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***Original Research Article***

# Assessing Nurse's Knowledge of Drug Dose Calculation: A Cross-Sectional Study in a Private Hospital in Lahore

**Shamas Rafique*, Shahroz Najam, Abdur Rehman Arif, Mishal Liaqat, Carol Samson**

*Al-Aleem Institute of Nursing, Gulab Devi Educational Complex, Lahore, Pakistan*
**Corresponding author`s email address:* shamasrehmani7860@gmail.com

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**Abstract:** *Accurate drug dose calculation is a critical competency for nurses to ensure safe and effective patient care. Medication errors, often linked to poor dosage knowledge, pose significant risks, particularly in developing countries like Pakistan. This study aims to assess the knowledge of drug dose calculations among registered nurses at a private tertiary care hospital in Lahore.* ***Objective:*** *To evaluate the level of knowledge regarding drug dose calculations among registered nurses and identify areas requiring educational intervention.* ***Methods:*** *A descriptive cross-sectional study was conducted from January to April 2025 at Gulab Devi Hospital, Lahore. A total of 126 registered nurses were selected using a non-probability convenience sampling technique. Data were collected via a self-administered questionnaire comprising demographic details and 20 multiple-choice questions on drug dose calculation. Each correct response earned one point, with knowledge categorized as poor (1–5), satisfactory (6–10), good (11–15), or excellent (16–20). Data were analyzed using SPSS version 27.* ***Results:*** *The majority of participants were female (88.1%) and aged 20–35 years (65.1%). Most held a General Nursing Diploma (55.6%), and one-third had over 10 years of experience. The mean knowledge score was 11.52 ± 4.93. Over half (55.6%) of the nurses demonstrated satisfactory knowledge, 33.3% had excellent knowledge, 8.7% showed good knowledge, while 2.4% had poor knowledge. High accuracy was noted in basic unit conversions, while lower performance was observed in complex calculations such as dilution and weight-based dosages.* ***Conclusion:*** *The findings indicate moderate competence in drug dose calculations among nurses, with significant room for improvement in complex clinical scenarios. Educational interventions, such as structured training and the use of digital tools, are recommended to enhance dosage calculation competencies and reduce medication errors.*

**Keywords:** Drug dose calculation, nursing knowledge, medication safety, dosage errors, nursing education, Pakistan

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## Introduction

In recent years, the importance of accurate drug dose calculation within nursing practice has gained significant attention, particularly in regions like Pakistan, where health systems are under constant strain. Drug-related errors can lead to substantial morbidity and mortality, emphasizing the necessity for nurses to possess a strong foundation in pharmacology and competent dosage calculation skills. A cross-sectional study conducted at a private hospital in Lahore aims to assess nurses' knowledge on drug dose calculations, a vital competency for ensuring patient safety and effective healthcare delivery (1).

Research indicates a concerning prevalence of medication errors directly correlated with insufficient knowledge among nursing personnel. Specifically, a systematic review identified that numerous studies reveal nurses often experience significant gaps in their drug calculation skills, which can lead to serious errors in patient care (2). An alarming aspect of these findings is that a significant proportion of nurses display poor proficiency in drug dosage calculations, affecting their overall confidence and performance in administering medications (3, 4). Furthermore, gender differences and education levels have been scrutinized, revealing that those with higher education levels tend to perform better in drug calculations (5, 6).

Moreover, the educational framework within nursing programs necessitates a thorough integration of mathematical principles alongside clinical practice to enhance the drug calculation competencies of both nursing students and practicing nurses. It has been established that structured training and educational interventions can lead to measurable improvements in nurses' performance regarding drug dosage calculations (7). However, despite ongoing improvements in educational strategies, many nursing professionals continue to face challenges when precise drug dose calculation is required, particularly in high-pressure environments such as emergency and critical care (8).

The implications of inadequate knowledge in drug dose calculations extend beyond mere oversight; they significantly compromise patient safety. Errors in medication dosages, particularly in vulnerable populations like pediatrics or oncology, are frequently attributed to insufficient understanding or miscalculations by nursing staff (9). This substantiates the need for continual education and assessment of nurse competencies in drug administration and calculation through innovative teaching methodologies, including simulation-based learning and digital technologies (10, 11).

In conclusion, this study stresses the critical need for enhancing the knowledge and skills of nurses regarding drug dose calculations in Lahore's private healthcare sector. With medication errors being preventable and linked directly to nursing knowledge deficits, implementing comprehensive training programs is essential to uphold patient safety standards and improve health outcomes (12, 13).

## Methodology

This study employed a descriptive cross-sectional design to assess the knowledge of drug dose calculation among registered nurses working at a private tertiary care hospital in Lahore, Pakistan. The study was conducted at Gulab Devi Hospital, which serves as a teaching and clinical training facility affiliated with the Al-Aleem Institute of Nursing. The target population consisted of registered nurses of both genders working in various wards, including medical, surgical, pediatric, and cardiac units. Data collection took place over a period of four months, from January to April 2025.

A sample size of 126 nurses was determined using Yamane's formula based on a total population of 183 nurses, assuming a 95% confidence

interval and a 5% margin of error. A non-probability convenience sampling technique was used to recruit participants who were willing to provide informed consent. Inclusion criteria encompassed registered staff nurses aged 20 years or above who were actively working in clinical departments at the time of data collection. Nurses who were on leave, undergoing clinical rotations, working in administrative roles, or categorized as CNAs or ULPNs were excluded from the study.

Data were collected using a structured, self-administered questionnaire distributed to participants after obtaining informed consent. The instrument consisted of two sections: the first captured demographic variables, including age, gender, qualification, ward placement, and years of experience; the second assessed drug dose calculation knowledge through 20 multiple-choice questions focusing on unit conversions, dosage adjustments based on weight, dilution calculations, and interpretation of medication labels.

Each correct response in the knowledge section was awarded one point, with a maximum possible score of 20. Based on their total scores, participants were categorized into four knowledge levels: *poor* (1–5), *satisfactory* (6–10), *good* (11–15), and *excellent* (16–20). The data were entered and analyzed using IBM SPSS Statistics version 27. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the data. No inferential statistical tests were applied, as the focus of the study was purely descriptive.

**Results**

A total of 126 registered nurses from Gulab Devi Hospital, Lahore, participated in this cross-sectional study to assess their knowledge of drug dose calculation. The demographic distribution of respondents is summarized in Table 1. The majority of participants were females (88.1%), and most were aged between 20–35 years (65.1%). In terms of education, 55.6% held a General Nursing Diploma, 36.5% had a BSN, and 7.9% were Post-RN qualified. Regarding experience, one-third (33.3%) had more than 10 years of work experience. Participants were distributed across medical (15.9%), cardiac (29.4%), pediatric (23.0%), and other wards (31.7%). (Table 1).

The overall drug dose calculation score ranged from 2 to 20, with a mean of 11.52 ± 4.93, as shown in Table 2. This indicates a moderate level of knowledge among the majority of nurses. (Table 2).

Based on scoring thresholds, the distribution of knowledge levels is presented in Table 3. The majority (55.6%) had satisfactory knowledge, while only 33.3% reached the excellent level. A small proportion showed poor (2.4%) or good (8.7%) knowledge. (Table 3).

Table 4 highlights the results of 12 selected questions from the knowledge section, along with the correct response and the percentage of participants who answered correctly. (Table 4). Most nurses had a moderate understanding of drug dose calculations, but critical errors were noted in questions requiring complex conversions or clinical dosing scenarios. The mean knowledge score of 11.52 (out of 20) indicates borderline competence. High correctness was seen in basic unit conversions (e.g., mg to mcg), while lower accuracy was observed in weight-based or dilution-based calculations. A significant proportion of nurses (55.6%) only demonstrated *satisfactory* knowledge, warranting educational interventions to strengthen medication safety practices.

**Table 1: Demographic Characteristics of Participants (n = 126)**

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age | 20–25 years | 42 | 33.3 |
| | 25–35 years | 40 | 31.7 |
| | 35–45 years | 34 | 27.0 |
| | >45 years | 10 | 7.9 |
| Gender | Female | 111 | 88.1 |
| | Male | 15 | 11.9 |
| Education | General Nursing | 70 | 55.6 |
| | Post-RN | 10 | 7.9 |
| | BSN | 46 | 36.5 |
| Experience | <2 years | 20 | 15.9 |
| | 2–5 years | 33 | 26.2 |
| | 5–10 years | 31 | 24.6 |
| | >10 years | 42 | 33.3 |
| Ward | Medical | 20 | 15.9 |
| | Cardiac | 37 | 29.4 |
| | Pediatric | 29 | 23.0 |
| | Other | 40 | 31.7 |

**Table 2: Descriptive Statistics of Knowledge Score (n = 126)**

| Statistic | Value |
|---|---|
| Minimum Score | 2 |
| Maximum Score | 20 |
| Mean Score | 11.52 |
| Standard Deviation | 4.93 |

**Table 3: Knowledge Level Classification**

| Knowledge Level | Score Range | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Poor | 1–5 | 3 | 2.4 |
| Satisfactory | 6–10 | 70 | 55.6 |
| Good | 11–15 | 11 | 8.7 |
| Excellent | 16–20 | 42 | 33.3 |

**Table 4: Selected Drug Dose Calculation Questions (n = 126)**

| No. | Question | Correct Answer | % Correct |
|---|---|---|---|
| 1 | Convert 5 mg into micrograms | 5000 mcg | 84.1% |
| 2 | 8 mL of drug solution equals how many microliters? | 8000 mL | 76.2% |
| 3 | Sodium chloride in 500 mL of 0.9% solution | 4.5 g | 80.2% |
| 4 | Dopamine 1% in a 5 mL ampoule equals how many mg? | 50 mg | 30.2% |
| 5 | Volume of 1:10000 adrenaline needed for 1 mg dose | 10 mL | 34.9% |
| 6 | Safe volume of 2% lignocaine for an 80 kg patient at 3 mg/kg | 12 mL | 46.0% |
| 7 | Dilution of 1 L of 10% sodium hypochlorite to 2% | 4000 mL | 47.6% |
| 8 | Concentration of 1 mg of atropine in a 10 mL solution | 0.1 mg/mL | 46.8% |
| 9 | Volume of atropine needed for a 45 kg patient at 20 mcg/kg | 9 mL | 40.5% |
| 10 | Volume of 750 mg cefuroxime diluted in 10 mL to give 375 mg | 5 mL | 41.3% |
| 11 | Paracetamol dose 130 mg from 250 mg/5 mL syrup | 2.6 mL | 44.4% |
| 12 | Calcium carbonate tablets needed for a 1500 mg dose from 250 mg tablets | 6 tablets | 81.7% |

**Discussion**

In this cross-sectional study conducted at Gulab Devi Hospital in Lahore, we aimed to assess the knowledge of drug dose calculations among registered nurses. The results indicated that the overall knowledge score of 11.52 (out of 20) suggested a moderate level of understanding, highlighting an urgent need for educational interventions. A substantial proportion of nurses, specifically 55.6%, demonstrated satisfactory knowledge, while only 33.3% achieved an excellent level. These findings resonate with existing literature, revealing a persistent gap in medication calculation competencies within the nursing profession in Pakistan and beyond (14).

In analyzing the demographic characteristics of our participants, it was noted that the majority were female (88.1%) and predominantly within the age range of 20-35 years (65.1%). This aligns with the demographic trends observed in nursing populations in other studies, where younger nurses generally exhibit less clinical experience than their older counterparts (1). Furthermore, a significant number of participants (55.6%) held a General Nursing Diploma, indicating a need for ongoing educational strategies to enhance training and improve competency levels in drug dose calculations among this demographic (15).

The marked variation in knowledge scores based on specific questions underscores the importance of targeted educational interventions. Particularly, performance was notably lower in complex scenarios such as weight-based calculations and drug dilutions, where participants achieved only about 30-47% accuracy (14). Such results reflect findings from previous studies that recommended systematic evaluation and enhancement of nursing curricula to include advanced pharmacology and dosage calculation training (10). Integrating innovative educational tools, such as mobile applications and simulation-based learning, could serve to reinforce medication competency and empower nurses in clinical settings (17).

Importantly, nurses expressed a favorable view toward the development of mobile applications designed specifically for dosage calculations, recognizing their potential to reduce errors and improve patient safety outcomes (17). Such technological solutions could be pivotal, especially in a context where high workloads and time constraints often impede detailed attention to dosage precision (15). Recent studies underline the necessity of collaborative approaches involving clinical pharmacists and interdisciplinary teams to bolster nursing education and performance in drug administration (17, 18).

Thus, our study highlights critical gaps in drug dosage calculation knowledge among nurses at Gulab Devi Hospital, with significant implications for patient safety. The evidence points toward the necessity of initiating comprehensive educational reforms tailored to enhance pharmacological education and dosing accuracy within nursing practice. Future research should focus on implementing and evaluating various educational interventions aimed at improving the clinical competencies of nursing staff in Lahore and similar contexts.

**Conclusion**

The findings indicate moderate competence in drug dose calculations among nurses, with significant room for improvement in complex clinical scenarios. Educational interventions, such as structured training and the use of digital tools, are recommended to enhance dosage calculation competencies and reduce medication errors.

**Declarations**

**Data Availability statement**

All data generated or analysed during the study are included in the manuscript.

**Ethics approval and consent to participate**

Approved by the department concerned. (IRBEC-NGDH-01170-24)

**Consent for publication**

Approved

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**Conflict of interest**

The authors declared the absence of a conflict of interest.

**Author Contribution**

**RS**
*Manuscript drafting, Study Design,*
**SN**
*Review of Literature, Data entry, Data analysis, and drafting an article.*
**ARA**
*Conception of Study, Development of Research Methodology Design,*
**ML** (Supervisor)
*Study Design, manuscript review, and critical input.*
**CS** (Co-supervisor)
*Manuscript drafting, Study Design,*

*All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.*

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