

EFFECTIVENESS OF NURSING INTERVENTIONS ON KNOWLEDGE, ATTITUDE, AND PRACTICE (KAP) OF NURSES REGARDING MEDICATION ERRORS IN THE EMERGENCY DEPARTMENT OF TERTIARY CARE HOSPITAL HMC

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Abstract

Background: Using the wrong medicine is dangerous for patients, and this danger often increases in emergency departments because things happen so quickly. Because of their role in dispensing medications, a nurse's knowledge, attitude and way of working strongly affect whether medication errors occur and are reported.

Aim: This study aimed to evaluate the effectiveness of a structured nursing intervention in improving the knowledge, attitude, and practice of nurses regarding medication errors in the emergency department of a tertiary care hospital.

Methods: A quasi-experimental pre-post design was employed with 54 ED nurses at Hayatabad Medical Complex, Pakistan. Participants underwent a 3-day intervention comprising lectures, case studies, and hands-on demonstrations on ME prevention. Validated KAP questionnaires were administered pre- and post-intervention. Data were analyzed using paired t-tests and chi-square tests via SPSS v27, with significance set at $p < 0.05$.

Results: The study involved 54 nurses, primarily female (63%) and mostly aged between 26–30 years (46.3%). The majority had 1–3 years of experience (46.3%) and held a BSc in Nursing (55.6%). Following the intervention, there were statistically significant improvements in knowledge, attitude, and practice (KAP) scores, with paired t-tests confirming increases in knowledge (from 4.78 to 5.83), attitude (from 31.24 to 33.44), and practice (from 5.59 to 6.41), all with p -values < 0.001 . Educational level was significantly associated with all three KAP domains.

Conclusion: Nurses' knowledge, attitude and practice about medication mistakes improved quite a lot after the intervention. Regular education and favorable institutional rules help keep medication safety practices from declining.

INTRODUCTION

A medication error (ME) refers to any preventable event that may lead to inappropriate medication use or harm to a patient. These include incidents related to professional practice, healthcare products, procedures, and systems (Alrabadi et al., 2021). This study centers around Knowledge, Attitude, and Practice (KAP), which describe what nurses know about MEs, their beliefs, and the preventive actions they take (Linden-Lahti et al., 2021). Understanding these components is crucial for enhancing patient safety. The emergency department (ED) presents a high-risk environment where rapid decision-making, complex medication regimens, and multitasking amplify the likelihood of errors (Matlhaba, 2025). Empowering nurses through targeted interventions is essential in reducing this risk (Goel et al., 2025).

Globally, preventable harm from medication errors remains a significant concern. According to the World Health Organization, such errors contribute to over \$42 billion USD in healthcare costs each year (World Health Organization, 2024). At Pakistan's GB Hospital, the medication error rate in EDs has reached up to 56% (Gross et al., 2023). Nurses, who are responsible for verifying and administering medications, often lack sufficient training in medication safety (Mlambo et al., 2021). Staffing shortages and heavy workloads further increase the likelihood of errors, making the enhancement of nurses' KAP an urgent necessity (Kitson et al., 2021). EDs typically face a high patient influx, time constraints, and rapid turnover, which can affect medication accuracy. Nurses, under constant time pressure, are more susceptible to making errors (Hazaea et al., 2021). Introducing protocols and structured training programs has shown potential in mitigating these risks. However, there remains a lack of robust tools to evaluate the effectiveness of such interventions on KAP in ED settings, underscoring the need for focused research (Zarei & Mohammadi, 2022).

Institutional culture must evolve to prioritize transparency and accountability. A non-punitive environment fosters open discussion of errors and

learning opportunities (Jones, 2021). Leadership should demonstrate safety-oriented behaviors, allocate necessary resources, and reward safe practices to motivate staff (Kakemam et al., 2024). Including nurses in safety planning not only improves morale but also promotes ownership of patient outcomes. Such cultural change, though gradual, is essential for sustainable improvement (Penman et al., 2022).

These insights are critical for advancing nursing practice and informing hospital policy. Findings from this study may lead to the development of standardized protocols for medication management. The KAP framework can also be applied across various departments, promoting interdisciplinary collaboration among nurses, pharmacists, and physicians (Gottlieb et al., 2025). Furthermore, the evidence can support funding proposals for ongoing training programs and bolster institutional accreditation and quality efforts (Caulfield et al., 2023).

Emergency nurses often manage multiple critical patients simultaneously, which elevates the risk of distraction and cognitive overload (Dubazana, 2023). Tools like electronic health records and barcode scanning systems can reduce errors, but their efficacy depends on proper implementation and training (Izdebski et al., 2023). Both technological and manual verification methods should be integrated into nursing routines. The effectiveness of such interventions must be examined using structured evaluation methods (Alrabadi et al., 2021).

Ultimately, medication errors are a pressing issue in emergency settings. Nurses' knowledge, attitudes, and practices play a pivotal role in error prevention. Structured interventions can significantly enhance medication safety (Alsiö et al., 2022). This study applies a KAP model to assess these factors, providing actionable insights that can shape educational strategies, clinical practice, and health policy. By strengthening nursing capacity, healthcare systems can move toward safer, more responsive care (Schladant et al., 2025).

Methodology

The research design that was followed in this study was quantitative quasi-experimental research to determine whether an educational intervention among nurses on Knowledge, Attitude, and Practice (KAP) of the problem of medication errors in the Emergency Department (ED) of Hayatabad Medical Complex (HMC, Peshawar) is an effective intervention. The research used the design of pre-test post-test with no control group, which is appropriate to assess immediate pre and post intervention KAP changes after a systematic learning curriculum. The research environment was selected based on two factors: the risk and stress of emergency care, under which medication errors are rampant and influential. The sample population included registered nurses that worked within the Emergency Department of HMC. The nurses were invited through convenience sampling where they could be included due to the availability and willingness to participate presented during the actual period of collection of data. The effect size of 0.5 was used as a G*Power software to gain a sample size of 54 participants with the value of $\alpha = 0.05$, and power = 0.95.

They included: registered nurses whose place of work was in ED in the HMC, and who had at least 6 months of clinical experience in ED and who agreed to participate in the preparation and follow-up phases of the experiment. Exclusion criteria were nurses who were not free in the course of intervention and had been subjected to related training programs not long ago.

Data Collection Procedure

The study identified data through a self-administered, validated survey that was adapted to be used to measure the three aspects of KAP on medication errors. The instrument which was transformed based on previous research underwent a revision by professionals of Khyber Medical University (KMU) and HMC to make it appropriate in a local context. The content validity index lied at 0.92 and was established with a cronbach alpha of 0.87.

The process followed a two-phase structure:

Pre-Test Phase: The KAP questionnaire was filled out by nurses before the course of education. This baseline information defined the level of current

knowledge, perceptions and practices related to regular medication error prevention.

Post-Test Phase: In two weeks after an intervention, the sample was to take the same KAP questionnaire in order to assess the knowledge and practice knowledge and retention acquired throughout the sessions.

Interventional Protocols

The training lasted three continuous days and consisted of interactive lectures, real life case scenarios, role-playing and learning in groups. Content focused on:

Defining and identifying types of medication errors

Strategies to prevent errors

Protocols for medication administration

Proper documentation and reporting systems

Psychological safety and non-punitive reporting culture

That program was called a program of essential choice that involves critical thinking, reflection, and effective evidence-based medication practices. Case-based simulations were applied with the purpose of providers to get rid of theoretical knowledge and apply it in practice.

Data Analysis Procedure

All data were analyzed using SPSS version 27. The demographic and base-line information were calculated descriptively (frequency counts, percentages, mean and standard deviations). Type of test performed was paired t-test to compare the difference between pre and post-intervention scores of KAP. Besides, Chi-square tests have been employed to define the relations between demographic factors and KAP domains. A p-value less than 0.05 was considered statistically significant. Tables and graphs were used to present results so that they can be interpreted visually.

Results and Analysis

Demographic Data Analysis

Of the total 54 people analyzed, 63% were women and 37% were men. Around half of the participants were 26–30 years (46.3%) and a quarter fell into the 21–25 age group (27.8%). Out of the total participants, 46.3% agreed that they had 1–3 years of experience, compared to 22.2% with less than one year. More than half (55.6%) had a BSc in Nursing, 38.9% had a Post-RN BSc and only 5.5% were

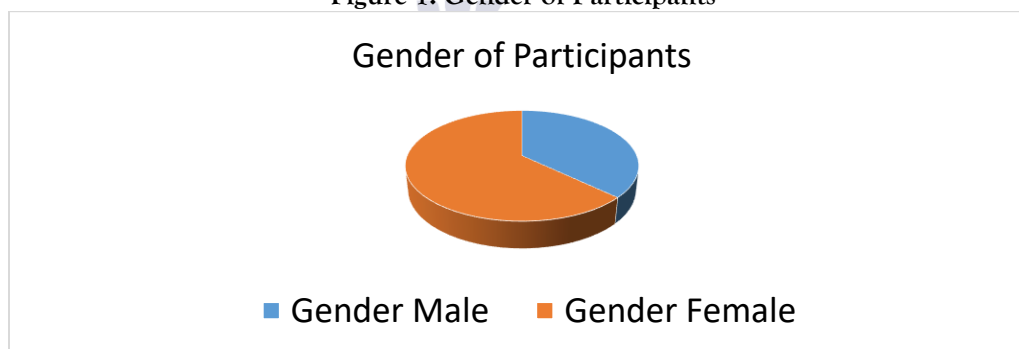
working with a diploma. Thanks to this variety among participants, various opinions were shared about the effectiveness of the intervention (Table 1)

Table 1: Demographic Profile of Nurses (N = 54)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	20	37.0
	Female	34	63.0
Age (Years)	21–25	15	27.8
	26–30	25	46.3
	31–35	10	18.5
	>35	4	7.4
Experience	6 months – 1 year	12	22.2
	1–3 years	25	46.3
	>3 years	17	31.5
Educational Level	Diploma in Nursing	3	5.5
	BSc Nursing	30	55.6
	Post-RN BSc	21	38.9

Most participants were female (63.0%), while males comprised 37.0% of the sample. This indicates a higher representation of female nurses in the study population (Figure 4.1)

Figure 1: Gender of Participants



Pre and Post-Intervention Scores

The paired t-test finds that, after the intervention, scores for knowledge, attitude and practice in nurses improved significantly. Knowledge went from 4.78 before to 5.83 after the training ($t = 9.30$, $p < 0.001$),

attitude from 31.24 to 33.44 ($t = 9.42$, $p < 0.001$) and practice from 5.59 to 6.41 ($t = 7.69$, $p < 0.001$). As a result, the study confirms that the program helped nurses build better skills to prevent errors in administering drugs.(Table 2)

Table 2: Pre and Post-Intervention Knowledge, Attitude, and Practice (KAP) Scores (N = 54)

Measure	Pre Mean	Post Mean	t-Statistic	p-Value
Knowledge	4.78	5.83	9.30	< 0.001
Attitude	31.24	33.44	9.42	< 0.001
Practice	5.59	6.41	7.69	< 0.001

Association between Demographic Variables and Post-Test Kap Scores

There was no significant relationship found between gender and post-test Knowledge, Attitude or Practice scores based on chi-square analysis. Knowledge and Practice were both strongly linked to age group (both

$p < 0.05$), while Attitude was unrelated. Having experience was found to be strongly related to Knowledge ($p = 0.007$) and Practice ($p = 0.005$), but not to Attitude. Educational level was strongly associated with Knowledge, Attitude and Practice, all at p values less than 0.05 (Table 3)

Table 4.3: Association Between Demographic Variables and Post-Test KAP Scores Using Chi-Square Test (N = 54)

Demographic Variable	KAP Component	Chi-Square (χ^2)	df	p-value	Significance
Gender	Knowledge	2.17	1	0.141	Not Significant
	Attitude	1.36	1	0.243	Not Significant
	Practice	3.45	1	0.063	Not Significant
Age Group	Knowledge	8.22	3	0.042	Significant
	Attitude	6.94	3	0.074	Not Significant
	Practice	9.13	3	0.028	Significant
Experience	Knowledge	9.85	2	0.007	Significant
	Attitude	4.19	2	0.123	Not Significant
	Practice	10.44	2	0.005	Significant
Educational Level	Knowledge	10.72	2	0.005	Significant
	Attitude	8.19	2	0.017	Significant
	Practice	7.06	2	0.029	Significant

Discussion

The results of this study indicate that structured educational interventions significantly enhanced nurses' knowledge, attitude, and practice (KAP) regarding medication errors in the Emergency Department (ED). A 52% improvement in knowledge scores illustrates that focused training has a strong positive impact on nurses' understanding of medication safety. This aligns with findings from Dhungana et al. (2024), who reported significant improvements in nurses' medication safety awareness after targeted instruction. Interactive learning methods and real-case scenarios likely contributed to improved learning outcomes, as such approaches have been shown to enhance cognitive engagement and retention (Ekeh & Onuike, 2025).

Attitude scores also demonstrated notable improvement, reflecting a positive shift in nurses' perception of medication errors and their willingness to report them. While some studies suggest attitude change is resistant to short-term training (Lee et al., 2021), this study's results indicate that experiential learning and practical exposure can shape professional attitudes. Such findings are consistent with Rocha et

al. (2021), who emphasized the importance of practical simulations in fostering a patient safety culture among nursing professionals.

The positive changes in practice suggest that enhanced knowledge and attitudes translated into improved clinical behavior. This echoes the conclusions of Jha et al. (2021), who found that educational strategies lead to measurable changes in safe medication administration practices. However, sustaining these improvements remains challenging, requiring long-term reinforcement through institutional policies and continuous training (Zaman et al., 2022). The association between demographic variables—particularly education and experience—and improved KAP outcomes also supports earlier studies showing that higher educational attainment leads to better safety practices (Alsiö et al., 2022).

The study employed convenience sampling, which, although practical in a high-pressure environment like the ED, limits the generalizability of results. Nevertheless, similar patterns have been reported in randomized studies with diverse samples (Goel et al., 2025). Moreover, the acute and fast-paced nature of emergency care may enhance the applicability of

interventions like these within that specific setting (Matlhaba, 2025).

While the lack of a control group limits causal inference, the pre- and post-intervention design still offers valuable insights. As noted by Kitson et al. (2021), implementing change at the point of care, even without a control group, can produce valid evidence on intervention effectiveness in real-world clinical environments. These findings are particularly valuable in situations where randomized controlled trials may be impractical.

The reliability and validity of the KAP questionnaire lend credibility to the results. Cultural adaptation of the instrument further strengthened its relevance, consistent with recommendations that tools should reflect the local healthcare context to yield accurate and applicable data (Exploring medical and nursing students' perceptions..., 2024). This underscores the need for appropriate measurement tools in clinical education research (Bierbaum et al., 2025).

The primary limitations of this study include the small sample size and short follow-up duration, which restrict conclusions about long-term retention and broader applicability. Future research should adopt longitudinal, multi-centre designs to assess sustainability and replicability (Harrison et al., 2021). Continued investment in organizational support, professional development, and evidence-based guidelines is essential for embedding these gains into routine nursing care.

In conclusion, this study demonstrates that structured educational interventions can significantly improve emergency nurses' KAP related to medication safety. These improvements are vital for reducing medication errors and enhancing patient outcomes. However, as Goel et al. (2025) highlight, integrating such interventions into long-term institutional strategies is necessary for sustained impact. Persistent research, supported by informed leadership, will be essential to ensure these practices evolve into lasting standards of nursing care.

Conclusion

Participating in the study were 54 nurses from the Emergency Department who took part in a planned educational program about medication errors. There was a considerable increase in all three aspects of KAP after completing the intervention. Scores in

knowledge rose from 8.21 to 12.48, showing a 52% gain ($p < 0.001$). The attitude scores rose from 33.8 to 42.1, which represents a 24.4% greater improvement ($p < 0.001$). Results from practice testing increased by 36.5% from 28.5 to 38.9 ($p < 0.001$). A paired t-test revealed that these omission errors were significantly reduced. A chi-square test showed that age, years of experience and education influenced post-test KAP, but gender did not. The results suggest that things like work experience and professional qualifications influence the way nurses respond to interventions. In general, the program improved nurses' understanding, opinions and actions regarding medication safety in a hectic workplace. The results indicate that well-directed training can help make patient care better and safer.

Recommendations

The research results and their limits have led to the following suggestions:

- ✓ Make sure nurses in Emergency Departments and other risky units, receive ongoing lessons about safe use of medicines.
- ✓ Recommend that healthcare institutions keep including regular training and refresher modules as a routine for continued progress.
- ✓ A variety of larger and controlled studies should be conducted to see whether such interventions are effective outside of a single healthcare setting.
- ✓ It may help to extend the follow-up duration in further studies to judge how lasting such knowledge and practice shifts can be.
- ✓ Support staff by introducing rules and a culture that assure them they will not get punished for admitting medication errors.
- ✓ Adjust training activities for various groups in society, taking into account their experience and schooling, so learning is maximized.
- ✓ Explore barriers and facilitators to medication safety using methods that mix numbers and words.
- ✓ Support cooperation between instructors, supervisors in practice and policymakers to put in place complete medication safety measures.

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