Asian Journal of Research in Nursing and Health

4(4): 75-96, 2021; Article no.AJRNH.74124

Assessing Intravenous Medication Administration among Nurses in the Emergency Department of the Komfo Anokye Teaching Hospital

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Authors' contributions

This work was carried out in collaboration among all authors. Author HDN designed the study, contributed to data acquisition, analyzed and interpreted the data with author AO and AAP under the supervision of author AM. Authors AO and HDN wrote the first draft of the manuscript. All authors read and approved the final manuscript for publication.

Article Information

Editor(s):
(1) Dr. Asmaa Fathi Moustafa Hamouda, Jazan University, Saudi Arabia.
Reviewers:
(1) Dhirja, Dr. Ram Manohar Lohia Hospital, India.
(2) Sachin Raval Pharmacy, Apollo Hospitals International Limited, India.
Complete Peer review History: https://www.sdiarticle4.com/review-history/74124

Original Research Article

Received 12 July 2021
Accepted 22 September 2021
Published 30 September 2021

ABSTRACT

Introduction: Patient safety is a major concept in the provision of health care and a significant factor in the maintenance of quality health care services. Medication errors are among one of patients' safety issues which needs to be dealt with because of consequences it poses to the patient. Intravenous medications administrations have high incidence of error but there is limited evidence of associated factors or error severity.
Objectives: The objective was to evaluate which elements such as nurses' knowledge, training needs, behaviour, and attitude could prevent medication errors in the emergency department during the administration of intravenous (IV) medications.
Methodology: The study used quantitative descriptive design. One hundred and thirty-nine (139) nurses were selected using a simple random sampling method. Open and closed ended structured

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questionnaires were used as the data collection tool and analysed with Stata Version 15.1 (IBM) Program. Descriptive and Inferential Statistics were employed to analyse the data.
Results and Finding: The results from the study indicated that more than half (65%) of the respondents had adequate knowledge on IV medication administration. Also less than half (19.4%) of the respondents had correct answers on the calculation and dosing of IV medications. The majority (55%) of respondents have poor attitude and poor behaviour (53%) towards IV drug administration. Training on IV medication administration was significant on the behaviour of nurses.
Conclusion: Training should be maximized on calculation and dosing skills of nurses. There should be regular update on the knowledge of nurses on IV medication administration to improve the safety of patients. Standardised reporting systems should be available in the facility so that errors will be captured and audited to reduce the incidence of errors.

Keywords: Intravenous medication; nurses, Emergency Department, and Komfo Anokye teaching Hospital.

1. INTRODUCTION

Medication error has been estimated to kill 7,000 patients per annum and accounts for nearly 1 in 20 admissions in the United States [1]. One of the common issues about patients' safety regards medication. Almost every person takes medication at one time or another. According to the Institute of Medicine, [2], four in every five adult use prescription medicines, over-the-counter drugs, dietary supplements, and almost one-third of adults take five different medications at any given day in the United States.

World Health Organisation has designed a global programme of work to help decrease mortality and morbidity as a result of medication errors by 50% by 2022 (WHO 2017). Globally, US$ 42 billion is spent annually on medication errors, which is 1% of total global health expenditure (WHO 2012).The Institute of Medicine of National Academics (2006) indicated that 1.5 million people are harmed every year, from preventive errors and 3.5 billion dollars are used in treating drug error -related injuries. It has been approximated that medication errors led to 12 000 deaths per year in the National Health Service (NHS) UK and that consequences of these errors may lead to an extra care cost of £0.75 billion–£1.5 billion [3].

According to studies done in the US, 60% of intravenous medication errors that occur leads to serious and life-threatening injuries [4]. In Germany, 70 % of all intravenous medications administered had at least one clinical error, and a quarter of these were serious errors likely to result in permanent harm to patients [5]. Medication errors exist in every section of clinical practice. National Coordinating Council for Medication Errors Reporting and Prevention describes medication error as any preventable event which is preventable and may lead or cause inappropriate medication use or patient harm, while the medication is in the control of the healthcare professional, patient, or consumer. Intravenous Medication errors are among one of patients' safety issues which needs to be dealt with because of the consequences it poses to the patient. Intravenous medication comes with the high possibility of medication error [6]. An intravenous medication error is defined as a deviation in the preparation or administration of a medicine from a doctor's prescription, hospital intravenous procedures, or the manufacturer's instructions [7]. How intravenous medications are prepared and administered can cause adverse effects to the patient when an error occurs and it becomes difficult to reverse it due to the fast absorption and distribution to the bloodstream. [8]. Intravenous medication administrations have a high incidence of error, but there is limited evidence of associated factors or error severity [9]. It has been estimated that there is a 73% probability of making at least one error in intravenous therapy.

Additionally, intravenous medication administration errors occur more than orally administered medications (Shane, 2009). The majority of these error occurrences are in the reconstitution and administration phases [11]. Errors in preparation and administration includes; wrong drug selection, using the incorrect diluent for diluting and wrong rate of infusion [12]. Systematic review indicates the overall probability of making at least one error in intravenous therapy was 0.73 and most of the errors occur in the reconstitution stage [13]. Studies done in two national Health Services (NHS) hospitals in the North West of England between June 2012 and August 2013 showed 21

intravenous medication administration error occurrences. The prevention of intravenous medication errors continues to be challenging despite efforts being made to curb it to promote patient safety. A study done in China also indicated intravenous medication error rate of 12.8% which is an error per day [14].

In Africa, Mekonen, Alhawassi, McLachlan and Brien, [15] revealed that medication errors are relatively common and the impact of errors and adverse drug events are substantial, but many are preventable. Moreover, TJFR, (2010) observed in Ethiopia that 90.8% of error with intravenous bolus medication occurred as compared to 8.2% in oral medication. Furthermore, studies done in Ghana by [16] (Debly, 2016) indicated a high incidence of medication errors.

The literature reviewed shows that few studies have been conducted on intravenous medication errors. The majority of the studies reviewed were done in general hospital wards. Moreover, the previous studies conducted in Ghana revealed contributing factors and the prevalence of medication errors in some hospitals. However, little is known about nurses' knowledge, attitude and behaviour regarding intravenous medication errors in the emergency department. The study therefore, seeks to examine nurses knowledge, attitude, and behaviour regarding IV drugs administration errors in the emergency department of Komfo Anokye Teaching Hospital and to suggest interventional strategies to prevent IV drug administration errors in the department.

1.1 Problem Statement

The fast paced nature and the large patient turn out at the emergency department makes it a high -risk area for medication errors (Cuong, Story, Hicks, & Shore, 2011), Globally, the rate of medication error is as high as 4% to 14% in the Emergency department [17]. An anonymous and confidential study which was done in 496 EDs in the USA through the medication error reporting programme showed 13,932 medication errors in 4 years. Moreover, McDowell et al. [11] estimated a 73% probability of at least one error occurring during a single given intravenous medication administration. WHO (2009) 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 unskilled human resources in hospitals. Debley (2016) reported that nurses commit medication administration errors of about 32.9% in Cape Coast Hospital. Searched results did not produce any research in the area of study in Kumasi. However, there is anecdotal evidence pointing to the fact that intravenous medications errors do occur in the Emergency Department of Komfo Anokye Teaching Hospital (KATH). This usually leads to adverse effects and sometimes mortality. Furthermore, the change project on medication errors done by residents of GCNM in March 2018 confirmed the occurrence of IV drug administration errors in the Emergency department. This study therefore, seeks to examine nurses knowledge, attitude and behaviour regarding IV drugs administration errors in the emergency department of Komfo Anokye Teaching Hospital and come out with interventional strategies to prevent IV drug administration errors in the department.

2. METHODOLOGY

2.1 Research Design

In this study, a descriptive, non-experimental design with a quantitative approach was used. Nurses were selected to respond to structured questions on IV medications administration within a one-time period (from 1st April to 14th April). Specific variables were measured to determine proportions or ratios. A cross-sectional design was selected because the people under study have similar characteristics but differ in a key factor of interest such as age, income level, socio-economic status or geographic location. Therefore this research adopted a descriptive cross-sectional survey which was used to come out with interventions to prevent the occurrence of intravenous medication errors in the Emergency Department at Komfo Anokye Teaching Hospital.

2.2 Study Setting

This study was carried out in the Accident and Emergency Department of the Komfo Anokye Teaching Hospital (KATH), as the researcher observed some IV medication errors committed by some nurses during the practicum period. Moreover,a report by Emergency nursing residents of the Ghana College of Nurses and Midwives, indicates that there were IV medication errors. Komfo Anokye Teaching Hospital (2015) is a Tertiary Referral Hospital located in Kumasi, the capital of Ashanti region in Ghana, with an in-patient bed capacity of 1200. KATH is the second-largest hospital in Ghana

and serves as the main referral hospital for the Ashanti region, Brong Ahafo, and the Northern regions (Upper East, Upper West and Northern region) in Ghana. The latter has been removed from KATH's referral catchment after Tamale regional hospital was upgraded to a teaching hospital hence controlling referral from Upper East, Upper West, and Northern region (KATH, 2015).

The Accident and Emergency Department handles all emergency services (Surgical, Trauma and Medical Emergencies) and has three well-defined zones: Red, Orange and Yellow areas based on patients' acuity using the South African Triage Score (SATS). The SATS has three main tools based on the ages of patients. The infant tool is used if a patient is under (3) years or below 95cm in height. The child tool is used for patients with ages between (3) years and twelve (12) years or with height ranging from 96 to 150cm. Patients aged 12 years and above or with a height beyond 120cm are subjected to the adult tool (Rominski, Bell, Oduro, & Ampong, 2014). The Red area is for patients who require immediate medical attention and resuscitation. The Orange area is for patients who should be seen within ten (10) minutes of arrival at the facility; and the Yellow area is for patients requiring treatment within one (1) hour of arrival (Wallis, Gottschalk, & Wood, 2008). The Red, Orange and Yellow areas have seven (7), twelve (12) and eighteen (18) bed capacity respectively.

The KATH A&E has a 28-bed clinical decision unit. The A&E serving as the main emergency referral unit for the Ashanti region and Brong Ahafo region is staffed by more specialised providers such as general and orthopaedic surgeons.

2.3 Population

All nurses at the Accident and Emergency Unit of Komfo Anokye Teaching Hospital were the target population for the study. There are about two hundred and twelve (212) nurses working at the Emergency units of KATH.

2.4 Inclusion Criteria

The study focused on graduate nurses, emergency nurses and registered general nurses who work at the Accident and Emergency Department.

2.5 Exclusion Criteria

All nurses who are on long-term sick leave, study leave or annual leave, as well as rotation and student nurses were excluded from the research study.

2.6 Sample Method and Sample Size

The study employed a simple random sampling technique to select the proportion of participants at the emergency unit of KATH. Participants were selected using simple random sampling. Arbitrary numbers between1 and 139 were assigned to each of the 212 nurses in the Emergency department who meet the inclusion criteria. The numbers were written on pieces of paper, rolled and put in a bowl. Rolled papers were picked one after the other until the number of participants needed was reached.

Sample Size Calculation using Yamane Formulae (n= N / 1+N(e^2))

n= N / 1+N(e^2)
n=212 / 1+212(0.05)
n=212 / 1+212(0.0025)
n=212 /1+0.53
n=198 / 1.53
n=139

n signifies the sample size
N signifies the population
e signifies margin error of 0.05
Sample size of 139 nurses was selected using Yamane formulae.

2.7 Instrumentation for Data Collection

The questionnaire contained both open and closed-ended questions. Open-ended questions were used to allow respondents to express their views and opinions on some of the objectives. The closed-ended questions were added to create uniformity in the responses and ensure self-expression of any kind (Sarandakos, 2005). The questionnaire was made of seven sections. Section A focused on the demographic and professional characteristics of the nurses. Section B contained 13 questions and deals with the knowledge of nurses on IV medications. Section C (13 items) studies the attitudes on IV medications and D (11 items) investigates behaviors adopted during IV medication administration whilst Section E (5 items) focuses on identifying the training needs on IV medication use. Finally, Section F (5 items) focused on the

error reporting system and barriers. The 5-point Likert- scale was used to elicit responses on attitude (section C) and barriers (section D) understudy and was rated as follows: SA=5, A=4, NS=3, D=2, SD=1. Also, a five-point Likert scale was used to determine the responses from behaviour which included statements such as 'never (=1)', 'once (=2)', 'sometimes (=3)', 'often (=4)' and 'always (=5)'. Questions were answered by ticking '√' in the answer box.

2.8 Data Collection Procedure

The data collection for this study was done over for two weeks. Participants were selected using simple random sampling. Arbitrary numbers for nurses in the Emergency department who meet the inclusion criteria were written on pieces of paper, rolled and put in a bowl. Rolled papers were picked one after the other until the number of participants needed was reached. All nurses who meet the inclusion criteria were approached and the study explained to them for their consent, willing respondents signed a consent form. One hundred and forty-two (142) questionnaires were given out and one hundred and thirty-nine (139) were returned. Questionnaires were given out from 1st April to 14th April 2019.A two-week duration was used for the administration of the questionnaires.

2.9 Pre-testing of Questionnaire

Pre-testing of the questionnaire was done for two days at the Emergency Department of Korle-bu Teaching Hospital which has a similar characteristic as KATH. This helped in the assessment of clarity of questions. It also helped to make the necessary corrections before the main study was conducted. 10% of the sample size was used for the pre-testing. The participants took about 20 –30 minutes to complete the questionnaire and it was easily understood with no suggestions for changes. Data collected was pre-tested to check for the reliability of the instrument.

2.10 Reliability and Validity

2.10.1 Reliability

The questionnaire was designed to ensure that questions are asked consistently and are clear. Moreover, the questionnaire was reviewed by the researcher's supervisor and an expert in the field of pharmacy. Furthermore, the Health Research Ethics Committee at KNUST also reviewed the questionnaires. In addition, the distribution of the questionnaires was done by the researcher only to ensure consistency when the need for clarifications arises. The Cronbach alpha is a widely used test in research because it is a robust method for finding consistency in research questions. All the standard tools were found to have solid psychometric reliability and internal consistency after pretesting was done, with Cronbach α values ≥ 0.70. The alpha value is 0.05 for each of the domains.

2.10.2 Validity

Validity was acquired through the pre-testing of the questionnaire and with adaptations according to the literature, the research objectives, the clinical knowledge and experience of the researcher and the suggestions made by the supervisor, one pharmacy specialist and a statistician.

Content validity was ensured by using concepts and items in the questionnaire which was established on substantial literature review and objectives of the study. The questions were designed specifically to test the knowledge, attitude behaviour, and training needs during intravenous medication administration. Also, pre-test of the questionnaire by nurses in another tertiary institution helped the researcher to find any ambiguity or inaccuracies with the data collection instrument.

Face validity was ensured by using one expert in the pharmacy who reviewed the questionnaire to certify the instrument measures the variables it is supposed to measure. Pre-testing was done using registered nurses. Nurses from similar tertiary institutions participated in the pre-testing of the questionnaire to review the questionnaire and to find out if it was of importance to those participants who were to complete it. The use of nurses ensured face validity.

2.11 Method of Data Analysis

The data obtained in the study were entered into Microsoft Office Excel (version 16) and imported into Stata version 15.1 for analysis. Some items on the scale which were negatively worded were reversed to allow for all item scores to be in the same direction. The Likert scale scores measuring the nurses' attitudes and practices of IV drug administration were summed for each item on the scale. A mean split approach was used to categorize the scores into two;

participants scoring above the mean score had good attitude or behaviour, whereas the scores below the mean score denoted poor attitude or behaviour. On the knowledge score, a score of 8 points represented the cut-off point. The participants who scored less than 8 on the score were categorized as having inadequate knowledge on IV medication administration, while scores of 8 and above were classified as adequate knowledge. Summary descriptive analyses of the study variables were done. The study assessed the factors that explained variations in the dependent variables using Pearson's Chi-square test for categorical variables and *t-test* for comparing continuous independent variables. Logistic regression analysis was done to assess the strength of association between the significant variables. The values of $p< 0.05$, were considered statistically significant. Results were presented in Tables and Figures.

3. RESULTS

3.1 Socio-demographics Characteristics

The socio-demographic characteristics assessed include age, gender, rank, basic qualification and years of work experience. The mean age (standard deviation) of the nurses is 33.2 ± 6.0 years. Majority the nurses (n=92, 66.2%) were aged between 30 and 39 years. The study population was predominantly made up of female (n=96, 69.1%). There were more Bachelor's degree holders (n=81, 58.3%) than Diploma (n=51, 36.7%). Only 2.2% (3/139) of the nurses had post-basic training. A greater proportion of the nurses were Nursing Officers (n=43, 30.9%). (Table 1).

Table 1. Socio-demographic characteristics of nurses (N= 139)

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
20 – 29	36	25.9
30 – 39	92	66.2
40 – 49	6	4.3
50 – 59	5	3.6
Sex		
Female	43	30.9
Male	96	69.1
Qualification		
Diploma	51	36.7
Post-basic	3	2.2
Bachelors	81	58.3
Masters	4	2.9
Rank		
Staff Nurse	28	20.2
Senior Staff Nurse	25	18.0
NO	43	30.9
SNO	30	21.6
PNO	11	7.9
DDNS	2	1.4

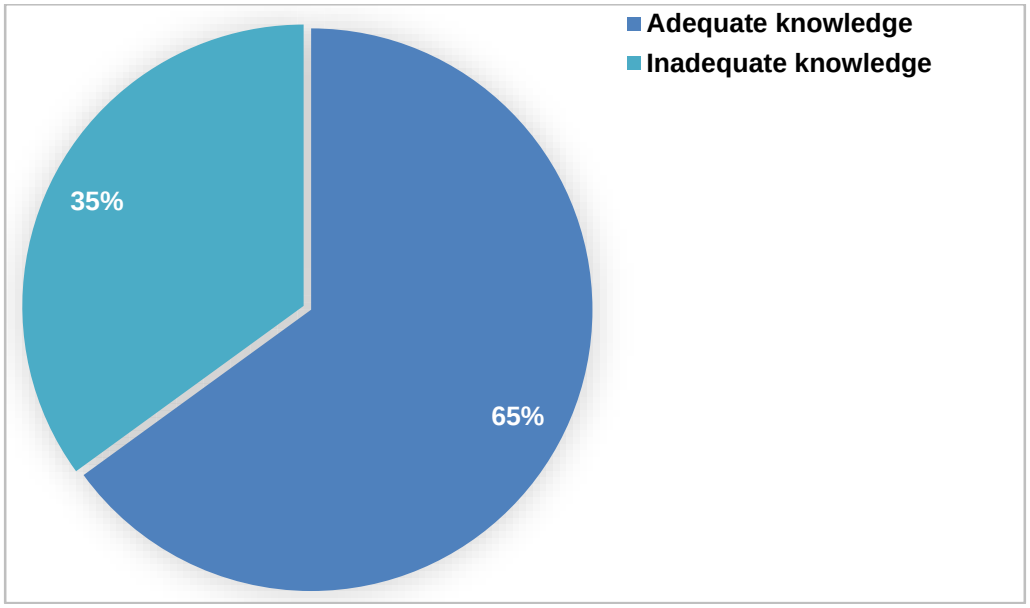

Fig. 1. Knowledge level of respondents on IV medication administration (n=139)

3.2 Knowledge of Nurses on Administration of IV Medication

To assess the knowledge of the respondents on the administration of IV medications, a 13-item true or false questionnaire with six (6) negatively worded statements. The average accurate knowledge scores were 9 (SD = 1.8). The highest knowledge score is 12 and the least is 3 points. The respondents who scored less than 8 –points were categorized as having inadequate knowledge. As illustrated in Fig. 1, about 65% (90/139) of the respondents had adequate knowledge on IV medications administration.

Most (n=137, 98.6%) of the participants thought it was necessary to check the expiry date of a medication that is requested from the Pharmacy. Majority (n=137, 93.5%) of the participants did not think that medications administered intramuscularly acts rapidly than if administered intravenous. Many (n=130, 79.1%) of the participants did know that “cc” or “ml” is not the dosage expression for IV insulin. About 75% (104/139) of the nurses did not think that any reconstituted IV medication can still be used if it is less than 48 hours from the date of reconstituted or preparation. Again, most of the respondents (n=59, 42.5%) agreed that IV antibiotics are stable when diluted using NaCl 0.9% or NaCl 3% while 46 (33.1%) did not agree. On the Question of when 6ml of IV Noradrenaline (4mg/ml) is diluted with 50ml of DNS final concentration is 480 g/ml, majority 52.5% (73/139) did not know the answer, only 19.4% (27/139) correctly agreed with the assertion made. More nurses (n=120, 86.3%) concurred that the calculation of IV drugs doses during the

Table 2. Knowledge of Nurses on administration of IV medication

Statement	(T/F)	Correct response (%)	Wrong response (%)	Don’t know (%)
It is necessary to check expiry date for a medication that is recently requested from pharmacy.	T	98.6	1.4	0
Medication administered intramuscularly acts rapidly than if administered intravenously	F	93.5	6.5	0
’cc’ or ‘ml’ is the dosage expression for IV insulin	F	79.1	10.8	10.1
Any reconstituted IV medication can still be used if it is less than 48 hours from the date of reconstitution or preparation	F	74.8	18.0	7.2
IV antibiotics are stable when diluted using NaCl 0.9% or NaCl 3%	F	33.1	42.5	24.5
When 6ml of IV Noradrenaline (4mg/ml) is diluted with 50ml of 5% dextrose saline, the final concentration of Noradrenaline infusion solution in g/ml is 480g/ml (1mg=1000g)	T	19.4	28.1	52.5
The calculation of IV drug doses during the preparation phase can reduce errors	T	86.3	10.1	3.6
Intravenous medication which requires maximum infusion rate 120 µg/hour should be infused at a constant rate of 4µg/hour for the first 1 hour	F	28.8	23.7	47.5
Slow bolus IV injection means administration of intravenous medication in 1 minute	F	64.1	30.9	5.0
Procedures, posters and brochures related to IV administration on the wards, helps to reduce errors	T	95.7	3.6	0.7
Medications that are classified as high alert medication include noradrenaline and insulin	T	69.8	13.6	16.6
Alarms and ward emergencies can cause distractions both in the preparation and administration phases of IV drugs	T	67.6	28.1	4.3
Shifts changes (double shifts, overtime, etc.) as well as workloads can contribute to IV medication errors	T	92.8	6.5	0.7
Mean± SD		**69.5±26.7**	**17.2±12.5**	**13.3±17.8**

preparation phase could reduce errors while 10.7% did not think so. About 48% (62/139) of the participants did not know that "intravenous medication which requires maximum infusion rate of 120Ug/h should be infused at a constant rate of 4Ug/min for the first hour". Nearly 64% (89/139) of the nurses did not think that slow bolus IV injection means administration of intravenous medication in 1 minute. More than 95% (133/139) of the nurses thought that procedures posters and brochures related to IV administration on the wards, help to reduce errors. About 70% (97/139) of participants agreed that medications that are classified as high alert medication include noradrenaline and insulin. Again, most of the participants (n=94, 67.6%) agreed that alarms and ward emergencies can causes distractions both in the preparation and administration phases of IV drugs. The majority of the nurses (n=129, 92.8%) concur that shift changes and workload can contribute to IV medication error (Table 2).

In Tables 3 and 4, the relationship between socio-demographic characteristics and the knowledge level of the nurses on IV medication administration. None of the socio-demographic characteristics assessed significantly influenced the knowledge level of the nurses (p>0.05). However, the rank of the respondents was only marginally not significant (p=0.06).

Table 3. Relationship between socio-demographic factors and adequate knowledge of nurses on IV medication administration

Characteristic	Knowledge level		Total (%)	Statistical significance	
	Inadequate=49	Adequate=90		Chi-square	p-value
Age (years)					
20 – 29	15	21	36 (25.9)	1.27	0.783¥
30 – 39	31	61	92 (66.2)		
40 – 39	2	4	6 (4.3)		
50 – 59	1	4	5 (3.6)		
Sex					
Female	11	32	43 (30.9)	2.55	0.110
Male	38	58	96 (69.1)		
Qualification					
Diploma	21	30	51 (36.7)	2.73	0.547¥
Post-basic	0	3	3 (2.2)		
Bachelors	27	54	81 (58.3)		
Masters	1	3	4 (2.9)		
Rank					
SN	14	16	28 (20.2)	9.73	0.064¥
SSN	6	19	25 (18.0)		
NO	13	30	43 (30.9)		
SNO	14	16	30 (21.6)		
PNO	1	10	11 (7.9)		
DDNS	1	1	2 (1.4)		

¥ Fisher's exact test statistic; SN-Staff nurse, SSN-Senior staff nurse, NO-Nursing Officer, SNO-Senior Nursing Officer, PNO-Principal Nursing Officer, DDNS-Deputy Director of Nursing Services

Table 4. Relationship between continuous socio-demographic variables and adequate knowledge of nurses on IV medication administration

Variables	Mean	Standard error	T–statistic	P-value
Age	33.15	0.51	-1.32	0.189
Number of years working	8.28	0.50	-1.57	0.120

3.3 Research Question 2: Attitude of Nurses towards IV Medication Administration

Attitude towards IV medication administration were examined based on level of agreement to a 13-item 5-point Likert scale ranging from strongly agree to strongly disagree. Six (6) of the items on the scale which were negatively worded, were reversed so that all scores were in the same direction. Higher scores denote better attitude towards drug administration.

As shown in Table .5 below, the average attitude score was 49.2 (SD=6.5). The majority of the nurses involved in the study (n=76, 55%) had poor attitude towards IV medication administration. There were four items to which average attitude scores were high (>4.0). The majority of the respondents scored highly (4.8 ± 0.4) on the assertion that ongoing and specific training on safe management of IV drugs could reduce the risk of error. Similarly, the scores for the statement: prevention of error and clinical risk management could reduce errors during the preparation and administration phases of drugs was high (4.6 ± 0.6). There was also strong agreement to the assertion that intravenous medication errors should be reported in order to provide an improved care (4.7 ± 0.5). The other statements with high scores include: mild side effects of IV medications can be ignored and need not be reported (4.1 ± 1.2), and if a loaded syringe in a tray contains clear fluid in it, assume it as normal saline and can be used as a diluent for IV medication (4.4 ± 1.2). The items on which majority of the nurses performed poorly (scores <3) were five (5). The nurses mainly disagreed

Table 5. Attitude of nurses towards IV medication administration

Item	Min	Max	Mean	SD
Attitude score	**32**	**62**	**49.2**	**6.5**
Ongoing and specific training on safe management of IV drugs could reduce the risk of error	4	5	4.8	0.4
Prevention of error and clinical risk management could reduce errors during the preparation and administration phases of drugs	2	5	4.6	0.6
Worker's motivation can improve professional performance during the whole medication process	1	5	2.6	1.6
Protocols/procedures can affect professional behaviour, ensuring proper management of therapeutic processes	1	5	2.7	1.6
Authoritative guidelines drawn up taking into account the available scientific evidence are necessary	1	5	2.9	1.5
Clinical skills about safe management of drug therapy should be regularly evaluated	1	5	2.2	0.5
Intravenous medication errors should be reported in order to provide an improved care	2	5	4.7	0.5
*IV medication prepared by others also can be administered	1	5	3.8	1.4
*Mild side effects of IV medications can be ignored and need not be reported	1	5	4.1	1.2
*During the administration of IV fluids, maintaining accurate flow rate is not a must for all fluids	1	5	3.6	1.4
*If a loaded syringe in a tray contains clear fluid in it, assume it as normal saline and can be used as a diluent for IV medication	1	5	4.4	1.2
*When there is a confusion with any details of the IV medication, it should be referred within a colleague	1	5	2.7	1.4
*Use of abbreviations and dose expressions helps in safe administration of IV medication	1	5	3.4	1.3

	Range Score	Frequency	Percentage
Poor	32 – 49	76	54.7
Good	50 – 62	63	45.3

** Scores for these items on the attitude scale have been reversed: (1=5, 2=4, 3=3, 4=2, 5=1).*

Table 6. Factors influencing nurses' attitude towards IV medication administration (N= 139)

Factors	Overall Stigma		Total (%)	Statistical significance	
	Poor=76	Good=63		Chi-square	p-value
Age (years)					
20-29	19	17	36 (25.9)	2.95	0.414¥
30-39	52	40	92 (66.2)		
40-49	4	2	6 (4.3)		
50-59	1	4	5 (3.6)		
Sex					
Female	46	50	43 (30.9)	5.722	0.017
Male	30	13	96 (69.1)		
Qualification					
Diploma	26	25	51 (36.7)	6.43	0.091¥
Post-basic	0	3	3 (2.2)		
Bachelors	49	32	81 (58.3)		
Masters	1	3	4 (2.9)		
Employment status					
SN	16	12	28 (20.2)	9.44	0.092¥
SSN	14	11	25 (18.0)		
NO	29	14	43 (30.9)		
SNO	14	16	30 (21.6)		
PNO	3	8	11 (7.9)		
DDNS	0	2	2 (1.4)		
Studied IV drug administration					
No	32	18	51 (19.6)	2.74	0.098
Yes	44	45	97 (37.3)		
Provision of IV reference books					
No	56	46	186 (71.5)	0.01	0.929
Yes	20	17	74 (28.5)		
Requires training on giving IV's					
No	54	48	56 (83.6)	0.47	0.495
Yes	22	15	11 (16.4)		
IV practices					
Good	32	33	243 (93.5)	1.46	0.227
Poor	44	30	17 (6.5)		
Knowledge level					
Adequate	62	55	61 (23.5)	0.85	0.357
Inadequate	14	8	199 (76.5)		

¥ Fisher's exact test statistic

on statements including protocols can affect professional behavior ensuring proper therapeutic management processes (2.7 ± 1.6), workers' motivation can improve professional performance during medication administration (2.6 ± 1.6), authoritative guidelines prepared with scientific evidence is necessary (2.9 ± 1.5), and clinical skills about safe management of drug therapy should be regularly evaluated (2.2 ± 0.5). The respondents also mainly disagreed that, when there is a confusion with any details of the IV medication, it should be referred to a colleague (2.7 ± 1.4).

In Table 6, the factors that influence the respondents' attitudes towards IV medication administration. Only the sex of the nurse significantly influenced the nurses' attitude towards IV drug administration. The male nurses were 2.5 times more likely as compared to female nurses to have a poor attitude towards IV drug administration [COR = 2.51 (95% CI = 1.17 – 5.39), p<0.05]. The qualification, rank, and studying IV drug administration during training, marginally not significant in predicting the attitude of the nurses towards IV drug administration (p = 0.09).

3.4 Nurses IV Medication Administration Behaviour

This study also assessed the IV medication practices of the nurses. Table 7 below illustrates the key findings. The mean score attained on this

scale was 50.6 (SD= 4.9). A little over 50% of the nurses (n= 74, 53%) engage in poor IV medication administration practices, however the performance of the nurses was generally okay as the mean score on almost all the items were high (≥4). On the question of whether IV therapy is prepared in a dedicated room, the average score was generally low (mean= 2.1). The respondents scored highly on five items (mean score≥ 4.5). The nurses mainly agreed to following the 10 rights of medication administration (mean= 4.6). They also most of the time dispose of waste materials in dedicated containers after administration (mean= 4.6). The respondents also assert mainly that they perform a double check to verify the correct correspondence between prescription, preparation and administration of IV drugs, before administration (mean= 4.6). Many of the respondents also often enquire about stat medication prescriptions and drugs they are unfamiliar with (mean= 4.6). The nurses also most of the time, check the peripheral sites of patients receiving IV therapy, for infiltration or extravasation before IV administration (mean= 4.5).

The average nurse sometimes was their hands before preparing IV therapy (mean= 4.1), and use personal protective equipment during the preparation and administration of IV drugs (mean= 4.1). Also, they do check vital signs before and after administration of vasoactive drugs (mean= 4.2), respect the rate of infusion of solutions for IV administration (mean= 4.4), and also flush the IV line after giving the medication (mean= 4.2).

3.4.1 Factors influencing IV medication administration practices of nurses

The factors that significantly influenced poor IV medication administration practices included learning about IV drug administration during training and the availability of IV medication reference books (Table 8). The nurses who did not learn about IV drug administration during their training were 2 times more likely to engage in poor IV medication administration practices compared to those who received training on IV drug administration [COR = 2.27 (95% CI = 1.11 – 4.66), $p<0.05$]. Similarly, the odds of practicing poor IV drug administration is 2.7 times as great if the nurses do not have IV medications reference books than if they do have them [COR = 2.75 (95% CI = 1.26 – 6.01), $p<0.05$].

Table 7. IV medication administration behaviour of nurses

Item	Min	Max	Mean	SD
Practices score	**38**	**60**	**50.6**	**4.9**
Do you wash your hands before preparing therapy?	1	5	4.1	0.9
Do you prepare therapy in a dedicated room?	1	5	2.1	1.4
Do you use personal protective equipment during the preparation and administration of IV drugs?	1	5	4.1	1.2
Do you check vital signs before and after administration of vasoactive drug?	1	5	4.2	1.0
Do you respect the rate of infusion of solutions for IV administration?	1	5	4.4	0.9
Do you follow the 10 rights of medication administration?	1	5	4.6	0.7
Do you dispose materials in dedicated containers after IV drug administration?	1	5	4.6	0.8
Do you perform a double check to verify the right correspondence between prescription, preparation and administration of IV drugs, before administration?	1	5	4.6	0.8
Do you check peripheral sites for infiltration or extravasation before IV administration?	1	5	4.5	0.8
Do you flush the IV line after giving the medication?	1	5	4.2	0.9
Do you inquire about unfamiliar unclear medications and ‘stat’ drug?	1	5	4.6	0.8

	Range Score	Frequency	Percentage
Poor	38 – 51	74	53.2
Good	52 – 60	65	46.8

Table 8. Factors influencing IV medication administration behaviour of nurses (N= 139)

Factors	Behavior		Total (%)	Statistical significance	
	Poor=74	Good=65		Chi-square	p-value
Work experience(mean ± SD) yrs	7.7 ± 0.6	9.0 ± 0.8		*t = 1.30	0.195*
Age (years)					
Less than 35	51	44	95 (68.4)	0.02	0.877
35 and older	23	23	44 (31.6)		
Sex					
Female	47	49	96 (69.1)	2.28	0.131
Male	27	16	43 (30.9)		
Qualification					
Diploma	30	24	54 (38.8)	0.19	0.662
Degree	44	41	85 (61.2)		
Rank					
Junior nurses	30	23	53 (38.1)	0.39	0.532
Senior nurses	44	42	86 (61.9)		
Studied IV drug administration					
No	33	17	50 (36.0)	3.80	0.024
Yes	41	44	89 (64.0)		
Provision of IV reference books					
No	61	41	102 (73.4)	6.64	0.010
Yes	13	24	37 (26.6)		
Requires training on giving IV's					
No	15	22	37 (26.6)	3.27	0.071
Yes	59	43	102 (73.4)		
Attitude towards IV injection					
Good	30	33	63 (45.3)	1.46	0.227
Poor	44	32	76 (54.7)		
Knowledge level					
Adequate	61	56	117 (84.2)	0.36	0.549
Inadequate	13	9	22 (15.8)		

*¥ Fisher's exact test statistic; Diploma= Diploma and post-basic; Degree= Bachelors and Masters; Junior nurses= SN and SSN; Senior officers= NO, SNO, PNO and DDNS; *result from two-sample t-test*

3.5 Training Needs of Nurses on IV Medication Administration

Majority of the participants (n= 125, 89.93%) studied on the preparation and administration of IV drugs during the basic or first-degree programs. A similar majority of the participants (n= 89, 64.0%), also learnt about preparation and administration of IV drugs during their post-basic/ postgraduate program. Most of the participants (n= 102, 73.4%) did not have reference books on IV medication administration on their units. About 75% (102/139) of the nurses said they need more training on IV medication administration (see Figure 2). Based on their own assessment, nearly 55% (117/139) of the nurses feel they had good knowledge of IV medication administration.

3.6 Systems for Reporting Errors in IV Medication Administration

Majority (n= 105, 75.5%) of the participants officially report drug administration errors when they occur. On the other hand, majority (n= 109, 78.4%) reported that there were no standard protocol/ procedure on how drug administration errors should be reported in the hospital.

3.7 Barriers to Reporting IV Medication Errors in the Health Facility

Fig. 3 illustrates the barriers identified by the participants in the study to the reporting of errors in IV medication administration. Three (3) of the issues raised were identified as barriers by the majority of the nurses. While about 70% (97/139) of the respondents fear that their charge nurses would focus on individual faults rather potential system-related causes, only 27% (37/139) of the respondents did not consider the situation as a barrier to reporting errors in IV drug administration. Similarly, most of the nurses (100, 71.9%) contend that the lack of a clear standard for reporting errors is a barrier. About 27% (37/139) however did not consider a lack of clear standards as a barrier. More so, the fear of

legal actions from patient and family was identified by the majority of the nurses (n= 91, 65.5%) of the respondents. To the statements that IV medication errors committed are not serious to be reported and other nurses considering me incompetent, the majority (80, 65.5%), and (69, 50%) respectively, did not view the occurrences as barriers to reporting of IV medication errors.

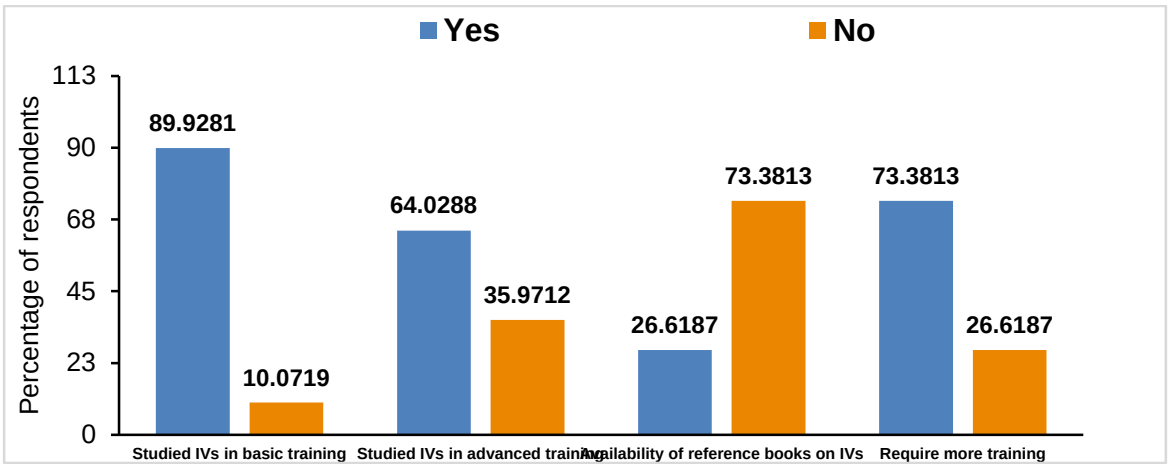

Fig. 2. Training acquired and training needs of nurses on IV medication administration

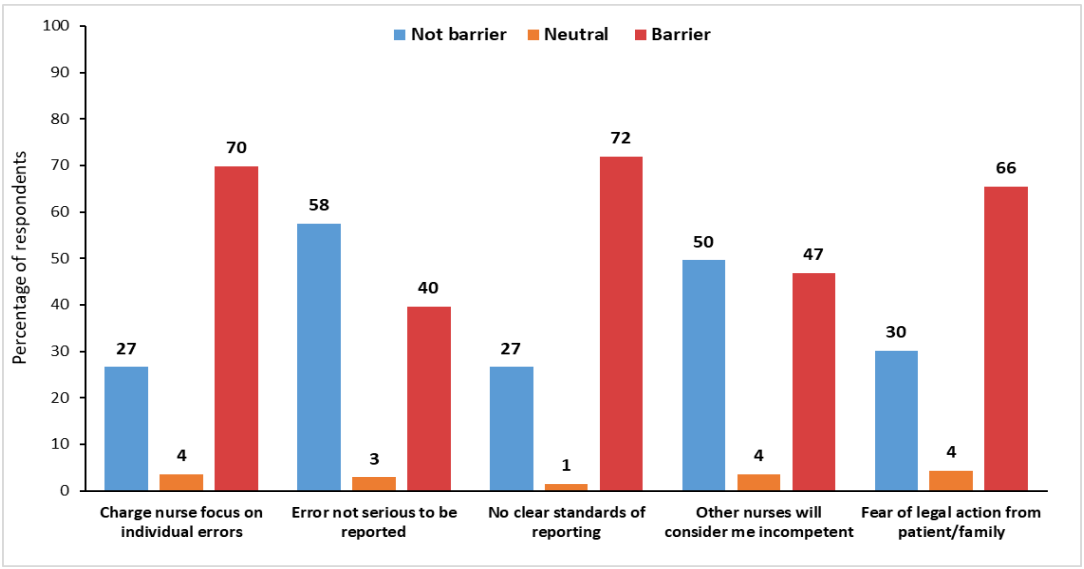

Fig. 3. Barriers to reporting IV medication errors in health facilities for nurses

Table 9. Error reporting systems for IV medication administration

Variable	Frequency (N=139)	Percentage (%)
Do you report IV drug administration error		
Yes	105	75.5
No	34	26.6
Is there standard protocol for reporting IV medication error		
Yes	30	21.6
No	109	78.4

4. DISCUSSIONS

4.1 Nurses Knowledge on IV Medication Administration

Results from the study indicate (65%) nurses have adequate knowledge on the administration of intravenous medication whilst 35% have inadequate knowledge. This should be a source of worry because a large amount (40%) of nurses clinical work time is on drug administration [19] so the nurses need to be very knowledgeable in this of aspect nursing. The levels of the knowledge base of the nurses in the study were not impacted by age, years of work experience, education, and rank. The findings showed years of work and educational level does not influence the knowledge level of nurses. This is similar to the study done by Johnson et al. [20] which revealed knowledge level among nurses is similar regardless of their clinical experience and educational level. However, in contrast to these findings, studies by Westbrooke et al. [9]; Tang et al. [21]; Wolf et al. [22] stated otherwise.

Results from the study show nurses know the essence of checking for the expiry date of drugs before administration and also agree intravenous medications acts quicker than intramuscular drugs. This is similar to studies by Shamsuddin et al. [23], and Ibrahim W& Kambal I, (2015) in which the majority of nurses check the expiry of medication and also know IV medications act quicker than intramuscular medications.

Almost 30% of participants did not know noradrenaline and insulin are classified as high alert medications (HAM) even though is amongst the common drugs used in the Emergency department. This finding is similar to studies by Zyoud et al. [24] and Shamsuddin, et al. [23]. Although 30% of respondents did not know (HAM), this study had slightly higher scores compares to other studies. This may be due to its frequent usage in the study setting. On the Question of calculating for IV Noradrenaline (4mg/ml) in 50ml 0f DNS, only 19.42% of respondents had the correct answers with an enormous 80.58% who either had it wrong or did not know. This is similar to findings by McMullan et al. [25], Fleming & Brady, [26] and Shamsuddin, et al. [23]. The probable cause of the poor scores may be as a result of the nurses dependency on the doctor's prescription which has calculated dosages to be given in ml/hour. This deprived the nurses of trying their hands on what they have learnt in schools. Wright (2015) emphasizes the relevance of better calculus' knowledge for medication dosage to decrease intravenous medication administration errors. The majority of nurses also had problems with the calculation of intravenous infusion drip or flow rates which is similar to studies done by Sultana N, (2017) and Shamsuddin et al. [27]. The findings are a source of worry because majority of the medication used at the emergency department are High Alert Medications with a narrow therapeutic index.

Wrong diluents used for reconstitution can affect the efficacy of the medication. The findings indicated most of the participants lack knowledge on various percentages of Normal saline and approved ones for dilution. The results are similar to findings by Shamsuddin et al. [27] and Cousins et al. [7].

From the study, less than half of nurses had no idea slow IV bolus medication should be given between 3-5minutes and not one minute. This is in similarity with studies where more than half of nurses also did not know slow IV bolus should be done within 3-5minutes depending on the type of medication [27]. Again, the study found that alarms, workload, and ward emergencies lead to distractions both in preparations and administration of IV medications. This study finding is consistent with a study by Palese et al. [28]. The Emergency department is chaotic most of the time due to the running of codes, resuscitation of new patients, overcrowding and caring for old critically ill patients. These coupled with alarms from ventilators, cardiac monitors and telephone calls make the place noisy. Most nurses are interrupted by all these during IV medication administration. The nurse patient ratio also is problematic due to the high turnout in the ED and is a cause of intravenous medication errors. Emergency nurses should therefore be trained to do multitasking and also there should be simulations on how to stay focus when interrupted during medication administration.

4.2 Nurses' Attitude towards IV Drug Administration

Studies done by Armstrong et al. (2017) reported that about 97% to 100% of medication errors were found to be related to attitude and behaviour. Findings from the study indicate the majority of the nurses involved in the study (n=76, 55%) had a poor attitude towards IV medication administration. This is similar to findings by Ibrahim W &Ibrahim K (2015). The

male nurses were 2.5 times more likely as compared to female nurses to have a poor attitude towards IV drug administration. This is consistent with studies by Di Muzio et al 2016 which showed female nurses have positive attitudes compared to male nurses. Results from the studies also indicate adequate knowledge is not associated with a good attitude. This is also consistent with studies by Di Muzio et al 2016 which showed no association between appropriate knowledge and a good attitude. The qualification, ranks, and studying IV drug administration during training, is marginally not significant in predicting the attitude of the nurses towards IV drug administration.

The majority of the nurses stated that awareness of the prevention of errors and clinical risk management allegedly reduces errors during drug preparation and administration. This is confirmed by studies by Valentin A, Schiffinger M, Steyrer J, Huber C, & Strunk G. [30] which showed safety culture is associated with reduction of IV medication errors. This is also in tandem with findings by Di Simone et al. (2016) & Di Muzio et al. [29] where the majority of the respondent also agreed to the assertion. This can be achieved when nurses make effort to read scientific pieces of literature on IV medication errors and awareness training programmes are done intermittently.

Furthermore, Majority of participants agree that for safe management of the entire managing process of IV drugs, authoritative guidelines should be drawn up taking into account the available scientific evidence. This can be made possible when hospital authorities make guidelines considering the emergency peculiarities or environment and current scientific evidence to make a tentative protocol to guide nurses during IV drug administration.

From the study results, the nurses strongly disagreed to the attitude of IV medication prepared by someone being administered by others, an unlabelled syringe in a tray loaded with clear fluid assumed to be as normal saline and being used for making the IV tubings patent, ignoring and not reporting the mild side effects of drugs and not maintaining the accurate flow rate of IV fluid administration. This finding has similarities to studies by Johnson et al. [20] on the attitude of nurses towards IV drug administration.

Finally, the study findings on attitude indicated intravenous medication errors should be reported to provide improved care. Reporting errors gives room for authorities to streamline structures and find possible ways to avert these errors from occurring. However, in contrast to the study above, findings by Ogunleye et al. [31] show some health professionals did not think reporting intravenous medication errors was necessary. This may be because not much is done when errors are reported or they only report errors when it leads to complications.

4.3 Nurses Behaviour towards IV Medication Error

A little over 50% of the nurses (n= 74, 53%) engage in poor IV medication administration practices, however, the performance of the nurses was generally okay as the mean score on almost all the items was high (≥4). The factors that significantly influenced poor IV medication administration practices included learning about IV drug administration during training and the availability of IV medication reference books. The nurses who did not learn about IV drug administration during their training were 2 times more likely to engage in poor IV medication administration practices compared to those who received training on IV drug administration. This is not surprising because studies indicate training courses reduce error risk by 54%. [32]. Similarly, the odds of practicing poor IV drug administration in this study is 2.7 times as great if the nurses do not have IV medications reference books than if they do have them. The majority (73.4) of the nurses do not have access to reference books because either nurses-in-charges do not know, see the significance and its relevance in the prevention of errors.

The study results reveal an average number of nurses wash their hands before the preparation and administration of drugs. This is should be cause for worry because it can lead to infections which can prolong patient's stay in the hospital and also affect their safety. The results of the study are in tandem with the findings of Ibrahim et al. (2015) where nurses have poor hand washing practice pre-administration of IV medications.

One of the significant findings is the absence of dedicated room for preparation of therapy. The result agrees with the findings of the study conducted by Di muzio et al. [29] where there is poor adherence to the use of dedicated rooms. This should be considered relevant as having dedicated rooms will reduce the number of

interruptions as well as the spread of infection during medication preparation. According to a study about 80% of nurses experienced work interruptions more than twice during that period of administration of IV medication. [33]. Several other studies also indicate nurses have to deal with lots of interruptions and with the majority being environmental such as untidy working areas, loud noise, and poor lighting. [34, 28],;(Helberg, et al, 2004). Again, the results reveal the majority of nurses make use of protective equipment during the administration of IV drugs, check vital signs, consider at least the 6 rights of patients, and also respect the rates of infusion of solution for IV administration. This result is consistent with the findings of Di Simone et al (2018) where the majority of the respondents have good behaviour on the above practices.

The introduction of technologies such as Computerised Provider ordering Entry (CPOE), Barcoding Medication administration (BCMA), and smart infusion pumps in medication administration in the hospital will cause a significant decrease in errors. Studies indicate a reduction in the incidence of errors of more than 50% with the use of these technologies [35,36].

4.4 Training Needs of Nurses on IV Medication Administration

The study revealed less than 10% of participants considered their knowledge level on IV medication administration to be excellent. This is in tandem with the studies conducted by Di Simone et al. [35] in which less than 20% of participants considered their knowledge levels to be excellent. This finding is not surprising because less than half of the population could not get the question on the calculation of Noradrenaline and infusion flow rate right. Similar studies by Shamsuddin & Sarah, (2011) also elicited less than 50% of nurses were able to handle calculations of drugs for IV administration. It is therefore imperative that greater emphasis is placed on training on drug calculation and understanding of IV medications administration. Also, studies revealed pharmacological teaching is not properly dealt with in the basic nursing or undergraduate courses and it requires intervention from the nursing institutions [32,26],. (Tshiamo et al, 2015).

Again, the result findings showed more of the participants believe they need more training on IV medication administration. This is also similar to findings by Di Simone et al, 2018 where more of the participants demanded training on IV medication administration. Studies show nursing students are incompetent in the process of medication therapy from their perspective as well as their clinical instructors. There is therefore the emergent need put to measures in place to strengthen the students' skills in dosage calculation and medication administration [37]. The study findings indicate the majority of the nurses had problems with the calculation of drug dosage and many did not attempt to answer questions that involve calculations. This is not peculiar to this study alone as literature reveals nurses have challenges in mathematical and numeracy skills worldwide. Studies by Ong et al. [38] & Ibrahim et al (2015) reveal that regular intensive awareness and training of the nurses will massively help to improve this inadequacy.

4.5 Error Reporting Systems for IV Medication Errors

The results from the study show more (75.54%) of the participants report drug administration errors when they occur but this finding is inconsistent with studies by Bifftu et al. [39] which showed error reporting rates of 20.6 % to 33.4 % of intravenous-related medication. Another study finding by Ogunley et al, (2016) indicates less than half of the population report drug administration errors which is also inconsistent with the findings of the study.

Moreover, Bayazidi et al. [40]also indicated that the medication error reporting rate among nurses was far less than medication errors committed. Furthermore, the findings indicate there are no standard protocols or procedures as to how the reporting should be done. Most of them either report them to their ward –in-charges write them in incidence books, fill adverse drug forms or report is made by someone else. Standardization of the reporting system should be a priority to give room for proper review of errors and how to curb them. The Institute of Medicine's (IOM) report To Err Is Human: Building a Safer Health System stress the relevance of reporting errors making use of systems to "hold providers accountable for performance," and "provide information that leads to improved safety".

The study also reveals there are barriers to the reporting of IV medication administration errors in the facility. Most of the participants agreed that when nurse managers tend to focus on the individual rather than the system as a potential cause, it leads to under reporting of errors. Also,

there are no clear definitions or standards to IV medication reporting and the fear of legal action from patients and families are some of the barriers to reporting IV medication errors in the facility. This result is consistent with the findings. Bahadori et al. [41] which revealed that the utmost reasons for not reporting on medication errors are is as a result of managerial factors, the process of reporting, and fear of the repercussions of reporting respectively. Similar studies indicated that nurses perceived administrative response, blaming, focusing on the individual rather than looking at the systems as potential cause to the under-reporting of medication administration errors [42]. Another similar study by (Rutledge DN, Retrosi T,& Ostrowski G,2018) confirms the fear of repercussions as one of the barriers to error reporting

Although despite the respondent disagreeing minor errors not being reported and colleague considering them incompetent not being a barrier there is a tendency to forfeit reporting the error. This is because there are no obvious side effects and your colleagues will not even know to doubt your competence. Standard protocols which are non-punitive will significantly reduce barriers in error reporting.

5. SUMMARY

This study was mainly sought to examine nurse's knowledge, attitude and behaviour regarding IV drugs administration errors in the emergency department of Komfo Anokye Teaching Hospital. Specific objectives set were to; assess the knowledge level of nurses on IV drug administration, determine the attitude of nurses towards IV drug administration, establish nurse's behaviour towards IV drug administration, determine the training needs of nurses on drug administration and examine the reporting system of drug IV administration errors in the facility.

The study revealed that the majority 66.19% of the respondents were within 30-39 years whiles the least 3.60% were aged from 50-59 years. On gender relation, it was seen that 69.06% of them were females. The study found that some 30.94% forming the majority of the nurses were "NO" and the least 1.44% were DDNS. Results from the study showed that most 58.27% of the respondents were degree holders and the least 2.16% were post- basic training.

5.1 Key Findings

5.1.1 The knowledge level of nurses on IV drug administration

More than half of the population has adequate knowledge on IV medication administration. The majority of the respondent know medication from the pharmacy has to be check for expiry. However, it was revealed that more than half of the respondents did not know how to calculate the dosage of IV medication in a given concentration. Also, almost half of the respondents did not know how to calculate the infusion rate of IV medication in the first hour. The levels of the knowledge base of the nurses in the study were not impacted by age, years of work experience, education, and rank. The findings showed years of work and educational level do not influence the knowledge level of nurses.

5.1.2 Nurses attitude towards IV drug administration

Findings from the study indicate the majority of the nurses involved in the study (n=76, 55%) had a poor attitude towards IV medication administration. The male nurses were 2.5 times more likely as compared to female nurses to have a poor attitude towards IV drug administration. Results from the studies also indicate adequate knowledge is not associated with a good attitude. The qualification ranks, and studying IV drug administration during training, is marginally not significant in predicting the attitude of the nurses towards IV drug administration.

5.1.3 Behaviour of nurses towards IV drug administration

A little over 50% of the nurses (n= 74, 53%) engage in poor IV medication administration practices, however, the performances of the nurses were generally okay as the mean score on almost all the items was high (≥4). The factors that significantly influenced poor IV medication administration practices included learning about IV drug administration during training and the availability of IV medication reference books. The nurses who did not learn about IV drug administration during their training have poor IV medication administration practices compared to those who received training on IV drug administration. Also, the absence IV medications reference books lead to poor IV medication practices.

5.1.4 Training needs of nurses on administration of IV medication errors

On the training needs of nurses on prevention of medication error, the study revealed that majority of the nurses learnt preparation and administration of IV drug during the basic or first-degree course. Majority of the nurses declared that their units did not have books for references during IV medication administration. Almost two-thirds of the nurses admitted they needed more training on IV medication administration. More than half of the nurses feel they had good knowledge of IV medication administration.

5.1.5 Error reporting systems

Findings from the study depicted that most of the nurses officially reported drug administration errors when they occur. The study found that there was no standard protocol/ procedure as to how drug administration errors should be reported in the hospital. Majority of the nurses also reported that Nurse Managers tend to focus on the individual rather than the system as a potential cause and there is fear of legal action from the family and patient.

6. CONCLUSION

Giving intravenous medication remains one of the topmost duties of emergency nurses since most of the medications in emergent cases are mostly given intravenously. It is also a key moment to correct errors that were not detected in the earlier phases before the medication is administered. The poor calculation and dosing skills of nurses on IV medications should be dealt with critically as mistakes can lead to complications or even deaths. The positive attitude of nurses should be encouraged as well as supervision. The experiences of nurses have an impact on the behaviour of nurses on IV medication administration. Therefore, senior nurses should be encouraged to work with junior staff during medication administration. Interruptions in the emergency department are inevitable especially with the resuscitation of coded patients so nurses should learn to do more multitasking to reduce the incidence of IV medication errors. Standard protocols for reporting IV medication administration errors should be a priority for the hospital authorities so that proper interventions can be put in place to prevent similar errors from occurring. Nursing institutions should review the course structure on pharmacology and also introduce simulation in the teaching of IV medication administration.

7. RECOMMENDATION

Based on the findings and conclusion drawn from this study, the following recommendations are made for practice, policy, education, and further research:

Practice

1. Nurses should be allocated a dedicated room or area for the preparation of IV medications to prevent contamination and reduce risk.
2. Nurse supervisors should entreat nurses to perform a double check to verify the correct correspondence between prescription, preparation and administration of IV drugs, before administration. Also, the checks can be done by two nurses using the 6' rights.
3. Nurses should impress on management to employ the new technologies on prevention of medication errors such as smart infusion pumps, Computerized Provider Order Entry (CPOE) , and Barcoding Medication Administration (BCMA).
4. Nurses should be encouraged to observe strict handwashing before the preparation and administration of IV medication to reduce the incidence of infection to promote patients' safety.
5. Nurses administering vasoactive drugs (dopamine, dobutamine, and nitroglycerin) should be encouraged to check vital signs before and after administration.
6. Nurses should also be encouraged to habitually make references on unfamiliar medications to be abreast with their mechanism of action and side effects before administration.
7. Nurses should dedicate some hours per week for continuing medical education to keep in touch with new developments in nursing.
8. All prescriptions should include the name of the patient, the drug, the dosage form, and the strength or concentration in the metric system, except for therapies that use standard units such as insulin, vitamins, etc. Units should be written in full and, the units specified rather than writing an abbreviation such as a "U", which could be misinterpreted as a zero.

9. Also, written drug or prescription orders should be completely readable, not merely recognizable through familiarity.

Policy

Hospital management should:

1. Provide dedicated rooms or areas for the preparation of IV medications to prevent contamination of drugs.
2. Provide protocols/guidelines/procedures on IV medications administration at dedicated areas or rooms to serve as a guide during administration.
3. Make available drug reference books and British National Formulary (BNF) on the Units for regular reviews during drug administration.
4. Provide a clinical pharmacist at the various Units to give assistance and advice when there are medication issues.
5. Organize regular training workshops on IV medication administration for staff and recruits at least once a year. Also, training should focus on the calculation of dosages of IV drugs and flow rates.
6. Provide training which are based on clinical practices in tandem with the theoretical knowledge of IV medication administration.
7. Furthermore, conditions of service in the health sector should be improved to reduce the brain drain.
8. Finally, the study recommends that emphasis should be placed on preventive medicine, which may result in a reduction in hospital attendance. This may translate into a reduction in workload at health facilities.
9. Provide a proper standardised reporting system to capture errors in the facility.
10. Proper registering and audit unit for errors should be set up and regular feedbacks from investigated errors should be made available to the staff.
11. Non-punitive error reporting channel should be set up to reduce the barriers to the reporting of errors

Education

1. The curricular of nursing training institutions should involve detailed pharmacology lessons with an emphasis on the calculation of IV medication and dosing. Simulations on IV medication administration should form part of the training which makes it more practical for the students.
2. Post basic and post-graduate training schools should include pharmacology and IV medication administration in their curriculum.
3. The Ghana College of Nurses and Midwives should be mandated to run short refresher courses on IV medication administration for practicing nurses to keep them updated on new trends on medication administration.
4. Nurses and Midwives Council (NMC) should make it compulsory for nurses to have continuous professional development training on IV medication administration before renewal of their professional pins. This will prevent medication errors and improve patient safety in the hospital.

ETHICAL APPROVAL

An introductory letter from the Ghana College of Nurses and Midwives was sent to Committee of Human Research, Publication and Ethics (CHRPE) KNUST for ethical clearance. Ethical approval (RE: CHRPE/AP/249/19) for the study was given from the Committee of Human Research, Publication and Ethics (CHRPE) KNUST after reviewing my proposal as well as other documents. After ethical approval was given, permission was sought from the various unit heads at Emergency department of KATH for the commencement of data collection.

CONSENT

The study was explained to the nurses using information sheets. The researcher ensured that the respondents understood the study before they were made to sign the consent. Respondents were made aware their responses to the questionnaires are anonymous. Eliminating the likelihood of identifying respondents' details was ensured by separating the consent form from the questionnaires. Voluntary participation and withdrawal at any time before or during the study were discussed with the participants during the information sessions and also explained in the cover letter. Participants were assured that withdrawal from the study would not affect them negatively in any way. It was also explained to them that their privacy would be respected.

However, signing the consent forms would be not compulsory, as a return of the questionnaire would indicate consent has been given voluntarily. The principles of maintaining participants' confidentiality and anonymity are vital ethical considerations and would be

explained to the participants. Privacy of participants would be ensured through informed consent and voluntary participation in the research study.

Records will be retained for 5 years. Hard copies would be kept under lock and key and only made accessible to the study team. Data entered will be stored on a pen drive and backed up on google drive belonging to the principal investigator.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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