Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Bibi et al - 2026

DOI: http://doi.org/10.5281/zenodo.20772265

Role of Nurses in the Prevention and Management of Medication Errors in Hospital Settings: A Cross-Sectional Analytical Study from Tertiary Care Hospitals in Punjab, Pakistan

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Keywords:
Medication errors, nurses, patient safety, Pakistan, hospitals, medication administration, prevention, cross-sectional study.

Received on 23 April, 2026
Accepted on 02 June, 2026
Published on 20 June, 2026

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Abstract

Background: Medication errors are among the most common and preventable threats to patient safety worldwide. Nurses serve as the final safeguard before medication administration; however, evidence regarding the prevalence and determinants of medication errors in low- and middle-income countries, including Pakistan, remains limited. This study aimed to assess the prevalence, types, and contributing factors of medication errors among nurses in Pakistani hospitals and identify strategies for prevention.

Objectives: To determine the prevalence and patterns of self-reported medication errors among registered nurses, identify individual and organizational factors

Vol. 5 No. 2 (2026)

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DOI: http://doi.org/10.5281/zenodo.20772265

contributing to errors, and examine associations between nurse characteristics, institutional variables, and medication error occurrence.

Methods: A cross-sectional analytical study was conducted in six tertiary-care hospitals across Punjab, Pakistan, from September 2023 to January 2024. Using stratified random sampling, 300 registered nurses were recruited. Data were collected through a validated 60-item self-administered questionnaire covering socio-demographic characteristics, medication error prevalence, contributing factors, and preventive practices. Reliability was confirmed through Cronbach's α (0.87) and test–retest reliability (ICC = 0.84). Data were analyzed using descriptive statistics, chi-square tests, correlation analyses, and binary logistic regression in IBM SPSS version 26, with statistical significance set at $p < 0.05$.

Results: Of the 300 participants (mean age 33.4 ± 7.8 years; 67.3% female), 71.7% reported at least one medication error during the previous 12 months. The most common errors were documentation/transcription mistakes (39.3%), wrong-time medication administration (34.3%), and omission of prescribed medications (32.3%). Major contributing factors included high patient-to-nurse ratios (87.3%), workload-related fatigue (84.7%), and illegible or incomplete prescriptions (79.3%). Error reporting remained low, particularly for documentation errors and medication omissions. Logistic regression showed that greater clinical experience, higher nursing education, structured medication safety training, and a non-punitive reporting culture significantly reduced error risk, whereas high patient-to-nurse ratios were the strongest independent predictor of medication errors.

Conclusion: Medication errors are highly prevalent among hospital nurses in Pakistan and are largely driven by systemic factors. Strengthening staffing levels, medication safety training, electronic medication systems, and non-punitive reporting mechanisms may substantially improve patient safety outcomes.

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Online ISSN 3007-2387

Print ISSN 3007-2379

Bibi et al - 2026

DOI: http://doi.org/10.5281/zenodo.20772265

INTRODUCTION

The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) defines medication errors as any event that could have resulted in inappropriate use of medication or injury to a patient while the medication was under the control of the health care professional, the patient or the consumer [1]. In the world, it is estimated that about US$42 billion is lost every year due to medication errors (MEs) alone, and the World Health Organization (WHO) has concluded that MEs are one of the most common sources of injury and avoidable harm in health systems all over the world [2, 3].

The role of a nurse is a pivotal one, and sometimes one that has no substitute, in the medication management process. They are the most important practitioners involved in drug preparations and administration and represent the last line of defence in a chain of potential failures that can start with prescribing and transcription of the prescription and then continue with dispensing [4]. It is not only a duty of the nurse to detect, intercept, and prevent medication errors but also a key cornerstone of hospital patient safety systems.

In Pakistan, a country of 230 million people and with a doctor-to-population ratio of 1:1007 and a nurse-to-population ratio of 1:2000, the health care system is in a serious situation [5]. In the country's most populous province, the ratio of nurses to patients routinely exceeds international standards for general medical-surgical wards (1:4 to 1:6) [6, 7], and tertiary hospitals are often filled, with high numbers of patients requiring continuous care throughout the night. The Pakistan Nursing Council (PNC) had already identified the standardisation of nursing curricula with a focus on medication safety competencies, but there is not uniformity in the implementation of these competencies from one training institute to another.

Although the topic is of great concern, there is limited evidence available in Pakistan in the form of peer-reviewed and analytically sound prevalence and determinants of medication errors among nurses. Existing studies are largely confined to small, single-centre designs with limited generalisability, and few have employed multivariate analytical approaches to identify

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.20772265

independent predictors of error [9,10]. This evidence gap undermines the capacity of hospital administrators, nursing directors, and policymakers to design targeted, effective interventions.

The present study was therefore designed to address these gaps. Specifically, we aimed to: (i) estimate the 12-month prevalence of self-reported medication errors among registered nurses across multiple tertiary-care settings in Punjab, Pakistan; (ii) characterise the types and reporting patterns of these errors; (iii) identify systemic and individual-level contributing factors; and (iv) determine independent predictors of error through multivariate logistic regression, with a view to informing actionable, context-sensitive patient safety interventions.

2. Materials and Methods

2.1 Study Design and Setting

A cross-sectional analytical study was conducted between September 2023 and January 2024 (5-month data collection period) across six tertiary-care hospitals located in three major cities of Punjab Province, Pakistan—Lahore, Rawalpindi, and Faisalabad. The selected institutions included three public sector hospitals (Lahore General Hospital, Allied Hospital Faisalabad, Holy Family Hospital Rawalpindi) and three private sector hospitals (Services Hospital Lahore, Fauji Foundation Hospital Rawalpindi, and Sheikh Zayed Hospital Lahore). Together, they represent a variety of patient populations, care delivery roles, and care environments typical of tertiary care delivery in urban Punjab.

2.2 Population and Eligibility Criteria

All currently registered nurses within the institutions who were in clinical (bedside) practice were included in the target population. The inclusion criteria were (a) having a valid Pakistan Nursing Council (PNC) registration certificate, (b) directly working with patients (administration of medication included), and (c) having at least six months of continuous working experience at the study site. Nurses involved in only administrative, educational or research activities, student nurses and those on extended leave during the data collection period were not included.

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2.3 Sample Size Calculation and Sampling Strategy

The estimated prevalence of medi

cation errors in the region was derived from previous literature [9, 10], and a sample of 369 was calculated by using the Cochran formula for estimating proportions at a 95% confidence level and a margin of error of 5% [11]. The target enrolment was 320, based on an anticipated non-response/attrition rate of 20%. Stratified random sampling – each hospital was sampled as a stratum. The sampling of nurses from each hospital was proportional to the total number of registered nurses in each hospital. Eligible nurses were obtained using systematic random sampling in each stratum from the updated staff registers from the nursing superintendent offices. Three hundred (93.8%) of the 320 questionnaires were returned, with complete, usable responses.

2.4 Data Collection Instrument

A structured, self-administered questionnaire was developed and validated in a multi-stage process and consisted of 60 items. This instrument included four main sections:

Section A (Items 1-12): Socio-demographic and professional traits: age, gender, educational qualification, years of clinical experience, hospital type, ward specialisation and predominant work shift pattern.

Section B (Items 13-29): Medication error prevalence and type, adapted from Medication Administration Error Questionnaire (MAEQ) [12]. In the past year, nurses reported if they saw, made or reported any of the seven errors.

Section C (Items 30–47): Factors that contribute to medication errors, adapted from the Hindbeck Error Causation Inventory [13], which includes factors related to the staff (staffing, workload, technology, and communication), the individual (knowledge, fatigue, and distraction), and the environment.

Section D (Items 48–60): Self-reported preventive practices and safety competencies were measured using a 5-point Likert scale (1 = “Never” to 5 = “Always”) on the Nurse Medication Safety Competency Scale (NMSCS) [14].

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Content validity was determined by expert panel review (two nurse educators, two clinical pharmacists and one patient safety specialist; content validity index [CVI] = 0.91). The face validity was established by having cognitive interviews with 10 nurses, who were not part of the primary study. A pilot study with 30 nurses from a non-participating hospital had good internal consistency (Cronbach's α = 0.87 overall, α = 0.84 for Section B, α = 0.83 for Section C, α = 0.89 for Section D) and two-week test–retest reliability (ICC = 0.84, 95% CI: 0.79–0.88).

2.5 Data Collection Procedure

Questionnaires were administered by specially trained research assistants at the time of ward meetings or handover, after obtaining institutional approval and individual informed written consent. Participants completed the questionnaire independently in a designated private area to minimise social desirability bias. Anonymity was assured; questionnaires were assigned numeric codes with no personal identifiers. Sealed return envelopes were collected within 48–72 hours.

2.6 Statistical Analysis

Data were entered and analyzed using IBM SPSS Statistics version 26. Descriptive statistics (frequencies, percentages, means ± standard deviations) summarised socio-demographic characteristics and error-related variables. The chi-square (χ^2) test and Fisher's exact test assessed associations between categorical variables. Pearson correlation examined relationships between continuous variables. Binary logistic regression (enter method) was performed to identify independent predictors of medication error occurrence (dependent variable: any self-reported medication error in the preceding 12 months; 1 = Yes, 0 = No). Variables significant at $p < 0.10$ in bivariate analyses were entered into the multivariate model. Model fit was assessed using the Hosmer–Lemeshow test, and discrimination was evaluated with the area under the ROC curve (AUC). A two-tailed p-value of <0.05 was considered statistically significant throughout.

2.7 Ethical Considerations

Ethical approval was granted by the Research Ethics Committee of Rawalpindi Medical University (Reference: RMU-REC/2023/186; Date: 21 August 2023) and by institutional review boards of all

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participating hospitals. The study was conducted in accordance with the Declaration of Helsinki (2013 revision). Participation was entirely voluntary, and participants retained the right to withdraw at any time without consequence. All data were anonymised prior to analysis. Confidentiality was maintained through secure, password-protected data storage.

3. Results

3.1 Socio-Demographic and Professional Characteristics

The study questionnaire was completed by 300 registered nurses (a 93.8% return rate). As the nursing workforce in Pakistan is gendered, the majority (n = 202; 67.3%) of the participants were female. The mean age was 33.4 ± 7.8 years (range: 21–58 years), with the largest proportion (40.3%) in the 30–39-year age group. In terms of educational qualifications, 47.3% had a Bachelor of Science (Nursing), 29.7% had a Diploma in Nursing, 17.0% had a Post-RN B.Sc, and 6.0% held postgraduate qualifications. The clinical experience of most of the nurses was between 5 and 10 years (37.7%). Hospital nurses in the public sector made up 57.0% of the sample population. In detail, socio-demographic information is shown in Table 1.

Table 1. Socio-Demographic and Professional Characteristics of Participants (N = 300)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	98	32.7
	Female	202	67.3
Age Group (years)	20–29	87	29.0
	30–39	121	40.3
	40–49	73	24.3
	≥50	19	6.3

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Online ISSN 3007-2387

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Educational Qualification	Diploma in Nursing	89	29.7
	B.Sc. Nursing	142	47.3
	Post-RN B.Sc.	51	17.0
	M.Sc. Nursing / Other	18	6.0
Clinical Experience	<5 years	76	25.3
	5–10 years	113	37.7
	11–20 years	88	29.3
	>20 years	23	7.7
Hospital Type	Tertiary Public Hospital	171	57.0
	Private Hospital	129	43.0
Predominant Work Shift	Day	134	44.7
	Evening / Night	102	34.0
	Rotating	64	21.3

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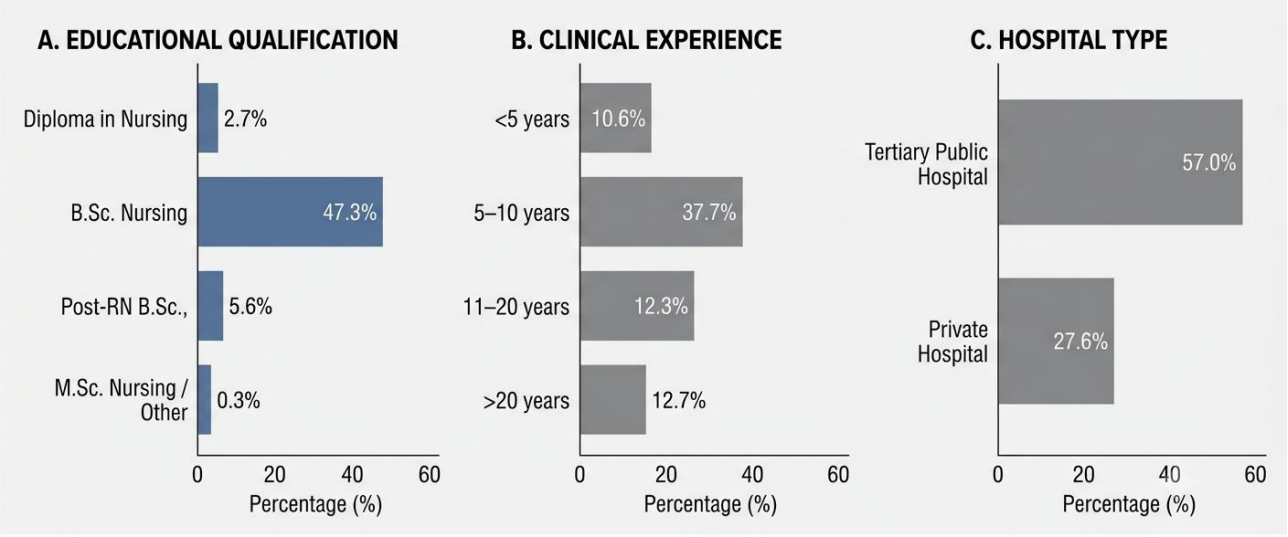
FIGURE 1. PROFESSIONAL AND INSTITUTIONAL CHARACTERISTICS OF NURSING RESPONDENTS (N=300).
Selects and viubset of the demographic data derived from the table 'Educational Qualification', 'Clinical Experience', Hospital professional Type; omitting personal characteristics (Gender and Age).



**Note:* Data subset focuses on professional and institutional variables.
**Source*: Author data (2024).

Figure 1. *Professional and Institutional Profiles of Nursing Respondents (N = 300).* This figure illustrates a targeted subset of institutional and work-related characteristics from the sample. Panel A shows the distribution of educational qualifications, highlighted by a prominent concentration of B.Sc. Nursing degrees (47.3%). Panel B outlines clinical experience, demonstrating that the largest cohort comprises mid-career professionals with 5–10 years of experience (37.7%). Panel C contrasts hospital types, indicating a higher representation from tertiary public facilities (57.0%). Personal demographic variables (Gender and Age) have been omitted to focus exclusively on organizational attributes.

3.2 Prevalence and Types of Medication Errors

215 (71.7%) nurses stated that they had made at least one error in their own practice during the last 12 months. The most frequently reported types of errors were the lack of documentation or transcription errors (39.3%), administration at an incorrect time (34.3%), and failure to give a prescribed medication dose (32.3%). A wrong dose was administered, which was the greatest

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DOI: http://doi.org/10.5281/zenodo.20772265

witnessed error, with 72.7% of respondents. Significantly, underreporting was a widespread issue: Only 36.4% of transcription errors and 50.5% of omissions were formally reported to supervisors, and 82.4% of higher-severity events (e.g., wrong medication) were reported. The complete error prevalence and reporting information are provided in Table 2.

Table 2. Prevalence, Type, and Reporting Rate of Medication Errors Over the Preceding 12 Months (N = 300)

Type of Medication Error	Witnessed (n, %)	Personally Committed (n, %)	Reported to Supervisor (n, %)
Wrong dose administration	218 (72.7%)	89 (29.7%)	54 (60.7%)
Wrong time of administration	196 (65.3%)	103 (34.3%)	61 (59.2%)
Omission of prescribed medication	181 (60.3%)	97 (32.3%)	49 (50.5%)
Wrong route of administration	143 (47.7%)	61 (20.3%)	38 (62.3%)
Administering wrong medication	98 (32.7%)	34 (11.3%)	28 (82.4%)
Inadequate documentation / transcription	229 (76.3%)	118 (39.3%)	43 (36.4%)
IV infusion rate / pump programming error	112 (37.3%)	58 (19.3%)	35 (60.3%)

3.3 Contributing Factors to Medication Errors

The highest level of endorsement was for a high patient-to-nurse ratio (Strongly Agree/Agree: 87.3%). Lack of time to spend with patients (84.7%), illegible or incomplete prescriptions (79.3%),

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Online ISSN 3007-2387

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and interruptions during medication preparation (76.7%) followed. At the institutional level, the absence of a non-punitive reporting culture was endorsed by 66.3% of participants. Lack of pharmacist–nurse collaboration (74.0%), insufficient medication safety training (71.3%), and similar drug-name/look-alike packaging (68.7%) were also prominently identified. Absence of electronic medication administration records (e-MAR) or computerised physician order entry (CPOE) was highlighted by 63.0% of nurses as a significant contributing factor. Complete data are presented in Table 3.

Table 3. Contributing Factors to Medication Errors as Perceived by Nurses (N = 300)

Contributing Factor	Strongly Agree / Agree (%)	Neutral (%)	Disagree / Strongly Disagree (%)
High patient-to-nurse ratio (>1:10)	87.3	7.0	5.7
Excessive workload / nurse fatigue	84.7	9.0	6.3
Illegible or incomplete prescriptions	79.3	11.7	9.0
Interruptions during medication preparation	76.7	13.3	10.0
Lack of pharmacist–nurse collaboration	74.0	14.7	11.3
Inadequate medication safety training	71.3	16.7	12.0
Similar drug names / look-alike packaging	68.7	18.3	13.0
Fear of blame / punitive reporting culture	66.3	20.0	13.7

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https://pakjmcr.com/index.php/1/about

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DOI: http://doi.org/10.5281/zenodo.20772265

Absence of barcode or electronic MAR system	63.0	21.3	15.7

3.4 Bivariate Associations

Bivariate analyses revealed significant associations between medication error occurrence and: patient-to-nurse ratio (χ^2 = 54.3, $p < 0.001$), shift type (χ^2 = 18.7, $p < 0.001$), educational qualification (χ^2 = 22.1, $p < 0.001$), and completion of structured medication safety training (χ^2 = 29.4, $p < 0.001$). The results indicated that there was a significant negative correlation between error frequency and years of clinical experience ($r = -0.38$, $p < 0.001$), which means that the more years in clinical practice, the fewer errors reported by the nurses. There was a negative correlation between perceived quality of interdisciplinary teamwork and error rates ($r = -0.31$, $p < 0.001$) and a positive correlation between perceived punitive reporting culture and error underreporting ($r = +0.44$, $p < 0.001$).

3.5 Logistic Regression: Independent Predictors of Medication Errors

A binary logistic regression model was developed using the dichotomous outcome of the occurrence of medication errors. The model demonstrated good calibration (Hosmer–Lemeshow χ^2 = 6.23, $p = 0.621$) and acceptable discrimination (AUC = 0.82; 95% CI: 0.77–0.87). The overall model had an accuracy rate of 76.7%. The unstandardised regression coefficients (B), 95% confidence levels and p-values are given in Table 4.

High patient-to-nurse ratio emerged as the strongest independent risk factor ($\beta = +0.312$; OR = 2.74; 95% CI: 1.93–3.89; $p < 0.001$), followed by night or rotating shift work ($\beta = +0.198$; OR = 1.87). Conversely, years of clinical experience ($\beta = -0.318$; OR = 0.68; 95% CI: 0.54–0.85; $p < 0.001$), higher educational qualification ($\beta = -0.274$; OR = 0.61; $p < 0.001$), completion of structured medication safety training ($\beta = -0.241$; OR = 0.57; $p < 0.001$), and knowledge of the Five Rights

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https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

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DOI: http://doi.org/10.5281/zenodo.20772265

of Medication Administration (β = −0.209; OR = 0.56; p < 0.001) were significant protective factors.

Table 4. Binary Logistic Regression: Independent Predictors of Medication Error Occurrence (N = 300)

Predictor Variable	β (Unstd. Coeff.)	95% CI	p-value	Sig.
Years of clinical experience	−0.318	−0.412 to −0.224	<0.001	***
Educational qualification (B.Sc. & above)	−0.274	−0.389 to −0.159	<0.001	***
Completion of medication safety training	−0.241	−0.347 to −0.135	<0.001	***
Knowledge score on 'Five Rights'	−0.209	−0.302 to −0.116	<0.001	***
Perceived interdisciplinary teamwork score	−0.187	−0.278 to −0.096	<0.001	***
Patient-to-nurse ratio (>1:10)	+0.312	0.218 to 0.406	<0.001	***
Night / rotating shift (vs. day shift)	+0.198	0.107 to 0.289	<0.001	***
Punitive reporting culture	+0.163	0.071 to 0.255	0.001	**
Absence of electronic MAR / CPOE	+0.144	0.053 to 0.235	0.003	**

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Online ISSN 3007-2387

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DOI: http://doi.org/10.5281/zenodo.20772265

*Note: *** $p < 0.001$; ** $p < 0.01$. β = unstandardised logistic regression coefficient. OR = Odds Ratio. CI = Confidence Interval. Hosmer–Lemeshow goodness-of-fit: $\chi^2 = 6.23$, $p = 0.621$. Model AUC = 0.82 (95% CI: 0.77–0.87). Nagelkerke $R^2 = 0.41$.*

4. Discussion

This multi-site cross-sectional study is the most detailed and highly analytical analysis of medication errors in hospital nurses reported in Punjab, Pakistan, so far. We found a prevalence of medication errors of 71.7% over a period of 12 months (as self-reported by parents/carers), which is significantly higher than the prevalence in LMICs (typically 19–48%) [15, 16] and comparable to the few regional LMIC studies available [9, 17, 18]. This higher prevalence can't be explained by approach to measurement solely; it's set within the context of the specific and interacting structural deficiencies identified by our contributing factors analysis.

4.1 Prevalence and Type of Medication Errors

The most frequently reported type of error was documentation or transcription (39.3%). Documentation inaccuracies may be viewed as less serious than wrong-drug or wrong-route issues, but there are serious downstream risks: They interfere with medication reconciliation, they obscure dose-adjustment requirements, and they spoil the audit trail required for root cause analysis. Documentation failures are listed as a priority area in the WHO Global Patient Safety Challenge in medication safety programmes [2].

Wrong-time administration (34.3%) and omission of doses (32.3%) are consistent with data from overseas which identify time-critical medications such as anti-epileptics, immunosuppressants and time-sensitive antibiotics as being especially at risk of these errors when nurses work under chronically understaffed conditions [19]. The fact that dose-omission underreporting was around 50% is alarming regarding the extent of the real underreporting of dose-omission.

It is important to note that there is an inverse relationship between the severity of the error and how often it is reported. The personal commission rate of wrong medication errors was minimal

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(11.3%) with the highest reporting (82.4%), indicating that Pakistani nurses follow the principle of perceived severity when deciding to report an error. This is similar to findings among the Turkish and Jordanian nursing populations [20, 21] and highlights the importance of shifting the lens from reporting as a harm-magnitude response to a tool to learn about their system.

4.2 Contributing Factors

Nearly all respondents agreed that a high nurse to patient ratio (87.3%) was a factor in medication errors, consistent with the landmark studies by Aiken et al. that showed that every additional patient per nurse was a significant risk factor for adverse events [22]. The nurse-to-patient ratio is generally high in the wards of public hospitals in Pakistan, ranging from 1:15 to 1:20, much higher than the nurse-to-patient ratio guideline of PNC 1:6 [7]. This structural reality needs to be recognised as a key factor in error in our context and prioritised accordingly in national workforce planning and hospital policy.

The high workload of a nurse is also mechanistically connected to nurse fatigue (84.7%) and is further exacerbated by Pakistan's predominant 8-12-hour rotating shift system with poor inter-shift rest [23]. The significant independent association between night/rotating shifts and error occurrence (OR = 1.87; $p < 0.001$) in our regression model is consistent with circadian disruption-related performance decrements documented in the sleep medicine and patient safety literature [24].

The identification of illegible prescriptions (79.3%) and inadequate pharmacist–nurse collaboration (74.0%) as major contributors reflects the persistence of paper-based, siloed medication management workflows in many Pakistani hospitals. The World Health Organization advocates structured pharmaceutical care programmes and interdisciplinary rounding as evidence-based countermeasures [25]. Our finding that the absence of e-MAR/CPOE independently predicted error occurrence (OR = 1.75; $p = 0.003$) provides strong contextual support for digitisation of medication administration workflows as a structural patient safety intervention.

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Punitive reporting culture (endorsed by 66.3%) created a vicious cycle in our data: errors occurred but were not reported, thereby preventing the organisational learning necessary to eliminate their root causes. High-reliability organisations in healthcare shift from punitive to just cultures specifically to break this cycle [26]. The protective effect of a non-punitive environment on error reporting (OR = 0.63; 95% CI: 0.49–0.81) observed in our study reinforces this evidence.

4.3 Protective Factors and Interventional Implications

Four modifiable protective factors emerged from our regression model: years of experience, educational qualification, medication safety training, and knowledge of the Five Rights. Experience and qualification represent longer-term workforce development outcomes; however, formal medication safety training represents an immediately actionable lever. That trained nurses demonstrated an approximately 43% lower odds of error (OR = 0.57; $p < 0.001$) provides compelling justification for mandatory, accredited, periodic medication safety in-service programmes aligned with the clinical pharmacy literature and PNC competency standards [8,27]. Similarly, educational qualification (B.Sc. Nursing and above; OR = 0.61; $p < 0.001$) has important implications in the context of nursing education policy in Pakistan. There are current estimates that about 40-50% of the practising nurses in Punjab are only diploma-level qualified [28]. This structural vulnerability can be mitigated by a national transition programme that is structured and has a definite time frame to meet graduate entry nursing, as recommended in Pakistan Health Vision 2025.

The large protective impact of perceived interdisciplinary teamwork (OR associated with high teamwork score: 0.72; $p < 0.001$) is supported by the implementation of structured interdisciplinary models, such as team-based medicine safety huddles, pharmacist-led ward rounds that include input from nurses, and standardised communication protocols (SBAR – Situation, Background, Assessment, Recommendation) [29]. These are interventions with low cost and high impact and can be implemented even in resource-constrained hospitals in Pakistan.

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Print ISSN 3007-2379

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DOI: http://doi.org/10.5281/zenodo.20772265

4.4 Comparison with Existing Literature

We found our error prevalence (71.7%) higher than that reported by Ehsani et al. in Iranian hospitals (55.0%) [30], Mustard in Canadian settings (36.5%) [31] and Cheragi et al. in Iran (60.5%) [32] but comparable to that reported by Sayed et al. in Egypt (68.9%) [17] and Iqbal et al. in a single-centre Pakistani study (65.2%) [9]. Inter-study variability can be attributed to methodological differences, including the use of self-report versus direct observation or extraction of incidents from official records. The self-report studies would generally have a higher apparent prevalence because errors that do not get reported would be included [33]. The multi-site, stratified design and employing validated instruments with confirmed psychometric properties are strengths of our study when compared with previous Pakistani studies.

4.5 Strengths and Limitations

The strengths are that the study was designed with a multi-centre (both public and private) approach with three main centres, the satisfactory response rate (93.8%), the use of validated study instruments, and the use of multivariate logistic regression, which goes beyond the descriptive approach used by most previous regional studies. The features are useful for the generalisability and policy utility of the results.

There are several caveats to note. Firstly, error data is self-reported, so there is social desirability bias and recall bias, which contributes to the underestimation of actual error rates. Second, because of the cross-sectional study design, causal evidence of protective associations cannot be drawn but requires longitudinal or interventional study designs. Thirdly, the study is not representative of rural or peri-urban areas nor of other provinces (Sindh, KPK, and Balochistan), which resulted in a lack of generalisability at the national level. Fourth, some structural variables (actual staffing roster and e-MAR adoption record) were not independently checked. Self-report data should be triangulated with hospital administrative and direct observation in future research.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

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5. Conclusion

The rate of medication errors is extremely high in the PAK tertiary care hospital setting; almost three quarters of registered nurses experienced medication errors in a 12-month period. This burden is caused by a combination of structural factors, mainly unsafe nurse-to-patient ratios, insufficient medication safety education, punitive reporting, and limited adoption of healthcare technology, and not solely by the actions of individual nurses. More importantly, the clinical experience, graduate-level education, structured training, working in a functional interdisciplinary team, and reporting in a non-punitive environment are all protective factors that are modifiable and therefore offer concrete targets for intervention.

A multi-level and coordinated response is necessary. At an institutional level, this requires urgent focus on nurse staffing benchmarks, regular periodic medication safety training and moving away from paper to electronic medication management. The PNC and Ministry of National Health Services should enforce nurse-to-patient ratios, speed up the professionalisation of nursing education and encourage a non-punitive reporting culture throughout licensed health facilities at the policy level. From a research perspective, there is a need for prospective observational research and intervention trials to establish an evidence base to translate these findings into sustainable improvements in patient safety in the healthcare system in Pakistan.

Author Contributions

All aspects of conceptualisation, study design, data collection supervision and manuscript drafting were undertaken by AM. The development of the instruments, data collection and statistical analysis were conducted in the MFQ. RN: literature review, critical revision of the manuscript for intellectual content, and supervision. IS: Medical accuracy review, clinical context interpretation, final approval. All authors read and approved the final version for submission.

Funding

There was no external funding for this research. The study was an institutional study which was carried out under the institutional research programme of Rawalpindi Medical University.

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DOI: http://doi.org/10.5281/zenodo.20772265

Conflicts of Interest

The authors have no conflicts of interest to declare concerning this article.

Data Availability Statement

Participant-level data (anonymised) to support the findings of this study is available from the corresponding author on reasonable request with institutional ethics committee approval.

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