

Knowledge, Attitude, and Practice of Medication Reconciliation among Pharmacy Interns in Jeddah, Saudi Arabia: A Cross-Sectional Study.

Abstract

Introduction: Medication reconciliation (MedRec) is a critical patient safety procedure that reduces medication discrepancies at care transition points. Pharmacy interns represent a key emerging workforce for MedRec implementation; however, their preparedness in Saudi Arabia remains understudied.

Aim: To evaluate the Knowledge, Attitude, and Practice (KAP) of pharmacy interns in Jeddah, Saudi Arabia, regarding MedRec, and to examine the influence of demographic factors, clinical rotation, and formal training on KAP levels.

Method: A cross-sectional study was conducted among 93 pharmacy interns in Jeddah using a validated, self-administered questionnaire. Non-parametric statistical methods were applied. Mann-Whitney U tests compared KAP scores by gender, clinical rotation completion, and formal MedRec training. Spearman's rank-order correlation assessed relationships between KAP domains.

Results: Median scores indicated poor knowledge (Median = 22/90, 24.4%), poor attitudes (Median = 24/90, 26.7%), and very limited self-reported practice (Median = 32/90, 35.6%), with substantial variability across domains. No significant differences were found by gender or clinical rotation completion. Interns who received formal MedRec training unexpectedly demonstrated significantly lower scores across all three KAP domains compared to untrained peers (Knowledge $p = 0.007$; Attitude $p < 0.001$; Practice $p = 0.007$). The strongest correlation was observed between Attitude and Practice ($\rho = 0.591$, $p < 0.01$).

Conclusion: Pharmacy interns in Jeddah demonstrate poor knowledge, poor attitudes, and very limited practice regarding MedRec, indicating significant gaps in current education and training. A standardized, practice-centered MedRec training program incorporating simulation and supervised clinical participation is recommended.

Impact Statement: This study provides baseline data on pharmacy intern preparedness for MedRec in Saudi Arabia, directly informing curriculum reform, internship program design, and national pharmacy workforce development strategies aligned with Vision 2030 patient safety goals.

Keywords: medication reconciliation; pharmacy interns; knowledge attitude practice; patient safety; Saudi Arabia; pharmacy education

Introduction

Medication errors are among the most frequent causes of preventable adverse events in healthcare systems worldwide. The World Health Organization (WHO) estimates that these errors generate billions of dollars in avoidable healthcare expenditure annually and substantially increase patient morbidity and mortality [1]. Care transitions admission, transfer, and discharge represent the most vulnerable points in the medication-use process, where discrepancies most commonly arise [2].

Medication reconciliation (MedRec) is a systematic process designed to prevent medication discrepancies by ensuring accurate and complete transfer of patients' medication information at care transition points. The Joint Commission defines MedRec as comparing a patient's medication orders to all medications the patient has been taking, with the goal of preventing omissions, duplications, dosing errors, and drug interactions [2]. International accreditation bodies, including Joint Commission International (JCI) and the Australian Commission on Safety and Quality in Health Care (ACSQHC), mandate MedRec as a core patient safety standard [3,4]. Despite this, unintended medication discrepancies affect nearly every patient moving across transitions of care, with full implementation of formal MedRec processes remaining an ongoing global challenge [5]. Pharmacist-led MedRec initiatives have demonstrated a 67% reduction in adverse drug event-related hospital revisits and a 28% reduction in emergency department visits [6].

Pharmacy interns represent the next generation of pharmacists and are well positioned to contribute to MedRec processes. Their readiness, however, depends on the quality of their education and clinical training. In Saudi Arabia, the Health Sector Transformation Program under Vision 2030 explicitly prioritizes improving healthcare quality and patient safety [7], and the Central Board for Accreditation of Healthcare Institutions (CBAHI) whose accreditation is mandatory for all Saudi hospitals explicitly requires medication reconciliation at admission and discharge as a national standard (MM.19.2) [8]; however, integration of MedRec training into pharmacy internship programs remains inconsistent and inadequately studied. In the Gulf Cooperation Council (GCC) region, studies among practicing pharmacists have identified substantial gaps in MedRec knowledge and practice [8,9]; however, data specific to pharmacy interns during their formative training year are largely absent.

The Knowledge, Attitude, and Practice (KAP) framework draws on two complementary theoretical foundations: Bandura's Social Cognitive Theory [10], which emphasizes that knowledge and competence are acquired through observational learning and that self-efficacy one's belief in their own capability shapes behavioral performance; and Ajzen's Theory of Planned Behavior [11], which holds that attitudes toward a behavior and perceived behavioral control determine behavioral intentions, which in turn are the most proximal predictors of actual conduct. Together, these frameworks provide a validated model for evaluating clinical readiness. Applying this framework to pharmacy interns allows educational institutions to identify competency gaps and guide curriculum development. This study addresses a documented gap in the regional literature by evaluating MedRec-related KAP among pharmacy interns in Jeddah, Saudi Arabia.

Aim

To evaluate the Knowledge, Attitude, and Practice of Medication Reconciliation among pharmacy interns in Jeddah, Saudi Arabia, and to explore associations between KAP domains and demographic and experiential factors including gender, clinical rotation completion, and formal MedRec training.

Method

Study Design and Setting

A cross-sectional study was conducted among pharmacy interns at King Abdulaziz University, Jeddah, Saudi Arabia, from March 2025 to December 2025.

Participants

The study population comprised male and female pharmacy interns enrolled at King Abdulaziz University, Jeddah, Saudi Arabia. Inclusion criterion was current pharmacy intern status; non-interns were excluded. Using G*Power software with an average effect size of 0.3, alpha error probability of 0.05, and power of 0.80, the required sample size was calculated as 143. A convenience (non-probability) sampling technique was employed; 93 interns participated and completed the questionnaire.

Data Collection Instrument

A validated, self-administered questionnaire was used for data collection, adapted from a previously published instrument [12]. The questionnaire comprised four sections: (1) demographic and training characteristics; (2) knowledge of MedRec (10 items); (3) attitudes toward MedRec (10 items); and (4) self-reported MedRec practices (10 items). Each item was responded to using a three-point scale (Yes = 9, Don't Know = 5, No = 1), yielding a possible domain score range of 10–90, with higher scores reflecting greater knowledge, more positive attitudes, or more frequent practice. The questionnaire was adapted from Hussain et al. [12] and face-validated by three clinical pharmacy experts for content relevance and clarity. A pilot test was conducted with 10 pharmacy interns (not included in the final analysis) to assess comprehension and readability, with minor wording revisions made based on their feedback. Demographic variables included age, gender, nationality, clinical rotation completion, and receipt of formal MedRec training.

Statistical Analysis

Data was entered and analyzed using SPSS version 22. Descriptive statistics including medians, interquartile ranges (IQRs), and frequencies were reported. Given the non-normal distribution of KAP scores (confirmed by

normality testing), non-parametric methods were used throughout. The Mann-Whitney U test was applied to compare KAP scores by gender, clinical rotation completion, and formal training receipt. Spearman's rank-order correlation coefficient (ρ) assessed relationships between Knowledge, Attitude, and Practice domains. Statistical significance was set at $p < 0.05$.

Ethics Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was granted by the Research Ethics Committee (REC) of King Abdulaziz University Hospital, Jeddah, Saudi Arabia (Approval No. 344-25). Informed consent was obtained from all participants prior to data collection. Participation was voluntary and responses were anonymized.

Results

Demographic and Training Characteristics

The study included 93 pharmacy interns. The median age was 23 years (IQR: 23–24). The majority were female (58.1%) and Saudi nationals (96.8%). Only 8.6% of participants completed clinical rotation at the time of the survey, and 33.0% reported having received any formal MedRec training (Table 1).

Table 1. Demographic and Training Characteristics of Participants (N = 93)

Variable	Category	N	%
Age (Median, IQR)	23 (23–24)	93	—
Gender	Male	39	41.9
	Female	54	58.1
Nationality	Saudi	90	96.8
	Non-Saudi	3	3.2
Clinical Rotation Completed	Yes	8	8.6
	No	85	91.4
Formal MedRec Training	Yes	30	33.0
	No	61	65.6

Two participants did not respond to the formal training question.

Distribution of KAP Scores

All three KAP domains showed non-normal distributions ($p < 0.001$ for each). Median scores indicated poor knowledge (Median = 22/90, IQR = 19, representing 24.4% of the maximum possible score), poor attitudes (Median = 24/90, IQR = 30.5, representing 26.7% of the maximum possible score), and very limited self-reported practice (Median = 32/90, IQR = 51, representing 35.6% of the maximum possible score). The wide interquartile ranges, particularly for practice (range 5–90), indicated substantial heterogeneity within the sample, suggesting inconsistent learning experiences (Table 2). A notable finding was that 77.4% of participants did not respond to the question regarding which MedRec form they would use (K9), suggesting significant unfamiliarity with the practical tools required for medication reconciliation.

Table 2. Distribution of Knowledge, Attitude, and Practice Scores (N = 93)

Variable	Median	IQR	Range
Knowledge	22	19	5–90
Attitude	24	30.5	5–90
Practice	32	51	5–90

Comparison of KAP Scores by Group

Mann-Whitney U testing revealed no significant differences in KAP scores by gender or by clinical rotation completion. The most notable finding was that interns who reported receiving formal MedRec training demonstrated significantly lower scores across all three KAP domains compared to those without formal

training: Knowledge (Median = 9 vs 23, $p = 0.007$), Attitude (Median = 10 vs 31, $p < 0.001$), and Practice (Median = 17 vs 41, $p = 0.007$) (Table 3).

Table 3. Mann-Whitney U Test Results Comparing KAP Scores by Group

Variable	Group	N	Knowledge Median (IQR)	p	Attitude Median (IQR)	p	Practice Median (IQR)
Gender	Male	39	22 (17.0)	NS	25 (32.0)	NS	32 (56.0)
	Female	54	17 (22.3)		24 (21.3)		30 (46.0)
Clinical Rotation	Yes	8	12.5 (16.8)	NS	17.5 (15.5)	NS	16 (27.8)
	No	85	22 (21.0)		24 (31.0)		34 (56.0)
Formal MedRec Training	Yes	30	9 (16.3)	0.007*	10 (17.0)	< 0.001*	17 (26.3)
	No	61	23 (19.5)		31 (28.5)		41 (66.5)

NS = not significant; IQR = interquartile range. * $p < 0.05$. All three KAP domains showed significant differences by formal MedRec training status.

Correlations between KAP Domains

All inter-domain correlations were positive and statistically significant ($p < 0.01$). A moderate positive correlation was observed between Knowledge and Attitude ($\rho = 0.505$) and between Knowledge and Practice ($\rho = 0.438$). The strongest correlation was between Attitude and Practice ($\rho = 0.591$), indicating that a positive attitude toward MedRec is more powerfully associated with actual practice than knowledge alone (Table 4).

Table 4. Spearman's Rho Correlations between KAP Domains

Variables	Spearman's rho	p-value	Interpretation
Knowledge ↔ Attitude	0.505	< 0.01	Moderate positive correlation
Knowledge ↔ Practice	0.438	< 0.01	Moderate positive correlation
Attitude ↔ Practice	0.591	< 0.01	Strong positive correlation

Discussion

This cross-sectional study provides a comprehensive baseline assessment of MedRec readiness among pharmacy interns in Jeddah. The pattern of poor knowledge, poor attitudes, and very limited self-reported practice reflects a widely observed challenge in healthcare education: the gap between theoretical understanding and clinical application. This trend mirrors findings reported across the GCC region, where studies have identified gaps between MedRec awareness and actual clinical practice [8,9]. MedRec policy awareness has advanced considerably in the Middle East; however, translation into daily bedside practice remains inconsistent.

The demographic profile of participants predominantly young (median age 23), Saudi, and female is broadly representative of pharmacy interns in Jeddah, though it may limit generalizability to more diverse settings. Critically, only one-third of interns had received formal MedRec training and fewer than one in ten had completed a clinical rotation at survey time. This sparse experiential background is a significant contextual factor. Farajallah et al. in the UAE similarly found that lack of training and knowledge were the most reported barriers to MedRec practice among hospital pharmacists, suggesting a systemic deficit in pre-service preparation that extends across the region [9]. The absence of significant differences in KAP scores by gender or clinical rotation completion underscores an important point: MedRec competency does not arise automatically from demographic characteristics or mere clinical exposure. A rotation that does not explicitly incorporate MedRec learning objectives represents a missed educational opportunity. Lemay et al. in Kuwait similarly found that both pharmacists and physicians demonstrated low awareness of their institution's MedRec policy, and that role clarity regarding who is responsible for each step of the process remained poorly defined [13]. The most

provocative finding of this study is that interns with formal MedRec training scored significantly lower across all three KAP domains Knowledge, Attitude, and Practice compared to those without training ($p < 0.05$ for all). Rather than indicating that training is detrimental, this paradox is best understood through the lens of Noel Burch's Conscious Competence model. Interns without training may exist in a state of 'unconscious incompetence' unaware of the breadth and complexity of MedRec leading to inflated self-assessments. Those who received training, having glimpsed the full scope of the process, may accurately recognize their own gaps, yielding more critically honest and consequently lower scores. This interpretation is consistent with the Dunning-Kruger effect, where individuals with limited knowledge tend to overestimate their abilities. Crucially, this finding reflects not the harm of training per se, but the inadequacy of its current quality and structure. It contrasts sharply with findings by Hussain et al. in Unaizah, Saudi Arabia, where a structured, five-hour CME-accredited workshop covering role definitions, evidence-based best practices, and implementation challenges produced significant improvements in KAP scores [12]. The training available in Jeddah appears to lack this structured, practice-centered approach. It is important to note that 77.4% of participants did not answer the question regarding which MedRec form they would use (K9), indicating a significant gap in practical knowledge. This high non-response rate underscores the distinction between theoretical awareness of MedRec (which was relatively high) and practical competence (which was extremely low).

The strong correlation between Attitude and Practice ($\rho = 0.591$) is theoretically consistent with Ajzen's Theory of Planned Behavior [11], which posits that attitudes shape behavioral intentions that in turn predict actual conduct. The stronger Attitude-Practice correlation compared to Knowledge-Practice ($\rho = 0.438$) further suggests that attitudinal motivation may be a more proximal driver of MedRec behavior than cognitive knowledge alone a finding with direct implications for intervention design. However, intention must be supported by favorable subjective norms institutional cultures that visibly prioritize pharmacist involvement in MedRec and adequate perceived behavioral control, meaning confidence, clear role definitions, and practical skills. Among the study participants, interns appear attitudinally motivated but structurally unsupported.

Effective models exist to guide reform. Alghamdi et al. demonstrated that a pharmacist intern-led Transition of Care service at an academic hospital in Saudi Arabia comprising medication reconciliation, discharge counseling, and follow-up calls enabled interns to contribute meaningfully to patient safety across 182 patients [14]. Deep et al. in Australia showed that pharmacy students could identify medication discrepancies in 72% of hospital inpatients, with drug omission being the most common type, demonstrating that students can contribute meaningfully to medication reconciliation services [15]. These studies confirm that the limiting factor is not intern capability but program structure and integration. For Jeddah, the path forward lies in combining a high-quality educational component modelled on the Unaizah workshop [12] with structured clinical participation modelled on the Riyadh Transition of Care service [14] to move interns from awareness to competence.

This study has several limitations. The cross-sectional design precludes causal inference. Self-reported practice data are susceptible to social desirability bias and the Dunning-Kruger effect. Single-centre data limit external validity. Furthermore, the achieved sample ($n = 93$) fell short of the a priori calculated requirement of 143 participants, which may have reduced statistical power to detect smaller effect sizes and should be considered when interpreting non-significant findings. Additionally, the high non-response rate (77.4%) to the knowledge question regarding which MedRec form to use represents a significant data limitation, reflecting participants' unfamiliarity with practical MedRec tools. Future research should include mixed methods approaches to contextualize quantitative findings, prospective interventional studies to evaluate structured programs, multi-centre studies across Saudi Arabia's regions, and longitudinal tracking of intern cohorts from the start to the end of their internship year.

Conclusion

Pharmacy interns in Jeddah demonstrate poor knowledge, poor attitudes, and very limited practice regarding MedRec, with current training failing to build clinical competence. The unexpected inverse association between formal training and KAP scores is best explained by two complementary phenomena: first, the Dunning-Kruger effect, whereby untrained interns may overestimate their competence due to lack of awareness of their

knowledge gaps; and second, and more concerning, the inadequate quality and structure of current trainingsuperficial training that raises awareness without building practical skills may leave trained interns more aware of their incompetence, leading to more honest self-assessment. The strong Attitude-Practice correlation signals a workforce that is motivationally ready but structurally unsupported.

Meaningful improvement requires a dual commitment: first, the development and mandatory implementation of a high-quality, standardized MedRec educational programincorporating simulation, case-based learning, and role-specific skill developmentmodelled on successful regional examples; and second, the establishment of structured clinical rotations that formally embed interns in MedRec processes with supervised, graduated responsibility. By integrating educational excellence with meaningful clinical participation, pharmacy educators and policymakers in Saudi Arabia can equip the next generation of pharmacists to serve as effective stewards of medication safety, fulfilling the patient safety ambitions of Vision 2030.

References

1. World Health Organization. Medication Without Harm -- WHO Global Patient Safety Challenge. (2017). <https://www.who.int/initiatives/medication-without-harm>.
2. Joint Commission on Accreditation of Healthcare Organizations. Using medication reconciliation to prevent errors. Sentinel Event Alert. 2006 Jan 23;(35):1-4. PMID: 16463453.. Sentinel Event Alert. 2006, 1:4.
3. Joint Commission International: International Patient Safety Goals (IPSG). In: Joint Commission International Accreditation Standards for Hospitals. 7th ed. Oak Brook, IL: JCI. 2021,
4. Australian Commission on Safety and Quality in Health Care. National Safety and Quality Health Service Standards. 2nd ed. Sydney: ACSQHC; 2021. Standard 4: Medication Safety. Available from: <https://www.safetyandquality.gov.au/standards/nsqhs-standards/medication-safety-standard>. National Safety and Quality Health Service Standards. 2nd ed. Sydney: ACSQHC. 2021, 4:
5. World Health Organization. Medication Safety in Transitions of Care. Technical Report. Geneva: WHO. (201920199). <https://www.who.int/publications/i/item/WHO-UHC-SDS-2019.9>.
6. Mekonnen AB, McLachlan AJ, Brien JA: Effectiveness of pharmacist-led medication reconciliation programmes on clinical outcomes at hospital transitions: a systematic review and meta-analysis. BMJ Open. 2016, 6:010003.
7. Saudi Arabia Vision 2030. Health Sector Transformation Program Delivery Plan. Riyadh: Vision Realization Office. (2021). https://www.vision2030.gov.sa/media/0wop2tds/hstp_eng.pdf.
8. Central Board for Accreditation of Healthcare Institutions (CBAHI). National Hospital Standards. Riyadh: CBAHI. 2016, 19:
9. Farajallah A, Zainal H, Palaian S, Alomar M: A national survey on assessment of knowledge, perceptions, practice, and barriers among hospital pharmacists towards medication reconciliation in United Arab Emirates. Sci Rep. 2024, 14:15370.
10. Bandura A. Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs, NJ: Prentice-Hall; 1986.: Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs, NJ: Prentice-Hall. 1986,
11. Ajzen I: The theory of planned behavior. Organ Behav Hum Decis Process. 1991, 50:179-211. [10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
12. Hussain ASM, Ghadzi SMS, Sulaiman SAS, Alsahali SM, Khan SF: Medication reconciliation: impact of an educational intervention on the knowledge, attitude and practices of healthcare professionals -- a prospective quasi-experimental study in a Saudi referral hospital. J Health PopulNutr. 2025, 44:15-10.
13. Lemay J, Bayoud T, Husain H, Sharma P: Assessing the knowledge, perception and practices of physicians and pharmacists towards medication reconciliation in Kuwait governmental hospitals: a cross-sectional study. BMJ Open. 2019, 9:027395-10.
14. Alghamdi A, Alhulaylah F, Al-Qahtani F, et al.: Evaluation of pharmacy intern-led transition of care service at an academic hospital in Saudi Arabia: A prospective pilot study. Saudi Pharm J. 2022, 30:629-634. [10.1016/j.jsps.2022.02.007](https://doi.org/10.1016/j.jsps.2022.02.007)
15. Deep L, Schneider CR, Burke R, et al.: Pharmacy student-assisted medication reconciliation: Number and types of medication discrepancies identified by pharmacy students. Pharm Pract :2471.