If it's something I goofed on it's a lot easier to say, I'm not sure that was an error"* (Elder et al., 2007).

Bayazidi et al,(2012) in a descriptive study conducted among 733 nurses working in Urmia teaching hospitals noted that nurses considered the most important barriers to medication error reporting as blaming individuals instead of the system, fear of consequences of reporting, and fear of being punished for the error. They also identified "*no need to report if no harm to patient", "medication error perceived as unimportant by nurses", and "medication error reports take too long to complete"* as less important barriers to medication error report (Bayazidi et al., 2012, p. 34).

A cross sectional, descriptive study conducted by Koohestani, & Baghchegh (2008) using self-report questionnaires among 240 nursing students in three nursing schools at Arak University of Medical Sciences in Iran used a Likert range of 1(strongly disagree) to 6 (strongly agree). It was found out that an estimated 80.12% of all medication errors by nursing students are mostly reported to their instructors. Administrative barrier (standardised mean=4.31) and fear (standardised mean=4.24) were the major reasons outlined for not reporting medication errors among nursing students. Comparing the standardised mean of each subscale, administrative barrier (standardised mean=4.31) was considered as a major barrier. "No positive feedback" tended to have the highest level of agreement with a mean greater than five; demonstrating the item "No positive feedback" was located between agree and strongly agree. However, the items ''focus on individual rather than system factors to medication administration error (MAE)' was 4.66(0.97) whereas 'Much emphasis on MAEs as nursing quality provided was 4.60(0.89) indicating agree and somewhat agree (Koohestani & Baghchegh 2008).

Theoretical Framework

Reason's Model of Accident Causation

Reason's model of Accident Causation (2000) is based on the assumption that active failures on the part of front-line individuals occurs as a result of the conditions in which they work, often termed error producing conditions. Reason's model proposes that within complex systems such as hospitals, multiple barriers or layers exist to prevent accidents or errors. In health care these layers may include hospital policies, protocols or clinical

guidelines. However, Reason (2000) suggests that each of these safety barriers has random holes or weaknesses and when these holes align, the patient is able to pass straight through the barrier, resulting in an adverse event.

These holes are labelled latent conditions and the adverse event which occurs is an active failure (Reason, 2000). Reason (2001) describes two simple ways in which failure can occur: the plan is adequate but the associated actions do not proceed as intended, or the actions go as intended but the original plan was flawed. These failures may be labelled as either an error or a violation. Errors are defined as the failure of a planned sequence of actions to achieve the desired goal (Reason, 2001). They can be further categorised as slips, lapses or mistakes. Slips are actions in which there are recognition or selection failures, such as confusing the dose of two drugs. Lapses are a failure of memory or attention, such as failing to cease a drug on a medication chart. Mistakes include the incorrect choice of objective, or choice of an incorrect path to achieve it (Dean et al,2002). Errors may therefore be a skill-based slip or memory-based lapse, or rule-based or knowledge-based mistakes. A violation is an instance in which rules of correct behaviour such as clinical guidelines are consciously ignored by the clinician (Dean et al., 2002).

The strength of Reason's (2000) model is the focus on the system or environment in which the event occurred, rather than the individual involved as the cause of the event, and to randomness rather than deliberate action, in medical errors (Perneger, 2005). This is because when an accident occurs it is usually due to a specific trigger which has influenced the long-term failures in the design of the system (Johnson & Botting, 1999). Examples of such triggers include staffing levels or staff workloads (Dean et al., 2002).

The implication of the model for the study is that medication errors that occur in the hospital settings are mostly as a result of the error prone environment in which doctors, pharmacist and nurses work. In turn, the healthcare system policies, organizational decision, and environment in which nurse's work can result in drug administration error. Over the years, the model has been used to critically examine and evaluate incidents in various clinical settings such as in obstetrics, mental health and emergency care settings.

Reason's error causation model guided the development of a protocol for the routine investigation of adverse incidents in hospitals (Vincent, 1999). The model was considered relevant to the study because it promotes the identification of environmental, institutional and system factors that contribute to drug administration error for the necessary intervention (Chang, 2007). However, the model does not aid in the identification of the individual factors that can contribute to drug administration errors in the hospital settings. It was therefore not directly adopted as the conceptual framework of the study, but combined with the behavioural health care model to construct the conceptual framework.

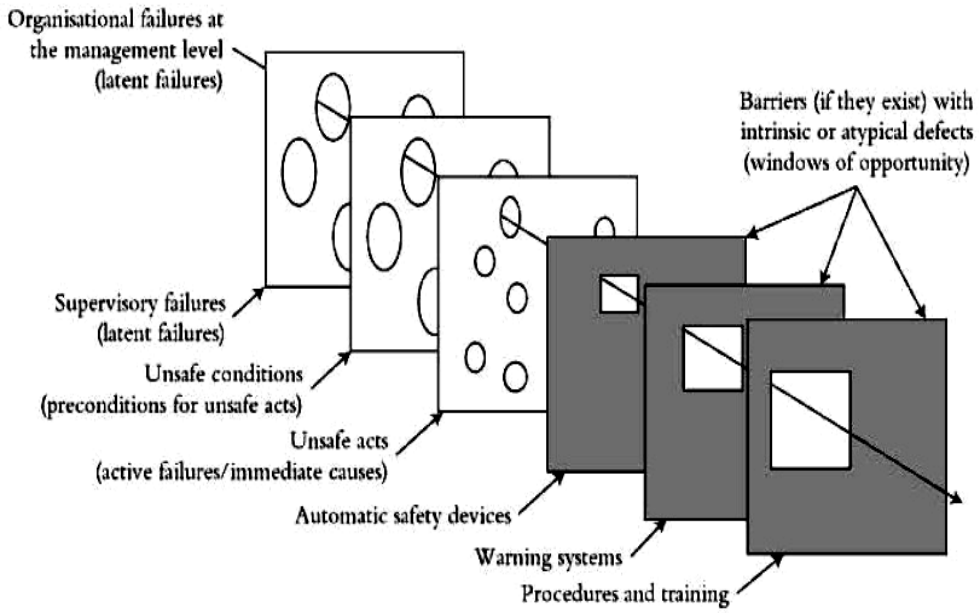

Figure 1: Reason's model of accident causation

Source: Reason (2001).

Behavioural Health Care Model

The model was originally propounded by Anderson in 1972. It was however, subsequently reviewed by Anderson and Newman (1973). The behavioural health care model was originally developed to aid investigations into the use of biomedical healthcare services. The main tenets of the theory are pre-disposing, need and enabling factors, which influence utilisation of health services. Thus, the theory describes the roles of predisposing, enabling and need factors in influencing utilisation of healthcare services (Andersen, 2008). Predisposing factors include religion, sex, education, age, previous experience with illness, attitude towards health and knowledge of health (Anderson, 1972).

Anderson (2008) describes the enabling factors as being external to the individual but important in influencing his/her decisions concerning the performance of behaviour and includes the presence of a health care facility

within a certain minimum distance, availability of financial resources to the individual and effectiveness of existing health support systems. The need factors according to Anderson (2008), refer to perceptions of the seriousness of a disease or health condition, which include availability of help for care and support. Existing predisposing factors as noted by Anderson, combine with enabling and need factors, influence a person's utilisation of healthcare facilities and services (Wilson, Deane, Ciarrochi, & Rickwood, 2005; Anderson & Newman, 1973; Anderson, 1972).

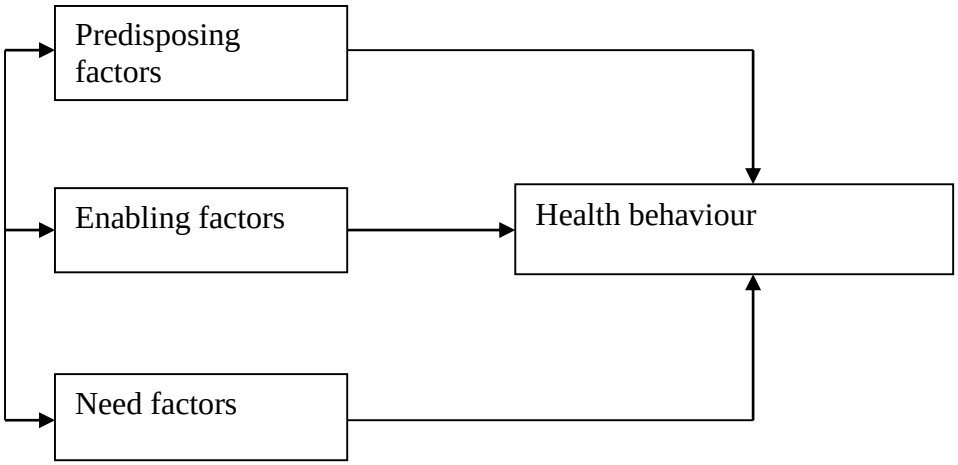

Figure 2: Behavioural healthcare model

Source: Anderson (2008)

The theory has been criticised for the fact that it does not pay attention to cultural dimensions and social interactions (Wilson et al., 2005). Also, the model has been criticised for over-emphasising need factors which influence health behaviour instead of social structure and health beliefs, even though Andersen (2008) argued that need, in itself, is a social construct.

Despite these criticisms, the Behavioural Health Care Model was considered relevant to the current study because of its strength in spelling out the various factors that may influence the reporting of drug administration errors by

nurses. Thus, with regards to drug administration errors, the healthcare utilisation model was relevant to this study in helping to identify the influence of factors such as age, knowledge and attitude of healthcare providers which may either serve as factors influencing or barriers in the reporting of drug administration error by nurses.

Although aspects of the model have been used to study healthcare utilizations behaviour of clients, no study has studied the predictions of the model fully on how personal characteristics of the nurse (representing the health status of the nurse, years of training, psychological factors, fatigue, level of training) can influence the healthcare practices of nurses in Ghana. Thus, there is a still a question as to whether personal characteristics of the nurse can contribute to drug administration error in Ghanaian hospitals. Therefore, this study seeks to modify and adapt the healthcare behaviour model.

This model was chosen as the suitable framework for this topic because although environmental factors, policies of the health care system can contribute to drug administration error's in the hospital settings, Andersen and Newman's model (1973) potentially provides a more comprehensive framework for understanding how personal characteristics of nurses can contribute to drug administration errors. For instance, when the ward environment is well equipped with safe medication administration equipment, there is an adequate staffing on the ward and standard protocols are available on the ward for administrations of high risk medications, the individual nurse characteristics and professional skills (drug administration techniques) can contribute to drug administration error.

Conceptual Framework

The Reason's model of accident causation and the behavioural health care utilization model were adapted to form the conceptual framework for the study. The behavioural health care utilization model for instance relates environmental and personal characteristics to health behaviour and reasons model of accident causation outlines organisational/system and internal factors that relate to error. Some people are more likely to err than others for constitutive (canonical) reasons, such as their intrinsic thoroughness, hesitancy, or perfectionism (McManus & Vincent, 1993).

The eclectic conceptual framework was important in realizing the role of organizational, nurse characteristics, internal environment, as well as the nature of the medication administration process in safe drug administration and hence, avoidance of drug administration errors. This is evident in the fact that preventing drug administration errors depends on awareness of the causes or contributing factors (Evans, 2009: Alsulami, Conroy, & Choonara, 2013).

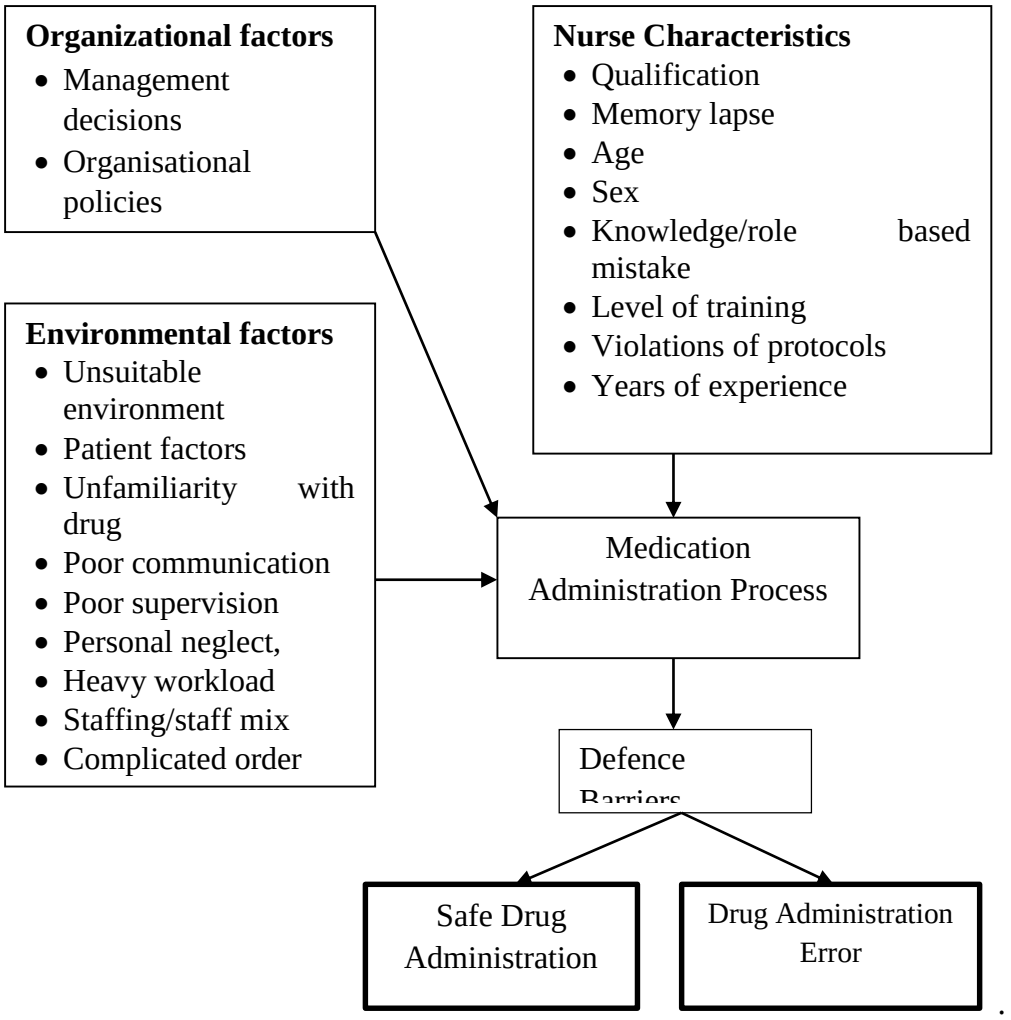

Figure 3: Conceptual framework
Adaption of Reason's Theory of Error Causation (1999) and Anderson's Behavioural Healthcare Model 1973)

Conclusion

The study reviewed various theories but used Reason's Accident Causation Model (Reason, 1999) and Andersen's health model (Andersen & Newman, 1973) to aid in identifying factors that contribute to drug administration error for the necessary intervention. The Reason's Accident Causation Model (Reason, 1999) was used to examine environmental, institutional and system factors that contribute to drug administration error whilst Andersen's health model examined how predisposing characteristics

from the work environment, enabling resources (the nurses level of training, years of experience), needs, personal way of practices, and psychological factors of the nurse influence their practices during drug administration procedures.

According to Ghasemi, Valizadeh and Moumennasab (2009), about 98.8% of drug administration errors can be prevented by increasing number of staff proportional to patient load, 96.5% by training personnel and 69.8% by providing information on new drugs to nurses through in-service training. A study by Baghcheghi and Koohestani (2010) among 22 nurse instructors in Arak recorded that increasing the duration of theoretical education for pharmacology courses can prevent drug administration error by 40%, in addition to adapting educational objectives to practical requirements of students in pharmacology (40%), providing access to pharmacology textbooks in wards and registration of drug history on admission by physicians (Nasiripour et al, 2011).

Literature outlined several available approaches to gathering data on medication errors. Voluntary reporting is the most common. Voluntary medication error reporting systems rely on the ability and willingness of individual physicians, pharmacists, and nurses to detect and report errors as part of their routine practice. A nurse reports to the nurse manager who then reports to the appropriate authorities for intervention and preventive feedbacks to the nurse. Other approaches involve filling an incidence form.

Promoting safety in the drug administration process is vital because adverse events have significant consequences, such as increasing hospital admissions, prolonging hospital stays, using additional resources, increasing

the amount of time staff spend away from work and lowering patient satisfaction. And, medication errors can cause patients harm, the result of which can range from slight discomfort to death (Härkäne et al,2013).

CHAPTER THREE

RESEARCH METHODS

The chapter discusses the study design, study setting, population, sample size and sampling procedure, data collection procedures, ethical considerations, data processing and analysis.

Study Design

The study employed a quantitative cross sectional survey design. The research was cross-sectional because the data covered the relationship between the variables of interest from different district hospitals in the Central Region, over a short period. Although this method did not capture changes in drug administration error that occur over time, it was easy to manage (Akpabio & Ebong, 2010).

Study Setting

The study area was the Central Region of Ghana, which lies in the south central part of Ghana. The Region is the second most densely populated in the country, with a population density of 224.1 persons per square kilometer (Central Regional Annual Report(CRAR), 2012). According to CRAR (2012) the land boundaries of the Central Region envelops 17 administrative districts.

Health care in the Region is provided by the government and administered by the Ghana Health Services through the Regional Health Directorate. The Region boasts of five levels of the health care providers: health posts, health centers and clinics, district hospitals, regional hospitals and a tertiary hospital.

Health care facilities is erratic throughout the Region where the urban centers contain most hospitals, clinics, and pharmacies (Central Regional

Annual Report, 2012). The Ghana Fact and Figure Report (GFFR) (2010) concerning the health sector shows that, the Central Region has 267 health facilities which comprised of 135 public, 115 private and 17 mission/quasi. The distribution of health facilities does not favour the large rural majority.

There are 13 major district/municipal hospitals (9 governments owned, 1 quasi, and 3 Christian health associations) that serve the majority of people within the urban areas. Over the years, access to health care within the region has increased because of the availability and use of the National Health Insurance Scheme (NHIS) (Gates, 2013).

The Human Resource Division –Ghana Health Service Report (2009) showed that there are about 740 professional nurses and 644 auxiliary nurses across the facilities within the Region (MOH, 2011).

Population

The study targeted all nurses who are licensed by the Nursing and Midwifery Council of Ghana to administer drugs to patients admitted to district hospitals within the Central Region of Ghana. These include registered general nurses (with Professional Identification Number) and enrolled nurses with (Auxiliary Identification Number). Three hundred and seventy (370) nurses work on the medical, surgical or general adult wards within the 12 district/municipal hospitals in the Central Region. However, for the sake of this study, only 263 nurses who work in the medical, surgical and general adult wards from 8 selected hospitals were targeted for the study.

Inclusion Criteria

The study focused on general registered and enrolled nurses who were actively involved in administering drugs to patients on admission in the general adult, medical and surgical wards.

Exclusion Criteria

Nurses who work in specialty wards were excluded. Thus, nurses who worked at the general out-patient department, intensive care, pediatric, emergency, public health, theatre and psychiatric wards were not included in the study.

Sample and Sampling Procedure

The study employed the multi stage sampling technique, a probability method to select a sample of 200 nurses for the study. The sample was necessary because all district hospitals within the Region could not be visited during the period of the study.

First, the list of district hospitals was obtained. The researcher randomly selected eight hospitals from this list. Subsequently, a proportional allocation was done with respect to the total number of nurses from each hospital (see Table 1). Finally, the simple random sampling technique was used to select the proportion of participants allocated to each of the hospitals.

The researcher visited each of the hospitals sampled within the hours of 7:15am – 10:00am and 1:30- 3:00pm during the morning and afternoon shifts respectively to administer the instrument. For the researcher to be able to access respondents who might be off duty for about three days or more, the researcher visited each of the hospitals sampled within these hours, on

alternate days until the researcher gets the total number of nurses allocated for that hospital.

A sample size of 163 nurses was determined for the study. The sample size was determined using a published sample size table by Glenn (2013). With a total population of 263 nurses from the eight district hospitals, 163 nurses were supposed to be selected for the study, at an assumed 5% level of precision and 95% confidence level. However, 200 nurses were selected to make up for non-respondents at an estimated 20% drop-out rate that may occur since some copies of the questionnaires were not collected on the same day of distribution.

Table 1: *The Population and Sample Size of the Nurses in the Hospitals Sampled*

Targets	Population	Percentage	Sample size
Swedru District Hospital	33	13	26
Ejumako District Hospital	29	11	22
St. Francis Hospital Asin-Foso	26	10	20
Winneba Municipal Hospital	34	12	24
Cape Coast Metropolitan Hospital	49	19	38
Abura-Dunkwa District Hospital	31	12	24
Ankaful Leprosarium and General Hospital	32	12	24
Salt Pond District Hospital	29	11	22
Total	263	100	200

Source: Fieldwork, 2014

Ethical Considerations

Ethical clearance was sought from the University of Cape Coast Institutional Review Board for ethical approval to conduct the study. An introduction letter from School of Graduate Studies, University of Cape Coast certified by the School of Nursing and Midwifery was also submitted to the administrators of the sampled hospitals to seek their approval to collect the data. These were done to ensure scientific integrity of the research and to protect the rights of the institution and the respondents.

The nature and purpose of the study was explained to participants. The questionnaires were anonymous and filled out by the participants themselves. Participants were also assured of privacy, confidentiality and the right to withdraw from the study at any point in time. A verbal permission was sought from participants, and field assistants to get participants' informed consent to partake in the research.

Field assistants were nurses selected by the researcher from each hospital to help the researcher in retrieving the copies of the questionnaires from the respondents. The field assistants were asked to sign a letter of confidentiality. Informed consent forms and letters of confidentiality were kept under lock and key, and only the researcher had access to them. The eight selected field assistants were trained on how to retrieve copies of the questionnaires from respondents.

Research Instrument

A researcher - designed questionnaire (See Appendix A), was used to gather primary data from respondents. The questionnaire was used because nurses are deemed literate and could read and write. The development of the

questionnaire was guided by literature and review of questionnaires used in other studies, as well as a recognizance survey which involved review of the incident books in the wards. The medication related comments from incident book were reviewed to identify additional variables to include in the questionnaire. The questionnaire was further designed based on the objectives of the study.

The questionnaire contained both open and close-ended questions. The open-ended questions were to allow respondents to express their views and opinions on some key issues. The close-ended questions aimed at ensuring uniformity in the responses and thus foiling self-expression of any kind (Sarandakos, 2005). There was a filter question to identify those who committed drug administration error.

The questionnaire consisted of six sections. Section A focused on the socio-demographic characteristics of the nurses. Sections B and C contained questions on the types and frequency of drug administration error, and the factors contributing to drug administration error, respectively. Section D had questions on channels of reporting drug administration errors whilst Section E presented questions on barriers of reporting drug administration error. Lastly, Section F focused on nurses' perception on effects of drug administration error on in-patients.

The researcher distributed the copies of the questionnaires to nurses who administer drugs to in-patients in the general adult, medical and surgical wards. The respondents were allowed to self-complete the questionnaire, which was collected by the researcher or the field assistants either on the spot or after three days. To ensure confidentiality of responses, filled questionnaire

were placed in envelope and sealed before handing them over to the field assistants. The field assistants followed-up on participants to ensure that they filled the questionnaires and then collected them on behalf of the researcher.

Pre-testing

To ensure the reliability of the questionnaire, 17 nurses from the medical and surgical wards of the University of Cape Coast hospital were selected to respond to the questionnaire prior to the start of the study. The pre-test was necessary to check whether the proposed methods and instruments were appropriate to measure the variables of interest. The University Hospital was selected because it had similar characteristics to the study hospitals as it serves a large portion of the population within the Cape Coast Metropolis, just as the district hospitals (Central Regional Annual Report, 2012).

The content and face validity of the questionnaire were established when it was reviewed by the study supervisors. The review allowed several constructive suggestions which were effected in the questionnaire. The least Cronbach alpha generated for each of the component was 0.768. This indicated that the instrument had relatively high internal consistency; therefore, reliability was considered adequate (Leedy & Ormrod, 2010).

Data Collection Procedures

The researcher administered copies of the questionnaire after receiving ethical approval (Appendix A). The copies of the questionnaires were coded prior to administration, to guide retrieval and analysis of instruments. The researcher visited each of the hospitals sampled within the hours of 7:15am – 9:00 am and 1:30- 3:00 pm during the morning and afternoon shifts respectively to be able to get respondents on all three shift. Respondents were

randomly selected and allowed to self-complete the questionnaire within three days after receiving the questionnaire. This was done to enhance maximum participation in the research. The researcher collected the names and telephone numbers of the field assistants. Two days after giving out the questionnaires, the researcher made a follow-up call to remind the field assistants to retrieve copies of the questionnaires. This was done to enhance maximum retrieval of instruments. The researcher thanked respondents and field assistants for their time and contributions.

Data Analysis

Data collected from the field were processed using the STATA, version 14. Descriptive and inferential statistics were used to analyse the data. Percentages, means, and standards deviations were used to describe the socio-demographic characteristics of the respondents. Responses on types of, and underlying factors to, drug error commitment were also analysed using descriptive statistics. Independent samples t-test and oneway analysis of variance (ANOVA) were used to assess whether there are variations in drug error commitment across respondents' background characteristics (e.g. sex, level of education). For the ANOVA, the Fisher's least significant difference (LSD) method, one of the post-hoc or *posteriori* methods (Pallant, 2005) was carried out to identify where differences existed among the various groups of nurses and errors. Third, the Ordinary Least Squares Regression (OLS) technique was used to identify predictors of drug error commitment. Types of drug errors committed were considered as the dependent variable, while personal, organisational and internal environmental factors were the

explanatory variables. For both the comparison of mean differences and the OLS regression, significance level was set at $P < 0.01$and 0.05.

CHAPTER FOUR

RESULT AND DISCUSSION

This chapter presents and discusses the results in relation to drug administration error and its perceived effect on patient safety in Central Ghana. Out of the 200 respondents selected, 168 responded, giving a retrieval rate of 84%. However, the analysis was based on 139 respondents who admitted that they had ever committed drug administration errors.

Results

Demographic Characteristics of Respondents

This section describes the background of the nurses included in the survey. Data on the characteristics of the respondents were collected to help have an understanding of the background of the 139 nurses from the eight selected hospitals in the Central Region. The characteristics examined comprised sex, age, marital status, religion, educational level, duration of practice and ward in which the nurses practiced at the time of the study. Table 3 presents the analyses on the above variables.

Table 2: *Demographic Characteristics of Nurses from Selected District Hospitals in the Central Region, Ghana (*N=139)

Characteristics	Frequency (%)
Sex	
Male	56(40.3)
Female	83(59.7)
Age	
>29 years	90(64.7)
30-39	31(22.3)
>40	18(12.9)

Table 2: *Cont'd*

Marital Status	
Unmarried	53(38.1)
Married	86(61.9)
Years of experience	
1-4 years	104(74.8)
5 years and above	35(25.2)
Qualification	
Enrolled nurse	62(44.6)
Diploma registered	52(37.4)
Post diploma nurse	12(8.6)
First degree nurse	13(9.4)
Ward	
Medical ward	52(37.4)
Surgical ward	8(5.8)
General adult ward	79(56.8)

Source: Field work, 2015

It was observed that more females (59.7%) than males (40.3%) participated in the study. The majority of the respondents representing (61.9%) were below the ages of 29 years, married and were Christians (87.1%). Most of the respondents (72.2%) had worked between one and four years. Respondents with certificate qualifications (45.5%) dominated, and most of them were working within the general ward (56.1%).

Before profiling the types and frequency of drug administration error, the researcher asked respondents to generally indicate the severity of drug administration error commitment, on a scale of 1 to five.

Table 3: *Relationship between Socio-Demographics and Severity of Drug Administration Error Commitment among Nurses from selected District Hospitals in the Central Region, Ghana*.

Characteristics	**Coef.**	**Std.Error**	**t**	**P-value**
Sex (reference. female)				
Male	-0.264	0.09	-2.89	0.004**
Religion (ref. Islam)				
Christianity	-0.081	0.19	-0.42	0.679
Marital Status (ref. unmarried)				
Married	-0.009	0.08	0.12	0.901
Years of experience (ref.1-4years)				
5 years and above	-0.017	0.12	-1.40	0.162
Age (ref.> 29 years)				
30-39	0.131	0.10	1.20	0.232
>40	0.129	0.19	0.65	0.519
Qualification (ref. Enrolled)				
Enrolled	0.065	0.08	0.73	0.468
Diploma	0.335	0.18	1.84	0.068
Post diploma	-0.549	0.18	-3.60	<0.0001**
First degree	-0.649	0.18	-3.70	<0.0001**
Ward (ref. Medical ward)				
Surgical ward	-0.001	0.21	-0.01	0.993
General adult ward	0.254	0.08	3.01	0.003**

Source: Field work, 2015 Notes: ** p-value < 0.01; * p-value < 0.05

From the table above, it can be observed that severity of commitment of drug administration error varied by sex such that severity of error commitment was higher for males (β = -0.264) compared to their female counterparts. Unexpectedly, error commitment severity increases with increasing level of education. It was established that respondents with post diploma (β = 0.549) and degree (β = 0.649) were more likely to commit drug administration error relative to the certificate holders. Respondents in the general adult ward (β = 0.254) were also more susceptible to drug administration error as opposed to those on medical ward. All in all, the OLS model predicted about 23% of the variance in drug administration error.

Research Question 1: Profile Drug Administration Error

This research question proposes to examine the types of drug administration error that occurs in the hospital; how often they occur; during which shift they often occur as well as identify which group of respondents are more likely to commit what type of error. In addressing this research question, respondents were asked to indicate the types of drug administration error and how often the errors occur in their respective facilities. Table 3 presents the level of occurrence of different types of errors.

Table 4: *Types and Frequency of Drug Administration error among Nurses from Selected District Hospitals in the Central Region, Ghana* (N=139)

Types of errors	Mean	Std.Error
Pre-administration	**2.67**	**0.86**
Not washing hands before administering drug	3.00	0.83
Not arranging folders according to bed number	3.00	0.90
Trolley not well equipped	2.00	0.85
Administration techniques	**2.67**	**0.80**
Right patient using 2 identifiers	3.00	0.75
Right medication by reading label, expiring date	3.10	0.78
Serving medication of one patients to another patient	2.00	0.88
Administration time error	**2.00**	**0.80**
Administering drug at wrong time	2.00	0.76
Administering drug over ordered duration	2.00	0.83
Order base error	**1.63**	**0.77**
Administering different amount of drug than prescribed	1.00	0.88
Administering drug not prescribed	1.64	0.79
Administering different dose than prescribed	1.56	0.71
Serving drug through a route different from the one ordered	1.00	0.71

Table 4: *Cont'd*

Drug preparation error	**1.67**	**0.89**
Diluting drug not supposed to be diluted	1.00	0.89
Using too much diluent to dilute	2.00	0.89
Crashing tablets that are not supposed to be crushed	2.00	0.89
Drug storage	**2.23**	**0.80**
Putting topical and oral drugs in same chamber on the medication trolley.	2.00	0.84
Constituting ampoule/vial and leaving it open	2.05	0.83
Poor refrigeration(long period, not to be used)	3.00	0.73
Drug documentation error	**2.00**	**0.84**
Pre-charting of drug before administering	2.09	0.87
Not/wrongfully charting drug administration	2.00	0.80

Scale: 1 = Never; 2 = Sometimes; 3 = Always
Source: Field work, 2015

The result from table 4 indicates that, on the average, respondents occasionally committed all the type of drug administration errors (mean 2.03). The most common types of error committed include pre-administration error (mean= 2.67), administration technique error (mean=2.67) and drug storage error (mean=2.23). A similar pattern was also observed on the specific drug administration constructs and how often they occur. As regards pre-administration error, what deserves highlighting is the fact that respondents do not always wash their hands before administering drugs (mean = 3.00) likewise, they do not arrange folders according to bed numbers (mean = 3.00). On administration technique errors, it was observed that respondents regularly do not identify "right patient using 2 identifiers (mean = 3.00) prior to drug administration and "right medication by reading label, expiring date (mean = 3.10). Poor refrigeration was also identified as a major error under the drug

storage error (mean = 3.00). However, order based error (mean = 1.63) and drug preparation error (mean = 1.67) were rarely committed.

The respondents were asked to indicate the shift within which these drug administration errors occurred more often. This is to enable the researcher to understand when the errors occur most often for necessary recommendation towards preventing drug administration error.

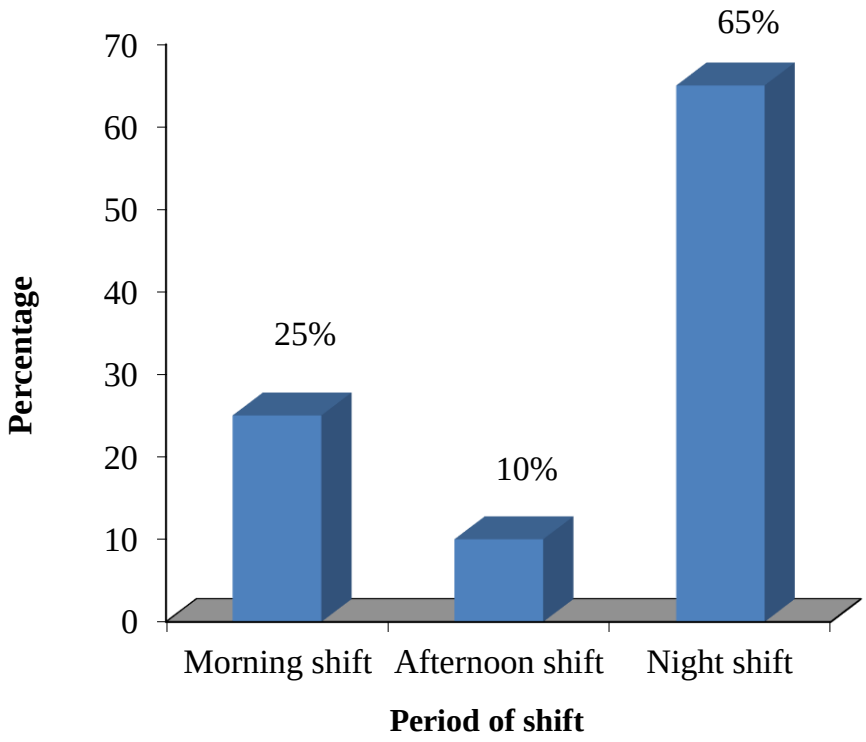

Figure 4: Occurrence of drug administration error during shift periods among nurses from selected district hospitals in the Central Region, Ghana

Figure 4 indicates that drug administration errors occurred most often (65%) during night shift. Inferential analysis was done to identify the characteristic of respondents who are more likely to commit which type of drug administration errors. Table 5 below outlines which category of respondents is likely to commit what type of drug administration error.

Table 5: *Background Characteristics by type of Drug Administration error among nurses from Selected District Hospitals in the Central Region, Ghana*(N=139)

		PAE		ATE		ATME		OBE		DPE		DSE		DDE	
Variable	N	Mean	t/F	Mean	t/F	Mean	t/F	Mean	t/F	Mean	t/F	Mean	t/F	Mean	t/F
Sex															
Male	56	1.98	3.25**	2.29	1.87	1.91	2.48**	1.53	2.69**	1.88	0.35	1.96	3.65**	1.70	4.82**
Female	83	2.37		2.52		2.15		1.81		1.84		2.38		2.17	
Religion															
Christianity	121	2.24	0.33	2.41	1.29	2.07	0.15	1.71	0.10	1.78	2.72**	2.26	1.25	2.02	0.38
Islam	18	2.18		2.62		2.09		1.70		2.29		2.07		1.96	
Marital Status															
Unmarried	53	2.25	0.32	2.52	1.05	2.03	0.37	1.74	0.62	1.83	0.26	2.22	0.039	1.97	0.29
Married	86	2.21		2.38		2.07		1.67		1.86		2.22		2.00	
Years of experience															
1-4 years	104	2.23	0.09	2.41	0.57	2.01	1.38	1.62	2.26*	1.78	1.67	2.20	0.33	1.95	1.28
5 years and above	35	2.21		2.49		2.17		1.90		2.03		2.25		2.10	
Age															
20-29	90	2.17		2.43		2.03		1.70		1.75		2.28		1.98	
30-39	31	2.38	1.03	2.31	0.98	2.13	0.37	1.70	0.01	1.97	2.65	2.06	1.17	2.03	0.09
>40	18	2.20		2.62		2.08		1.68		2.16		2.16		1.97	
Qualification															
Enrolled	62	2.26		2.21		2.06		1.60		1.91		2.38		2.01	
Diploma	52	2.10	7.34**	2.62	5.45**	1.95	8.71**	1.69	9.12**	1.61	10.8**	2.05	3.52**	1.88	5.51**
Post-diploma	12	1.73		2.26		1.73		1.40		1.53		1.86		1.73	
First degree	13	2.94		2.88		2.77		2.50		2.83		2.38		2.58	
Ward															
Medical ward	52	2.38		2.80		2.19		1.96		2.10		2.26		2.16	
Surgical ward	8	2.18	2.13	2.09	12.6**	2.04	2.16	1.68	8.48**	1.72	4.92**	2.09	0.24	2.13	4.26**
General adult ward	79	2.12		2.21		1.97		1.52		1.69		2.20		1.86	

Source: Field work, 2015 Notes:statistically significant: p-value < 0.01**; p-value < 0.05* Scale: 1 = Always; 2 = Sometimes; 3 = Never

Commitment of drug administration error was further analyzed across respondents' background characteristics using independent samples t-test and ANOVA. Sex, education qualification and type of ward consistently predicted variation in respondents' views on commitment of drug administration error. As regards sex and the various types of drug error commitment, except for administration technique (t = 1.87) and drug preparation error (t= 0.35), significant difference were noted in the rest of the errors. Whereas males indicated that they often commit pre-administration error (mean = 1.98), the females were of the view that it occurred occasionally (mean = 2.37). Similarly, males acknowledged that administration time error (mean = 1.91) and drug storage error (mean = 1.96) occur every time, which is contrary to the females' opinion that they seldomly occur (Table 5).

Worth commenting on is the variation observed in drug documentation error commitment and level of education or qualification. ANOVA showed that whereas those in the general adult ward agreed that drug documentation error occurs often (mean = 1.86), those in the surgical (mean = 2.13) and medical wards (mean = 2.16) said it occurs occasionally. Drug preparation error occurrence was also high among those in general (1.69) and surgical (mean = 1.72) wards compared to those in the medical ward (mean = 2.10). The indication here is that respondents in the surgical and general wards admit that they often commit drug preparation error, whilst those in the medical ward opined that it occurs but not often.

Research Question 2: Factors Contributing to Drug Administration Error

Factors contributing to drug administration error were examined based on personal, organizational and internal environmental factors.

Table 6: Factors *Contributing to Drug Administration Error among Nurses from selected District Hospitals in the Central Region, Ghana* (N=139)

Causes	Mean	Std. Error
Personal factors	**3.22**	**0.83**
Lack of sufficient information about the medication	2.41	0.68
Lack of adequate information about the patient	2.42	0.78
Forgetfulness/memory lapse	3.64	0.85
Too much work load	2.62	0.87
Psychological state of the nurse	2.88	1.03
Not observing the 5 rights of medication administration process	3.06	0.86
Lack of understanding of medical/medication jargons	3.89	0.87
Poor handing/taking over	3.45	0.93
Feeling too sleepy	3.56	0.85
Feeling uncomfortable to wake patient up	3.78	0.76
Eager to go home	3.67	0.65
Organisational/system factors	**2.94**	**0.86**
Lack of standard protocols for administration of high risk medications on the ward	2.93	0.87
No in-service training on new medication products and their use	2.59	0.92
Poor working condition in the ward	2.52	0.88
Poor staffing on the ward	3.41	0.93
Long consecutive hours of working	2.81	0.90
Inaccessibility of patient information	2.84	0.88

Use of outdated drug reference /medication protocol	3.48	0.65
Internal environment factors	**2.75**	**1.03**
Poor communication with other nurses	2.81	0.84
Inaccurate handing over of medication orders and changes	3.06	0.86
No documentation of medication administration procedure	2.74	2.74
Miscommunication of drug orders from prescribers	2.80	0.84
Illegible handwriting of medication orders	2.87	1.07
Use of abbreviations	2.66	0.90
Writing incomplete prescription	2.73	0.99
Difficulty in hearing drug orders over phone	2.60	0.90
Poor lighting in the ward	2.68	0.98
Poor preparation / storage or labeling of drug	2.63	0.95
Interruption during medication administration	2.79	0.82
Demanding of attention by other patients	2.97	0.82
Receiving telephone calls from other units	2.45	0.95
Poor supervision of new staff/student nurses	2.88	0.83

Source: Field work, 2015
Scale: 1 = strongly disagreed; 2 = disagreed; 3 = agreed; 4 = strongly agreed

Personal related issues appeared as the most dominant factor that influenced drug administration error commitment (mean = 3.22). More specifically, 'lack of understanding of medical/medication jargons' (mean = 3.89), feeling uncomfortable to wake patient up (mean = 3.78) and eagerness to go home (mean = 3.67) were reported as the most predisposing factors to

drug administration error commitment. Moreover, forgetfulness (mean = 3.64) and poor handing/taking over were also highlighted (mean = 3.45). Though on the whole organization/system and environmental factors were disagreed by respondents as predisposing factors to drug error commitment, few issues were outstanding. These included use of outdated drug reference /medication protocol (mean = 3.48), poor staffing on the ward (mean = 3.41) and inaccurate handing over of medication orders and changes (mean =3.06) respectively.

OLS model was used to further find out which factor is more likely to contribute to a particular type of drug administration error commitment.

Table 7: Contributing Factors to Types of Errors *Nurses from selected District Hospitals in the Central Region, Ghana* (N=139)

Dependent variable	Explanatory variables	Coefficient	Std. Error	t	P>|t|
Drug administration error	Personal factors	0.216	0.12	1.82	0.070
	Organisational/system factors	0.035	0.11	0.32	0.750
	Internal environment factors	0.228	0.12	1.96	0.052*
	Constant	0.668	0.28	2.32	0.021
	$R^2 = 0.111$; $p < 0.0001$				
Pre-administration error	Personal factors	0.23	0.11	1.99	0.048*
	Organisational/system factors	0.09	0.11	0.83	0.408
	Internal environment factors	0.33	0.11	2.84	0.005**
	Constant	0.39	0.29	1.34	0.181
	$R^2 = 0.186$; $p<0.0001$				

Administration technique error	Personal factors	0.32	0.13	2.43	0.016
	Organisational/system factors	0.19	0.12	1.57	0.118
	Internal environment factors	-0.47	0.13	-3.65	<0.0001**
	Constant	2.37	0.32	7.37	<0.0001
	R^2 = 0.183; p<0.0001				
Administration time error	Personal factors	0.31	0.10	3.07	0.002**
	Organisational/system factors	0.01	0.09	0.17	0.867
	Internal environment factors	0.23	0.10	2.37	0.019*
	Constant	0.51	0.24	2.07	0.040
	R^2 = 0.153; p<0.0001				
Order base Error	Personal factors	0.12	0.11	1.06	0.289
	Organisational/system factors	-0.15	0.10	-1.40	0.165
	Internal environment factors	0.28	0.11	2.47	0.015**
	Constant	0.99	0.28	3.53	0.001
	R^2 = 0.125; p<0.0001				
Drug preparation Error	Personal factors	0.146	0.14	1.03	0.303
	Organisational/system factors	-0.01	0.13	-0.14	0.891
	Internal environment factors	0.18	0.14	1.35	0.178
	Constant	0.98	0.34	2.84	0.005
	R2=0.172; P< 0.0001				
Drug storage error	Personal factors	-0.08	0.11	0.49	0.49
	Organisational/system factors	-0.08	0.10	0.42	0.42

	Internal environment factors	0.63	0.11	4.00	<0.001**
	Constant	0.91	0.28	2.60	0.00
	R^2 = 0.195; p<0.0001				
Drug documentation Error	Personal factors	0.04	0.11	0.40	0.687
	Organisational/system factors	0.16	0.10	1.60	0.110
	Internal environment factors	0.15	0.10	2.42	0.03*
	Constant	0.97	0.27	3.61	0.000
	R^2 = 0.114; p<0.0001				

Source: Field work, 2015 Notes: Statistically significant **p-value < 0.01; * p-value < 0.05

The OLS model indicated that the factors all together explained about 11% of the variation in error commitment (as shown by the $R^{2)}$. Therefore, internal environment factors appeared to have contributed more to drug administration errors. The results suggest that internal factors were positively associated with drug administration error (β = 0.228). This means that increasing internal environment constraints corresponds with increasing drug administration error commitment by a factor of 0.228. In a similar vein, a significant association was observed between personal factors and drug administration error (β= 0.216); nevertheless, this relationship was not significant. Further disaggregation of the types of drug administration error by the factors showed that personal factors significantly accounted for all the administration related errors. These include pre-administration error (β = 0.23), administration technique error (β = 0.32) and administration time error (β = 0.31). Similarly, Table 7 suggests that the internal environment factors

significantly influenced the incidence of all the administration associated errors as well as drug storage error (β = 0.63) and order base error (β = 0.23). None of the factors markedly explained the incidence of drug documentation error.

Research Question 4: Nurses' Perception on the Effects of Drug Administration Error on Patient Safety

The perception of nurses on the effects of drug administration error on patient safety was examined. Respondents were asked to indicate if patients on admission are adversely affected when drug administration error occurs.

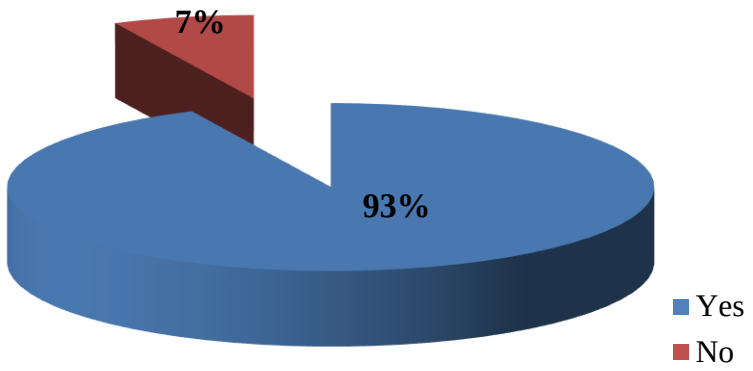

Figure 5: Patients being negatively affected when drug administration error occurs (N=139)

The result from Figure 5 show that 93% of the respondents said drug administration error does have negative effects on the patients. Respondents who said drug administration error does have adverse effects on patient safety, were asked to indicate the specific effects on in-patients.

Table 8: *Effects of Drug Administration Error on Patients among Nurses from selected District Hospitals in the Central Region, Ghana* (N=139)

Effects	Frequency (%)
Prolonged stay on admission	73(29.2)
Allergic reactions	64(25.6)
Death	49(19.6)
Poor recovery	48(19.2)
Extra cost of health care	16(6.4)

Source: Field work, 2015

As indicated in Table 8, more than one-quarter of the respondents felt prolonged stay on the ward (29.2%) was the most common effect of drug administration error on patients. Other effects mentioned include allergic reactions (25.6%) and death (19.6%).

Research Question 5: Channels of Reporting Drug Administration Errors

Respondents were asked to indicate whether they officially report the drug administration errors they committed.

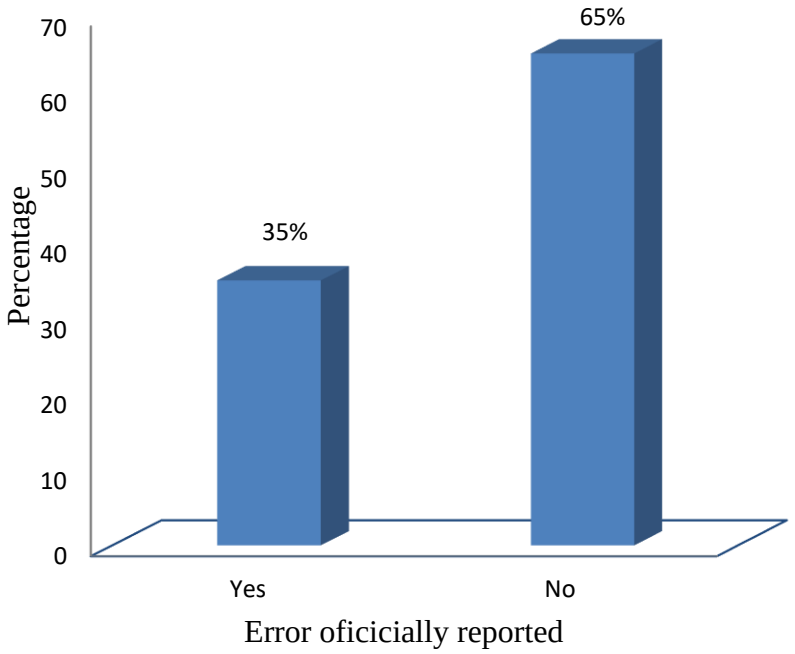

Figure 6: Drug administration error officially reported among nurses from selected district hospitals in the Central Region, Ghana

Source: Field work, 2015

From figure 7 above, among nurses who committed an error, only 35% said the errors were officially reported. Respondents who said they had reported the error (n=49) were asked to indicate how the errors were reported.

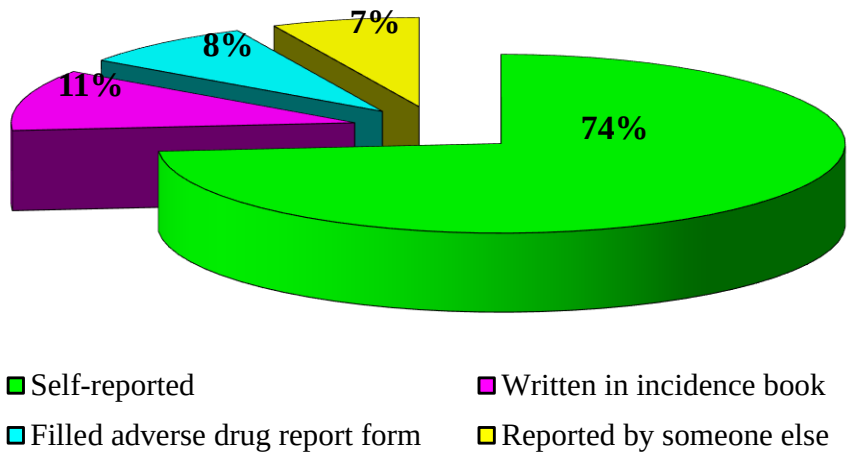

Figure 7: How drug administration error was reported *among nurses from selected district hospitals in the Central Region, Ghana*

Figure 7 points to the fact that 74% of the respondents said they self-reported the errors whilst 11% stated that the errors committed was recorded in the incident book on the ward. Respondents who self-reported drug administration error were asked to indicate the people to whom the errors were reported.

Table 9: *People to whom Drug Administration Error was Self-reported among Nurses from selected District Hospitals in the Central Region, Ghana*

Person error was reported to	Frequency (%)
Senior nurse on duty	23(23.5)
Colleague nurse on duty	31(31.6)
Ward in-charge	24(24.5)
Deputy Director of Nursing Services (DDNS)	88.2)
Pharmacist	12(12.2)

Source: Field work, 2015

Table 9 indicates that one third (32%) of the nurse's reported errors to their colleague nurses on duty, 25% reported to the ward in-charges whilst only 8% said they reported to the Deputy Director of Nursing Services in their hospitals.

Respondents were asked to indicate the availability of standard protocols/procedures at their facilities for the reporting of drug administration error. Those who said they had such protocols/ procedures at their facilities were then asked to indicate the specific protocols/procedures available.

Table 10: *Standard Protocols/Procedures available for Reporting Drug Administration Error among Nurses from selected District Hospitals in the Central Region, Ghana*

Specific Standard protocol/procedure available	Availability of a standard protocol/procedure in reporting drug administration error Yes Frequency (%)
Writing in incident book	15(10.6)
Report to nurse in charge through report writing	8(6.1)
Report to doctor on duty	2(1.5)
Not applicable	-

Source: Field work, 2015

Table 10 shows that 82% of respondents reported that no standard protocols/ procedures existed in their facilities for reporting drug administration error. Out of the 18% who said such protocols existed in their facilities, 11% said errors are reported by writing them in incident books.

Research Question 6: Barriers to Drug Administration Error Reporting

Barriers to drug administration error reporting were examined based on level of agreement ranging from strongly disagree to strongly agree on items that could serve as barriers. The barriers were classified as management-related and individual/personal based barriers. From the results in Table 11, it can be seen that the respondents had different beliefs about barriers in relation to reporting drug administration error.

Table 11: *Barriers to Drug Administration Error Reporting among Nurses from selected District Hospitals in the Central Region, Ghana*

Barriers	Mean	Standard Error
Management related barrier	**3.10**	**0.88**
No positive feedback is given for passing medications correctly	3.20	0.89
Nurse administrator focuses on the person committing the error rather than looking at the system	3.00	0.90
No /less emphasis placed on medication errors as a measure of the quality of care	3.10	0.85
Individual /personal factor	**2.89**	**1.09**
Nurses fear losing their license	3.00	0.82
Nurse not aware that an error occurred	2.00	0.87
Nurses could be blame if something happened to the patient	3.11	0.83
Nurses believe other nurses will think they are incompetent	3.00	0.65
Nurses fear rebuke from physician	3.00	0.74
No need to report if no harm to patient	3.10	0.74
Nurses want to avoid potential publicity of medication errors in the media	3.00	3.00

Scale: 1 = strongly disagreed; 2 = disagreed; 3 = agreed; 4 = strongly agree

Source: Field work, 2015

Comparing the standardized mean of each subscale, management related barriers (mean = 3.10) were acknowledged as reason why respondents

do not report errors committed. Respondents agreed that no positive feedback being given for passing medications correctly (mean = 3.20) discourages them from reporting errors, as well as no/less emphasis being placed on medication errors as a measure of the quality care (mean = 3.10). Despite the fact that the individual factors were mostly disagreed to, worth highlighting are that respondents agreed to "no need to report if no harm to patient" (mean = 3.10) and "nurses could be blamed if something happened to the patient "(mean = 3.11) as reason for not reporting drug administration errors.

Discussion

Drug administration error continues to threaten the safety of patient admitted to hospitals. Very little researches have been done on drug administration error in Ghana. This study aims to profile drug administration error from the nurse's perspective, identify the contributing factors and reasons that prevent the reporting of drug administration errors in the hospitals in Central Ghana.

Socio-demographic Characteristics of Respondents

The majority of the respondents (59.7%) were females. This could be due to the fact that nursing is usually considered as a profession for females, as such females are the ones who enter into it (Ozdemir, Akansel, & Tunk, 2008). Participants were generally 29 years or less and married. As women who were within their reproductive stage of life (almost thirty years old), they were supposed to get married early and give birth early, so as to avoid complications associated with childbirth at an older age of above 30 years as pointed out by Hope (2013). In this regard, Carlson (2007) found a positive relationship between marriage and first child birth.

Christianity was also found as the most dominant religion among the participants. Findings of the study in relation to religion are consistent with findings of the 2010 Population and Housing Census, of Ghana, which found that 71.2% of Ghanaians were Christians. (Ghana Statistical Service [GSS], 2013). In the present study however, the percentage coverage for Christians, were higher than those recorded in the census.

The nurses surveyed were generally enrolled and diploma nurses. Most of them had been practicing nursing for at least one to four years, with one out of ten practicing for five years and above. This implies that nurses making or reporting drug administration errors are young, less educated and less experienced.

Relationship between socio-demographic factors and severity of drug administration error committing

Findings of the OLS model analysis indicate a significant association between sex and committing drug administration error. The result confirms results of a similar study conducted by Fathi et al. (2014) among nurses at the intensive care unit of Imam Khomeini Hospital. Females were more likely to commit drug administration error than males. This may be because females care more for humanity and as such may want to report errors committed in order to avoid or reduce harm caused to the patient, owing to their errors.

Religion, marital status, years of experience and age were less likely to influence the severity of committing drug administration error in this study. This contrasts with findings of a study conducted by Tabatabaee et al, (2014) who recorded a significant association between marital status (separated) and drug administration error commitment and reporting. Even though no

significant association was found between years of practice and drug administration commitment in this study, Tabatabaee et al. (2014) reported that the probability of committing drug administration error increases with years of practicing.

Unexpectedly, there was a significant association among post-diploma and first degree nurses and severity of committing drug administration error. These findings are astounding as it is generally believed that, people who have attained higher level of education should be more knowledgeable hence make less mistakes. Besides the probable reason for this result could be because the post- diploma and first degree nurses may feel they 'know better,' and are the 'boss', hence tend not to adhere to medication protocols and opinions or command from senior colleagues. This could also be attributed to the fact that they are being forthright in answering the survey, having in mind the implications of underreporting of drug administration error. The finding is similar to a finding by Poorolajal, Rezaie & Aghighi (2015) who stated that the rate of committing medical errors was higher in men with educational level of MSc (87.5%). However, this finding is in contrast with the findings of a systematic review by Dornan et al. (2009) noted that healthcare providers who are less educated present high risk of committing medication error (Dornan et al.,2009). Therefore, providing regular in-service training for all nurses on medication protocols as well as sponsoring certificate and diploma- awarded nurses to go to school will reduce commitment of drug administration errors in the hospitals.

Respondents in the general wards were more likely to commit drug administration error than those respondents working at the medical ward. The

significant association found between ward and drug administration error is similar to a study by Tabatabaee et al. (2014) among 97 nurses from different wards in a private hospital in Iran. The similarity in findings could be due to the fact that patients admitted to these general wards in Ghana are of different ages, different illnesses, and care needs. These in-patients often require multidisciplinary expertise to care for them, making the care process cumbersome and increases the likelihoods of committing drug administration error.

Profile Drug Administration Error

Types and frequency of drug administration error

Inference from the data shows that all the seven types of drug administration errors outlined in this study occur at a point in time in the hospitals surveyed. However, pre-administration error and administration technique error were recorded as the most common types of drug administration error that occurs in the hospitals. Others include drug storage error, administration time error and drug documentation error. Similar findings were reported by several other studies (Dabaghzadeh et al, 2013; Beyea et al., 2008; Sheu et al., 2008). Findings are similar because all the classifications of drug administration error are derived from the ‘‘rights’’ of medication administration which guides drug administration procedure all over the world. However, a systematic analysis by Alsulami, Conroy & Choonara (2013) in the Middle East showed that wrong dose error is the commonest. The finding is analogise with the recent findings, as most of the studies reviewed were done in emergency departments, paediatric units and

intensive care unit; which are exposed to committing drug administration error.

With regards to the frequency of specific drug administration construct's it was observed that the nurses always forget to either wash their hands or arrange patient folders according to bed or cubicle numbers prior to drug administration procedure. This practice is very poor, owing to the fact that the hand is the main mode of transmission of hospital-acquired infections, which accounts for over thousands of in-patient death in the hospitals (WHO, 2009). Aside transmission of hospital acquired infection to the patient, the patient may have an adverse drug reaction which will prolong the duration of hospitalization; requiring additional diagnostic and therapeutic interventions, which generate added costs to those already incurred by the patient's underlying disease; and patients sometimes poorly recover from sickness or die (Collins,2008). It is therefore necessary that nurse's regularly wash hands with hospital–based soap and water before and after drug administration to prevent infections related to the drug administration procedure and promote the safety of patients receiving care.

Another finding also showed that nurses do not arrange folders well prior to the drug administration procedure. This finding is congruent with a report from ''Oops, Sorry, Wrong Patient!' (2011) which, says that mixing up medication administration records (MARs) of patients resulted in the administration of a drug of one patient to the other (wrong drug error). Thus, arranging the folders gives nurses the opportunity to go through the care records of client and identify patients due for medication at each point in time. This practice, although not standardised, also helps nurses to do basic

assessment of the client's condition, familiarize themselves to the medication and plan the flow of the drug administration process to avoid drug omission errors. This implies that nurses who work in the district hospitals surveyed are likely to commit more pre- administration errors if they continue not to organise folders prior to drug administration in an orderly manner.

Additionally, the nurses commit administration technique errors by not using two identifiers during drug administration process nor reading labels or checking expire dates of medications. Finding from this survey is similar to findings by Lisby et al. (2005) and Jo, Marquard, Clarke, & Henneman (2013) that non/misidentification of patient accounts for about 80% of drug administration errors, with only a small percentage of nurses who verify patient's identity manually or using barcode verification technology. According to the Joint Commission on Accreditation of Healthcare (2013), the healthcare provider should ''use at least two patient identifiers when providing care, treatment, and services….''. The identifiers involve asking the patient's name and comparing it with medication orders, the drug at hand and patient folder records or hospital cards. Nurses do not use the two identifiers because patient identification process seems to be complex and time consuming (Henneman et al., 2010). At other times, the nurses may feel they already know the patient and continuous cross checking the patient NHIS card and asking the patient to mention their name creates the impression of the nurse not being clever and thus keeps forgetting patient's names. Other clients may even feel the nurses do not concentrate on the care process. Other reasons include inadequate staff on duty; busy nature of the ward; distraction from other patients or senior colleagues and a staff rush (Henneman et al., 2010).

That notwithstanding, the practice of not using the two identifiers is venomous to nursing practice. For instance, serving a drug of one patient to the other as a result of non/misidentification of client may results in wrong drug error to the one receiving the wrong drug and drug omission error to the intended recipient It is a very poor practice which the nurses must avoid. To address this, drug administration nurses should be encouraged to read the patient's identifiers out loud to draw the nurses attention to the task and creates mindfulness.

Period of drug administration error occurrence

The majority of respondents in our study reported that drug administration error occurs mostly during the night shifts. The finding is analogous to other studies conducted in public hospitals (Grou et al. 2014: Härkänen et al. 2013; Anselmi, Peduzzi & Santos, 2007; Dibbi, Al-Abrashy et ai, 2006; Port, Fanton & Albertic, 2005). The major reasons inferred from the occurrence of the errors at night was attributed to sleeping staff feeling reluctant to wake up to administer medications due, inadequate staffing for night shifts, heavy workload, sleeping clients feeling reluctant to wake up, less/no supervision during the shift, no pharmacist and doctor available during night shift, unavailability of drugs, poor handing and taking over, and poor lighting on the ward (Cheragi, Manoocheri, Mohammadnejad & Ehsani, 2013).

Demographic characteristics and commitment of the types of error

Diploma nurses re likely to commit all types of drug administration error than other nurses. This finding is startling because it is generally assumed that those with more knowledge, skills and experience on a subject are less likely to make mistakes. The reason for this outcome may be because

the diploma nurses are feels that they have more experiences and hence could not commit an error during medication administration. Meanwhile, it is said that procedures that are done routinely like medication administration are those that are done in a hurry (Oops, sorry, wrong patient, 2011) and once the done in a hurry, there is a possibility for error. Another reason may be a flaw in training, where perhaps the concept of drug administration error was not communicated well to nurses at the lower level. For instance, the Australian Nursing and Midwifery Accreditation Council (ANMAC) (2008) stated that enrolled nurses must complete two essential Board-approved units of study for administration of medicines before they will be allowed to serve medication on the ward, even after their two years of training in school, and diploma nurses are to take a continuous professional development courses in medication administration regularly. It is disheartening that enrolled nurses in Ghana are posted to the wards immediately after two years of training and one year internship.

Secondly, the male nurses are more likely to commit most of the drug administration errors, except for administration technique and drug preparation error. This finding is in contrast to the general myth about male nurses. Although female nurses are judged as 'smart' nurses, they tend to multitask, which makes the female nurses prone to committing more errors. According to Downey (2013), females generally do multitask in nursing, hence they were judged as the smartest, but men don't. Therefore, male nurses make far less medication errors than the female nurses as the male nurses often do one thing at a time, and do it very well (Downey, 2013).

Factors Contributing to Drug Administration Error

Factors contributing to DAE were examined based on personal, organizational and internal environmental factors. Findings of the study show that the nurses-related issues significantly accounted for all the types of drug administration errors, except for drug documentation error. This point out the fact that the majority of nurses in the district hospitals in the Central Region of Ghana commit drug administration errors because they lacked understanding of medication related jargons. Most nurses after passing their licensure examination from the regulatory body (NMC) fail to learn, and rely solely on experience and little in-service training to provide care. They tend to forget the meaning of most medical and medicine-related jargons, which increases their chances of committing drug administration errors.

Until recently, Ghanaian nurses are promoted based on the number years of practice, unlike in other parts of the world where they promote career advancement for nurses to enable them provide specialised care and assume accountability for quality care. This enables the nurses from the other parts of the world to keep abreast with the meanings of medical terms and know the pharmacological implications of omitting medication.

Secondly, nurse's eagerness to go home from work contributes tremendously to committing drug administration errors. Findings of the study show that most of the nurses are married and in the quest to keep their homes they are torn between family commitments (cleaning, cooking, doing laundry) and work, hence they are eager to go home to their other commitments. Furthermore, the economic destitutions and meagreness of nurses' salaries, lures them to take other private jobs, engage in trade or try to further their

education. These situations become stressors which either affects the nurses psychologically or urges them to leave the ward. This prevents the nurses from concentrating during drug administration procedures or compel them to hand over all medication-related orders to the nurses coming for the next shift. Another indication is that, due to various commitments, they tend to sleep whilst on duty (especially night duty) and omit the administration of evening medications to patients, despite the nurses' pharmacological knowledge on the effect of omitting some drugs (especially antibiotic). In view of these, nurses must be encouraged and supported to manage their stressors by providing counselling, financial support and other incentives.

Another contributing factor is nurses feeling uncomfortable to wake sleepy patient up to take medications due. The majority of the nurses have become sympathetic rather than being ethically empathetic hence they were unable to wake sleepy clients up to take their medications.

The above findings are congruent with previous studies conducted to that effect (Mansouria, et al., 2014; Cheraghi et al., 2012; Vincent & Barber's, 2012; Ghasemi et al., 2009; Nikpeyma & Gholamnejad, 2009; Ross et al., 2009; Udge et al., 2009; Fahrenkopf et., 2008; Wolf et al., 2006), except for the lack of understanding of medical/medication jargons, nurses' eagerness to go home, nurses feeling too sleepy to serve medications, and nurses feeling reluctant to wake patients up to take medications due.

Although organisational factors did not significantly contribute to drug administration error, poor staffing on the wards as well as use of out-dated drug reference and medication protocols, significantly influenced commitment of drug administration errors. This implies that adequate numbers of nurses are

not placed on the wards or the fundamental changes in patients' care (patient-focused care) whilst on admission might be compounding the shortage. The few nurses on the wards tend to do the work of other allied health professionals (ward clerks, carers and other support staff) and burn out, which increases the chances of committing drug administration error.

Likewise, the nurses using out-dated drug reference books, makes them prone to committing drug administration errors,. inferring that, nurses are unable to verify drug details prior to medication administration especially since there are no pharmacy personnel on the wards to consult. The findings are congruent with a systematic review report of 25 medication error papers on nurses' views, which showed that shortage of workforce is one of the most reported sources (4 out of 5 studies; 80%) and had one of the highest prevalence in all contributing factors (12.8% to 100.0%) (Barber, Dean, Vincent and Schechter 2009: Javadi, 2014).

Apparently, aside personal and some organisational factors that significantly contribute to drug administration error, an increase in internal environmental factors will increase drug administration error occurrence. Therefore, measures must be put in place to promote a conducive working environment in the wards.

Perception of effects of drug administration error on patient safety

Patients are either harmed or not harmed when drug administration errors occurs. Findings from the present study show a clear indication thatdrug administration errors committed have undesirable effects on patients. These effects include prolonged stay on admission, allergic reactions and death. Similar findings were also identified by previous researchers (Aboshaiqah,

2014; Patterson et al., 2009; Cousins, Sabatier, Begue, Schmitt, & Hoppe-Tichy, 2005). Meanwhile, studies by European Medicines Agency, 2013; Cheragi et al., 2013; Fahimi et al., 2009); outlined poor recovery and extra cost of health care as one of the major effects of drug administration error commitment. No similarity exists between the current findings and the studies quoted above, because the majority of Ghanaians access health care through the National Health Insurance Scheme and hence will not be able to infer the extra cost on care. A second reason may be that most deaths that occur on the wards are not reviewed to know the cause of death so the nurses will not be able to ascertain that the drug administration error they committed are the the direct cause of death to patients.

This is a clear indication that the safety of patients under the care of the nurses is compromised since some effects of drug administration error on patients might go unnoticed, and no measures are in place to prevent or avoid future occurrences. Emphasis must be placed on drug administration error to draw nurse's attention to providing standardized care.

Channels of Reporting Drug Administration Errors

Out of the 139 nurses who committed an error, only 49 (35%) reported the error. Similarly, the majority of the nurses self-reported the error to colleague nurses on duty instead of filling drug report form, filling institutional incident book or reporting to the doctor (Garnerin et al. 2009). This infers that most drug administration errors committed are not reported. They are ignored either because they are able to treat adverse reactions when they occur or there is no platform to report them. Cohen & Shastay (2008); Garnerin et al. (2009); Mayo & Duncan, (20014) and Poorolajal, Rezaie, &

Aghighi, (2015) recorded similar findings where over 50.26% of health care provider's committed medical errors but are not reported.

Further findings from table 9 shows that no standard protocols exist in the hospitals for reporting drug administration errors. In the facilities where such channels exist, writing in incident books, reporting to nurses in charge through report writing and reporting to doctors on duty (depending on the degree of severity of effect) were the channels available. Do the nurses really use this channels? Are these channels well instituted or are there things that should be researched into to provide optimum solution to drug administration error?. An error that is not reported cannot be investigated for the cause to be identified. Consequently, the same errors may occur many times in different settings in the hospitals and patients will continue to be injured by these preventable errors.

One thing that is obvious here is that nurses do not report the error and there are no standard protocols for error reporting. This is a clear indication that the nurses are not enthused to report drug administration errors as the Ghana Health Service(GHS) or the hospitals' administrations do not place much emphasis on drug administration errors. This is a very poor practice that is compromising the safety of patients, especially in-patients. Error reporting is fundamental to error prevention (WHO, 2006), so nurses should be cultured to report drug administration errors. Likewise, standard protocols should be enacted to report drug administration error for prompt investigation and further corrective actions.

Barriers to Drug Administration Error Reporting

Developing measures to prevent drug administration errors depends on accurate reporting of these errors. Although nurses are aware of the importance of reporting, some situations might prevent them from reporting drug administration errors. In line with the study of Koohestani, & Baghchegh, (2008), the current study found management-related factors as the main reasons for not reporting drug administration errors. Specifically, the nurses fail to report drug administration errors because no positive feedback is given them for serving medication correctly and management does not place any emphasis on medication error as a tool for assessing quality of care. The district hospitals are large institutions, so it is perhaps more difficult to discover and discuss the errors. Consequently, the nurses will not be able to report drug administration error when there are no formal procedures to reporting the error especially when the nurses already feel they could be punished when management get to know (Edmondson, 2004; Butt, 2010).

Conversely, studies from other parts of the world reveal that rather too much emphasis are placed on drug administration error as a yardstick for measuring the quality of care foil nurses from reporting administration error (Canadian Institute for Health Information, 2009; Waring, 2008). According to CIHI (2009), despite the fact that the health care industry recognizes the importance of standardization as an indicator of quality and safety, variations exist across the board. A possible explanation for such inconsistencies is that organizations may be unsure of what information on medication errors and safety is pertinent to gather and disclose. Baker and Norton (2012) argued that there are few, standardized, and comprehensive mechanisms to collect and

analyse information on medication errors and patient safety. Thus, greater coordination and communication is required to have systematic, simplified, and standardized reporting mechanisms in place. Hospitals can rely on information technology systems to assist in the process of error reporting.

Despite the observation that nurses disagreed to the individual factors (mean=2.89), worth highlighting is the detail that the nurses feared they could be reprimanded if patient suffers a major adverse effects due to the drug administration errors committed. This finding is congruent to other research findings on medication error in large hospitals (Butt, 2010; Moumtzoglou, 2010; Chiang & Pepper, 2009; Chiang et al., 2009; Petrova et al., 2009; Covell & Ritchie, 2009; Kwon et al., 2011; Kim et al., 2011; B`aker & Norton, 2012; Bayazidi et al., 2012 and Hartnell et al., 2012). Mostly, the effects of drug administration errors on patients may either occur shortly after the error occurred (allergic reaction/extra cost of drug to replace the one wrongfully given to another patient) or later (like death, disability & complications). Until the nurse is aware of the severity of the effect on patient, the error will not be reported, implying that drug administration error with no harm to patient may be reported to colleague nurses on duty but those that have a major/notable effects on patient may not be reported. It is necessary that a standardized, non-punitive drug administration error system be instituted in the district hospitals, as well as encouraging nurses to report drug administration errors.

Interestingly, the nurses fail to report drug administration error when there was no harm to patient. This finding is congruent with findings by Elder et al., 2007: Bayazidi, et al., 2012; Aboshaiqah, 2014. According to Millenson (2003), failure to perceive the prevalence and seriousness of drug

administration errors will not promote error reporting. The effect of drug administration error on patient could extend from no harm to physical effects such as rash from allergic reactions, disability, death or socioeconomic effects such as prolong stay on admission and extra cost of care (Aboshaiqah, 2014). However, the nurse will not report the error if there is no harm to the patient or if the nurse is able to manage the effect. This is a poor practice which needs to be corrected.

In conclusion, it will be difficult to report drug administration errors if there are no reporting systems/protocols in the hospitals.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter summarises the research process and major findings of the study. Conclusions are then drawn based on the major findings. Recommendations are also made for policy and practice towards avoiding drug administration error and promoting reporting of drug administration error in the district hospitals within Central Region of Ghana. Suggestions were also made for further research on drug administration errors and patient safety.

Summary

The study sought to profile drug administration error and assessed nurses' view on the effect of drug administration error on the safety of patients admitted into the medical, surgical and general adult units of the district hospitals within the Central Region of Ghana. It specifically assessed the types and frequencies of drug administration errors, periods during which drug administration errors normally occur, which nurses are likely to commit drug administration error and factors that contribute to its occurrence. It also assessed nurses' perceptions on the effects of drug administration error on patient safety, channel of reporting drug administration errors and the barriers nurses face in reporting drug administration error.

The study reviewed both empirical and theoretical literature. The review was aimed at finding out what has been done and what gaps exist on drug administration error both in Ghana and other parts of the world. Relevant empirical literature on medication error, drug administration error and patient safety were reviewed; Reasons theory of accident causation and Anderson's

Behavioural Healthcare Model were reviewed and adapted for the theoretical framework of the study.

The research employed a quantitative approach using a descriptive cross sectional design. The study targeted all nurses who were licensed by the Nursing and Midwifery Council of Ghana to administer drugs to patients admitted to the medical, surgical and general adult wards of district hospitals within the Central Region, Ghana. The study employed a probability method using the multi stage technique to select the sample for the study. A sample size of 163 nurses was determined from a total population of 263 nurses from the medical, surgical and general adult wards of eight selected district hospitals in the Central Region. The sample size was determined using Glenn, D. (2013) sample size determination table (Appendix A). Ethical clearance was sought from the University of Cape Coast Institutional Review Board.

The researcher designed a questionnaire to gather primary data from respondents. The development of the questionnaire was guided by literature, review of questionnaires used in other studies, and review of the incident books on the ward. The researcher engaged the services of eight field assistants to achieve a retrieval rate of 84%. The data was analysed according to the research questions using the Predictive Analytical Software (PAS) version 23. Inferential statistical tools such as ANOVA, least significant difference (LSD) and Least Squares Regression (OLS) were also employed. Findings from the study and empirical literature were unified to discuss the findings.

The majority of nurses surveyed were generally enrolled and diploma registered female nurses, who are 29 years old or less. The nurses had worked between one to four years and were working within the general ward. Most of the nurses were Christians and were married.

Key Findings

The following were the major findings that emerged from the study:

- Severity of drug administration error commitment varied by sex such that severity of error commitment was higher in males (p-value 0.004) than females.
- Respondents with post diploma ($\beta = 0.549$) and degree ($\beta = 0.649$) were more likely to commit drug administration error relative to the enrolled nurses.
- Respondents in the general adult ward ($\beta = 0.254$) were also more susceptible to drug administration error as opposed to those on medical ward.

Profiling drug administration error.

- Pre-administration error (mean= 2.67), administration technique error (mean=2.67) and drug storage error (mean=2) were the most common types of drug administration errors that occur.
- As regards pre-administration error, respondents do not always wash their hands (mean = 3.00) nor go through the folders (mean = 3.00) prior to drug administration.
- On administration technique errors, respondents do not identify right patient using 2 identifiers (mean = 3.00) or check right medication by

reading labels and expire date of medications (mean = 3.10) during medication administration.

- On drug storage error, nurses always administer drug that are poorly refrigerated/stored (mean=3.00).
- Drug administration error occurs most on the night shift (65%).
- Diploma nurses commit more drug administration error than the enrolled and first degree.
- Respondents in the surgical and general wards often commit drug preparation error while those in the medical ward opine that though it occurs but not often.

Contributing factors to drug administration error

- Nurse-related factors significantly influenced drug administration error commitment. Specifically, 'lack of understanding of medical/medication jargons' (mean= 3.89), the nurse "feeling uncomfortable to wake patient up' (mean=3.78) and eagerness to go home (mean=3.67) were regarded as the most predisposing factors to drug administration error commitment.
- Organizational factors such as ''use of out-dated drug reference/medication protocols'' and poor staffing on the ward significantly predisposed to error commitment.
- Internal environmental factors significantly influence the occurrence of all types of drug administration error by a p-value of 0.052

Nurses perception of the effect of drug administration error

- Nurses (93%) affirm that patients are affected when drug administration error occurs.

- Prolonged stay on admission (29.2%) was the most common effect of drug administration error on patients.

Channels of error reporting

- Drug administration errors are not reported (65%) as no official channels of reporting exist in the hospitals.
- Nurses report errors to colleague nurses on duty when the error occurs. In the facilities where there are channels for reporting: use of incident books was the main channels available.

Barriers to error reporting

- The main barriers to drug administration error reporting were management related. Thus, ‘‘No positive feedback is given for serving medications correctly’’ (mean=3.20) and ‘‘no/less emphasis being placed on medication errors as a measure of the quality of care in the hospital (mean =3.10)
- Individual-related factors: nurse being afraid to be ‘‘blamed if something happened to the patient (mean=3.11).
- No harm to patient following drug administration error.

Conclusions

It is convincing that drug administration errors occur in Ghanaian hospitals just as revealed in studies from other parts of the world. Patients suffer allergic reactions or stay longer on admission which exposes them to hospital-acquired infection and subsequently, complications, disabilities or death.

However, these patient safety issues are not reported because the GHS does not place emphasis on these errors as a yardstick to measuring quality of

care rendered. Likewise, there are no institutionalised standard protocols for reporting these errors. It is also startling to know that nurses' eagerness to go home, use of out-dated drug reference/medication protocols and poor staffing on the ward contributes to error commitment. Drug administration error cannot be reported if there are no reporting systems. The GHS and the hospital authorities need to be disquiet on occurrences of drug administration error and design protocols or policies for drug administration error to be reported for analysis and intervention. Likewise, in-depth interview and focus group discussion should be done in follow-up studies to find out reasons why nurses are eager to go home, for prompt intervention.

Recommendations

The following recommendations are made for practice, policy, education and further research:

Practice

1. Nurse's should regularly wash hands with hospital–based soap and water before and after drug administration to prevent infection related to drug administration and promote the safety of patients in their care.
2. Nurse supervisors should encourage nurses to use two-patient identifiers habitually, even if the nurses feel they know the client already. Similarly, two nurses should be allowed to do the drug administration to double check patient identity prior to medication administration, or nurses should be encouraged to perform an independent double check by matching patient's statements about their identity and the patient name and date of birth on NHIS card to patient's folder number, the drug at hand and the medication order on the treatment sheet.

3. To address the issue of poor staffing on the ward, nurse managers should ensure that adult care nurses are placed on medical/surgical wards whilst paediatric nurses are placed in paediatrics ward. Secondly, the nurse manager should structure duty roster well to allow adequate number of staff on duty especially during the night shift.
4. Nurses taking over from others should be properly informed about changes made in patient's medication before they assume duty.
5. Physicians and pharmacy staffs should also be on duty during the night shift to reduce the workload on the nurses.

Policy

Hospital management should:

1. Provide identification wrist bands for all in-patients especially those who are unconscious, to enhance manual verification of patient identity prior to medication administration.
2. Provide up to date Standard Treatment Guidelines, British National Formulary and other drug reference books on the ward for regular reviews during drug administration.
3. Have a pharmacy staff on the ward to educate or be consulted on medication issues.
4. Organize regular clinical meetings to discuss and educate on administration errors that have occurred in the hospital, as well as design strategies to prevent these errors.
5. Provide nurses with the necessary support and time to attend educational programs related to medication use and error prevention.

6. Provide protocols, guidelines and checklist on proper storage of medications on the wards to avoid drug storage errors.
7. Non-punitive reporting channels should be instituted by the various health facilities in the Central Region to report drug administration error.
8. Ghana Health Service should place emphasis on medication errors as a measure of the quality of care in hospitals. This will motivate nurses on the importance of reporting drug administration errors.
9. Standard protocols for administration of high-risk medications should be posted for easy verification of medication orders by nurses.

Education

1. The Ghana College of Nurses and Midwives and the regulatory body should provide a continuous professional development trainings or refresher courses for practicing nurses on medication administration. The training will keep the nurses abreast with medication jargons and the importance of using the rights of medication administration to ensure drugs are administered with minimal or no errors.

Suggestions for Further Research

A study to qualitatively explore the experiences of patients regarding drug administration error and the effects it has on them. This is because the present study focused on nurses.

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APPENDICES

APPENDIX A

Sample Size Determination Table

Table 2. Sample size for ±5%, ±7% and ±10% Precision Levels Where Confidence Level is 95%.

Size of Population	Sample Size (n) for Precision (e) of:		
	±5%	**±7%**	**±10%**
100	81	67	51
125	96	78	56
150	110	86	61
175	122	94	64
200	134	101	67
225	144	107	70
250	154	112	72
275	163	117	74
300	172	121	76
325	180	125	77
350	187	129	78
375	194	132	80
400	201	135	81
425	207	138	82
450	212	140	82

Source: Adapted from Glenn, (2013).

APPENDIX B

QUESTIONNAIRE

UNIVERSITY OF CAPE COAST

SCHOOL OF NURSING AND MIDWIFERY

QUESTIONNAIRE FOR NURSES

I am Thywill Degley, a student of the University of Cape Coast and conducting a research on **drug administration errors and nurse's perception on the effects of drug administration error on patient safety at health facilities in the Central Region of Ghana.** It will take you about 30-45minutes to complete the questionnaire. The type of questions in the questionnaires includes choosing the most appropriate response and at times explaining choices made. You can skip a question at any time you feel uneasy about answering a question. However, I consider you a treasured partner whose candid responses will significantly aid the conduct of this research. Your openness and willingness to answer questions is central to making this research a success. I wish to assure you that your responses will be treated with utmost confidentiality and any information provided will be strictly used for academic purpose only.

Filter Question. Have you ever committed any drug administration error whilst working as a professional nurse?

Yes [ ] No [ ]

Kindly complete the rest of the questionnaire if you respond 'Yes' to the above question. If 'No' you may however decline from completing the questionnaire or could express your view on the subject.

Section A: Socio-demographic Characteristics of respondents

Instruction**:** *Please put a tick [✓] in the applicable boxes provided next to the answers.*

1. Sex:

   (1) Male [ ] (2) Female [ ]

2. Age:

   (1) Less than 29 [ ] (2) 30- 39 [ ] (3) Above 40 [ ]

3. Religion

(1) Christianity [ ] (2) Islam [ ] (3) African Traditional [ ]

4. Marital status

(1) Married [ ] (2) Unmarried [ ]

5. How long have you been practicing as a nurse?

(1) 1- 4 years [ ] (2) 5 years and above [ ]

6. What is your Qualification/Level of Training?

(1) Enrolled Nurse [ ]

(2) Diploma Nurse [ ]

(3) Post Diploma Nurse [ ] Please specify your area of specialty…....

(4) First degree Nurse [ ]

7. In which unit/ward do you currently work?

(1) Medical ward [ ] (2) Surgical ward [ ] (3) General ward [ ]

Section B: Types and Frequency of Drug Administration Error

Tick (✓) the response that is most reflective of your opinion for the following questions. Select only one response.

8. On a scale of 1-5 (with five being the highest) how will you rate your extent of drug administration error commitment on the ward?

1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ]

9. Which of the following drug administration errors commonly occurs in the ward***? Indicate how often these errors occur by ticking the appropriate response that pertains to each type.***

Error	Frequency				
	Never (0)	Almost everyday (1)	Every other day	Every 3-5 days	Every 6-7days (4)

			(2)	(3)	
Pre-Administration Error (PAE) 10. Not washing hands before administering drug					
11. Not arranging folders according to bed number					
12. Trolley not well equipped					
Administration Technique Error (ATE) Not double checking the following :					
13. Right patient using 2 identifiers,					
14. Right medication by reading label, expiring date and comparing the order with the drug at hand					
15. Serving medication of one patient to another patient					
Administration Time Error (ATE)					
16. Administering drug at wrong time					
17. Administering drug over ordered duration					
Order base Error (OBE) 18. Administering different amount of drug than amount prescribed					
19. Administering drug not prescribed					
20. Administering different dose than prescribed					
21. Serving drug through a route different from the one ordered					

Drug preparation Error					
22. Diluting drug not supposed to be diluted.					
23. Using too much diluent to dilute.					
24. Crashing tablets that are not supposed to be crushed					
Drug Storage Error (DSE)					
25. Putting topical with orals drugs in same chamber					
26. Constituting ampoule/vial and leaving it open					
27. Poor refrigeration (long period, not to be used)					
Drug Documentation Error (DDE)					
28. Pre-charting of drug before administering					
29. Not or wrongfully charting drug administration procedure					

30. In own opinion, during which shift does drug administration error occurs most?

(1) Morning shift [ ] (2) Afternoon shift [ ] (3)Night shift [ ]

Section C: Factors contributing to drug administration error

Which of the following factors in your own opinion contributes to the occurrence of drug administration errors on the ward? *Indicate your level of agreement to each factor by ticking [✓] as many as apply*

Factors	Strongly disagree (0)	Disagree (1)	Agree (2)	Strongly Agree (3)
Personal factors				
31. Lack of sufficient information about the medication				
32. Lack of adequate information about the patient				
33. Forgetfulness/memory lapse				
34. Too much work load				
35. Psychological state of the nurse				
36. Not observing the 5 rights of medication administrations process				
37. Lack of understanding of medical/medication jargons				
38. Poor handing /taking over				
39. Nurse feeling sleepy on night duty				
40. Feeling uncomfortable to wake sleepy client up				
41. Eager to go home				
Organizational /system factors				
42. Lack of standard protocols for administration of high risk medications on the ward				
43. No in-service training on new medication products and their use				
44. Poor working conditions				
45. Poor staffing on the ward				

46. Long consecutive hours of working				
47. Inaccessibility of patient information's such as drug allergies, age, weight, health status e.g. pregnancy				
48. Use of outdated drug reference/medication protocols				
Internal environment				
49. Poor communication with other nurses				
50. Inaccurate handing over of medication orders and changes				
51. No documentation of medication administration procedure				
52. Miscommunication of drug orders from prescribers				
53. Illegible handwriting of medication orders				
54. Use of abbreviations				
55. Writing incomplete prescriptions				
56. Difficulty hearing drug orders over phone				
57. Poor lighting in the ward				
58. Poor preparation / storage or				

labeling of drug				
59. Interruption during drug administration				
60. Demanding of attention by other patients				
61. Receiving telephone phone calls from other units				
62. Poor supervision of new staff or student nurses				

63. Specify other factors that contribute to drug administration error on the wards.

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Section D: Nurse's Perception on effects of drug administration error on in-patients.

64. Do you think patients on admission are affected when drug administration error occurs?

(1) Yes [ ] (2) No [ ]

65. In your opinion, state how patients on admission are affected when drug administration error occurs?

(1)…….
(2)……..
(3)……...
(4)……...
(5)……

Section E: Channels of Reporting drug administration error

66. Do you officially report drug administration error when they occur?

(1) Yes [ ] (2) No [ ]

67. How was the drug administration error reported? *Tick (✓) all that apply.*

(1) Self-reported to	
i. Senior nurse on duty	
ii. Colleague nurse on duty	
iii. Ward in-charge	
iv. DDNS	
v. Pharmacist	
vi. Doctor	
(2) Written in incidence book	
(1) Filled adverse drug report form	
(2) Reported by someone else specify who…….	

68. Is there any standard protocol/procedure as to how drug administration errors should be reported in the hospital?

(1) Yes [ ] (2) No [ ]

69. If *yes* specify the protocol/procedure for reporting drug administration error in your facility?

(i)…….
(ii)……
(iii)……
(iv)……...

Section E: Barriers to Drug Administration Error Reporting

The following reasons may prevent / prevents you from reporting drug administration error when they occur? ***In your own opinion rank how each factor prevented you from reporting drug administration error***.

Barriers	Strongly Disagree (0)	Disagree (1)	Agree (2)	Strongly agree (3)
Management-related barriers				
70. No positive feedback is given for passing medications correctly				
71. Nurse administrator focuses on the person committing the error rather than looking at the system				
72. No/less emphasis is placed on medication errors as a measure of the quality of care in the hospital				
Individual/personal barriers				
73. Nurses fear losing their license				
74. Nurse are not aware that an error occurred				
75. Nurses could be blame if something happened to the patient				
76. Nurses believe other nurses will think they are incompetent				
77. No harm to patient following drug administration error				
78. Nurses fear rebuke from physician				
79. Nurses want to avoid potential publicity of medication errors in the media				

80. Please specify other barriers reporting drug administration error

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Thank you for taking the time to complete this survey.

APPENDIX C

APPENDIX D