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The impact of virtual healthcare models on the sustainability of health services and improving access to care in the Riyadh

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تأثير نماذج الرعاية الصحية الافتراضية على استدامة الخدمات الصحية وتحسين الوصول للرعاية في الرياض

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Introduction

Healthcare systems today are expected to deliver care that is timely, accessible, and patient-centered while also coping with rising demand and pressure on traditional service models. Within this context, virtual healthcare has become an important part of modern health service delivery. It includes telemedicine, virtual clinics, immediate digital consultations, and remote follow-up through national health platforms. International guidance has also emphasized that telehealth should be accessible, practical, and integrated into routine care rather than treated as a temporary solution only for emergencies (World Health Organization [WHO] & International Telecommunication Union [ITU], 2024; Ministry of Health [MOH], 2021).

In Saudi Arabia, the expansion of virtual healthcare is closely linked to the broader health transformation agenda under Vision 2030. The Health Sector Transformation Program places strong emphasis on improving access, quality, and digital capability across the healthcare system, while the Ministry of Health's e-health initiative explicitly aims to improve the efficiency and effectiveness of healthcare services, facilitate access to care, increase service availability, and support remote consultations through integrated digital systems and unified health records. In practice, this direction is reflected in national services such as the Sehhaty platform and Seha Virtual Hospital, which have made remote consultations, appointment booking, follow-up care, and specialist support more available across the Kingdom (Saudi Vision 2030, n.d.; MOH, 2024a, 2024b, 2025).

Recent evidence from Saudi Arabia suggests that virtual healthcare can positively influence several outcomes that matter to both patients and health systems. Awadh et al. (2025) found that telemedicine services delivered through the 937 Medical Call Center and immediate virtual consultations via the Sehhaty application handled very large service volumes, with high satisfaction levels and short average response times. In another nationwide study, AlShareef and AlWabel (2024a) reported that more than 90% of participants considered virtual consultations useful, convenient, reliable, and easy to use, while 97.4% were satisfied with their remote consultation experience. Their second nationwide study further showed that virtual consultations were perceived as more convenient and more prompt than in-person visits, which directly supports their potential role in improving access and reducing waiting-related burden (AlShareef & AlWabel, 2024b). Likewise, Alsaif et al. (2024) found a high overall satisfaction score for virtual clinic experience in Saudi Arabia and recommended broader use of such clinics when clinically appropriate.

Despite these positive findings, the continued value of virtual healthcare depends on how well it performs in real service settings and whether patients can use it easily and consistently. A recent qualitative study in Riyadh found that patients and healthcare providers viewed telehealth positively because it reduced physical visits, saved time, and supported continuity of follow-up. At the same time, the study identified practical barriers, including technical issues, weak system integration, insurance limitations, and digital literacy gaps, all of which may reduce the full benefit of virtual care if left unresolved (Alomar et al., 2025). For this reason, there is still a need to examine virtual healthcare in Riyadh more directly through measurable outcomes that reflect the patient experience and service performance. Accordingly, the present study focuses on the impact of virtual healthcare models on improving access to care, patient satisfaction, and waiting time reduction in Riyadh.

Research Problem

The core problem of this study is that, despite the rapid expansion of virtual healthcare services in Saudi Arabia, it is still not clearly known whether this expansion is translating into

real and consistent improvement in access to care for patients in Riyadh. Saudi Arabia has invested heavily in digital health under Vision 2030, and the Ministry of Health presents virtual clinics through the Sehhaty platform as a way to facilitate remote access to integrated health services, reduce unnecessary physical visits, and improve patient satisfaction by saving time and effort. At the policy level, the Health Sector Transformation Program also emphasizes better access, quality, and digital transformation as key goals of the Saudi health system. This means that virtual healthcare is no longer a marginal service; it has become part of the official strategy for improving how care is delivered. However, the existence of digital platforms and services does not, by itself, prove that patients are experiencing easier, faster, and more effective access to care in real practice.

This problem becomes more important because available national evidence is encouraging, yet still incomplete for the Riyadh context. Recent Saudi studies show that virtual healthcare is widely accepted and often associated with positive patient experience. For example, Awadh et al. found high satisfaction with the 937 Medical Call Center and immediate virtual consultations via Sehhaty, with short average response times and strong service performance. Likewise, AlShareef and AlWabel reported that most participants in Saudi Arabia viewed virtual consultations as useful, convenient, easy to use, effective, and reliable, and their comparison study found that virtual consultations were perceived as more prompt and more convenient than in-person consultations, with very high satisfaction levels. These findings suggest that virtual healthcare may improve access and reduce the burden of waiting. Nevertheless, such findings mainly show potential and broad national patterns; they do not fully explain whether patients in Riyadh are experiencing the same benefits in a clear, stable, and measurable way across different groups of users and types of services.

The problem is further deepened by Riyadh-based evidence showing that access through virtual care is not equally smooth for all patients. A recent qualitative study in Riyadh hospitals found that telehealth offered clear benefits such as convenience, reduced physical visits, time savings, and more accessible follow-up, all of which support continuity of care. At the same time, the same study identified major barriers, including technical instability, weak integration across hospital branches, limited insurance links, and patient support challenges. In addition, research on older adults in Riyadh found that telehealth adoption is still affected by digital literacy, internet connectivity, trust in providers, and the need for family support. These findings are important because they show that the main issue is not simply whether virtual healthcare exists, but whether it can function as an accessible care model for different patients in everyday settings. In other words, service availability may be expanding faster than the evidence showing that access has improved equally and effectively for those who need care.

Accordingly, the central problem addressed by this study is the lack of clear local empirical evidence in Riyadh on whether virtual healthcare models truly improve access to care in the way health policy intends. Because access to care is the main problem, related outcomes such as patient satisfaction and waiting time reduction can be treated as practical indicators of whether access is improving in a meaningful way. If patients can obtain care more easily, more quickly, and with a satisfactory service experience, then virtual healthcare can be said to support better access. But if technical barriers, usability issues, or system limitations continue to affect patients, then the mere expansion of virtual health platforms may not be enough. Therefore, this study is needed to evaluate whether virtual healthcare models in Riyadh are genuinely improving access to care, as reflected in patient satisfaction and reduced waiting time, rather than if digital expansion automatically produces better healthcare access.

Research Importance

Theoretical Importance

Theoretically importance addresses a clear gap in the Saudi healthcare literature concerning the actual effect of virtual healthcare models on access to care in a major urban setting such as Riyadh. Although recent Saudi studies have reported positive perceptions of virtual consultations, high satisfaction, and better convenience, much of the available evidence remains either national in scope or descriptive in nature, without sufficiently clarifying how virtual healthcare contributes to access to care as a central outcome at the local level. By focusing on access to care as the core issue, this study helps organize related outcomes such as patient satisfaction and waiting time reduction as practical indicators of whether access is genuinely improving. In this way, the study contributes to a more focused academic understanding of virtual healthcare effectiveness in the Saudi context and strengthens the literature on digital health service delivery in developing health systems (AlShareef & AlWabel, 2024a, 2024b; Awadh et al., 2025; Alomar et al., 2025).

The study is also theoretically important because it shifts the discussion from the simple availability of digital health platforms to the more meaningful question of whether these platforms are producing measurable patient-centered outcomes. Current evidence from Riyadh shows that virtual care offers real benefits, including convenience, reduced travel, and easier follow-up, but it also shows that barriers such as technical instability, limited integration, and digital literacy challenges still affect patient use. Therefore, this study provides a more structured way to examine virtual healthcare by linking the independent variable, namely virtual healthcare models, to concrete dependent outcomes that reflect better access in practice. This can support future researchers in building more precise models and hypotheses around telehealth, access, and service performance in Saudi Arabia (Alomar et al., 2025; AlShareef & AlWabel, 2024a).

Practical Importance

This study is practically important because it can provide useful evidence for healthcare decision-makers, hospital administrators, and digital health planners in Riyadh regarding whether virtual healthcare models are achieving one of their most important intended goals, which is improving access to care. Saudi health policy strongly supports digital transformation through the Health Sector Transformation Program and Ministry of Health virtual services, including virtual clinics and platform-based consultations. However, policy expansion alone is not enough unless it is supported by local evidence showing that patients can access care more easily, experience shorter waiting-related burden, and remain satisfied with the service they receive. The findings of this study can therefore help decision-makers identify whether the current use of virtual healthcare is meeting patient needs in Riyadh or whether there are still barriers that limit its effectiveness (Saudi Vision 2030, n.d.; Ministry of Health, n.d.).

The practical value of this study also lies in its ability to guide improvements in service design and implementation. If the findings show that virtual healthcare significantly improves access, satisfaction, and waiting time, this will support broader investment in these services and encourage stronger integration into routine care. On the other hand, if the findings reveal weaknesses, such as usability problems or unequal benefit across patients, then healthcare providers and policymakers can use the results to improve patient support, platform usability, digital literacy efforts, and service coordination. This makes the study directly relevant to the real operational needs of Riyadh's healthcare sector and aligned with Saudi Arabia's broader effort to make healthcare more accessible, efficient, and patient-centered through digital transformation (Awadh et al., 2025; Alomar et al., 2025; AlShareef & AlWabel, 2024b).

Research Objectives

The main objective of this study is to evaluate the impact of virtual healthcare models on improving access to care in Riyadh. This objective is based on the central research problem, which lies in the lack of clear local evidence regarding whether the increasing use of virtual healthcare services is producing real and measurable improvement in patients' ability to obtain healthcare services in an easier, faster, and more effective manner. Although virtual healthcare has expanded significantly within the Saudi health sector, particularly under the direction of digital transformation initiatives and Vision 2030, there is still a need to assess its actual outcomes from the patient perspective in a specific local context such as Riyadh.

More specifically, this study seeks to examine whether virtual healthcare models contribute to better access to care by reducing some of the common barriers associated with traditional healthcare delivery, such as delays in obtaining consultations, difficulty reaching services, and long waiting periods. In this sense, access to care represents the central outcome of the study, while patient satisfaction and waiting time reduction are treated as important practical indicators that help explain whether access is genuinely improving in real healthcare settings.

In addition, the study aims to assess the extent to which virtual healthcare models influence patient satisfaction in Riyadh. This objective is important because patient satisfaction reflects the quality of the healthcare experience and provides an indication of whether virtual healthcare services are meeting users' expectations in terms of convenience, responsiveness, communication, and overall service value. Since the practical importance of the study lies in supporting the improvement of digital health services, understanding patient satisfaction is essential for evaluating whether virtual healthcare is functioning effectively as a patient-centered model of care.

The study also aims to determine whether virtual healthcare models contribute to reducing waiting time for patients in Riyadh. Waiting time remains one of the most visible and important indicators of service accessibility and operational efficiency in healthcare. Therefore, examining this outcome helps clarify whether virtual healthcare is offering a real advantage over conventional care pathways by enabling faster consultation, easier follow-up, and quicker access to professional advice and support.

Finally, this study seeks to generate empirical evidence that can support healthcare providers, administrators, and policymakers in Riyadh in improving the planning, design, and implementation of virtual healthcare services. By examining the relationship between virtual healthcare models and the outcomes of access to care, patient satisfaction, and waiting time reduction, the study aims to provide findings that are not only academically valuable but also practically useful for strengthening digital health services and improving patient-centered healthcare delivery in Riyadh.

Research Questions

The study seeks to answer a central question related to the effectiveness of virtual healthcare models in improving access to care in Riyadh. This question emerges directly from the research problem, which lies in the lack of clear local evidence on whether the expansion of virtual healthcare services is translating into real improvement in patients' ability to obtain healthcare in an accessible and efficient manner. To examine this issue, the study asks whether virtual healthcare models improve access to care in Riyadh, whether they enhance patient satisfaction, and whether they reduce waiting time. These questions are closely connected to the study

objectives and are intended to provide a clear framework for examining the patient-centered outcomes of virtual healthcare services in Riyadh.

What is the impact of virtual healthcare models on improving access to care in Riyadh?

To address this main question in a more detailed and measurable way, the study is further guided by the following sub-questions:

- To what extent do virtual healthcare models improve access to care for patients in Riyadh?
- What is the effect of virtual healthcare models on patient satisfaction in Riyadh?
- To what extent do virtual healthcare models contribute to reducing waiting time in Riyadh?
- How can the findings relate to access to care, patient satisfaction, and waiting time help improve the effectiveness of virtual healthcare services in Riyadh?

Research Hypotheses

H1: Virtual healthcare models have a statistically significant positive impact on improving access to care in Riyadh.

H0: Virtual healthcare models do not have a statistically significant positive impact on improving access to care in Riyadh.

Explanation:

This is the central hypothesis of the study because it directly addresses the main research problem, which concerns whether the expansion of virtual healthcare in Riyadh is improving patients' ability to obtain healthcare services. It tests the overall assumption that virtual healthcare is not merely available as a digital option but is functioning as an effective means of improving healthcare access in practice.

First Sub-Hypothesis

H2: Virtual healthcare models have a statistically significant positive effect on patients' access to care in Riyadh.

H0: Virtual healthcare models do not have a statistically significant positive effect on patients' access to care in Riyadh.

Explanation:

This hypothesis focuses specifically on the direct relationship between virtual healthcare and access to care. It examines whether virtual healthcare helps patients obtain services more easily, more conveniently, and with fewer barriers than traditional care pathways. This hypothesis is important because access to care is the central dependent outcome of the study.

Second Sub-Hypothesis

H3: Virtual healthcare models have a statistically significant positive effect on patient satisfaction in Riyadh.

H0: Virtual healthcare models do not have a statistically significant positive effect on patient satisfaction in Riyadh.

Explanation:

This hypothesis examines whether patients who use virtual healthcare report a better overall care experience. Patient satisfaction is treated here as an important practical indicator of whether access is improving in a meaningful way. If patients find the service convenient,

responsive, and useful, this suggests that virtual healthcare is not only available but is also meeting their expectations effectively.

Third Sub-Hypothesis

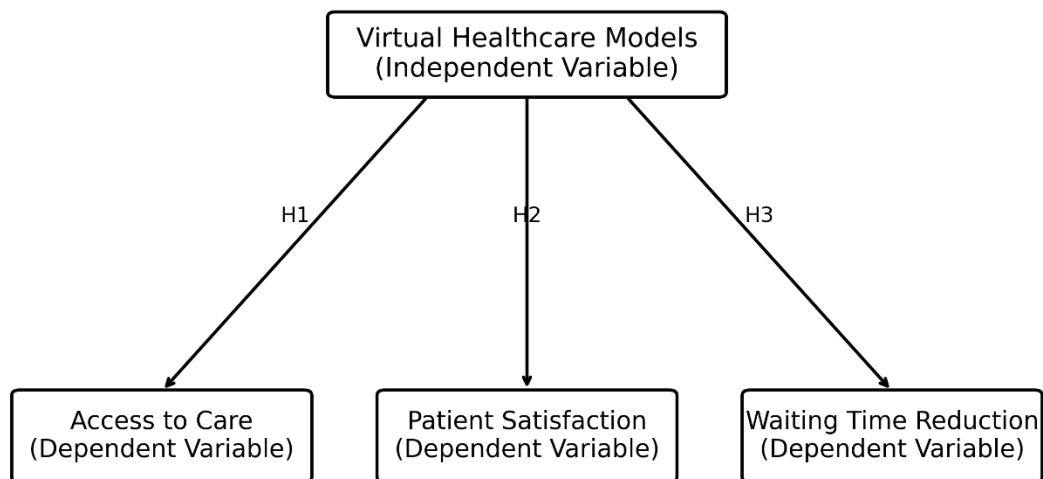
H4: Virtual healthcare models have a statistically significant effect on reducing waiting time in Riyadh.

H0: Virtual healthcare models do not have a statistically significant effect on reducing waiting time in Riyadh.

Explanation:

This hypothesis tests whether virtual healthcare contributes to faster access to consultation, follow-up, or medical advice. Waiting time is one of the clearest operational indicators of healthcare accessibility. Therefore, if virtual healthcare reduces the time patients spend waiting to receive care, this will support the argument that it improves access in a practical and measurable way.

Conceptual Framework of the Study



Research Variables

The variables are built on one independent variable and three dependent variables. These variables are selected directly from the research hypotheses to ensure consistency between the problem statement, objectives, research questions, hypotheses, and the later stages of data analysis.

Independent Variable

Virtual Healthcare Models

This variable represents the use of digitally enabled healthcare services that allow patients to receive healthcare remotely without the need for a traditional face-to-face visit. In the context of this study, virtual healthcare models refer to services such as virtual consultations, digital medical communication, remote follow-up, and the use of healthcare platforms and similar

virtual service channels. This variable is treated as the main predictor in the study because the research seeks to examine whether the use of virtual healthcare contributes to improving patient-centered healthcare outcomes in Riyadh.

Dependent Variables

1. Access to Care

Access to care is the primary dependent variable of the study. It refers to the extent to which patients can obtain needed healthcare services in an easy, timely, and convenient manner. This variable is directly linked to **H1**, which tests whether virtual healthcare models have a statistically significant positive effect on improving access to care in Riyadh.

2. Patient Satisfaction

Patient satisfaction is the second dependent variable. It refers to the degree to which patients feel satisfied with their experience of using virtual healthcare services, including convenience, responsiveness, usefulness, and overall service quality. This variable is directly linked to **H2**, which tests whether virtual healthcare models have a statistically significant positive effect on patient satisfaction in Riyadh.

3. Waiting Time Reduction

Waiting time reduction is the third dependent variable. It refers to the extent to which virtual healthcare services help patients receive care, consultation, or follow-up more quickly and with less delay than traditional service pathways. This variable is directly linked to **H3**, which tests whether virtual healthcare models have a statistically significant effect on reducing waiting time in Riyadh.

Variable Link to Hypotheses

To ensure full consistency between the variables and the hypotheses, the relationships in this study are structured as follows:

- **H1:** Virtual Healthcare Models → Access to Care
- **H2:** Virtual Healthcare Models → Patient Satisfaction
- **H3:** Virtual Healthcare Models → Waiting Time Reduction

Previous Studies

Saudi Arabia has shown that virtual healthcare can improve the patient experience, especially in relation to access, satisfaction, and service efficiency. One of the earlier studies closely related to the current topic was conducted by Alharbi et al. (2021), who evaluated the Seha application in Saudi Arabia using a cross-sectional design. The study concluded that users of the application reported a better healthcare experience in terms of perceived ease of access to healthcare services, satisfaction with healthcare services, and system efficiency, as reflected in fewer required doctor visits. At the same time, the study showed that technical difficulties negatively affected these outcomes, indicating that the benefits of virtual care depend not only on service availability but also on platform functionality and ease of use. This study is important for the current research because it provides early Saudi evidence that virtual healthcare may improve access to care, while also drawing attention to usability barriers that can weaken this benefit.

A more focused Riyadh-based study was carried out by Almalki et al. (2023), who examined access to and disparities in telemedicine use among patients with chronic conditions in Riyadh. Using a cross-sectional survey of 342 participants recruited from primary healthcare centers

representing all 17 municipalities in Riyadh, the study found that only 25.73% of participants used telemedicine. The findings also revealed important disparities: older adults, people with lower socioeconomic status, and those living outside urban settings had lower odds of telemedicine use, whereas women, urban residents, employed participants, and those with higher education were more likely to use it. This study is highly relevant because it shows that the issue is not simply whether virtual healthcare exists, but whether access to it is distributed equitably across different patient groups. It therefore supports the current study's concern with assessing whether virtual healthcare is genuinely improving access to care in Riyadh.

In another important nationwide study, AlShareef and AlWabel (2024a) explored patient opinions about virtual consultations in Saudi Arabia using a prospective cross-sectional design. Their sample included 916 participants, and the findings showed that more than 90% of respondents considered virtual consultations useful, convenient, easy to use, effective, and reliable, while 97.4% reported satisfaction with their remote consultation experience. However, the study also found that lower satisfaction was associated with younger age, urban residence, specialty clinic attendance, and telephone-based rather than video-based consultations. This study strengthens the case for virtual healthcare as a promising service model, but it also suggests that the quality of experience varies across patient categories and service formats. For the present study, this is useful because it confirms that satisfaction is a valid outcome through which the effectiveness of virtual healthcare can be assessed.

AlShareef and AlWabel (2024b) extended this line of inquiry by directly comparing virtual consultations with in-person consultations across Saudi Arabia. In a prospective cross-sectional study of 3,196 adults, they found that patients who attended virtual consultations rated them as significantly more convenient, prompt, private, and well communicated than face-to-face visits. Overall satisfaction was also significantly higher in virtual consultations (97.4%) than in in-person consultations (84.0%). These findings are especially relevant to the current study because they connect virtual care not only with patient satisfaction but also with promptness, which closely relates to the study variable of waiting time reduction. The study therefore offers strong empirical support for the assumption that virtual healthcare can improve practical access outcomes when compared with traditional consultation pathways.

Further evidence on satisfaction with virtual care in Saudi Arabia was provided by Alsaif et al. (2024), who examined patient satisfaction with virtual clinic services in the Ministry of National Guard Health Affairs across four regions of the Kingdom. Using retrospective secondary data from virtual clinic visits, the authors found that the overall satisfaction score was 4.1 out of 5, indicating generally positive patient experiences. Their regression analysis also showed that satisfaction differed according to age, gender, region, and survey method. The significance of this study lies in its confirmation that large-scale virtual clinic delivery can achieve good patient acceptance, but that satisfaction is not uniform across all users. This supports the current study's inclusion of patient satisfaction as a dependent variable, while also showing the value of examining the Riyadh context specifically rather than relying only on national aggregates.

Awadh et al. (2025) provided more direct evidence on service responsiveness and waiting-related performance in Saudi telemedicine. Using secondary data from January 2022 to June 2023, the study evaluated the 937 Medical Call Center and immediate virtual consultations through the Sehhaty application. The study reported 7,481,259 offered calls to the 937 service, with an average speed of answer of 13.2 seconds and satisfaction of 94.9%. For Sehhaty's immediate virtual consultations, the study found 712,984 offered consultations, with an average waiting time of 3.41 minutes and satisfaction of 77.7%. This study is particularly important for the current research because it links virtual healthcare to measurable operational outcomes such

as response speed and waiting time, not just user opinion. It therefore provides strong support for using waiting time reduction as one of the study's main dependent variables.

Riyadh-specific qualitative evidence was later added by Alodhialah et al. (2024), who explored telehealth adoption among older adults in Riyadh, and by Alomar et al. (2025), who investigated EHR-integrated telehealth in a major Riyadh hospital. Alodhialah et al. found that telehealth adoption among older adults was shaped by barriers such as low digital literacy, unreliable internet access, and the need for trust in healthcare providers, while family support and training resources acted as facilitators. Alomar et al., based on interviews with 20 patients and 10 healthcare providers at Sulaiman Al Habib Hospital in Riyadh, reported benefits such as reduced physical visits, time savings, and more accessible follow-ups, but also identified barriers including technical instability, limited system integration across branches, lack of insurance payment linkages, and limited provider choice. Together, these two studies are highly relevant because they show that virtual healthcare in Riyadh has clear potential to improve access, but that this potential can be weakened by digital, organizational, and usability barriers.

More recently, Alzghaibi (2025) examined barriers to using the Sehaty mobile health application among 344 patients with chronic diseases in Saudi Arabia. The study found that frequent application crashes, slow responsiveness, navigation difficulties, privacy concerns, and accessibility problems were all associated with reduced engagement and lower user satisfaction. Although this study did not focus specifically on Riyadh, it is important to the current research because it confirms that mobile health platforms may fail to improve access if technical and usability problems are not adequately addressed. In other words, digital health expansion alone does not guarantee improved healthcare access unless service quality and user experience are maintained.

Taken together, the previous studies show a consistent pattern. Most Saudi studies report that virtual healthcare is associated with higher convenience, good satisfaction, and in some cases faster service response. However, the literature also shows that access to virtual care is not equally distributed, and that barriers related to age, education, socioeconomic status, digital literacy, technical stability, and system design continue to affect patient use. In addition, much of the literature is either nationwide or focused on a specific platform, hospital, or patient group. This leaves a clear gap for a study that examines, within Riyadh, whether virtual healthcare models are truly improving access to care, as reflected in patient satisfaction and waiting time reduction, within one integrated framework.

Theoretical Principles of the Study

1. Access to Care Principle

The first theoretical principle relevant to this study is the principle of access to care. Andersen's Behavioral Model explains healthcare use through three major categories: predisposing factors, enabling factors, and need factors. In this perspective, access is not determined only by the existence of a service, but also by whether patients have the social, economic, technical, and practical conditions that allow them to use it. Andersen later reaffirmed the continuing relevance of this model for understanding access to medical care, while Penchansky and Thomas defined access as the degree of fit between the patient and the healthcare system, organized through dimensions such as availability, accessibility, accommodation, affordability, and acceptability. In the digital era, Fortney et al. further argued that traditional access models should be updated because digital communication changes access by reducing geographical and temporal barriers while also creating new forms of digital inequality.

This principle is highly relevant to the present study because access to care is the main dependent outcome. In virtual healthcare, better access may appear in the form of easier appointment reach, reduced travel burden, faster response, and continuity of follow-up. At the same time, access may still be limited by factors such as age, education, digital literacy, internet connectivity, or platform usability. This logic is supported by real Saudi studies. Almalki et al. found that telemedicine use among patients with chronic conditions in Riyadh was uneven across patient groups, which means that availability alone does not guarantee equal access. Likewise, Alharbi et al. reported that users of the Seha application experienced better perceived ease of access and higher satisfaction, but technical difficulties still influenced use. These findings support the use of access to care as the central outcome in this study.

2. Technology Acceptance Principle

The second theoretical principle is the Technology Acceptance Model (TAM) and its later extensions. Davis proposed that the acceptance of a new technology is primarily shaped by two factors: perceived usefulness and perceived ease of use. In simple terms, people are more likely to accept a digital system when they believe it is beneficial and not difficult to use. This principle is especially appropriate for virtual healthcare because telemedicine is not only a healthcare service but also a technology-mediated mode of care. Therefore, the effectiveness of virtual healthcare depends partly on whether patients and providers perceive the system as useful, easy, and worth using.

Later, Venkatesh et al. developed the Unified Theory of Acceptance and Use of Technology (UTAUT), which broadened this logic by introducing performance expectancy, effort expectancy, social influence, and facilitating conditions as major determinants of intention and actual use. This is important for the current study because virtual healthcare in Riyadh may improve access and satisfaction only when users believe that the service is effective, easy to navigate, socially acceptable, and supported by proper infrastructure. Recent telemedicine studies support this principle. Kissi et al. found that perceived ease of use and perceived usefulness influenced physicians' behavioral intentions and were linked to efficiency, quality of care, and physician satisfaction with telemedicine. An et al., using an extended TAM, reported that increased accessibility, enhanced care, and ease of use positively influenced the perceived usefulness and acceptance of telehealth. Similarly, Hailu et al. found that performance expectancy, effort expectancy, facilitating conditions, and digital literacy significantly affected acceptance of telemedicine services among healthcare professionals. These studies make technology acceptance theory highly suitable for explaining how virtual healthcare models can lead to better patient outcomes.

3. Quality of Care Principle

The third theoretical principle is the quality of care principle based on Donabedian's Structure–Process–Outcome framework. Donabedian argued that healthcare quality should be understood through the relationship between the structure of care, the process of care, and the outcomes of care. In the context of virtual healthcare, structure includes digital platforms, internet availability, technical support, and staffing arrangements; process includes communication quality, responsiveness, continuity of follow-up, and ease of interaction; and outcomes include patient satisfaction, efficiency, perceived access, and waiting time. This framework is especially appropriate for the present study because two of the dependent variables, patient satisfaction and waiting time reduction, are direct outcome indicators, while access to care reflects whether the whole system is functioning effectively for patients.

Recent virtual care literature supports using Donabedian's framework in digital health. Tossaint-Schoenmakers et al. reviewed eHealth integration studies using the Structure–Process–Outcome model and found that ease of use, technical issues, human-resource deployment, and health logistics were among the most important indicators connected to

successful eHealth integration and efficiency outcomes. Demaerschalk et al. also described quality frameworks for virtual care that explicitly used the Donabedian approach and emphasized patient experience, equity, technical reliability, and outcomes as central dimensions of quality measurement in virtual care. This logic is also consistent with recent Saudi evidence: AlShareef and AlWabel found that virtual consultations were perceived as more convenient and more prompt than in-person consultations, while Awadh et al. showed high satisfaction and short response times in Saudi telemedicine services. These findings support the use of satisfaction and waiting time reduction as valid quality-related outcomes in the present study.

Methodology and Research Methods

The study will adopt a quantitative, applied, descriptive-analytical, cross-sectional design. This approach is appropriate because the study seeks to examine the effect of virtual healthcare models on the measurable outcomes of access to care, patient satisfaction, and waiting time reduction in Riyadh through a structured survey administered to patients at a single point in time. This design is suitable for identifying patterns, measuring relationships between variables, and testing the study hypotheses in a clear and systematic manner.

The study population will consist of adult patients in Riyadh who have used virtual healthcare services. These services include virtual consultations, remote follow-up, digital appointment-related services, and other forms of healthcare provided through electronic platforms. Accordingly, the target population for this study will include individuals aged 18 years and above who live in Riyadh and have previous experience using virtual healthcare services.

Regarding sampling, the study will use a non-probability convenience sampling technique. This method is appropriate because the study aims to reach actual users of virtual healthcare services in Riyadh in a practical and efficient manner. It also allows the researcher to collect data from respondents who meet the study criteria without the need for complex institutional access procedures. A sample size of approximately 300 to 400 respondents will be considered appropriate for achieving the objectives of the study and conducting the required statistical analyses.

The data collection instrument for this study will be a structured questionnaire designed to reflect the study variables and hypotheses. The questionnaire will be divided into two main parts. The first part will collect respondents' demographic information, such as age, gender, educational level, employment status, and frequency of virtual healthcare use. The second part will include statements measuring the study variables.

The independent variable, namely virtual healthcare models, will be measured through a set of items related to the use, usefulness, convenience, responsiveness, and reliability of virtual healthcare services. The dependent variables will also be measured through separate groups of items. Access to care will be assessed through items related to the ease, speed, and convenience of obtaining healthcare services. Patient satisfaction will be measured through items related to the overall experience of using virtual healthcare services. Waiting time reduction will be measured through items related to the extent to which virtual healthcare helps patients receive consultations and follow-up services more quickly.

The questionnaire will be designed using a five-point Likert scale, ranging from strongly disagree to strongly agree. This scale is appropriate because it allows respondents to express their level of agreement clearly and helps convert responses into measurable numerical data suitable for statistical analysis.

To ensure the validity of the instrument, the questionnaire will be presented to a number of academic experts and specialists in healthcare management and research methods for review and evaluation. Their comments and suggestions will be used to improve the clarity, relevance, and suitability of the items. To ensure reliability, a pilot test will be conducted on a small group of respondents from the target population before full data collection. After the final data are collected, Cronbach's alpha will be calculated to test the internal consistency of the questionnaire items.

The data collection process will be carried out electronically using an online questionnaire distributed to eligible respondents in Riyadh. Participation in the study will be limited to individuals who are 18 years or older, live in Riyadh, and have used virtual healthcare services. Incomplete responses or responses from individuals who do not meet these criteria will be excluded from the final analysis.

The study will also observe appropriate ethical considerations. Participation will be voluntary, and respondents will be informed about the purpose of the study before answering the questionnaire. They will also be assured that their responses will remain anonymous and confidential and that the collected data will be used only for academic purposes.

Study Tools

The study will rely on a structured questionnaire as the main data collection tool on google forms. The questionnaire will be divided into two sections. The first section will collect demographic information about the respondents. The second section will include statements designed to measure the study variables, namely virtual healthcare models, access to care, patient satisfaction, and waiting time reduction. Responses will be measured using a five-point Likert scale. The questionnaire will be reviewed by specialists to ensure validity and will be pilot tested before final distribution.

The collected data will be analyzed using SPSS. Descriptive statistics such as frequencies, percentages, means, and standard deviations will be used to describe the sample and summarize responses. Reliability analysis will be conducted using Cronbach's alpha. In addition, inferential statistical techniques such as Pearson correlation and regression analysis will be used to test the relationships between the independent and dependent variables and to determine whether the study hypotheses are supported. If needed, tests such as t-test and ANOVA may also be used to examine differences in responses according to demographic characteristics.

The Limits of Study

First, the study does not extend to other possible outcomes of virtual healthcare, such as clinical effectiveness, cost efficiency, physician performance, or long-term health outcomes.

Second, the study is spatially limited to Riyadh, Saudi Arabia. This means that the findings will reflect the experiences of patients using virtual healthcare services within Riyadh and may not fully represent patients in other cities or rural areas that may differ in service availability, digital infrastructure, or patterns of healthcare use.

Third, the study is humanly limited to adult patients who have used virtual healthcare services. It does not include healthcare providers, hospital administrators, or patients who have never used virtual healthcare platforms. Therefore, the results will be based only on the perceptions and experiences of eligible users of virtual healthcare services.

Fourth, the study is temporally limited to the period in which the data are collected. Since the study uses a cross-sectional design, it reflects respondents' views at a specific point in time and does not examine changes in perceptions or service use over a longer period.

Finally, the study is methodologically limited to a quantitative survey approach using a structured questionnaire. This means that the study focuses on measurable responses and statistical relationships between variables, without using qualitative methods that might provide deeper explanations of patient experiences.

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Questionnaire

Table 1. Informed Consent and Eligibility

No.	Statement	Response
1	I confirm that I am 18 years old or above.	Yes / No
2	I confirm that I live in Riyadh.	Yes / No
3	I confirm that I have used virtual healthcare services before.	Yes / No
4	I agree to participate voluntarily in this study.	Yes / No

Table 2. Demographic Information

No.	Item	Response Options
1	Gender	Male / Female / Prefer not to say
2	Age	18–24 / 25–34 / 35–44 / 45–54 / 55 and above
3	Educational level	Secondary or below / Diploma / Bachelor's degree / Master's degree / Doctorate
4	Employment status	Employed / Unemployed / Student / Retired / Other
5	Frequency of using virtual healthcare services during the last 12 months	Once / 2–3 times / 4–5 times / More than 5 times
6	Most frequently used virtual healthcare service	Sehhaty / Seha / 937 / Private hospital virtual clinic / Other
7	Type of consultation most frequently used	General consultation / Follow-up consultation / Specialist consultation / Prescription-related service / Other

Table 3. Questionnaire Items for Study Variables

Variable	Type	Hypothesis Link	Item No.	Statement	Scale
Virtual Healthcare Models	Independent	Basis for H1, H2, H3	1	Virtual healthcare services are easy for me to use.	1–5

Virtual Healthcare Models	Independent	Basis for H1, H2, H3	2	The virtual healthcare platform provides healthcare services in a convenient way.	1–5
Virtual Healthcare Models	Independent	Basis for H1, H2, H3	3	I can communicate effectively with healthcare providers through virtual healthcare services.	1–5
Virtual Healthcare Models	Independent	Basis for H1, H2, H3	4	Virtual healthcare services are reliable when I need medical assistance.	1–5
Virtual Healthcare Models	Independent	Basis for H1, H2, H3	5	Virtual healthcare services help me receive healthcare support without unnecessary difficulty.	1–5
Access to Care	Dependent	H1	6	Virtual healthcare makes it easier for me to obtain healthcare services when needed.	1–5
Access to Care	Dependent	H1	7	Virtual healthcare reduces barriers to reaching healthcare services.	1–5
Access to Care	Dependent	H1	8	Virtual healthcare helps me receive care more quickly than traditional visits.	1–5
Access to Care	Dependent	H1	9	Virtual healthcare improves my ability to follow up with healthcare	1–5

				providers when needed.	
Access to Care	Dependent	H1	10	Virtual healthcare has improved my overall access to healthcare services.	1–5
Patient Satisfaction	Dependent	H2	11	I am satisfied with my overall experience using virtual healthcare services.	1–5
Patient Satisfaction	Dependent	H2	12	Virtual healthcare services meet my expectations as a patient.	1–5
Patient Satisfaction	Dependent	H2	13	I feel comfortable receiving healthcare services through virtual platforms.	1–5
Patient Satisfaction	Dependent	H2	14	I would use virtual healthcare services again in the future.	1–5
Patient Satisfaction	Dependent	H2	15	I would recommend virtual healthcare services to others.	1–5
Waiting Time Reduction	Dependent	H3	16	Virtual healthcare reduces the time I wait to receive medical consultation.	1–5
Waiting Time Reduction	Dependent	H3	17	I can obtain healthcare advice faster through virtual healthcare than through in-person visits.	1–5

Waiting Time Reduction	Dependent	H3	18	Virtual healthcare makes follow-up appointments faster and easier.	1–5
Waiting Time Reduction	Dependent	H3	19	Virtual healthcare reduces delays in receiving the healthcare service I need.	1–5
Waiting Time Reduction	Dependent	H3	20	Using virtual healthcare saves me time compared with traditional healthcare visits.	1–5

Table 4. Variable Coding and Measurement

Variable	Item Numbers	Number of Items	Measurement Type	Expected Direction
Virtual Healthcare Models	1–5	5	Mean or total score	Higher score = better perception of virtual healthcare
Access to Care	6–10	5	Mean or total score	Higher score = better access to care
Patient Satisfaction	11–15	5	Mean or total score	Higher score = greater patient satisfaction
Waiting Time Reduction	16–20	5	Mean or total score	Higher score = greater reduction in waiting time