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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDE, AND PRACTICE OF MEDICATION RECONCILIATION AMONG PHARMACY INTERNS IN JEDDAH, SAUDI ARABIA: A CROSS-SECTIONAL STUDY

Anas Mohammed Awidah[1], Jumana Hamed Khouja[2] and Khaled Rashad Ahmed Abdellatif[3]

1. Pharmaceutical Training Department, Faculty of Pharmacy, King Abdulaziz University, Jeddah, Saudi Arabia.
2. Ministry of National Guard Health Affairs, King Abdulaziz Medical City, Department of Preventive Medicine, Jeddah, Saudi Arabia.
3. Professor of Medicinal Chemistry, Ibn Sina National College for Medical Studies, Jeddah, Saudi Arabia.

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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, data specifically examining MedRec-related KAP among pharmacy interns in Saudi Arabia remain limited.

Aim: To evaluate the Knowledge, Attitude, and Practice (KAP) of pharmacy interns in Jeddah, Saudi Arabia, regarding MedRec, and to explore associations between KAP levels and demographic factors, clinical rotation completion, and reported formal training.

Method: A cross-sectional study was conducted among 93 pharmacy interns in Jeddah using a self-administered questionnaire adapted from a previously published instrument. 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 were 22/90 for knowledge, 24/90 for attitudes, and 32/90 for self-reported practice, with substantial variability across domains. No statistically significant differences were found by gender or clinical rotation completion.

Participants who reported having received formal MedRec training had significantly lower scores across all three KAP domains compared with those who did not report formal training (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: The findings identify areas for further development in MedRec knowledge, attitudes, and self-reported practice among the participating pharmacy interns. Reported formal training was unexpectedly associated with lower KAP scores, and this association warrants further investigation. Future studies should evaluate structured, practice-centered MedRec educational approaches incorporating simulation and supervised clinical participation.

Corresponding Author:-Anas Mohammed Awidah
Address:-Pharmaceutical Training Department, Faculty of Pharmacy, King Abdulaziz University, Jeddah, Saudi Arabia.

Impact Statement: This study provides baseline data on MedRec-related KAP among the participating pharmacy interns and may inform future curriculum development, internship program design, and pharmacy workforce development initiatives aligned with patient safety goals.

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 may be influenced by 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 Saudi hospitals, requires medication reconciliation at admission and discharge as a national standard (MM.19.2) [8]. However, the extent, structure, and implementation of MedRec training within pharmacy internship programs remain insufficiently characterized in the available literature. In the Gulf Cooperation Council (GCC) region, studies among practicing pharmacists have identified gaps in MedRec knowledge and practice [8,9]; however, data specific to pharmacy interns during their formative training year remain limited.

The Knowledge, Attitude, and Practice (KAP) framework draws on two complementary theoretical foundations: Bandura's Social Cognitive Theory [10], which emphasizes observational learning and self-efficacy, and Ajzen's Theory of Planned Behavior [11], which emphasizes attitudes, perceived behavioral control, behavioral intentions, and behavior. Together, these frameworks provide a conceptual basis for examining MedRec-related KAP. Applying this framework to pharmacy interns can help characterize areas for further development and inform future educational research. This study addresses a 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 self-administered questionnaire adapted from a previously published instrument [12] was used for data collection. 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 self-reported 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 (rho) 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 were 22/90 for knowledge (IQR = 19), 24/90 for attitudes (IQR = 30.5), and 32/90 for self-reported practice (IQR = 51). The wide interquartile ranges, particularly for practice (range 5–90), indicated substantial heterogeneity in KAP scores within the sample (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). Given the high non-response rate, this finding should be interpreted cautiously.

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 statistically significant differences in KAP scores by gender or clinical rotation completion. Participants who reported receiving formal MedRec training had significantly lower scores across all three KAP domains compared with those who did not report 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 higher attitude scores were associated with higher self-reported practice scores (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 baseline assessment of MedRec-related KAP among pharmacy interns in Jeddah. The observed distributions of knowledge, attitude, and self-reported practice scores identify areas for further development. Similar gaps between MedRec awareness and clinical practice have been reported in studies from the GCC region [8,9], providing regional context for the present findings. The demographic profile of the participants—predominantly young (median age 23), Saudi, and female—describes the study sample and may limit generalizability to other intern populations. Only one-third of interns reported having received formal MedRec training, and fewer than one in ten had completed a clinical rotation at the time of the survey. This limited experiential exposure is an important contextual factor. Farajallah et al. in the UAE similarly found that lack of training and knowledge were commonly reported barriers to MedRec practice among hospital pharmacists, suggesting that educational and training factors may influence MedRec practice across different settings in the region [9]. The absence of statistically significant differences in KAP scores by gender or clinical rotation completion should be interpreted cautiously, particularly given the small clinical-rotation subgroup. Clinical exposure alone may not be sufficient to influence MedRec-related KAP unless relevant learning objectives are

explicitly incorporated. Lemay et al. in Kuwait similarly found low awareness of institutional MedRec policy and limited role clarity among pharmacists and physicians [13]. The most notable finding of the present study was that participants who reported formal MedRec training had significantly lower KAP scores than those who did not report formal training.

This unexpected association should not be interpreted as evidence that training is detrimental. Several possible explanations may exist, including differences in participant characteristics, training exposure, and self-assessment. One possible hypothesis is that prior training exposure may increase awareness of knowledge gaps and lead to more critical self-assessment; however, this mechanism was not directly assessed in the present study. This hypothesis may be considered in relation to the Dunning-Kruger framework, but prospective investigation is required. Importantly, the present findings do not establish the effectiveness, quality, or structure of the training received by participants. Hussain et al. in Unaizah, Saudi Arabia, reported significant improvements in KAP scores after a structured, five-hour CME-accredited workshop covering role definitions, evidence-based best practices, and implementation challenges [12]. The present study did not assess the content, duration, delivery method, timing, provider, or institution of the training received; therefore, conclusions regarding the characteristics or effectiveness of training programs in Jeddah cannot be drawn. It is also important to note that 77.4% of participants did not answer the question regarding which MedRec form they would use (K9). Given the high non-response rate, this finding should be interpreted cautiously and should not be taken as direct evidence of practical competence or incompetence.

The positive correlation between Attitude and Practice (rho = 0.591) is theoretically consistent with Ajzen's Theory of Planned Behavior [11]. The observed Attitude-Practice correlation, which was stronger than the Knowledge-Practice correlation (rho = 0.438), suggests that attitudinal factors may be relevant to self-reported MedRec practice. However, because practice was self-reported and the study was cross-sectional, this relationship should not be interpreted causally. Within the Theory of Planned Behavior, behavioral intentions may also be influenced by subjective norms and perceived behavioral control, including confidence, role clarity, and practical skills. Among the study participants, positive attitudes may not consistently translate into self-reported MedRec practice.

Previous studies provide examples of structured educational and clinical approaches to MedRec. 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 [15]. These studies suggest that structured educational and clinical experiences may support the development of MedRec-related competencies. Future studies involving pharmacy interns in Jeddah could evaluate approaches similar to those implemented in other settings.

This study has several limitations. The cross-sectional design precludes causal inference. Self-reported practice data may be susceptible to social desirability and other self-assessment biases. 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 missing-data limitation, and the reason for non-response cannot be determined with certainty. The study recorded participants' self-reported receipt of formal MedRec training but did not assess the training provider, institution, duration, content, timing, delivery method, or quality. Accordingly, the findings should not be interpreted as an evaluation of any specific university, institution, internship program, or training program. 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:-

Among the participating pharmacy interns, MedRec-related KAP scores showed substantial variability, and reported formal training exposure was not associated with higher KAP scores. The unexpected inverse association between reported formal training and KAP scores should be interpreted cautiously. Because the study did not assess training characteristics or pre- and post-training performance, the reasons for this association cannot be determined from the present data. Possible explanations, including differences in participant characteristics, training exposure, and self-

assessment, require prospective investigation. The positive Attitude-Practice correlation suggests that attitudinal factors may be relevant to self-reported MedRec practice.

Future research should consider the development and evaluation of standardized MedRec educational approaches incorporating simulation, case-based learning, role-specific skill development, and supervised clinical participation. Such approaches could be prospectively evaluated to determine their effects on MedRec-related knowledge, attitudes, and practice among pharmacy interns. This work may contribute to broader patient-safety goals, including those of Vision 2030.

Declarations:-

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Competing Interests:-
The authors have no relevant financial or non-financial interests to disclose.

Author Contributions:-
Anas Mohammed Awidah: study conception, design, data collection, statistical analysis, and original draft preparation.Jumana Hamed Khouja: methodology, statistical analysis, data interpretation, and critical review of the manuscript. Khaled Rashad Ahmed Abdellatif: supervision, critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

Ethics Approval:-
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Consent to Participate:-
Informed consent was obtained from all individual participants included in the study.

Consent to Publish:-
All participants provided consent for publication of anonymized data.

Data Availability:-
The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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