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ORIGINAL RESEARCH

Examining Healthcare Practitioners' Perceptions of Virtual Physicians, mHealth Applications, and Barriers to Adoption: Insights for Improving Patient Care and Digital Health Integration

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Introduction: Mobile health (mHealth) applications have transformed healthcare by enhancing access to medical information, facilitating remote consultations, and improving patient engagement. Despite their potential, adoption challenges persist, particularly concerning usability, integration with existing healthcare systems, and user trust. The Sehhaty application, a national digital health platform in Saudi Arabia, exemplifies these challenges. Identifying the barriers that hinder healthcare practitioners' engagement with mHealth applications is crucial for optimising their implementation and ensuring equitable access to healthcare services.

Aim: This study examines healthcare practitioners' perceptions of mHealth applications, with a specific focus on the Sehhaty app, to identify key adoption barriers. It further aims to provide recommendations for enhancing usability, accessibility, and integration within existing healthcare infrastructures.

Methods: A cross-sectional study was conducted among 574 secondary healthcare practitioners (SHCPs), including physicians, nurses, and administrative staff, working in secondary healthcare centres across Saudi Arabia. Data were collected using a structured questionnaire assessing ten primary barriers to mHealth adoption, including technical, usability, training, integration, privacy, organisational, communication, financial, and productivity-related challenges. The reliability of the instrument was evaluated using Cronbach's alpha, and descriptive statistics (frequencies, means, standard deviations) were computed. Correlation analysis was conducted to examine interrelationships among the identified barriers, providing insights into how different factors influence adoption. Data analysis was performed using SPSS (version 29) and R software.

Results: The questionnaire demonstrated excellent internal consistency (Cronbach's $\alpha = 0.95$). The most significant barriers identified included Technical Barriers (Mean = 3.32), Usability Barriers (Mean = 3.05), and Integration and Workflow Challenges (Mean = 3.20). Participants reported frequent technical glitches, slow system performance, and poor compatibility with existing healthcare platforms. Usability concerns, such as complex navigation and excessive steps required to complete tasks, further hindered adoption. Integration challenges, including lack of interoperability with electronic health records, were also highlighted. Privacy and security concerns (Mean = 3.26) emerged as a significant factor affecting trust in the application. Correlation analysis revealed strong interdependencies among barriers, with Technical Barriers correlating with Usability Barriers ($r = 0.69$) and Integration and Workflow Barriers ($r = 0.62$), underscoring the compounded effect of these challenges on user adoption.

Conclusion: Healthcare practitioners encounter multiple barriers in adopting the Sehhaty app, predominantly related to technical performance, usability, and system integration. Addressing these challenges requires targeted improvements in interface design, system interoperability, and technical support. Future research should incorporate patient perspectives, examine long-term adoption trends, and evaluate the impact of mHealth applications on clinical efficiency and patient outcomes. The study's findings provide critical insights for policymakers, healthcare institutions, and technology developers seeking to enhance mHealth usability, digital health integration, and healthcare accessibility in Saudi Arabia's evolving healthcare landscape.

Keywords: mHealth adoption, Sehhaty application, healthcare practitioners, usability barriers, digital health integration, Saudi Arabia

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Introduction

Mobile health (mHealth) applications have revolutionized healthcare by enhancing access to medical information, enabling remote monitoring, and facilitating communication between patients and healthcare providers.[1] Despite these advantages, adoption and sustained use remain significant challenges, particularly from the patient's perspective. Barriers such as usability issues, financial constraints, technical limitations, and privacy concerns continue to hinder the widespread adoption of these tools, ultimately affecting their accessibility and impact.

Usability and Accessibility Barriers

One of the primary barriers to mHealth adoption is usability. Many patients struggle with complex interfaces and poorly designed features, making these applications difficult to navigate. This challenge is particularly pronounced among older adults and individuals with limited digital literacy, who may encounter difficulties due to small fonts, confusing layouts, or unintuitive workflows. Additionally, users with physical impairments, such as visual or dexterity issues, often face accessibility barriers that make app usage cumbersome.[2,3] Another factor influencing usability is the time required to learn and effectively use these applications. Individuals with busy schedules may be reluctant to invest time in mastering an unfamiliar platform, particularly if they perceive limited immediate benefits.[3] Designing user-friendly, adaptive interfaces that accommodate diverse needs is essential to improving.

Integration With Healthcare Systems

A significant limitation of many mHealth applications is their lack of integration with existing healthcare systems. Many apps function as standalone tools, with little or no connectivity to electronic health records (EHRs) or provider networks, reducing their effectiveness for both patients and clinicians.[3,4] This lack of interoperability forces patients to manually enter health data, increasing the likelihood of errors, frustration, and disengagement. The issue is particularly pronounced among vulnerable populations, such as elderly individuals and those in marginalized communities, where limited digital literacy and uneven access to technology further exacerbate disparities. Without targeted initiatives to improve digital literacy, many individuals will remain unable to fully utilize mHealth applications.

The integration of mHealth applications into existing healthcare systems presents an additional challenge. Many applications operate autonomously, devoid of seamless connectivity with EHRs or healthcare providers' systems.[3,4] This lack of interoperability limits their efficacy for both patients and professionals. Patients may need to manually input data into applications that lack automated synchronisation with other platforms, hence creating additional burdens and reducing participation.[5,6]

Privacy and Security Concerns

Data security remains a major concern for many potential mHealth users. Patients are often reluctant to share sensitive health information due to fears of unauthorized access, data breaches, or misuse of personal data. This apprehension is heightened for applications dealing with stigmatised conditions such as mental health, HIV/AIDS, or reproductive health, where privacy violations can have serious social and psychological consequences.[3,7] Furthermore, many mHealth applications lack clear privacy policies or robust security measures, eroding user trust. Strengthening encryption protocols, transparency in data handling, and regulatory oversight is critical to reassuring users and fostering confidence in digital health solutions.

Financial and Infrastructure Barriers

Cost remains another significant hurdle. While some mHealth applications are free, others require subscriptions, in-app purchases, or additional hardware, creating a financial burden for users, particularly in low-income communities. Even for "free" applications, hidden costs such as internet connectivity, smartphone compatibility, or additional data usage can deter long-term adoption.[2] In addition, technological infrastructure plays a crucial role in ensuring accessibility. Many rural and underserved areas lack high-speed internet, modern mobile devices, or technical support, making it difficult for residents to fully benefit from mHealth services.[4] Limited network coverage, outdated devices, and software compatibility issues further

restrict access.[6] Without investments in digital infrastructure, these disparities will persist, preventing mHealth from reaching its full potential.

Regulatory and Ethical Considerations

The lack of a standardized regulatory framework for mHealth applications also presents challenges. Patients often struggle to understand accountability whether responsibility for their treatment lies with healthcare providers or app developers.[2,6] Ethical concerns surrounding informed consent, data ownership, and transparency further complicate adoption, as many users remain unaware of how their data is collected, stored, and shared.[6] Addressing these gaps through clear policies and patient education is essential to promoting safe and responsible mHealth usage.

Motivational Barriers and Patient Engagement

Patient motivation is crucial for the adoption of mHealth applications. Many individuals lack the incentive to continually employ these technologies, especially if they see few immediate benefits.[8] Time constraints exacerbate this problem; rigorous schedules impede patients' capacity to dedicate time for acquiring new technology or consistently entering data into programs.[3]

Sehhaty Application

The Sehhaty application, which translates to "My Health", is a comprehensive digital health platform developed by the Saudi Ministry of Health (MoH). As part of Saudi Arabia's digital health transformation, Sehhaty serves as a centralized healthcare management tool, allowing citizens and residents to access a wide range of medical services. The platform provides essential functionalities such as booking medical appointments, accessing teleconsultations, managing prescriptions, and receiving immunization updates. Additionally, it enables users to track health metrics, such as step counts and heart rate, fostering a more proactive approach to personal health management.[9] The Sehhaty application has become a pivotal component of Saudi Arabia's digital health transformation, playing a crucial role in enhancing healthcare accessibility, efficiency, and patient engagement. Since its launch in 2020, Sehhaty has experienced widespread adoption, now serving over 24 million users, representing approximately 68.5% of the country's population. The platform is widely utilized by both citizens and residents, providing essential healthcare services such as appointment scheduling, teleconsultations, prescription management, and vaccination tracking.[9]

During the COVID-19 pandemic, Sehhaty played a critical role in the national response, facilitating over 24 million COVID-19 testing appointments and assisting in the administration of more than 61 million vaccine doses.[10] The mandated use of Sehhaty for all citizens and visitors has solidified its status as a cornerstone of digital healthcare delivery in the Kingdom. By integrating virtual health services with traditional healthcare access, the application has significantly improved operational efficiency and healthcare accessibility across diverse population groups.[9]

Sehhaty is designed with accessibility and inclusivity in mind, offering a user-friendly interface and seamless integration with healthcare systems. The application is available for free on both Android and iOS platforms, ensuring broad compatibility across different mobile devices. This accessibility eliminates financial barriers to digital healthcare engagement, allowing users to conveniently manage their healthcare needs from any location.

Despite its success and widespread adoption, there remain barriers that hinder its full potential. Key challenges include technical limitations, usability issues, digital literacy gaps, and infrastructure constraints, all of which impact adoption and user satisfaction. Addressing these obstacles is critical to ensuring equitable access and optimizing the platform's effectiveness.

Sehhaty's Physician Chatbot: A Tool for Digital Healthcare Transformations

The influence of physician chatbots and virtual physicians on healthcare is substantial and complex, leading to transformative changes throughout the healthcare sector. AI-powered tools are transforming patient care by optimizing administrative tasks, improving healthcare delivery, and increasing patient access to medical advice and services.[11] The primary advantage of virtual physicians and chatbots is their continuous availability, allowing patients to access medical guidance at any time and from any location. This is especially beneficial for individuals in remote or underserved regions with restricted access to healthcare facilities.[12] Furthermore, by enabling virtual consultations, these AI systems minimize the necessity for superfluous in-person

appointments, thereby conserving patients' time and decreasing expenses related to travel and clinic visits.[12] In addition to accessibility, chatbots and virtual physicians significantly contribute to the enhancement of patient education and engagement, thereby improving health outcomes. These AI tools enhance patient health management by providing personalized health information, medication reminders, and lifestyle recommendations. This tailored support promotes adherence to treatment plans and improves patients' comprehension of their conditions, facilitating greater engagement in their healthcare.[13] Virtual physicians do not serve as replacements for human physicians; rather, they enhance clinical expertise by aiding in diagnostic processes and treatment planning. AI systems can analyze extensive medical data to provide differential diagnoses, recommend suitable tests or examinations, and support decision-making, thereby improving the diagnostic and therapeutic processes for healthcare providers.[14] Physician chatbot have demonstrated significant potential in the management of chronic conditions by offering innovative solutions that enhance patient care and outcomes. These tools are essential for managing chronic diseases, providing customized support to patients throughout all phases of their treatment.[14,15] Physician chatbot are significantly transforming chronic disease management by delivering tailored health education. Chatbots can provide tailored recommendations informed by a patient's individual condition, medical history, and specific requirements.[16] This enables patients to comprehend their condition, make informed choices regarding lifestyle modifications, and adopt self-care strategies that enhance long-term health.[15] Additionally, chatbots function as effective instruments for ongoing symptom monitoring and health data acquisition. Patients are able to submit regular updates regarding their symptoms, facilitating real-time monitoring of chronic conditions.[13,16] This automated data logging produces structured records that healthcare providers can utilize to evaluate patient progress and modify treatment plans as needed.[17] Physician chatbot can initiate alerts upon detecting concerning patterns or changes in symptoms, facilitating timely interventions to address potential issues before escalation. The enhancement of medication adherence is another essential function of Physician chatbot in the management of chronic diseases.[13] These systems provide timely reminders to patients, facilitating adherence to prescribed medication regimens.[11] Chatbots facilitate the consistent adherence to treatment regimens by prompting patients to log each dose and monitor medication intake.[18] Furthermore, chatbots enable patients to report any side effects encountered, thereby facilitating timely modifications to treatment plans as needed.[17] The provision of continuous support is especially beneficial for patients with chronic conditions, who frequently necessitate long-term, intricate medication regimens.

Study Aims and Objectives

This study aims to examine healthcare practitioners' perspectives on mHealth applications, with a particular focus on the adoption barriers and integration of AI-powered physician chatbots in clinical workflows. By assessing their perceived challenges, benefits, and impact on patient engagement, the study seeks to provide insights that can inform strategies for optimizing digital health tool adoption in healthcare settings.

- To assess healthcare practitioners' perceptions of the usability and effectiveness of mHealth applications, with a particular emphasis on the Sehhaty app.
- To identify key barriers to the adoption of mHealth applications, including usability challenges, privacy concerns, and integration difficulties.
- To explore the potential role of AI-powered virtual physicians (chatbots) in enhancing patient care, particularly in chronic disease management.
- To propose practical solutions to enhance the accessibility, usability, and interoperability of mHealth technologies within existing healthcare systems.

Methods

Study Design

This study employed a cross-sectional design to examine the barriers encountered by secondary healthcare practitioners (SHCPs) in Saudi Arabia when using the Sehhaty application. A cross-sectional approach was chosen to provide a snapshot of the challenges experienced by users at a specific point in time, facilitating an evaluation of the factors influencing adoption and engagement with the app.

Study Population and Ethical Approval

The study targeted SHCPs, including physicians, nurses, and administrative staff, who actively used the Sehhaty application within secondary healthcare centres (SHCs) in Saudi Arabia. Ethical approval for this study was obtained from [insert name of the approving ethics committee or institution], ensuring adherence to ethical guidelines concerning participant confidentiality, informed consent, and data security. Participants were informed of the study's purpose, voluntary nature, and data anonymisation procedures prior to participation.

Sampling Strategy

A purposive sampling approach was employed to specifically target SHCPs who actively used the Sehhaty mobile health application. This method ensured that the study focused on individuals with direct experience using the app, allowing for a more relevant and insightful exploration of the barriers to adoption. To enhance diversity, the sample size was set at 574 participants. Additionally, stratified sampling was incorporated to ensure proportionate representation across key demographic subgroups, including professional roles, geographical regions, and levels of experience. Strict inclusion and exclusion criteria were established to ensure that the sample accurately reflected the target population. Multiple recruitment channels, including online surveys, in-person outreach, and workplace collaboration, were utilised to maximise participant engagement. Demographic distribution was monitored throughout the data collection process, with additional efforts made to recruit underrepresented groups where necessary. These measures collectively strengthened the representativeness and validity of the study sample.

To assess the adequacy of the sample size, we applied Cochran's formula, a widely recognised method for determining the minimum required sample size in population-based studies. Given an estimated total population of 16,998 SHCPs,[19] a 95% confidence level ($Z = 1.96$), an assumed proportion of 0.5 for maximum variability ($p = 0.5$), and a margin of error of 5% ($e = 0.05$), the formula yielded a minimum sample size requirement of 384 participants.

Data Collection Procedure

Data collection was conducted over a six-month period, commencing on 11 August 2024. The questionnaire was distributed to SHCPs via an online survey platform to facilitate accessibility and response efficiency. A purposive sampling strategy was employed to specifically reach both clinical and non-clinical secondary healthcare practitioners. To ensure broad and relevant participation, the online survey link was disseminated through designated representatives of clinicians within government hospitals under the Gassim Health Cluster. These representatives played a pivotal role in forwarding the survey link to physicians, nurses, and allied healthcare professionals, as well as administrative and support staff involved in healthcare service delivery.

To enhance response rates and engagement, two follow-up reminders were sent, one in the third week and another in the sixth week of data collection, encouraging participation from a diverse set of healthcare practitioners. This structured distribution approach ensured that the dataset captured perspectives from various healthcare roles, improving the reliability and comprehensiveness of the collected data. The multi-channel recruitment strategy reinforced the representativeness of the study, ensuring that insights gathered reflected real-world experiences of secondary healthcare practitioners using the Sehhaty app.

Instrument Development and Validation

Data were collected using a structured questionnaire designed to identify key barriers to mobile health application adoption, specifically in the context of the Sehhaty app (see Supplementary File 1). The questionnaire was developed based on a synthesis of existing literature, identifying ten primary barriers:

1. Technical Barriers
2. Usability Barriers
3. Support and Training
4. Accessibility Barriers

5. Privacy and Security Barriers
6. Communication and Interaction Barriers
7. Functionality Barriers
8. User Satisfaction Barriers
9. Cost and Accessibility Barriers
10. Time and Productivity Barriers

Each variable was operationalised using 4–5 items, resulting in a total of 49 items measuring different aspects of the adoption barriers. The questionnaire comprised four sections:

1. Introduction: A participant information sheet detailing the study's objectives, ethical considerations, voluntary participation, data confidentiality, and anonymisation procedures.
2. Demographic Information: Questions regarding participants' age, gender, occupation, years of professional experience, and familiarity with mobile health applications.
3. Assessment of Adoption Barriers: A series of 49 Likert-scale items assessing perceived challenges in Sehhaty app usage.
4. Evaluation of AI-Based Physician Chatbots: Twenty Likert-scale items evaluating healthcare practitioners' perceptions of AI-driven physician chatbots, such as ChatGPT, concerning their potential benefits and challenges in clinical practice. This section addressed factors such as patient engagement, care quality, workload reduction, and the effectiveness of physician chatbot in enhancing healthcare delivery.

To evaluate the internal consistency of the questionnaire, Cronbach's alpha was calculated for each primary variable. The results indicate strong to excellent reliability across all measured domains, ensuring the instrument's robustness in assessing key barriers to application adoption. Among the highest reliability scores were Support and Training Barriers ($\alpha = 0.90$), Cost and Resource Barriers ($\alpha = 0.91$), and Time and Productivity Barriers ($\alpha = 0.89$), suggesting that responses within these domains were highly consistent and reliable. Similarly, Technical Barriers ($\alpha = 0.84$), Data Management and Security Barriers ($\alpha = 0.85$), and Communication and Collaboration Barriers ($\alpha = 0.89$) exhibited strong internal consistency, reinforcing the validity of these constructs.

Other measured variables, including Usability Barriers ($\alpha = 0.82$), Integration and Workflow Barriers ($\alpha = 0.80$), and Organizational Barriers ($\alpha = 0.80$), demonstrated acceptable reliability, indicating stable measurement across participants. Overall, the questionnaire achieved an excellent Cronbach's alpha of 0.95, confirming that the instrument provides a highly consistent and reliable measure of the perceived barriers affecting system adoption (see Figure 1). These findings underscore the robustness of the survey tool in capturing key challenges, ensuring confidence in the validity of the collected data (see Figure 1).

Pilot Study

A pilot study was conducted with seven SHCPs, comprising two physicians, four nurses, and one administrator to evaluate the clarity, readability, and relevance of the questionnaire. Participants provided feedback on potential ambiguities, inconsistencies, and unclear instructions. Based on their responses, modifications were made to improve item wording, refine response scales, and enhance construct validity. This process ensured that the final instrument accurately captured the barriers to mobile health application adoption and was appropriately tailored to the target population.

Data Analysis

Statistical analysis was conducted using SPSS (version 29) and R software. Descriptive statistics, including frequencies, percentages, and means, were computed to summarise participants' responses to the 49 adoption barrier items. Internal consistency was assessed using Cronbach's alpha to determine the reliability of the overall instrument and its ten subscales.

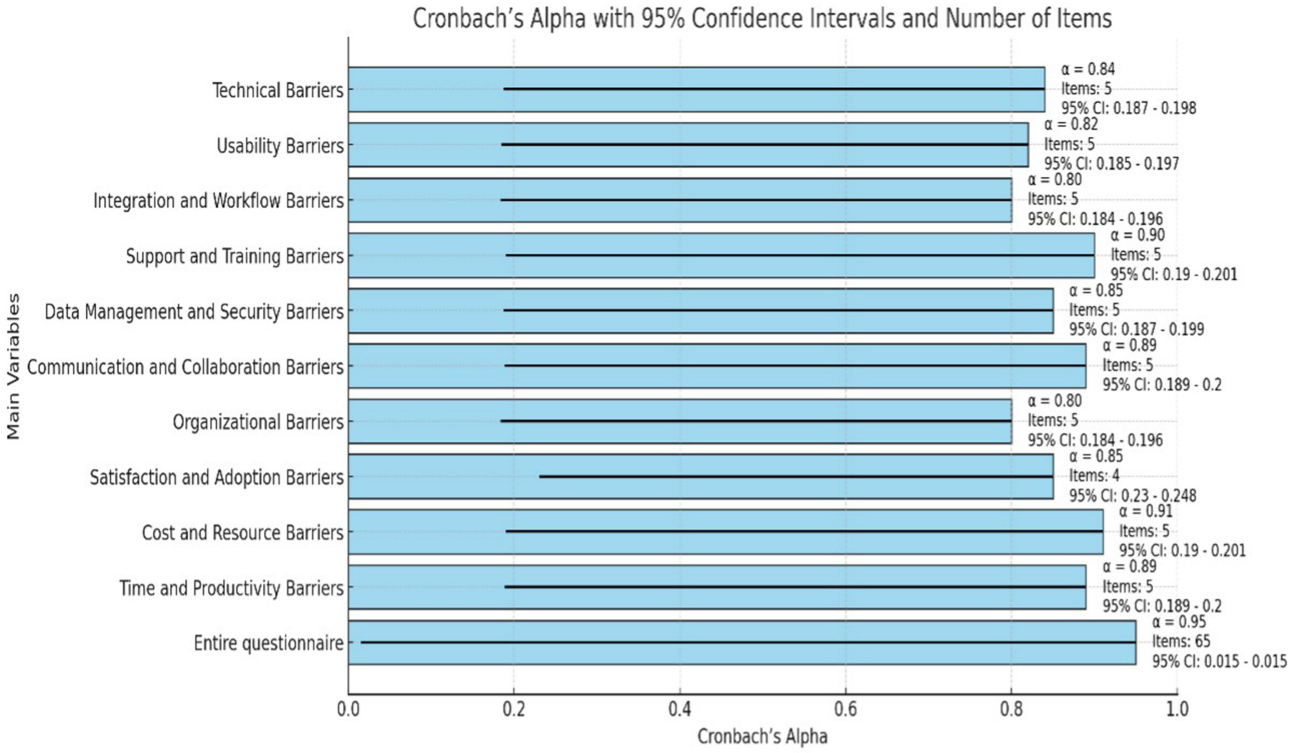

Figure 1 Questionnaire reliability.

Inferential statistical tests were employed to identify significant differences in responses across demographic categories. Correlation analyses were conducted to examine interrelationships among the ten adoption barriers, providing insights into potential interdependencies and areas requiring further intervention. Data visualisation techniques in R were used to illustrate the relationships among the key barriers, facilitating a comprehensive understanding of their impact on mobile health application adoption.

Ethical Considerations

This study was approved by the Institutional Review Board (IRB) of Qassim University No. 23–19-02. All the participants provided informed consent to participate. In the case of the questionnaire-based study, all participants were informed of the voluntary nature, confidentiality, and aim of the study and the nature of their participation before they participated in the study.

Results

With a final sample size of 574 participants exceeding the required threshold—this study ensures statistical adequacy for reliable inferences. Figure 2 presents an overview of the demographic characteristics of the 574 study participants, highlighting key distributions in age, gender, occupation, work experience, and mobile application proficiency.

Age Distribution

The majority of participants fell within the 30–39 age group (36.7%), making it the largest demographic category. This was followed by those aged 20–29 (29.3%), indicating a relatively young participant base. Individuals in the 40–49 age group comprised 20.8% of the sample, while participants aged 50 and above made up the smallest proportion (13.2%). This distribution suggests that the study primarily involved early-to-mid-career professionals, with fewer older participants.

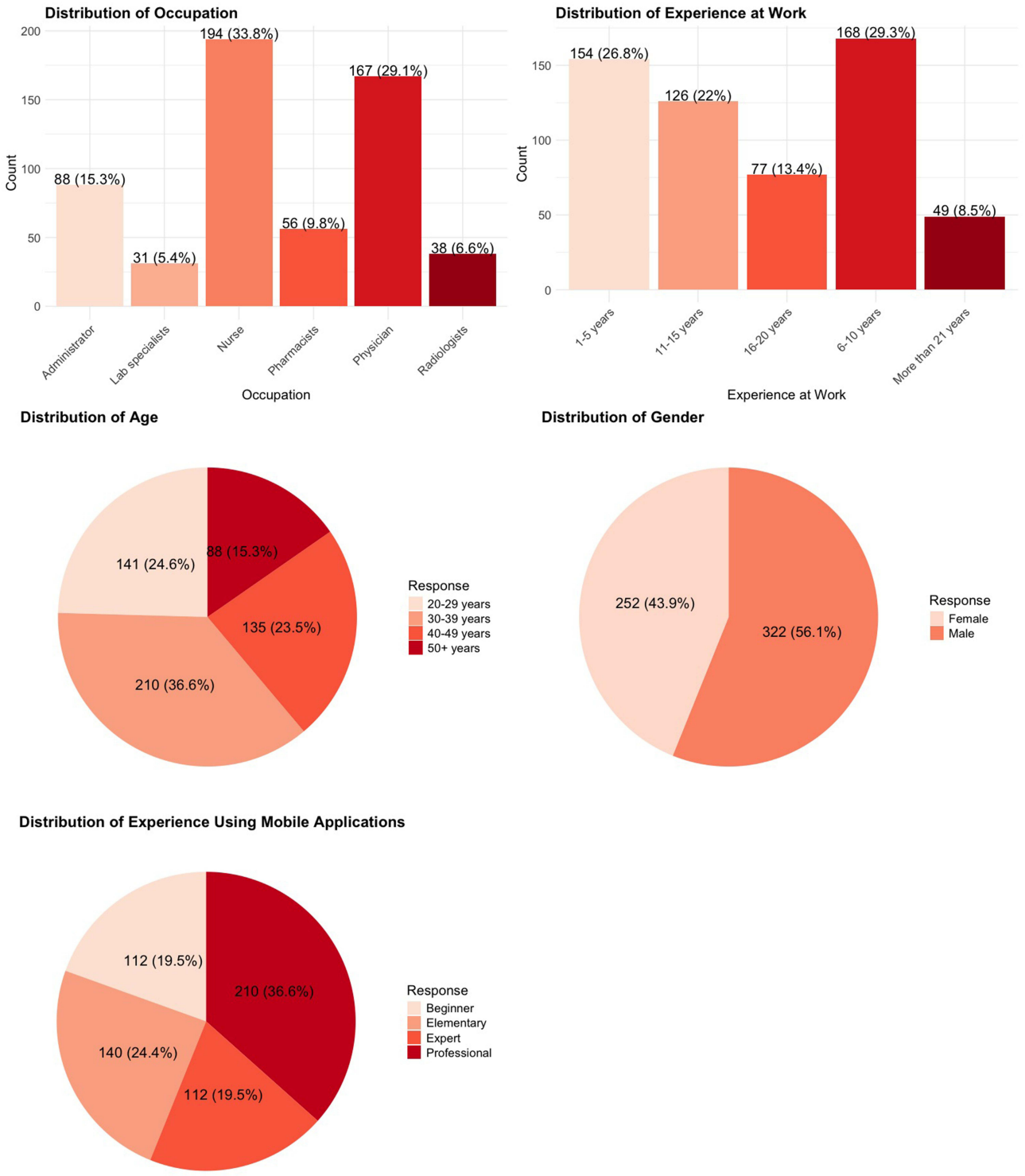

Figure 2 Practitioners' demographic distribution.

Gender Representation

The gender breakdown showed a slightly higher proportion of male participants (56.2%) compared to female participants (43.8%). While the difference is not substantial, it may reflect underlying workforce demographics or sector-specific variations in healthcare roles.

Occupational Background

In terms of profession, nurses represented the largest occupational group (44.0%), followed by physicians (36.7%). Other professional roles included pharmacists (26.9%), radiologists (29.3%), and laboratory specialists (22.0%). Administrative personnel accounted for 19.3% of the sample. The occupational diversity among participants provides valuable insights into how different healthcare professionals engage with the application.

Work Experience

Work experience varied considerably among participants. The most common category was 6–10 years of experience (29.3%), closely followed by 1–5 years (26.9%). More experienced participants included those with 11–15 years in the field (22.0%), while 16–20 years (13.4%) and 21+ years (8.3%) represented smaller proportions. These figures suggest a balanced mix of early-career and seasoned professionals, allowing for diverse perspectives on technology adoption.

Experience With Mobile Applications

Participants also reported different levels of familiarity with mobile applications. The largest proportion (36.7%) identified themselves as professional users, meaning they had substantial experience with digital tools. A quarter of the respondents (24.4%) classified themselves as elementary users, indicating basic familiarity. Novice users (19.6%) represented a smaller portion, while expert users (19.3%)—those with advanced proficiency—comprised the least common category. This distribution reflects varied digital literacy levels, which could influence user engagement and adoption rates.

Barriers in the Adoption of Mobile Health (mHealth) Applications

Table 1 presents a range of substantial barriers affecting the adoption and effective utilization of the application. These challenges span multiple dimensions, including technical limitations, usability concerns, training gaps, integration difficulties, data security issues, organizational constraints, communication hurdles, financial limitations, and productivity challenges. Each of these barriers plays a critical role in shaping user experience and influencing adoption rates.

Technical Barriers

Technical challenges emerged as a significant obstacle to application adoption. A notable proportion of respondents reported frequent system crashes and technical glitches (Mean = 3.32), as well as delays due to slow system performance (Mean = 3.29). Connectivity issues, such as server downtime and inadequate internet speed, were also widely cited (Mean = 3.05). Additionally, concerns over system compatibility were prevalent, with many users indicating that the application did not integrate seamlessly with other software they relied on (Mean = 3.24). A related issue was the perceived lack of essential features needed for efficient workflow management (Mean = 3.17). These findings highlight an urgent need for system optimization and infrastructure improvements to ensure smooth and reliable functionality.

Usability Barriers

Several usability issues were identified, making the application less intuitive and accessible for users. Many respondents found the interface difficult to navigate (Mean = 3.05) and reported that the system required prior guidance to operate effectively (Mean = 3.00). Basic tasks were perceived as unnecessarily complex, requiring too many steps to complete (Mean = 3.09), while data entry processes were time-consuming (Mean = 3.23). Additionally, a considerable number of users described the application as overly complex for routine tasks (Mean = 3.39). These concerns suggest a need for design improvements focused on streamlining workflows and enhancing user experience through a more intuitive and efficient interface.

Training and Support Barriers

The study also revealed a lack of adequate training and ongoing technical support, which significantly impacted adoption. Many users did not receive sufficient training on how to effectively use the system (Mean = 3.28), while others noted that

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Table 1 Practitioners' Perception Towards the Implementation of the mHealth Services

Category	Item	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	Mean
Technical Barriers	The application frequently experiences technical glitches or crashes.	42 (7.32%)	115 (20.03%)	138 (24.04%)	176 (30.66%)	103 (17.94%)	3.32
	The application is slow and causes delays in completing tasks.	31 (5.4%)	103 (17.94%)	193 (33.62%)	163 (28.4%)	84 (14.63%)	3.29
	The application often has connectivity issues (eg poor internet connection, server downtime).	83 (14.46%)	95 (16.55%)	171 (29.79%)	162 (28.22%)	63 (10.98%)	3.05
	The application is not compatible with other systems or software I use.	87 (15.16%)	85 (14.81%)	128 (22.3%)	153 (26.66%)	121 (21.08%)	3.24
	The application lacks the necessary features to fulfill my work requirements.	69 (12.02%)	101 (17.6%)	147 (25.61%)	175 (30.49%)	82 (14.29%)	3.17
Usability Barriers	The interface of the application is difficult to navigate.	73 (12.72%)	110 (19.16%)	175 (30.49%)	147 (25.61%)	69 (12.02%)	3.05
	The design of the application is not intuitive, making it hard to use without guidance.	76 (13.24%)	122 (21.25%)	157 (27.35%)	166 (28.92%)	53 (9.23%)	3
	The application requires too many steps to complete simple tasks.	61 (10.63%)	134 (23.34%)	146 (25.44%)	156 (27.18%)	77 (13.41%)	3.09
	It takes too long to enter data into the application.	43 (7.49%)	108 (18.82%)	175 (30.49%)	171 (29.79%)	77 (13.41%)	3.23
	I find the application to be too complex for routine use.	41 (7.14%)	87 (15.16%)	173 (30.14%)	154 (26.83%)	119 (20.73%)	3.39
Training and Support	I did not receive adequate training on how to use the application.	34 (5.92%)	104 (18.12%)	201 (35.02%)	137 (23.87%)	98 (17.07%)	3.28
	There is insufficient ongoing technical support for the application.	42 (7.32%)	70 (12.2%)	184 (32.06%)	197 (34.32%)	81 (14.11%)	3.36
	There is no easily accessible user manual or help function within the application.	73 (12.72%)	72 (12.54%)	163 (28.4%)	152 (26.48%)	114 (19.86%)	3.28
	The training provided did not cover all of the application's features.	49 (8.54%)	115 (20.03%)	169 (29.44%)	166 (28.92%)	75 (13.07%)	3.18
	When I encounter issues it takes too long to get help from the support team.	74 (12.89%)	115 (20.03%)	180 (31.36%)	118 (20.56%)	87 (15.16%)	3.05
Integration and Workflow Barriers	The application does not integrate well with my existing workflow.	47 (8.19%)	102 (17.77%)	189 (32.93%)	164 (28.57%)	72 (12.54%)	3.2
	Using the application disrupts the way I normally interact with patients.	44 (7.67%)	119 (20.73%)	156 (27.18%)	189 (32.93%)	66 (11.5%)	3.2
	The application does not effectively integrate with other medical systems we use.	48 (8.36%)	126 (21.95%)	170 (29.62%)	170 (29.62%)	60 (10.45%)	3.12
	The application slows down the overall workflow of my department.	38 (6.62%)	120 (20.91%)	153 (26.66%)	183 (31.88%)	80 (13.94%)	3.26
	I often have to use other tools or systems alongside the application to complete my tasks.	43 (7.49%)	135 (23.52%)	133 (23.17%)	169 (29.44%)	94 (16.38%)	3.24

Data Management and Security Barriers	I am concerned about the privacy and security of patient data in the application.	62 (10.8%)	84 (14.63%)	153 (26.66%)	192 (33.45%)	83 (14.46%)	3.26
	The application does not provide adequate features to ensure data accuracy.	76 (13.24%)	130 (22.65%)	161 (28.05%)	144 (25.09%)	63 (10.98%)	2.98
	It is difficult to retrieve patient information from the application when needed.	81 (14.11%)	82 (14.29%)	119 (20.73%)	194 (33.8%)	98 (17.07%)	3.25
	I am unsure how the application stores or shares sensitive patient information.	36 (6.27%)	103 (17.94%)	194 (33.8%)	162 (28.22%)	79 (13.76%)	3.25
	The application's data input or retrieval processes are cumbersome and time-consuming.	75 (13.07%)	97 (16.9%)	161 (28.05%)	152 (26.48%)	89 (15.51%)	3.14
Organizational Barriers	The leadership in my organization does not actively support the use of the application.	97 (16.9%)	81 (14.11%)	140 (24.39%)	145 (25.26%)	111 (19.34%)	3.16
	There is a lack of sufficient resources to fully implement the application.	58 (10.1%)	121 (21.08%)	156 (27.18%)	160 (27.87%)	79 (13.76%)	3.14
	There is resistance to adopting the application from other colleagues or departments.	58 (10.1%)	112 (19.51%)	159 (27.7%)	173 (30.14%)	72 (12.54%)	3.16
	The organizational policies do not align well with the use of this application.	54 (9.41%)	108 (18.82%)	135 (23.52%)	153 (26.66%)	124 (21.6%)	3.32
	The application has not been prioritized in my department's workflow.	51 (8.89%)	94 (16.38%)	146 (25.44%)	163 (28.4%)	120 (20.91%)	3.36
Communication and Collaboration	The application makes communication with my colleagues more difficult.	84 (14.63%)	109 (18.99%)	162 (28.22%)	149 (25.96%)	70 (12.2%)	3.02
	The application does not support team-based care effectively.	57 (9.93%)	119 (20.73%)	149 (25.96%)	171 (29.79%)	78 (13.59%)	3.16
	It is challenging to share information with other healthcare professionals using the application.	61 (10.63%)	93 (16.2%)	181 (31.53%)	156 (27.18%)	83 (14.46%)	3.19
	The application lacks features that enhance interdisciplinary collaboration.	63 (10.98%)	129 (22.47%)	143 (24.91%)	161 (28.05%)	78 (13.59%)	3.11
	I often need to follow up with other team members outside the application to confirm details.	62 (10.8%)	70 (12.2%)	180 (31.36%)	171 (29.79%)	91 (15.85%)	3.28

(*Continued*)

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Table 1 (Continued).

Category	Item	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	Mean
Cost and Resource Barriers	The cost of implementing the application is too high for my department.	62 (10.8%)	86 (14.98%)	155 (27%)	183 (31.88%)	88 (15.33%)	3.26
	The application requires additional hardware that is not available.	78 (13.59%)	85 (14.81%)	178 (31.01%)	140 (24.39%)	93 (16.2%)	3.15
	The cost of maintaining the application is not sustainable in the long term.	54 (9.41%)	76 (13.24%)	156 (27.18%)	184 (32.06%)	104 (18.12%)	3.36
	Budget limitations prevent us from fully utilizing the application.	42 (7.32%)	80 (13.94%)	188 (32.75%)	159 (27.7%)	105 (18.29%)	3.36
	The application does not justify the costs compared to its benefits.	59 (10.28%)	99 (17.25%)	183 (31.88%)	137 (23.87%)	96 (16.72%)	3.2
Time and Productivity	Using the application adds extra time to my daily tasks.	41 (7.14%)	137 (23.87%)	163 (28.4%)	155 (27%)	78 (13.59%)	3.16
	The application requires more effort compared to traditional methods.	90 (15.68%)	101 (17.6%)	159 (27.7%)	147 (25.61%)	77 (13.41%)	3.03
	The application affects my productivity negatively.	64 (11.15%)	91 (15.85%)	153 (26.66%)	197 (34.32%)	69 (12.02%)	3.2
	I feel that using the application adds unnecessary steps to my work.	66 (11.5%)	84 (14.63%)	143 (24.91%)	176 (30.66%)	105 (18.29%)	3.3
	I frequently experience delays in completing tasks due to issues with the application.	43 (7.49%)	135 (23.52%)	171 (29.79%)	167 (29.09%)	58 (10.1%)	3.11
Satisfaction and Adoption Barriers	I do not see the value in using this application for patient care.	49 (8.54%)	95 (16.55%)	157 (27.35%)	167 (29.09%)	106 (18.47%)	3.32
	The application does not meet my expectations for improving work efficiency.	72 (12.54%)	106 (18.47%)	181 (31.53%)	134 (23.34%)	81 (14.11%)	3.08
	I do not feel confident using the application in my daily work.	54 (9.41%)	79 (13.76%)	197 (34.32%)	135 (23.52%)	109 (18.99%)	3.29
	There is a lack of motivation among my colleagues to adopt and use the application.	63 (10.98%)	120 (20.91%)	136 (23.69%)	176 (30.66%)	79 (13.76%)	3.15

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technical support was inadequate or difficult to access (Mean = 3.36). Additionally, respondents highlighted the absence of comprehensive user manuals or in-system help functions (Mean = 3.28) and expressed that training sessions did not cover all features thoroughly (Mean = 3.18). Delays in receiving technical assistance when encountering issues further compounded these problems (Mean = 3.05). Addressing these gaps through structured training programs and more accessible support mechanisms would likely enhance user confidence and overall adoption rates.

Integration and Workflow Barriers

Integration issues also emerged as a major concern. Many users felt that the application did not align well with their existing workflows (Mean = 3.20), and some reported that it even disrupted patient interactions (Mean = 3.20). A lack of seamless integration with other medical systems was another common issue (Mean = 3.12), making it difficult to incorporate the application into routine clinical practice. Additionally, a significant number of respondents indicated that the system slowed down departmental workflows (Mean = 3.26), often forcing them to rely on supplementary tools to complete their tasks (Mean = 3.24). These findings emphasize the importance of developing better integration mechanisms that ensure smooth interoperability with existing health IT infrastructure.

Data Management and Security Barriers

Concerns around data security and accessibility were also prevalent. A significant proportion of users expressed concerns about data privacy and security (Mean = 3.26), while others struggled with retrieving patient information efficiently when needed (Mean = 3.25). There was also uncertainty regarding how sensitive patient data was stored and shared (Mean = 3.25), leading to low confidence in data protection measures. Additionally, cumbersome data entry and retrieval processes (Mean = 3.14) contributed to inefficiencies in information management. Addressing these challenges requires clearer security policies, improved data storage protocols, and enhanced system functionality for streamlined access.

Organizational Barriers

Organizational constraints played a key role in limiting adoption. Users reported insufficient leadership support for the application (Mean = 3.16) and a lack of adequate resources for full implementation (Mean = 3.14). Resistance from colleagues and departments was also a challenge (Mean = 3.16), with some respondents indicating that existing policies did not align well with application use (Mean = 3.32). Furthermore, there was a perception that the application was not prioritized in institutional workflows (Mean = 3.36). These findings highlight the need for stronger institutional commitment, better alignment with policies, and leadership-driven adoption strategies.

Communication and Collaboration Barriers

Barriers related to communication and collaboration were also evident. Some respondents reported that the application made it more difficult to communicate with colleagues (Mean = 3.02) and lacked features that effectively supported team-based care (Mean = 3.16). Users also faced challenges in sharing patient information with other healthcare professionals (Mean = 3.19), and many felt that the system did not adequately facilitate interdisciplinary collaboration (Mean = 3.11). Additionally, a large proportion of participants stated that they often had to follow up outside the application to confirm information (Mean = 3.28). Improving the system's collaborative functionalities could significantly enhance efficiency in team-based care environments.

Financial and Resource Barriers

Financial constraints were a significant adoption barrier. Users expressed concerns about high implementation and maintenance costs (Mean = 3.26 and 3.36, respectively), with budget limitations preventing full utilization of the system (Mean = 3.36). Additionally, respondents noted that the application required additional hardware that was not always available (Mean = 3.15), and some questioned whether the benefits justified the associated costs (Mean = 3.20). These findings indicate the need for a cost-benefit analysis and more resource-efficient solutions to ensure long-term sustainability.

Time and Productivity Barriers

Time constraints and productivity concerns also hindered adoption. Many users reported that using the application added extra time to their daily tasks (Mean = 3.16) and required more effort than traditional methods (Mean = 3.03). The system was also perceived to reduce overall productivity (Mean = 3.20), introducing unnecessary steps (Mean = 3.30) and delaying task completion (Mean = 3.11). These inefficiencies highlight the need for workflow optimization and performance enhancements to reduce the burden on users.

Satisfaction and Adoption Challenges

Finally, barriers related to user satisfaction and adoption were observed. A considerable number of participants indicated that the application failed to meet expectations for improving efficiency (Mean = 3.08) and reported low motivation among colleagues to adopt the system (Mean = 3.15). Concerns were also raised about the application's overall value in patient care (Mean = 3.32), along with low confidence in its daily use (Mean = 3.29). These findings suggest that engaging users through targeted improvements and usability enhancements is crucial to increasing adoption rates.

Healthcare Practitioners' Perspectives on Virtual Physicians

Table 2, provides valuable insights into how healthcare practitioners perceive virtual physicians, particularly AI-driven doctor chatbots (eg, GPT-based systems), and their potential impact on patient care. Overall, respondents expressed a moderately positive stance on the integration of physician chatbot into healthcare workflows, with an average mean score of approximately 3.5 across all evaluated aspects. These results suggest general agreement on the potential benefits of AI-powered healthcare tools, particularly in enhancing accessibility, efficiency, and patient engagement.

Table 2 The Impact of Physician Chatbot

Items	Strongly Disagree (5)	Disagree (4)	Neutral (3)	Agree (2)	Strongly Agree (1)	Mean
I believe physician chatbot can improve the efficiency of patient triage in healthcare settings.	32 (5.62%)	62 (10.76%)	135 (23.47%)	202 (35.21%)	143 (24.94%)	3.60
Physician chatbot provide accurate and reliable medical information to support healthcare decisions.	42 (7.33%)	84 (14.67%)	108 (18.83%)	191 (33.25%)	149 (25.92%)	3.59
Using physician chatbot can reduce the workload of healthcare practitioners in routine consultations.	48 (8.31%)	86 (14.91%)	117 (20.29%)	181 (31.54%)	142 (24.94%)	3.57
Physician chatbot can improve access to healthcare services for patients in remote areas.	25 (4.4%)	53 (9.29%)	124 (21.52%)	220 (38.39%)	152 (26.41%)	3.78
I believe physician chatbot can enhance the overall quality of care in healthcare systems.	39 (6.85%)	67 (11.74%)	128 (22.25%)	185 (32.27%)	155 (26.89%)	3.65
I find physician chatbot easy to use and navigate in a healthcare environment.	36 (6.36%)	74 (12.96%)	140 (24.45%)	180 (31.3%)	144 (24.94%)	3.55
Training healthcare staff to work with physician chatbot is straightforward.	45 (7.82%)	97 (16.87%)	125 (21.76%)	173 (30.07%)	134 (23.47%)	3.49
Integrating physician chatbot into existing healthcare workflows is seamless.	55 (9.54%)	105 (18.34%)	135 (23.47%)	153 (26.65%)	126 (22%)	3.41
The interface of physician chatbot is intuitive and user-friendly for practitioners.	32 (5.62%)	67 (11.74%)	143 (24.94%)	192 (33.5%)	140 (24.21%)	3.60
I believe physician chatbot can be easily adapted for various medical specialties.	42 (7.33%)	90 (15.65%)	122 (21.27%)	180 (31.3%)	140 (24.45%)	3.57

(*Continued*)

Table 2 (Continued).

Items	Strongly Disagree (5)	Disagree (4)	Neutral (3)	Agree (2)	Strongly Agree (1)	Mean
Physician chatbot enhance patient engagement by encouraging active participation in their healthcare.	27 (4.65%)	65 (11.25%)	125 (21.76%)	218 (37.9%)	140 (24.45%)	3.67
Physician chatbot improve patient adherence to treatment plans by providing regular reminders and follow-up support.	35 (6.11%)	79 (13.69%)	128 (22.25%)	194 (33.74%)	138 (24.21%)	3.58
Physician chatbot are effective in addressing patients' questions about their treatment and medications.	39 (6.85%)	76 (13.2%)	121 (21.03%)	191 (33.25%)	147 (25.67%)	3.59
Patients feel more empowered in managing their health when using Physician chatbot for consultation and support.	29 (5.13%)	69 (11.98%)	119 (20.78%)	205 (35.7%)	152 (26.41%)	3.64
Physician chatbot can support chronic disease management by tracking symptoms and monitoring patient progress.	22 (3.91%)	56 (9.78%)	108 (18.83%)	227 (39.61%)	161 (27.87%)	3.80
Physician chatbot help patients schedule and manage routine check-ups and follow-ups effectively.	34 (5.87%)	76 (13.2%)	131 (22.74%)	188 (32.76%)	145 (25.43%)	3.63
Physician chatbot reduce the communication gap between patients and healthcare providers especially for chronic conditions.	41 (7.09%)	93 (16.14%)	124 (21.52%)	183 (31.78%)	133 (23.47%)	3.50
Physician chatbot can provide personalized health recommendations for chronic disease control.	25 (4.4%)	63 (11%)	129 (22.49%)	211 (36.67%)	146 (25.43%)	3.69
Patients with chronic conditions benefit from regular updates and tailored guidance offered by Physician chatbot.	29 (5.13%)	76 (13.2%)	119 (20.78%)	205 (35.7%)	145 (25.18%)	3.64
Physician chatbot help patients set and achieve health-related goals such as improving lifestyle or adhering to medication schedules.	36 (6.36%)	86 (14.91%)	132 (22.98%)	193 (33.5%)	127 (22.25%)	3.54

Perceived Benefits of Virtual Physicians

A considerable proportion of respondents acknowledged the value of physician chatbot in addressing key challenges within the healthcare system. Notably, participants strongly agreed that these tools could improve the efficiency of patient triage (mean = 3.63), increase access to healthcare for remote patients (mean = 3.73), and enhance patient engagement (mean = 3.66). These findings highlight the recognition among healthcare professionals that physician chatbot can play a critical role in optimizing healthcare delivery, particularly for underserved populations.

Furthermore, AI-driven physician chatbot were perceived as beneficial for chronic disease management, with respondents expressing strong agreement on their ability to facilitate adherence to treatment plans (mean = 3.56) and support long-term disease monitoring (mean = 3.78). This aligns with existing research indicating that AI-powered healthcare solutions contribute to better patient outcomes through continuous monitoring, personalized recommendations, and data-driven interventions.

Concerns Regarding Integration and Usability

Despite their recognition of the advantages, healthcare practitioners expressed some skepticism regarding the seamless integration of physician chatbot into existing workflows. The lowest-rated item (mean = 3.33) pertained to concerns about whether physician chatbot could be smoothly incorporated into current clinical systems, reflecting apprehensions about compatibility with existing healthcare infrastructure.

Similarly, questions about healthcare professionals' training and the intuitive design of virtual physician interfaces received moderate scores (mean = 3.44 and 3.56, respectively). These findings suggest that successful adoption of AI-driven healthcare tools requires structured training programs and ongoing support. Many practitioners likely see the potential of physician chatbot

but recognize that their effectiveness depends on how well they integrate into routine practice and whether sufficient training is provided to facilitate adoption.

Balancing Optimism With Practical Considerations

The survey results reflect measured but significant support for the incorporation of physician chatbot into healthcare practice. While healthcare practitioners generally acknowledge the potential of AI-driven solutions to improve clinical efficiency and patient care, they also emphasize the importance of a well-planned implementation strategy. Addressing workflow integration issues, ensuring user-friendly designs, and providing comprehensive training will be key factors in determining the long-term success of these technologies in clinical environments.

Ultimately, while physician chatbot offer promising solutions to enhance accessibility and efficiency, healthcare institutions must adopt a strategic, step-by-step approach to implementation. By focusing on seamless integration, usability improvements, and practitioner training, these technologies can deliver meaningful advancements in patient care while ensuring that clinicians feel supported in their adoption.

Interdependencies Among Barriers

The correlation analysis (Figure 3) provides valuable insights into how different barriers to application adoption are interconnected. One of the most notable findings is the strong association between technical challenges and usability difficulties ($r = 0.69$), as well as workflow integration issues ($r = 0.62$). This suggests that system inefficiencies such as frequent glitches, slow performance, and compatibility issues directly impact how easily users can navigate the application and incorporate it into their daily tasks. Improving technical stability and system design could therefore help mitigate broader usability and workflow concerns.

Similarly, concerns about data management and security were closely linked to organizational barriers ($r = 0.70$). This highlights the critical role that institutional policies and leadership support play in ensuring confidence in data privacy and security protocols. A lack of clear guidelines or inadequate enforcement of security measures may lead to uncertainty among users, further complicating adoption efforts. Addressing these concerns requires a stronger institutional commitment to data governance and transparency.

Training and support also demonstrated moderate correlations with usability barriers ($r = 0.58$) and workflow integration issues ($r = 0.52$). This indicates that when users do not receive adequate training, they are more likely to struggle with system navigation and experience difficulty integrating the application into their existing processes. Enhancing training programs particularly through hands-on guidance and ongoing technical support could improve overall usability and ensure smoother integration into clinical workflows.

Financial constraints emerged as another major challenge, with cost and resource barriers correlating strongly with both organizational barriers ($r = 0.69$) and time and productivity concerns ($r = 0.66$). This suggests that budget limitations not only hinder implementation but also contribute to inefficiencies in daily operations. Institutions facing financial constraints may struggle to provide necessary system upgrades, additional hardware, or sufficient staffing, leading to lower productivity and increased frustration among users. Strategic resource allocation and cost-benefit analyses could help optimize spending while maximizing the system's impact.

On the other hand, satisfaction and adoption levels were negatively correlated with technical ($r = -0.44$) and usability barriers ($r = -0.42$). This finding reinforces the idea that when users encounter frequent technical problems or struggle with the system's interface, their overall satisfaction declines, reducing their willingness to fully integrate the application into their routines. These results underscore the importance of a holistic intervention strategy one that focuses on improving technical reliability, simplifying usability, enhancing training, and ensuring adequate institutional support. By addressing these barriers collectively, organizations can create a more seamless and effective adoption process, ultimately leading to higher user confidence and sustained engagement with the system.

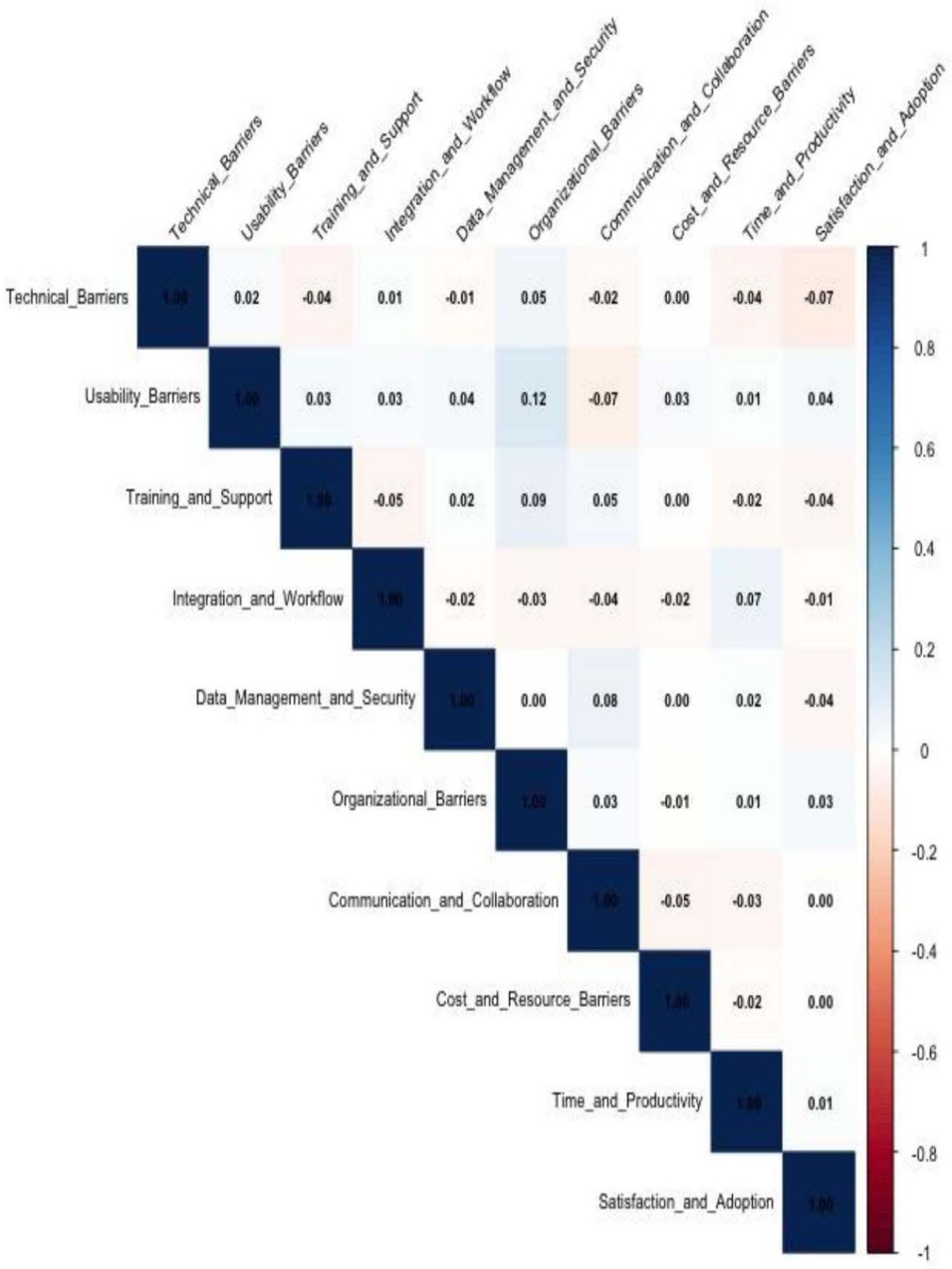

Figure 3 Correlation Matrix of Barriers Affecting Application.

Discussion

This study evaluates healthcare practitioners' perceptions of mHealth applications, specifically the Sehhaty app, and the influence of virtual physicians, including physician chatbots, on patient care. The findings underscore the potential advantages and considerable obstacles to the extensive implementation and use of these technologies in healthcare environments. This study analyses findings related to the usability, accessibility, and integration of mHealth applications, alongside the changing role of AI-powered tools, such as physician chatbots, in enhancing patient care. This study identifies usability of mHealth applications as a primary obstacle, aligning with prior research that underscores the difficulties patients encounter when navigating complex interfaces.[20] Patients, particularly older adults or individuals with restricted digital literacy, encounter difficulties with the technical requirements of these applications. This finding is supported by literature indicating that older individuals may encounter challenges in utilizing technology due to limited

experience or physical limitations, including impaired vision and dexterity.[21] The Sehhaty app, while popular in Saudi Arabia, should focus on streamlining its interface and improving accessibility for users with different levels of technical skill. Improving the usability of the Sehhaty app, which is essential to the national healthcare system, could enhance its reach and impact, particularly among older and less technologically proficient populations. The study identifies the digital literacy gap as a significant obstacle to mHealth adoption, particularly affecting patients in marginalized areas and older populations who frequently lack awareness of the benefits and availability of these technologies. This aligns with previous research highlighting the digital divide, especially in rural or underserved regions, where access to technology and education remains constrained.[22] To address this gap, it is essential to implement targeted efforts aimed at enhancing digital literacy through educational campaigns and training programs. Enhancing patients' digital competencies may render mHealth applications such as Sehhaty more accessible and user-friendly, thereby enabling all individuals, irrespective of age or location, to fully utilize these services. This study highlighted significant concerns related to privacy and security, mirroring broader issues identified in the literature regarding the safeguarding of sensitive health information. Patients frequently articulate concerns regarding the security of their data in mHealth applications, apprehensive about potential unauthorized access or misuse, particularly in relation to sensitive health issues like mental health or HIV/AIDS.[23] The Sehhaty app, similar to other mHealth platforms, must implement strong privacy protections and clear security measures to establish user trust. Sehhaty provides essential services, including teleconsultations and vaccination tracking; however, the protection of users' health data is crucial for maintaining user engagement and reducing concerns regarding possible breaches. Effective communication regarding data usage policies, coupled with robust encryption techniques, can alleviate these concerns. This study identifies the integration of mHealth applications into existing healthcare systems as a significant challenge. Participants observed that numerous applications, such as Sehhaty, operate independently and lack seamless integration with EHRs or other clinical systems. The absence of interoperability limits the effectiveness of mHealth applications, as patients may need to input data manually, which diminishes engagement and raises the risk of errors. Prior research highlights the necessity for mHealth applications to integrate with the broader healthcare infrastructure, facilitating seamless data exchange between platforms and healthcare providers.[24] The Sehhaty app would benefit from improved synchronization with EHR systems to allow for real-time updates and a comprehensive view of patient health data, thereby enhancing clinical decision-making. The expense associated with mHealth applications presents a considerable obstacle, especially for patients with low income. Many applications, such as Sehhaty, are available at no cost; however, certain features may incur additional charges or necessitate high-speed internet and modern devices, potentially limiting access for some populations.[20] This study indicates that financial barriers continue to exist despite the extensive implementation of digital health tools. This highlights the necessity of making mHealth solutions both affordable and accessible for individuals in rural or underserved regions, where technology and reliable internet access are frequently constrained.[25] Addressing financial and infrastructural challenges is essential for maximizing the reach and efficacy of applications such as Sehhaty.

The Influence of Physician Chatbots on the Delivery of Healthcare Services

The integration of physician chatbots and virtual physicians represents a significant advancement in AI, with our findings corroborating existing literature that underscores their potential to enhance patient care. According to respondents in this study, virtual physicians and chatbots provide notable benefits regarding patient education, chronic disease management, and medication adherence.[26,27] Providing continuous access to medical guidance, delivering personalized health information, and facilitating medication reminders enhance patient engagement and lead to improved health outcomes. AI-powered chatbots can enhance chronic disease management by enabling real-time symptom tracking, which allows for timely interventions and alleviates pressure on healthcare systems.[27] Nevertheless, similar to mHealth applications, the implementation of virtual physicians must consider the integration into clinical workflows. Physician chatbots can aid diagnostic processes and assist in decision-making; however, healthcare practitioners require proper training to integrate these tools into their practice, ensuring that AI complements rather than replaces human expertise.[28] Chatbots must be developed to support clinical decision-making while preserving the essential functions of healthcare professionals, thereby ensuring that patients receive comprehensive, human-centered care.

Limitations and Recommendation for Future Research

This study provides significant insights into the barriers affecting the adoption and usability of healthcare applications. However, several limitations must be acknowledged. Although the sample size of 574 participants is substantial, its representativeness across different healthcare settings and professional roles may be limited. Future research should strive for a more diverse and geographically varied sample, encompassing healthcare professionals from multiple institutions and specialisations to better capture variations in experiences and perspectives. Additionally, the reliance on self-reported data introduces potential biases, such as social desirability and recall bias. To enhance the validity of future research, objective performance metrics including system usage logs, error rates, and task completion times should be incorporated alongside self-reported perceptions to provide a more comprehensive assessment of system performance and usability.

Beyond healthcare practitioners, future studies should expand the scope to include other key stakeholders, such as patients, administrators, policymakers, and IT professionals, all of whom play crucial roles in decision-making, system implementation, and optimisation. Understanding patient perspectives, particularly regarding usability, accessibility, and engagement, is essential for ensuring the successful integration of healthcare applications into clinical practice. Moreover, this study did not investigate long-term adoption trends or the impact of healthcare applications on patient outcomes, such as treatment adherence, engagement with healthcare services, and overall satisfaction. Future research should adopt longitudinal approaches to examine how barriers evolve over time, assess the effectiveness of interventions, and determine the sustainability of system use. Addressing these gaps will contribute to the development of more user-centred, efficient, and sustainable healthcare technologies that enhance both practitioner and patient experiences.

Future studies could benefit from adopting a qualitative or mixed-methods approach to gain deeper insights into practitioners' experiences and perceptions. Qualitative methods, such as in-depth interviews or focus groups, would allow for a more nuanced exploration of the underlying factors influencing mHealth adoption. Additionally, a mixed-methods design integrating both quantitative data and qualitative narratives could provide a more comprehensive understanding of the barriers, facilitators, and contextual factors affecting digital health integration. This approach would enhance the richness of the findings and inform more targeted interventions to improve usability, adoption, and long-term sustainability.

Conclusion

This study provides valuable insights into secondary healthcare practitioners' perceptions of mHealth applications, specifically the Sehhaty app, and the barriers influencing their adoption. The findings highlight significant challenges related to technical performance, usability, integration with existing healthcare systems, and organisational support. While mHealth applications offer substantial benefits in improving healthcare accessibility, facilitating digital health management, and enhancing patient engagement, their effectiveness is hindered by frequent technical malfunctions, poor interoperability with electronic health records, and insufficient training and support. Healthcare practitioners emphasised the critical need for enhanced usability, streamlined workflows, and robust integration mechanisms to ensure seamless adoption. Privacy and security concerns also emerged as key factors influencing user trust and engagement. Addressing these challenges requires a multi-faceted approach, including optimising system design, strengthening digital infrastructure, and providing comprehensive user training. Future research should expand the scope to include patient perspectives, investigate longitudinal adoption trends, and evaluate the long-term impact of mHealth applications on clinical efficiency and patient outcomes. By mitigating technical, organisational, and educational barriers, healthcare institutions can foster a more effective, user-centred, and sustainable digital health ecosystem.

Data Sharing Statement

The study data are available from the corresponding author on reasonable request.

Ethical Approval

All methods in this study were performed in accordance with the declaration of Helsinki and was approved by the Institutional Review Board (IRB) of Qassim University No. 23-19-02. All the participants provided informed consent to participate. In the case of the questionnaire-based study, all participants were informed of the voluntary nature, confidentiality, and aim of the study and the nature of their participation before they participated in the study.

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Disclosure

The authors declare that they have no competing interests.

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