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EVALUATING THE CLINICAL INTEGRATION OF THE MEDSCAPE APP AMONG HEALTHCARE PERSONNEL IN PAKISTAN

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Abstract

Objectives: *This study aimed to assess the prevalence and patterns of Medscape app usage among healthcare professionals, medical students, and AI conference attendees in Pakistan, identify barriers and facilitators to its clinical integration, and evaluate its perceived effectiveness in supporting clinical decision-making.*

Method: *A cross-sectional survey was conducted with 351 participants from POF Hospital, WAH Medical College, and an AI conference in Pakistan. Data were collected using a structured questionnaire based on the Technology Acceptance Model (TAM), employing online (Google Forms) and offline (paper-based) methods. The questionnaire included Likert-scale, multiple-choice, and binary response questions, pilot-tested for reliability (Cronbach's alpha > 0.7). Quantitative data were analyzed using SPSS, with descriptive statistics (frequencies, percentages, means, standard deviations), inferential statistics (ANOVA, t-tests), and Pearson correlations, setting a p-value threshold of <0.05.*

Result: *Of the 351 participants, 58.1% used Medscape, primarily for clinical guidelines (40.8%) and drug interaction checkers (28.0%). Barriers included time constraints (33.3%), lack of training (25.2%), and technical issues (16.0%), while facilitators were perceived reliability (73.8%) and ease of navigation (50.4% rated easy/very easy). Medscape moderately improved clinical decision-making (Mean=2.74, SD=0.70) and reduced diagnostic uncertainty (Mean=2.94, SD=0.79), with nursing professionals showing greater uncertainty reduction than medicine professionals (p=0.032).*

Conclusion: *Medscape demonstrates moderate integration in Pakistan's healthcare system, with significant potential to enhance clinical decision-making. Addressing barriers like training gaps and technical issues through targeted interventions could promote broader mHealth adoption, informing strategies for digital health integration in resource-constrained settings.*

INTRODUCTION

The advent of mobile health (mHealth) applications has transformed clinical practice by providing healthcare professionals with instant access to evidence-based medical resources, drug databases, and clinical guidelines. Medscape, a widely adopted mHealth app, supports clinical decision-making by offering reliable, up-to-date content tailored to healthcare professionals' needs. While global adoption of clinical apps is high, particularly in developed nations, their integration in developing

countries like Pakistan faces challenges due to infrastructural constraints and varying digital literacy levels. This study evaluates the clinical integration of the Medscape app among healthcare personnel in Pakistan, exploring usage patterns, barriers, and facilitators to adoption, with the aim of informing strategies to enhance digital health tool utilization in resource-constrained settings.

The integration of mHealth applications into clinical practice enhances healthcare delivery by providing immediate access to critical medical information. Globally, approximately 70–80% of healthcare professionals in developed nations use clinical apps to support patient care (1). In Pakistan, however, adoption is inconsistent due to limited internet connectivity, low technological literacy, and inadequate institutional support (2).Medscape, a leading mHealth app, offers evidence-based clinical information, drug references, and educational resources, making it a valuable tool for healthcare personnel. This study examines how healthcare professionals, medical students, and AI conference attendees in Pakistan integrate Medscape into clinical practice, focusing on the variables of accessibility, perceived usefulness, and institutional support.

Several factors influence the clinical integration of mHealth apps. Accessibility, including smartphone availability and stable internet, is a primary determinant, particularly in Pakistan, where internet reliability varies. Perceived usefulness, ease of use, and content credibility also drive adoption, while age, professional experience, and technological familiarity further shape usage patterns(3). Researches have found high awareness of mHealth apps among Pakistani healthcare professionals, yet routine clinical integration remains limited due to infrastructural and training gaps. These factors directly relate to the study's aim of understanding barriers and facilitators to Medscape's adoption in Pakistan.

Global research underscores the benefits of mHealth apps in clinical settings(4) reported that medical students and residents frequently used mobile devices to access drug information and clinical guidelines, enhancing efficiency and decision-making. (5) highlighted that apps like Medscape improve patient outcomes by providing timely clinical resources. Similarly(6) noted that mobile apps foster evidence-based practice among medical students. (6, 7) found that clinical apps improve workflow and diagnostic accuracy. In Pakistan, a cross-sectional study showed that 64.1% of medical students used medical apps, with Medscape (29.3%) being a top choice for accessing medical information and exam preparation, though textbooks remained preferred for in-depth learning(8) .(9) reported that 99% of medical residents and students used apps like Medscape for clinical decision-making, citing quick access to reliable knowledge as a benefit, but barriers such as poor Wi-Fi and lack of localized content hindered integration. These studies highlight the global relevance of mHealth apps but lack specificity to Pakistan's unique healthcare challenges.

A critical research gap exists regarding the clinical integration of the Medscape app among healthcare personnel in Pakistan. Most studies, such as(10) and (11) focus on developed countries with advanced digital infrastructure, which differs significantly from Pakistan's resource-constrained settings. While (12) noted high awareness of mHealth apps in Pakistan, routine clinical integration remains underexplored. Additionally, little research evaluates Medscape's role in enhancing clinical decision-making in low-resource environments, where internet access and digital literacy vary widely. This study addresses this gap by investigating usage patterns, barriers (e.g., internet reliability, technological literacy), and facilitators (e.g., perceived usefulness, institutional support) of Medscape's clinical integration among Pakistani healthcare personnel, medical students, and AI conference attendees.

The significance of this study lies in its potential to guide strategies for enhancing mHealth adoption in Pakistan's healthcare system. By identifying barriers and facilitators to Medscape's integration, the study will inform healthcare organizations in developing targeted interventions, such as training programs and infrastructure improvements, to promote effective use of reliable mHealth tools. The findings will also support educators in integrating digital health tools into medical curricula, equipping future healthcare professionals with essential digital literacy skills. The inclusion of AI conference attendees, who are likely early adopters of technology, will provide insights into designing AI-enhanced mHealth apps tailored to Pakistan's needs. This research contributes localized evidence to the global mHealth literature, addressing

an understudied context in low- and middle-income countries.

The objectives of this study were as fellows;

1. Assess the prevalence and patterns of Medscape app usage among healthcare professionals, medical students, and AI conference attendees in Pakistan;
2. Identify barriers and facilitators to its clinical integration.
3. Evaluate its perceived effectiveness in supporting clinical decision-making.

METHODOLOGY

A cross-sectional survey was conducted to evaluate the clinical integration of the Medscape app among healthcare personnel in Pakistan. The design facilitated the collection of quantitative data on usage patterns, perceived usefulness, barriers, and facilitators, aligning with the three study objectives. The target population included Healthcare professionals (medical professionals, nurses, medical lab technologists MTL) from POF Hospital, Wah Cantt, Pakistan and medical students (undergraduate and postgraduate) from WAH Medical College and other medical institutions represented at an AI conference.AI conference attendees at WAH Medical College, included for their likely familiarity with mHealth technologies and interest in AI-enhanced tools. These groups were selected to represent diverse professional roles and levels of technological familiarity, ensuring a comprehensive assessment of Medscape's integration.

A purposive sampling technique was used to recruit 351 participants from POF Hospital, WAH Medical College, and an AI conference, ensuring representation from healthcare professionals (7.4%), medical students (88.0%), and AI conference attendees (4.6%). The sample size was calculated using a 95% confidence level and a 5% margin of error, assuming a 50% prevalence of mHealth app usage in Pakistan.

Data were collected using a structured questionnaire based on the Technology Acceptance Model (TAM), which evaluates perceived usefulness and ease of use as predictors of technology adoption. The questionnaire included Likert-scale, multiple-choice, and binary response questions. It was pilot-tested with 20–30 participants from WAH Medical College, achieving a Cronbach's alpha > 0.7 for Likert-scale items, confirming reliability. Data collection used both online (Google Forms) and offline (paper-based) methods to accommodate Pakistan's variable internet access. Ethical approval was secured from the Institutional Review Board of Wah Medical College.

The data analysis utilized SPSS and employed descriptive statistics (frequencies, percentages, means, standard deviations) to summarize variables, inferential statistics (one-way ANOVA, t-tests) to compare group differences, and Pearson correlations to explore associations between variables. A p-value threshold of <0.05 was set for statistical significance, with post-hoc Tukey HSD tests applied for significant ANOVA results. Bar and pie charts were generated using SPSS Chart Builder for visualization.

RESULTS

Table 1

Participant Demographics sheet (n=351)

Variable	Category	F	(%)
Gender	Male	100	28.5
	Female	251	71.4
Age Group	18–20 years	108	30.8
	21–30 years	208	59.3
	31–40 years	27	7.7
	>40 years	8	2.3
Professional Status	Medical student	309	88.0
	Medical professional	26	7.4
	AI Conference attendee	16	4.6

Field of Study	Medicine	200	56.9
	Nursing	109	31.1
	Medical laboratory technology	29	8.3
	Other (AI conference attendees)	13	3.7
Education	Undergraduate	310	88.3
	Postgraduate	41	11.7
Primary Device	Smartphone	286	81.5
	Laptop	52	14.8
	Tablet	13	3.7

The sample consisted of 351 participants, predominantly female (71.4%), aged 21–30 years (59.3%), and medical students (88.0%). The primary fields of study were medicine (56.9%), nursing (31.1%), and medical laboratory technology (8.3%). Most participants were undergraduates (88.3%), and 81.5% used smartphones for medical information access. The predominance of medical students and undergraduates reflects the study's focus on academic settings. The high female representation may align with enrollment trends in medical institutions. Smartphone dominance underscores the accessibility of mHealth apps in this population.

Table 2
Prevalence and Patterns of Medscape App Usage (n=351)

Variable	Category	f	(%)
Prior Usage of Medscape	Yes, regularly	78	22.2
	Yes, occasionally	126	35.9
	No, never	147	41.9
Expectations from Medscape	News update	50	14.2
	Clinical guidelines	115	32.8
	Medical news	44	12.5
	Disease and drug reference	44	12.5
Use for Clinical Queries	Rarely	44	12.5
	Occasionally	139	39.6
	Frequently	95	27.1
	Always	4	1.1

Table-2 shows that of the 351 participants, 77.5% had prior knowledge of Medscape, and 58.1% had used it (22.2% regularly, 35.9% occasionally). Non-users (41.9%) cited lack of awareness (47.9%) or preference for other resources (22.2%), such as Google (55.3%) or textbooks (23.1%). Expectations were high, with 55.3% anticipating all Medscape features. Among users (n=282), clinical guidelines (40.8%) and drug interaction checkers (28.0%) were the most useful features. For clinical queries, 33.7% used Medscape frequently, and 28.0% used the drug dosage calculator multiple times a day. Daily clinical practice usage was occasional for 55.7% and frequent for 24.5%. The 58.1% usage rate indicates moderate adoption. The preference for clinical guidelines and drug interaction checkers suggests these features support rapid clinical decisions. The high reliance on Google indicates competition from accessible, non-specialized tools, particularly among students. Frequent use of the drug dosage calculator underscores Medscape's utility in time-sensitive tasks.

Figure-1
Bar Chart of Most Useful Medscape Features (n=351).

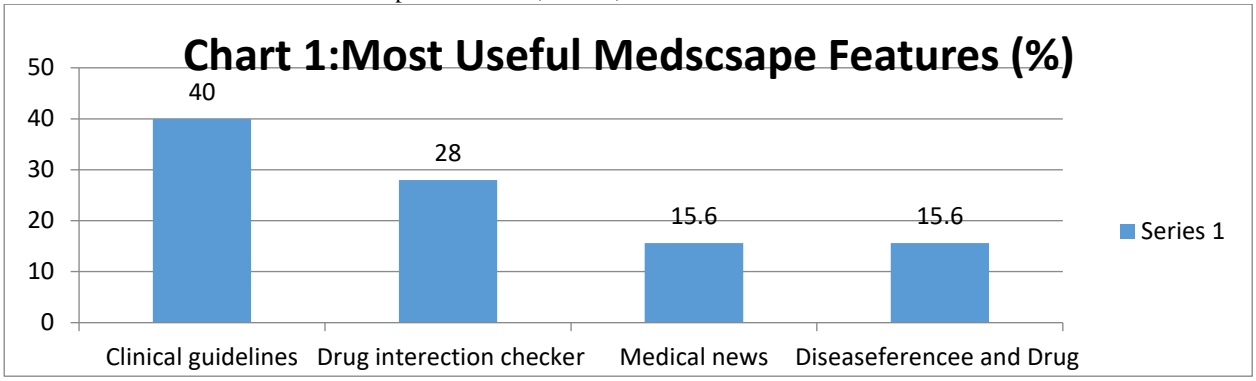

Figure-1, bar chart displaying the valid percentage of users (n=282) selecting each Medscape feature as the most useful. The x-axis lists features (Drug interaction checker, Clinical guidelines, Medical news, Disease and drug reference), and the y-axis shows percentages (0–50%). Clinical guidelines (40.8%) would have the tallest bar, followed by drug interaction checker (28.0%), with medical news and reference library at 15.6%.

Table 3
Barriers and Facilitators to Medscape Integration (n=282)

Variable	Category	F	(%)
Biggest Challenges	Lack of training	71	20.2
	Time constraints	94	26.8
	Technical issues	45	12.8
	Lack of interest in the app	50	14.2
	Other	22	6.3
Navigation Ease	Very difficult	17	4.8
	Difficult	17	4.8
	Neutral	106	30.2
	Easy	133	37.9
	Very easy	9	2.6
Drug Interaction Checks Helpfulness	Not at all	9	2.6
	Somewhat	60	17.1
	Neutral	53	15.1
	Helpful	147	41.9
	Very helpful	13	3.7
Reliability	Yes	208	59.3
	No	48	13.7
	Unsure	26	7.4

The primary barriers to Medscape's integration were time constraints (33.3%), lack of training (25.2%), and technical issues (16.0%). Facilitators included perceived reliability (73.8% rated Medscape reliable) and ease of navigation (47.2% easy, 3.2% very easy). Drug interaction checks were helpful or very helpful for 56.7% of users, and 91.1% would recommend Medscape to colleagues. Trust in AI-generated content was moderate (66.7% trusted, 21.6% unsure), and 53.3% were likely to continue using Medscape (22.0%

very likely, 9.9% extremely likely). Time constraints and lack of training suggest challenges in busy clinical environments and limited mHealth training. Technical issues point to infrastructural limitations. High reliability and navigation ease indicate strong user satisfaction, while moderate trust in AI content suggests a need for greater transparency.

Figure- 2

Pie Chart of Biggest Challenges to Medscape Integration (n=351)

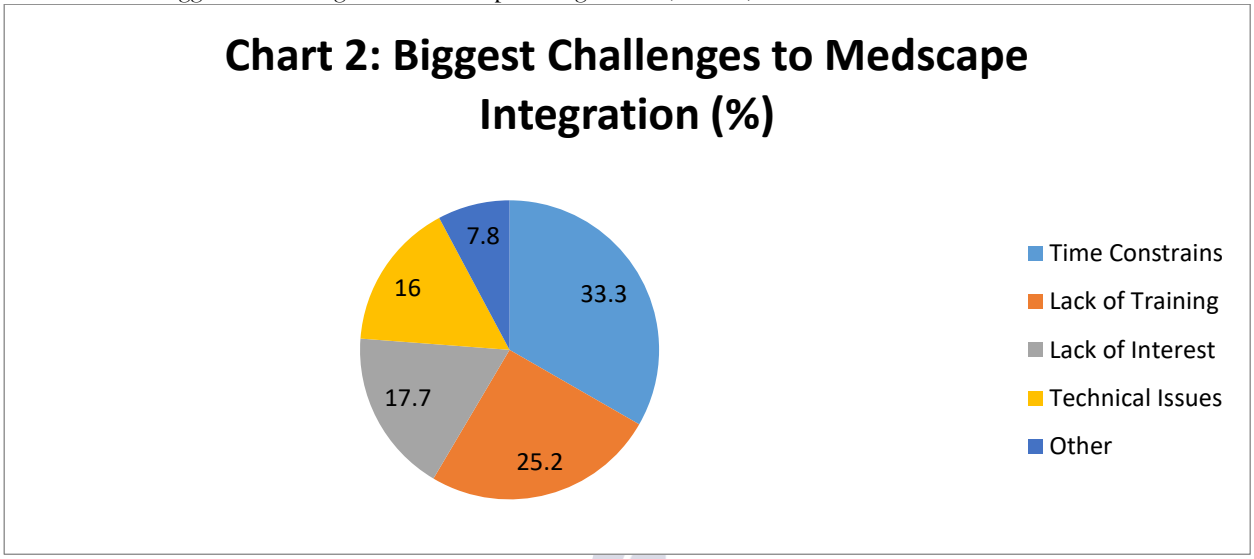

Figure-2 show pie chart distribution of barriers to Medscape use (n=282). Slices represent Lack of training (25.2%), Time constraints (33.3%), Technical issues (16.0%), Lack of interest (17.7%), and Other (7.8%). Time constraints would be the largest slice.

Table 4

Perceived Effectiveness of Medscape (n=351)

Variable	Category	f(%)	Mean (SD)
Diagnostic uncertainty reduction	Not at all	5.1	2.94 (0.79)
	Slightly	12.0	
	Moderate	45.9	
	Significantly	17.4	
Critical Decision-Making Improvement	Always	19.1	2.72(0.92)
	Often	24.5	
	Sometimes	31.9	
	Never	4.8	
Clinical Decision-Making Improvement	Not at all	1.1	2.74(0.70)
	Slightly	21.4	
	Moderate	48.4	
	Significantly	9.4	
Speed of Decision Making	Slowed it down	10.3	-
	Had no impact	19.1	
	Speed it up	51.0	

Tabel-4 shows that Medscape moderately improved clinical decision-making (Mean=2.74, SD=0.70), with 60.3% reporting moderate improvement and 11.7% significant improvement. It reduced diagnostic uncertainty moderately (Mean=2.94, SD=0.79), with 57.1% noting moderate reduction. Clinical cases improved critical thinking for 94.0% (23.8% always, 30.5% often). The app sped up decision-making for 63.5% of users. One-way ANOVA revealed significant differences in diagnostic uncertainty reduction by field of study (F=3.842, p=0.010), with nursing professionals reporting greater reduction than those in medicine (Mean difference=0.278, p=0.032, Tukey HSD). Pearson correlation showed a moderate positive relationship between usage frequency and decision-making improvement (r=0.45, p<0.01). The moderate effectiveness suggests Medscape enhances workflow and decision-making. The field-based difference indicates nursing professionals may benefit more from structured guidelines. The correlation between usage frequency and effectiveness suggests regular use improves outcomes.

Figure-3
Bar Chart of Clinical Decision-Making Improvement (n=351)

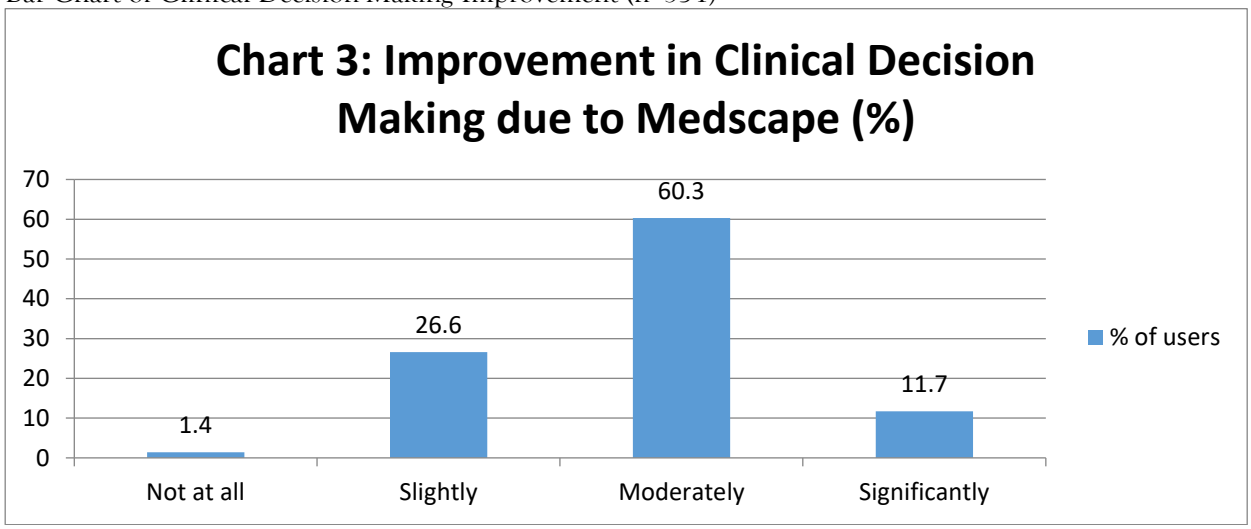

Figure-4 show bar chart distribution of responses for clinical decision-making improvement (n=282). The x-axis lists categories (Not at all: 1.4%, Slightly: 26.6%, Moderately: 60.3%, Significantly: 11.7%), and the y-axis shows valid percentages (0–70%). The "Moderately" bar would be the tallest.

DISCUSSION

The demographic profile of the study population, with 71.4% female participants, 88.0% medical students, and 81.5% using smartphones as their primary device, reflects the academic and technological context of the study. The predominance of medical students, primarily undergraduates (88.3%), aligns with the recruitment focus on WAH Medical College, a hub for medical education in Pakistan. The high female representation may mirror enrollment trends in Pakistani medical institutions, where women increasingly dominate health sciences programs. The reliance on smartphones underscores the accessibility of mHealth apps in this population, consistent with global trends where mobile devices are the primary tool for accessing clinical resources (13, 14). However, the underrepresentation of practicing professionals (7.4%) and older participants (>40 years, 2.3%) limits insights into the app's integration in clinical practice, suggesting a need for broader sampling in future studies (15).

The moderate adoption rate of Medscape (58.1%) indicates significant but not universal engagement among the study population. The preference for clinical guidelines (40.8%) and drug interaction checkers (28.0%) highlights the app's role in supporting rapid, evidence-based decisions, particularly for students preparing for clinical scenarios. The high reliance on Google (55.3%) among non-users suggests that accessible, non-

specialized tools compete with Medscape, likely due to familiarity and ease of access. This trend is particularly pronounced among students, who may prioritize quick searches over specialized apps(16). The frequent use of the drug dosage calculator (28.0% multiple times a day) underscores Medscape's utility in time-sensitive tasks, addressing a critical need in resource-constrained settings where access to comprehensive drug references may be limited (17).

The 41.9% non-usage rate, driven by lack of awareness (47.9%) and preference for other resources (22.2%), points to gaps in mHealth education and promotion. This finding aligns with prior research indicating that awareness of mHealth apps in Pakistan is high, but routine integration remains limited due to educational and systemic barriers (18).The expectation that Medscape offers a comprehensive suite of features (55.3%) reflects a positive perception of its multifunctionality, which could be leveraged to increase adoption. However, the reliance on textbooks (23.1%) for in-depth learning suggests that Medscape is seen as a supplementary tool rather than a primary resource, consistent with studies showing students' preference for traditional resources for complex learning (19).

Barriers to Medscape's integration, including time constraints (33.3%), lack of training (25.2%), and technical issues (16.0%), reflect systemic challenges in Pakistan's healthcare and educational systems. Time constraints likely stem from demanding academic and clinical schedules, particularly for students and professionals in high-pressure environments. The lack of training highlights a critical gap in digital health education, where users may not be equipped to maximize app functionality (20).Patient and physician perspectives on the use and outcome measures of mHealth apps: Exploratory survey and focus group study(21). Technical issues, such as unreliable internet connectivity, are a known barrier in Pakistan, particularly in semi-urban areas like Wah Cantt . These barriers underscore the need for targeted interventions, such as integrating mHealth training into medical curricula and improving digital infrastructure (22).

Facilitators like perceived reliability (73.8%) and ease of navigation (50.4%) align with the Technology Acceptance Model, which emphasizes perceived usefulness and ease of use as drivers of technology adoption (23). The high recommendation rate (91.1%) indicates strong user satisfaction, suggesting that positive user experiences could drive peer-to-peer promotion. However, the moderate trust in AI-generated content (66.7%, with 21.6% unsure) reflects skepticism about automated features, possibly due to limited understanding of AI algorithms. This finding highlights the need for transparent AI integration in mHealth apps to build confidence, particularly in settings with varying digital literacy levels (24).Enhancing offline functionality and localized content could further improve adoption in Pakistan's context.

Medscape's moderate effectiveness in improving clinical decision-making (Mean=2.74) and reducing diagnostic uncertainty (Mean=2.94) underscores its value as a clinical support tool. The significant difference in diagnostic uncertainty reduction between nursing and medicine fields ($p=0.032$) suggests that nursing professionals, who often rely on structured guidelines, benefit more from Medscape's standardized content. This aligns with global evidence that mHealth apps enhance workflow and accuracy, particularly for professionals with guideline-driven roles . The app's ability to speed up decision-making for 63.5% of users highlights its practical utility in time-sensitive clinical scenarios, a critical advantage in resource-constrained settings where rapid decisions can improve patient outcomes (25).

The positive correlation between usage frequency and decision-making improvement ($r=0.45$, $p<0.01$) indicates that regular engagement enhances Medscape's benefits, suggesting that interventions to increase routine use could amplify its impact. The high rate of critical thinking improvement (94.0%) reflects Medscape's role in fostering evidence-based practice, particularly among students preparing for clinical practice. However, the moderate overall effectiveness suggests that while Medscape is valuable, it may not fully replace traditional resources or address complex clinical challenges in Pakistan's context. Future enhancements, such as tailored content for local diseases and offline access, could strengthen its impact, aligning with Pakistan's digital health strategy (Ministry of National Health Services, 2022)

CONCLUSION

This study demonstrates moderate integration of the Medscape app in Pakistan, with clinical guidelines and drug interaction checkers being the most valued features. Time constraints, lack of training, and technical issues hinder adoption, while reliability and ease of use facilitate it. Medscape moderately enhances clinical decision-making and reduces diagnostic uncertainty, particularly among nursing professionals. These findings underscore the need for targeted interventions to promote mHealth adoption in Pakistan's healthcare system.

LIMMITATION AND RECOMMENDATION OF THE STUDY

This study has several limitations that should be considered when interpreting its findings. The use of purposive sampling may have introduced selection bias, as the inclusion of tech-savvy participants, particularly AI conference attendees, could overestimate familiarity with mHealth apps and underestimate barriers faced by less digitally literate groups. Additionally, the reliance on quantitative data, without open-ended questions, restricted the ability to capture nuanced insights into participants' experiences, such as specific contextual factors influencing barriers or facilitators. The geographic focus on POF Hospital and WAH Medical College, both in urban and semi-urban settings, limits the generalizability of findings to rural areas, where infrastructure and digital literacy may differ significantly. Finally, the self-reported nature of the data raises the possibility of social desirability bias, where participants may have overstated positive perceptions of Medscape's utility to align with perceived expectations.

To enhance the clinical integration of Medscape and similar mHealth apps in Pakistan, several strategies are proposed. First, training programs should be developed and implemented within medical curricula and hospital settings to address the identified lack of training, equipping users with the skills to effectively utilize app features. Second, investments in digital infrastructure, particularly reliable internet connectivity, are essential to mitigate technical barriers, aligning with Pakistan's Digital Health Strategy (Ministry of National Health Services, 2022). Third, integrating mHealth tools into medical education can prepare students for digital health practices, fostering long-term adoption. Fourth, customizing Medscape to include offline functionality and localized content tailored to Pakistan's disease profiles and healthcare needs could enhance its relevance and accessibility. Finally, future research should include qualitative studies in rural areas to explore contextual barriers and longitudinal studies to assess the long-term impact of mHealth adoption, providing a more comprehensive understanding of its potential in Pakistan's healthcare system.

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