

Original Article

Evaluating nurses' knowledge regarding dosage calculation at Civil Hospital, Karachi

Abdul Rahim Mangrio¹, Pir Bux Jokhio² & Saif Ullah Mahar²

¹School of Nursing, Peoples Medical Hospital, Nawabshah, Pakistan

²Begum Bilquees Sultana Institute of Nursing, Peoples University of Medical & Health Sciences for Women, Shaheed Benazirabad, Nawabshah, Pakistan



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Corresponding Author Email:

pjokhio@pumhs.edu.pk

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Abstract

Background: Appropriate therapeutic care and management are primarily based on the knowledge of dosage calculation and associated skills. The objective of this study was to determine the awareness of staff nurses working in a tertiary care hospital regarding the dose calculation.

Methodology: A pre and post-test interventional study were conducted at a Civil Hospital, Karachi over a sample of 50 staff nurses working in different departments. The data was collected using an assessment tool containing 20 items to evaluate the drug dosage calculation skills and knowledge of the staff nurses. The assessment test was taken once initially after enrolment and then an extensive interventional training regarding the dosage calculation was provided to each nurse which was followed by a post-intervention assessment test. The results were then rated based on knowledge scores both before and after intervention i.e. 1-5 (poor), 6-10 (satisfactory), 11-15 (good), and 16-20 (excellent). Data were analyzed using SPSS version 21.0.

Results: A total of 50 nurses participated in this study, of which 44% were males and 56% were females. The nurses had better knowledge both pre & post-test regarding the intravenous medication as compared to the oral e.g. the nurses of the neurosurgery department obtained a mean pre-test score of 4.2 ± 0.8 (Oral) and 10.1 ± 2.4 (Intravenous), while the mean post-test were 4.7 ± 0.7 (Oral) and 14.6 ± 0.7 (Intravenous). Another point of concern was the dosage calculation in the pediatrics department was compromised both for oral and intravenous 2.8 ± 1.7 (pre-oral) and 6.5 ± 1.2 (post-intravenous) increased to 4.6 ± 0.7 (post-oral) and 13.6 ± 1.8 (post-intravenous). Moreover, 18% of the nurses had poor knowledge of dosage calculation as rated on the pre-test assessment while based on the post-test score none of the nurses had poor knowledge, the majority was labeled as having improved knowledge of dosage calculation after interventional training.

Conclusion: Overall, the study reveals that the majority of the staff nurses lack adequate knowledge and skills related to drug dosage calculations. There is a dire need for in-service education to enhance the knowledge and skills of staff nurses related to drug dosage calculations.

Keywords

Dosage Calculation, Nurse Knowledge, Skills, Oral Medication, Intravenous Medication.



Introduction

Appropriate medication administration by the correct calculated dose is an essential component of delivering patients' care¹. It is a complex process that needs mathematical proficiency to mitigate the chances of medication calculation errors and enhances the patient's safety¹. Nurses' drug calculation ability is a topic that had remained a central point of debate and discussion in the recent years^{2,3}. In a randomized controlled comparative study, it was identified that staff nurses possessed better knowledge related to drug dose calculation as compared to the undergraduate counterparts². The main reasons for poor drug calculation knowledge and skills were related to insufficient pharmacological awareness, non-integration of mathematics & pharmacology courses, an inability to calculate the medication dosage correctly and work-load burdens etc³.

It has been found that nearly one in every five dosage calculation errors is mostly associated with the decreased knowledge of the nursing staff which has greatly put the patient's safety at stake⁴. It is very necessary to review nurses' drug calculation knowledge and skills not only at the time of employment⁵ but also it must be reassessed continually with the upgradations of the guidelines to reduce the chances of drug calculation errors to keep the patients' safety intact¹. Furthermore, it is a common understanding that children are at higher risk for adverse medication events than adults because of weight variations between two groups^{6,7}. There are many medications available in the market in adults' dosages and forms, hence for pediatric usage, the dosage must be adjusted according to the weight and age of that child⁸.

It is argued that the staff nurses' medication calculation ability is vital and has been associated with quick & prompt recovery among patients. Therefore, registered nurses'

good knowledge and skills are an important indicator of adherence to safety protocols⁵. This study was aimed to assess the staff nurse' knowledge and skills related to drug calculations. The main reason for this research was to fill in the gap in the knowledge and skills related to drug calculation as there is little known locally about the significance of this concern and its impact on public health and wellbeing.

Methodology

This pre and post-test interventional study were conducted to assess the knowledge of the staff nurses related to the dosage calculation from May to September 2018. A sample of 50 staff nurses of Civil Hospital, Karachi were included in the study through a non-probability purposive sampling technique. All staff nurses registered with Pakistan Nursing Council (PNC) and having at least six-month work experience were included in the study while those who had completed some specific mathematical courses were kept in the exclusion criteria.

The study was approved by the Institutional Review Board of the Dow University of Health Science (DUHS) & permission for the study conduction was granted by the Medical Superintendent of Civil Hospital Karachi. The purpose of the study was explained to all nurses, written informed consent were taken before the study conduction and confidentiality was maintained. Data was collected through an assessment tool containing 20 items and each item carried one mark, it was designed to evaluate the drug dosage calculation skills and knowledge of the staff nurses. The important aspects covered in the study questionnaire were metrics conversions, drip rate, oral & intravenous dosage calculation, blood, and its products rate, and the proportion of inotropic infusions.

Initially, all enrolled nurses were pretested for their abilities and knowledge regarding dose calculation, and then each nurse was made to participate in the drug dosage calculation training in which instructors and researchers provided the complete concept of drug dosage calculation both micro and macro. Moreover, individual assistance and teaching including exercises and examples associated with the practice were informed and provided, assignments and group projects were also incorporated for better understanding. After training completion, the post-test assessment was conducted to re-evaluate the knowledge of these nurses.

The nurse knowledge was determined based on the scores obtained during the assessment both pre and post-intervention, a score between 1-5 was considered as poor, 6-10 is satisfactory, 11-15 as good, and between 16-20, it was considered as an excellent score.

Data were analyzed using SPSS version 21.0, the mean and standard deviation was computed for all continuous variables like age of nurses, work experience, etc. Frequency and percentages were calculated for all categorical variables like gender and education, etc.

Results

A total of 50 nurses participated in this study, out of which 22(44%) were males and 28(56%) were females. Of the sample, 42(84%) were registered nurses' and 8(16%) were senior staff nurses. Moreover, based on the academic background, 31(62%) were nursing diplomates and had a post-basic specialty (RN), whereas, 17(34%) were baccalaureate and only 2 nurses had a diploma in general nursing. Nurses from different departments were recruited i.e. pediatric, neurosurgery, orthopedic, medicine, surgical, emergency, and vascular surgery, etc.

Table I: Demographic characteristics of the enrolled nurses

Variables	n(%)	
Gender	Male	22(44)
	Female	28(56)
Marital Status	Unmarried	17(34)
	Married	33(66)
Age (Years)	20 – 29	23(46)
	30 – 39	19(38)
	40 – 49	6(12)
	50+	2(4)
Work Experience	≤ 1 year	2(4)
	2- 5 years	22(42)
	6-10 years	14(28)
	11-15 years	6(12)
	16-20 years	2(4)
	> 20 years	4(4)
Present Position	Registered Nurse	42(84)
	Senior Staff Nurse	8(16)
Departmental distribution	Neurosurgery	16(32)
	Pediatrics	8(16)
	Vascular surgery	7(14)

Medicine	5(10)
Ear	4(8)
Eye	3(6)
Surgical	3(6)
Emergency	2(4)
Orthopedic	2(4)

The mean pre and post-test scores indicated positive variation in the knowledge of nurses regarding dosage calculation after the interventional training program. The departmental distribution indicated that maximum knowledge variation related to intravenous medication among the nurses of medicine and surgery department i.e. mean intravenous medication pre-test score in medicine department was 6 ± 4.3 vs 13.2 ± 2.5 (post-test scores). While in the surgery department, it was 3.3 ± 1.2 (pre-test) and 11.3 ± 0.6 (post-test). Whereas, for oral medication, the result scores varied from pre to post-test but the variation was not much prominent.

Table 2: Mean pre & post-test scores regarding oral and intravenous medication

Departments	n	Pre-test		Post-test	
		Oral Medication	Intravenous Medication	Oral Medication	Intravenous Medication
Neurosurgery	16	4.2 ± 0.8	10.1 ± 2.4	4.7 ± 0.7	14.6 ± 0.7
Pead's	08	2.8 ± 1.7	6.5 ± 1.2	4.6 ± 0.7	13.6 ± 1.8
Orthopaedics	02	1.7 ± 1.1	1.8 ± 1.4	5.5 ± 0.7	09 ± 9.0
Medicine	05	02 ± 1.2	06 ± 4.3	4.4 ± 1.3	13.2 ± 2.5
Surgery	03	1.3 ± 0.6	3.3 ± 1.2	3.7 ± 0.6	11.3 ± 0.6
Emergency	03	2.3 ± 0.6	10 ± 0.0	4.7 ± 0.6	12.3 ± 2.3
Eye	02	1.7 ± 0.9	07 ± 1.3	2.5 ± 0.5	6.5 ± 2.7
ENT	04	4.5 ± 0.5	09 ± 2.8	05 ± 0.0	11.5 ± 3.4
Vascular	07	2.4 ± 1.5	6.1 ± 4.7	4.1 ± 1.6	13.4 ± 2.4

*Values are given as Mean \pm SD.

Table 3 shows the grade performance of nurses in pre & post-test assessment. Based on the scoring, 9(18%) nurses obtained poor scores, 11(22%) had satisfactory scores, 23(46%) and 7(14%) had good and excellent scores respectively in the pre-test assessment. However, as compared to the post-test a quite difference was observed as 41(82%) respondents obtained excellent grade and their scores range from 16 to 20. And 9(18%) obtained good grade scores. It means good improvements in the nurses' knowledge were noted in the post-test.

Table 3: Evaluation of Questionnaire following Rating Scale

Knowledge scores	Pre-test	Post-test
Poor (1-5)	09(18)	-
Satisfactory (6-10)	11(22)	-
Good (11-15)	23(46)	09(8)
Excellent (16-20)	07(14)	41(82)

*Values are given as n(%)

Discussion

Medication administration is an essential part of the nursing performance and an important feature of delivering patient care up to the standard. This is why qualified and trained staff nurses are required to mitigate the chances of drug dosages related errors and controversies¹. Complex calculations are needed for medication preparation therefore skills and proficiency in mathematics are necessary for accurate medication calculation³. Pre-test data analysis revealed that the nurses had limited knowledge related to medication dosage calculation as 18% were unable to calculate proper medication dose. These results were compared with the results of another study conducted by Ashby⁹, which reported that 56.4% of nurses could not calculate medication dosage accurately. Moreover, in a study conducted in North England, the main reason identified behind nurses' inadequate knowledge related to medication calculation was poor integration of pharmacological knowledge¹⁰. In this study, only 11(26%) clinical nurses possessed adequate knowledge of drug pharmacology while 31(74%) didn't have sufficient knowledge. Hence it was apparent that drug calculation knowledge and skills improved with experiences.

In a study conducted in Saudi Arabia, it was highlighted that drug dosage calculation errors were common among staff nurses working in the critical care department of a tertiary care hospital¹¹. It was excavated that recurrent alteration of orders and workload were common causes. The study further explained that drug dosage calculation related deficiencies among staff nurses were very common irrespective of their level of degree¹¹. In our study, it was found that the intravenous medication drug dosage related skills of staff nurses were much better than oral medication dosage calculations both before and after the intervention. The results of our study are concurrent with a study conducted in Iran³.

The study had found that nurses' main problem in drug dosage calculation constituted giving post-operative analgesics without prescriptions (34.2%). The study further examined that multiple oral drugs' administration processes made nurses confused and they lacked proper calculation skills in this regard⁵. While in contradiction, a study conducted by the Medical Centre University of Malaysia revealed that staff nurses had a piece of average knowledge about I/V drug preparation and administration¹².

Our study further elaborated that staff nurses working in children wards had poor oral drug calculation skills (Table 2). Our findings that nurses' drug dosage calculation skills vary between nurses working in different wards were also supported⁷. It was also discovered that interaction between degree level and experience had significant *vis-à-vis* drug dosage calculation assessment⁷. It has been documented that the main problem of inconsistency in drug dosage calculation skills of registered nurses was due to a lack of pharmacologically related content in nursing curricula and lack of focus on educating nursing students. It is highly recommended that new teaching strategies must be adopted to enhance students' skills¹³. In this way, after the transition from nurse student to a registered nurse, that person will not be confused at the time of providing their services to the patients with confidence and autonomy¹³.

It is suggested that special concern must be directed towards taking initiatives to improve drug calculation knowledge and skills as this is a valued area to secure patients' safety. This activity or endeavour doesn't exist alone but is influenced by the work conditions around which nurses are engaged. Therefore, it is augmented that accurate and efficient drug calculation skills are pre-requisites for safe medication administration and it becomes real through a favourable learning environment¹⁴.

There were few limitations related to this study. The sample size was small, as this study was limited to a specific public hospital, hence, there is a chance that the nurses who are working in other public hospitals may seek further knowledge related to dosage calculation. Thus, the result cannot be generalized, a better representation would have included nurses across the city.

Conclusion

This is crucial for nurses to keep themselves updated regarding medication dosage calculation. In baseline assessment, majority nurses had poor knowledge of dosage calculation while the post-test results were quite improved. The results of this study highlighted the need and importance of in-service sessions for nurses on drug calculation to keep them updated with the drug dosage knowledge, which could be helpful in the reduction of calculation errors.

Conflicts of Interest

None.

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