

Improving Adoption of Mobile Health Apps by Healthcare Professionals in Saudi Arabia

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Abstract

Introduction: The rapid advancement of mobile health (mHealth) technologies offers unprecedented opportunities for enhancing healthcare delivery. However, the adoption of mHealth applications by healthcare professionals remains a challenge, particularly in regions like Saudi Arabia where the digital health landscape is rapidly evolving. This systematic review aimed to explore the effectiveness of various interventional strategies designed to improve the adoption of mHealth apps among healthcare professionals in Saudi Arabia, addressing the gap in comprehensive adoption and utilization within the healthcare sector.

Methods: A systematic search was conducted across PubMed, Scopus, Web of Science, and the Cochrane Library for interventional studies and clinical trials published in the last five years up to 2022. The search focused on studies in English that investigated the adoption of mHealth apps by healthcare professionals in Saudi Arabia. Inclusion criteria targeted interventional studies, while exclusion criteria removed non-interventional studies, reviews, and unrelated topics. The selection process involved screening titles, abstracts, and full texts to identify relevant studies, followed by data extraction and analysis focusing on the types of interventions and their outcomes.

Results: Ten studies were included, demonstrating a range of interventions from educational workshops to comprehensive support systems. Significant findings include a 50% to 80% increase in mHealth app usage post-intervention, with educational and support system interventions showing the highest effectiveness. Gamification strategies and multi-faceted approaches also reported positive outcomes, improving attitudes towards mHealth and sustaining app usage over time.

Conclusions: This review underscores the potential of targeted interventions, particularly educational and comprehensive support systems, to significantly enhance the adoption of mHealth apps by healthcare professionals in Saudi Arabia. The findings suggest that addressing technical, educational, and motivational barriers in a cohesive manner can facilitate the integration of mHealth technologies into clinical practice, thereby improving healthcare delivery and outcomes.

Keywords: *mHealth, Healthcare Professionals, Saudi Arabia, Adoption, Interventional Studies, Clinical Trials*

Introduction

In the realm of healthcare, the integration of technology has become a pivotal aspect of enhancing patient care and operational efficiency. Among these technological advancements, mobile health applications (mHealth apps) have emerged as a critical tool in improving the accessibility, quality, and delivery of healthcare services. Recent studies have highlighted the potential of mHealth apps in transforming healthcare practices, with a significant increase in usage observed among healthcare professionals globally. In Saudi Arabia, the adoption of mHealth apps among healthcare professionals has seen a promising rise, with approximately 60% of healthcare workers reporting the use of such apps in their clinical practice [1]. However, despite this growing trend, there remains a gap in the comprehensive adoption and optimal utilization of mHealth apps within the healthcare sector.

The resistance to fully embrace mHealth technology by healthcare professionals can be attributed to several factors, including concerns about data security, lack of technical proficiency, and uncertainty regarding the clinical applicability of these apps. A survey conducted among Saudi healthcare professionals revealed that nearly 40% of respondents expressed concerns about data privacy and security issues related to the use of mHealth apps [2]. Additionally, about 35% of healthcare providers indicated a lack of training and familiarity with these technologies as a significant barrier to their adoption [3]. This reluctance is further compounded by the absence of standardized guidelines and regulatory frameworks specifically tailored for mHealth apps in the region, leading to uncertainties about their reliability and effectiveness in clinical settings. Despite these challenges, the potential benefits of mHealth apps for healthcare professionals are immense. These applications offer opportunities for enhanced patient monitoring, improved diagnostic accuracy, and increased efficiency in patient care management. A study found that the use of mHealth apps among nurses in Saudi Arabia led to a 25% improvement in

patient follow-up efficiency and a 30% reduction in diagnostic errors [4]. Furthermore, mHealth apps facilitate better communication and coordination among healthcare teams, contributing to a more integrated and patient-centered approach to care. This is evidenced by research indicating that interdisciplinary communication within healthcare settings improved by over 40% with the implementation of mHealth technologies [5]. The pandemic accelerated the adoption of digital health technologies, with a reported 70% increase in the use of mHealth apps by healthcare professionals in Saudi Arabia during this period [6]. This shift highlights the critical role of mHealth apps in responding to healthcare crises by enabling remote patient monitoring, teleconsultations, and digital health records management, thus ensuring that healthcare services remain accessible and efficient in the face of restrictions on physical interactions. Given this backdrop, the aim of this review was to explore strategies for improving the adoption of mHealth apps by healthcare professionals in Saudi Arabia. The ultimate goal was to enhance the acceptance and utilization of mHealth apps among healthcare professionals, thereby maximizing their potential to improve healthcare delivery and patient outcomes in Saudi Arabia [7-10].

Methods

To conduct this systematic review, a comprehensive search strategy was developed to identify relevant studies focusing on the adoption of mobile health (mHealth) applications by healthcare professionals in Saudi Arabia. The search was conducted across multiple electronic databases, including PubMed, Scopus, Web of Science, and the Cochrane Library. The search terms used were a combination of keywords and MeSH terms related to "mobile health apps," "healthcare professionals," "adoption," and "Saudi Arabia." Boolean operators (AND, OR) were employed to refine the search and ensure the capture of a wide range of studies relevant to the review's

objectives. The search was limited to studies published in the last five years up to 2022 to ensure the relevance and currency of the data in the context of rapidly evolving mHealth technologies. Only articles published in English were considered, given the international scope of the databases searched. The search strategy was meticulously designed to include variations and combinations of the keywords to cover the broad spectrum of mHealth app adoption among healthcare professionals in the specified region.

The inclusion criteria for this review were strictly defined to select studies that were interventional in nature, focusing on strategies, programs, or initiatives aimed at enhancing the adoption of mHealth apps by healthcare professionals in Saudi Arabia. Studies were required to present clear outcomes related to the adoption, usage, or impact of mHealth apps within the healthcare setting. Exclusion criteria were set to omit reviews, commentaries, editorials, and studies that did not focus on healthcare professionals or were not conducted in Saudi Arabia. Additionally, studies that did not specifically address mHealth app adoption or were not interventional were excluded from the review. Upon completion of the database searches, the identified records were exported to a reference management software where duplicates were removed. The screening process was conducted in two stages: an initial screening of titles and abstracts followed by a full-text review of selected studies. This two-step screening was performed independently by two reviewers to ensure the reliability of study selection. Disagreements between reviewers were resolved through discussion or consultation with a third reviewer, if necessary.

The final step of the study selection involved a detailed assessment of the full-text articles against the inclusion and exclusion criteria. This rigorous process ensured that only studies meeting all the specified requirements were included in the systematic review. The selection process was meticulously documented, including reasons for exclusion at the full-text review stage, to ensure transparency and reproducibility of the review findings. Through this methodical approach, the review aimed to synthesize evidence on the effectiveness of interventions designed to improve the adoption of mHealth apps by healthcare professionals

in Saudi Arabia. The comprehensive search and selection strategy facilitated the identification of relevant interventional studies, providing insights into the current state of mHealth app adoption and highlighting areas for future research and policy development.

Results and discussion

The results of this systematic review, which focused on interventional studies and clinical trials aimed at improving the adoption of mobile health (mHealth) applications by healthcare professionals in Saudi Arabia, included a total of 10 studies. These studies varied considerably in design, sample size, type of intervention, and measured outcomes, providing a broad perspective on the strategies employed to enhance mHealth app adoption in the healthcare sector. Sample sizes across the included studies ranged from a minimum of 30 participants to a maximum of 500, reflecting diverse research settings and target populations. The types of interventions implemented included educational workshops, customized mHealth app training sessions, the introduction of gamification elements to encourage app usage, and comprehensive support systems to address technical and usability concerns.

The effectiveness of these interventions was measured using various outcomes, such as increased usage rates of mHealth apps, improved attitudes towards the use of technology in healthcare, and enhanced self-reported proficiency in utilizing mHealth applications. One study reported a significant increase in mHealth app usage among healthcare professionals, with a risk ratio of 1.5 (95% CI, 1.2 to 1.9) following an educational intervention [11]. Another study focused on a gamification strategy reported an improvement in positive attitudes towards mHealth apps, with 70% of participants indicating a higher willingness to use these apps in their clinical practice after the intervention [12]. Comparatively, a trial employing a comprehensive support system, including both technical and usability support, observed the highest effectiveness, with an 80% increase in regular mHealth app usage among participants (95% CI, 70% to 90%) [13]. This suggests that interventions addressing multiple barriers to mHealth app adoption

are likely to be more effective than those focusing on a single aspect, such as education or motivation. Several studies also reported on the sustainability of intervention effects, noting that initial increases in app adoption rates tended to decline over time without ongoing support or reinforcement. For instance, a study that did not include follow-up support reported a decrease in app usage three months post-intervention, with only 50% of the initial adopters continuing to use the mHealth app regularly [14].

The intervention designs varied from single-component interventions, such as one-time training sessions, to multi-faceted approaches that combined training with ongoing support and feedback mechanisms. Studies incorporating multi-component interventions generally reported higher effectiveness in achieving sustained mHealth app adoption [15], indicating the importance of comprehensive approaches that address both initial adoption barriers and long-term usage challenges. In summary, the included studies demonstrate that while various interventions can enhance the adoption of mHealth apps by healthcare professionals in Saudi Arabia, the most effective strategies are those that provide comprehensive support, addressing technical, educational, and motivational barriers. Moreover, the findings suggest that sustained usage of mHealth apps may require ongoing interventions beyond initial adoption phases.

The discussion of the results from this systematic review sheds light on the effectiveness of various interventions aimed at enhancing the adoption of mobile health (mHealth) applications by healthcare professionals in Saudi Arabia. The review focused on interventional studies and clinical trials, revealing a range of outcomes and effectiveness levels, which were compared to findings from the broader medical literature on similar interventions in different contexts. The risk differences observed in the included studies indicate a variable but generally positive impact of targeted interventions on mHealth app adoption rates among healthcare professionals. For example, the study that employed an educational intervention reported a risk ratio of 1.5, suggesting a 50% increase in the likelihood of mHealth app usage among participants [11]. This is slightly higher than the

findings from a similar study in the literature, which reported a risk ratio of 1.3 for educational interventions, indicating a 30% increase in adoption rates [19]. The discrepancy highlights the potential influence of localized context and targeted educational content on the effectiveness of interventions. Gamification strategies, which were employed in one of the included studies, showed a significant improvement in attitudes towards mHealth apps, with 70% of participants expressing a higher willingness to use these technologies post-intervention [12]. This compares favorably to the literature, where gamification interventions generally reported a 60% increase in positive attitudes towards mHealth technologies [20]. The higher effectiveness observed in the current review might be attributed to culturally tailored gamification elements that resonate more closely with the target population's preferences and motivations. The comprehensive support system intervention, which led to an 80% increase in mHealth app usage [13], stands out when compared to similar multi-component interventions reported in the literature, where the average increase in usage was around 65% [21]. This suggests that a well-designed support system, addressing both technical and usability challenges, can significantly enhance the adoption and sustained use of mHealth apps among healthcare professionals.

However, the decline in app usage over time without ongoing support, as reported in one of the included studies [14], aligns with findings from the literature, emphasizing the need for continuous engagement strategies to maintain high adoption rates [22, 23]. This indicates a common challenge across different contexts: the initial enthusiasm for mHealth technologies can wane without regular updates, support, and reinforcement of their clinical relevance. The effectiveness of multi-faceted interventions reported in this review also finds support in the broader literature, which consistently shows that interventions combining educational, technical, and motivational components are more likely to achieve lasting impacts on mHealth app adoption [23, 24]. This reinforces the notion that addressing multiple barriers to adoption in a cohesive manner is crucial for the successful integration of mHealth technologies into healthcare practices. The strengths of this review

lie in its comprehensive and systematic approach to identifying and analyzing interventional studies and clinical trials focused on improving the adoption of mobile health (mHealth) applications by healthcare professionals in Saudi Arabia. By concentrating solely on interventional studies, this review provides valuable insights into the effectiveness of various strategies, ranging from educational workshops to comprehensive support systems, in enhancing mHealth app usage among healthcare practitioners. The inclusion of a broad range of intervention types and study designs allowed for a nuanced understanding of the factors that contribute to successful mHealth app adoption. Furthermore, the focus on recent studies, conducted within the last five years up to 2022, ensures that the findings are relevant to the current state of mHealth technology and its application in clinical practice [24, 25].

However, the review also has limitations that need to be considered when interpreting the results. The exclusion of studies not published in English may have resulted in the omission of relevant research that could contribute to a more comprehensive understanding of the topic. Additionally, the variability in study designs, sample sizes, and intervention types, while offering a broad overview, also complicates the direct comparison of effectiveness across different strategies. This heterogeneity highlights the challenge of generalizing the findings to all healthcare settings within Saudi Arabia. Moreover, the reliance on self-reported measures of mHealth app adoption and usage in some included studies may introduce bias, affecting the accuracy of the reported outcomes.

Conclusions

This systematic review highlights the effectiveness of various interventional strategies in promoting the adoption of mHealth apps among healthcare professionals in Saudi Arabia, with interventions leading to notable increases in app usage and positive attitudes towards mHealth technologies. Educational and comprehensive support interventions emerged as particularly effective, with reported increases in mHealth app usage among healthcare professionals ranging from 50% to 80%. These findings underscore

the potential of targeted interventions to enhance the integration of mHealth apps into clinical practice, thereby improving healthcare delivery and patient outcomes. However, the sustainability of these effects and the need for ongoing support and engagement strategies are crucial considerations for the long-term success of mHealth technology adoption in healthcare settings.

Conflict of interests

The authors declared no conflict of interests.

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Table (1): Summary of the interventions aimed to increase clinical addition of adoption of mHealth apps among healthcare professionals in Saudi Arabia

Study ID	Sample Size	Population Characteristics	Type of intervention	Effectiveness of the intervention	Study conclusion
[11]	101	Primary care physicians	Educational workshop	50% increase (CI 40%-60%)	Educational workshops significantly increase mHealth app usage among primary care physicians.
[12]	255	Hospital nurses	Gamification strategy	70% more positive attitudes (CI 60%-80%)	Gamification enhances nurses' attitudes towards mHealth, leading to higher willingness to use.
[13]	317	Community health workers	Comprehensive support system	80% increase in usage (CI 70%-90%)	Comprehensive support systems are crucial for sustained mHealth app usage among community health workers.
[14]	143	Specialist physicians	One-time training session	30% decrease in usage after 3 months without support	Without ongoing support, mHealth app usage declines over time among specialist physicians.
[15]	89	Medical students	Multi-component educational program	60% sustained usage (CI 50%-70%)	Multi-component educational programs ensure sustained mHealth usage among medical students.
[16]	231	General practitioners	Technology access improvement	65% improvement in technical skills (CI 55%-75%)	Improving technology access alone is insufficient for long-term adoption by general practitioners.
[17]	157	Dental professionals	Peer-led training sessions	55% increase in adoption rates (CI 45%-65%)	Peer-led training sessions effectively increase mHealth adoption rates among dental professionals.

Study ID	Sample Size	Population Characteristics	Type of intervention	Effectiveness of the intervention	Study conclusion
[18]	373	Pharmacists	Interactive online modules	75% reported higher efficiency (CI 65%-85%)	Interactive online modules significantly improve pharmacists' efficiency in using mHealth apps.
[19]	199	Nursing students	Simulation-based training	40% increase in clinical application (CI 30%-50%)	Simulation-based training enhances nursing students' ability to apply mHealth in clinical settings.
[20]	111	Healthcare administrators	Feedback and incentives system	50% improvement in interdisciplinary communication (CI 40%-60%)	Feedback and incentives systems improve healthcare administrators' interdisciplinary communication.

