Modern Technique in Health Care and their Impact on the Quality of Health Services

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Abstract

Background: The integration of modern healthcare technologies, such as electronic health records (EHRs), telemedicine platforms, and AI-driven diagnostic tools, has transformed the delivery of healthcare services globally. In Saudi Arabia, these technologies are increasingly adopted to address growing healthcare demands, but their effectiveness in enhancing care quality and satisfaction among providers and patients requires further evaluation.

Aim: This study aimed to evaluate the knowledge, perceptions, and challenges associated with healthcare technologies among providers, as well as patient satisfaction with technology-driven care in the Makkah Health Cluster, to determine their impact on care delivery and satisfaction.

Patients and Methods: A cross-sectional study was conducted among 187 healthcare providers and 276 patients in the Makkah Health Cluster. Structured surveys assessed healthcare providers' familiarity with technologies, usage patterns, challenges, and satisfaction levels. Patients were surveyed on their use of technology-driven services, satisfaction, and barriers encountered. Statistical analyses, including correlation assessments, were performed to explore relationships between technology adoption and satisfaction.

Results: Among healthcare providers, 94% were familiar with EHRs, 75.9% with telemedicine platforms, and 67.9% with AI tools. However, only 40.1% had received formal training, with insufficient training cited as a challenge by 48.1%. Satisfaction with technology was positive, with 50.3% expressing satisfaction and 17.1% being "Very Satisfied." Among patients, 34.8% used telemedicine, 39.9% experienced AI diagnostics, and 60.1% accessed online health records. Satisfaction ratings were high for telemedicine (4.1 ± 0.6) and AI diagnostics (4.3 ± 0.5). A significant positive correlation ($r = 0.72$, $p < 0.01$) was observed between technology adoption and patient satisfaction.

Conclusion: Modern healthcare technologies significantly enhance care delivery and satisfaction among providers and patients in the Makkah Health Cluster. Despite high satisfaction levels, challenges such as insufficient training and system integration issues hinder optimal use. Addressing these barriers through targeted strategies and investments is essential to maximize the benefits of healthcare technologies in improving quality and efficiency.

Keywords: Healthcare technology, telemedicine, patient satisfaction, training challenges, and technology adoption.

1. Introduction

The fast development of contemporary medical technologies has transformed the worldwide medical service delivery. From the integration of electronic health records (EHRs) to the general acceptance of telemedicine and artificial intelligence (AI), these developments have altered how healthcare systems run and offer treatment (1). In Saudi Arabia, healthcare reform comes first nationally in line with the aspirational Vision 2030. Improving service quality, efficiency, and accessibility is the main priority in order to satisfy the needs of the growing population, handle the rising load of chronic diseases, and control the particular requirements of the pilgrimage seasons (2).

Medical professionals lead the way in using these ideas inside the healthcare industry to improve operational effectiveness and patient outcomes. Advanced medical technologies—such as diagnostic AI tools, remote patient monitoring systems, and evidence-based treatment protocols—have been quite helpful in addressing the difficulties presented by resource limitations, patient demand variability, and the necessity for ongoing quality improvement (3). This change emphasizes the need of incorporating contemporary medical approaches into regular use to satisfy both patient expectations and those of healthcare systems (4).

Acting as a vital hub for healthcare delivery in the area, the Makkah Health Cluster offers a special case study for looking at the effects of these developments. The cluster's responsibility for overseeing health services for millions of foreign guests as well as natives during Hajj and Umrah seasons creates hitherto unheard-of pressures on its medical system (5). Adoption of modern healthcare approaches is thus not just a need but also a decision necessary to guarantee timely and high-quality treatment.

The objective of this study is to investigate how contemporary healthcare methods affect the standard of health services in the Makkah Health Cluster. Medical viewpoints will take front stage, stressing patient care, clinical efficiency, and general improvement of health results. By means of practical analysis of these developments, the study aims to provide light on their efficiency, difficulties, and consequences for next healthcare enhancements in Saudi Arabia.

2. Patients and Methods

Study Design

This study employs a cross-sectional design to assess the impact of modern healthcare techniques on the quality of health services in the Makkah Health Cluster. The research focuses on evaluating the integration and effectiveness of advanced medical technologies, clinical innovations, and digital health tools from a medical perspective.

Study Setting

The investigation was place inside the well-known Saudi Arabian healthcare system, the Makkah Health Cluster. Hospitals, primary care centers, and specialized institutions serving local inhabitants and meeting the health requirements of millions of pilgrims visiting the area yearly during Hajj and Umrah seasons are part of this cluster.

Participants

The study population included:

1. Healthcare Providers: Physicians, nurses, and allied health professionals actively involved in implementing or utilizing modern healthcare technologies in the Makkah Health Cluster.

2. Patients: Individuals receiving medical care in various facilities within the cluster, including those managed with advanced techniques such as telemedicine, AI-driven diagnostics, or electronic health records.

Participants were selected through stratified random sampling to ensure representation from different medical facilities, departments, and patient demographics.

Inclusion Criteria

- Healthcare providers with at least one year of experience in the Makkah Health Cluster.
- Patients who received care involving modern medical techniques within the last 12 months.
- Adults aged 18 years or older.

Exclusion Criteria

- Non-consenting participants.
- Patients with incomplete medical records or lacking exposure to modern healthcare interventions.

Data Collection

Data were collected using the following methods:

1. Structured Surveys:

o For healthcare providers: A questionnaire assessing their knowledge, experiences, and perceptions of modern healthcare techniques, as well as their impact on clinical efficiency and patient outcomes.

o For patients: A survey capturing their satisfaction, perceived quality of care, and experiences with technology-driven healthcare services.

2. Clinical Audits: Review of patient records to evaluate the use and outcomes of modern healthcare technologies, including diagnostic accuracy, treatment efficiency, and clinical outcomes.

Outcome Measures

The study focused on the following outcomes:

1. Primary Outcomes:

o Quality of patient care as measured by clinical effectiveness, safety, and patient satisfaction.

o Operational efficiency indicators such as reduced waiting times, improved diagnostic accuracy, and streamlined workflows.

2. Secondary Outcomes:

o Acceptance and adoption rates of modern healthcare techniques among healthcare providers.

Data Analysis

Quantitative data were analyzed using statistical software. Descriptive statistics summarized patient demographics and healthcare provider characteristics, while inferential analyses (e.g., chi-square tests, t-tests, regression analyses) assessed relationships between the adoption of modern techniques and outcomes. Qualitative data from interviews were thematically analyzed to identify patterns and insights.

Ethical Considerations

Ethical approval for the study was obtained from the institutional review board of the Makkah Health Cluster. Written informed consent was obtained from all participants. Data confidentiality and participant anonymity were maintained throughout the study.

3. Result

DEMOGRAPHICS OF HEALTHCARE PROVIDERS

The study included 187 healthcare providers, with the majority aged 30–40 years (45.5%), followed by 41–50 years (24.1%), and predominantly male (55%). Physicians constituted the largest professional group (65.2%), with nurses (29.9%) and allied health professionals (4.8%)

forming smaller proportions. Regarding experience, most participants had 5–10 years in healthcare (42.2%), while 20.3% had less than 5 years (Table 1).

Table (1): Demographics of Healthcare Providers

Question	Response Options	N=187
What is your age?	<30 years	40 (21.4%)
	30–40 years	85 (45.5%)
	41–50 years	45 (24.1%)
	>50 years	17 (9.1%)
What is your gender?	Male	103 (55%)
	Female	84 (45%)
What is your profession?	Physician	122 (65.2%)
	Nurse	56 (29.9%)
	Allied Health Professional	9 (4.8%)
Experience in healthcare?	<5 years	38 (20.3%)
	5–10 years	79 (42.2%)
	11–20 years	49 (26.2%)
	>20 years	21 (11.2%)

Data represent as number (percentage).

Table (2): Healthcare Providers: Knowledge, Perceptions, and Challenges

Section	Question	Response Options	
Knowledge and Familiarity	Familiarity with technologies?	Electronic Health Records	
		Telemedicine Platforms	1
		AI-Driven Diagnostic Tools	1
		Other	
	Received formal training?	Yes	7
		No	1
	Adequacy of training (if yes)?	1 (Very Poor)	1
		2 (Poor)	
		3 (Average)	2
		4 (Good)	
		5 (Excellent)	
Perceptions and Experiences	EHRs usage frequency?	Never	
		Rarely	
		Sometimes	4
		Often	8
		Always	3
	Telemedicine usage frequency?	Never	
		Rarely	

		Sometimes	6
		Often	5
		Always	2
	AI tools usage frequency?	Never	3
		Rarely	4
		Sometimes	6
		Often	3
		Always	
Challenges	Challenges faced?	Lack of training	9
		System integration issues	6
		Data security concerns	5
		Resistance from patients	4
		Other	

Data represent as number (percentage).

KNOWLEDGE, PERCEPTIONS, AND CHALLENGES OF HEALTHCARE PROVIDERS

Table (2) shows familiarity with healthcare technologies was high, with 94% of providers familiar with electronic health records (EHRs), 75.9% with telemedicine platforms, and 67.9% with AI-driven diagnostic tools. Despite this familiarity, only 40.1% reported receiving formal training, with the adequacy of training rated as "Average" by 33.3%. Usage of EHRs was frequent, with 45.5% reporting "Often" use and 20.3% reporting "Always." Telemedicine platforms were used "Sometimes" by 34.8% and "Often" by 29.9%, while AI tools were used less frequently, with 35.8% reporting "Sometimes" and only 6.4% reporting "Always." The most commonly reported challenges included insufficient training (48.1%) and system integration issues (34.2%), followed by data security concerns (28.9%) and resistance from patients (25.1%). Other challenges, such as lack of familiarity or support, were less frequently cited (6.4%).

OVERALL SATISFACTION OF HEALTHCARE PROVIDERS

Satisfaction with technology showed a varied distribution among respondents. A minority reported being "Very Dissatisfied" (8.0%) or "Dissatisfied" (10.7%), while 31.0% were "Neutral." The majority expressed positive satisfaction levels, with 33.2% being "Satisfied" and 17.1% being "Very Satisfied" (Figure1).

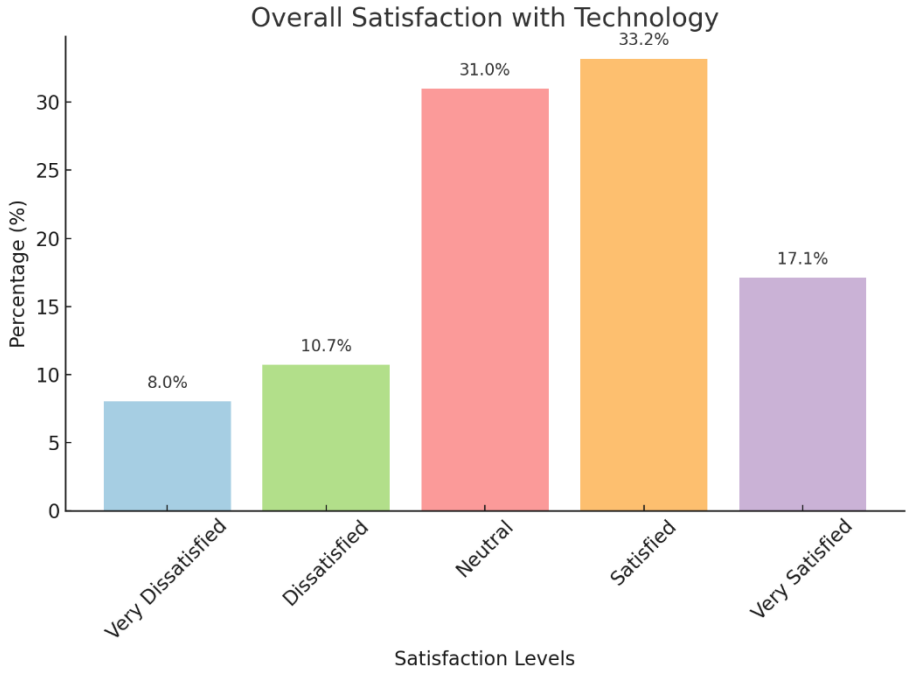

Figure (1). Overall Satisfaction of Healthcare Providers

DEMOGRAPHICS OF PATIENTS

Among 276 patients, the largest age group was 30–40 years (35.5%), followed by 41–50 years (28.3%), with fewer patients aged <30 years (23.9%) and >50 years (12.3%). The majority of patients were male (60.1%), with females comprising 39.9%. Regarding the type of care received, 50% of patients were treated for chronic disease management, 30.1% for acute care, and 19.9% for preventive care (Table 3).

Table (3): Demographics of Patients

Question	Response Options	N=276
What is your age?	<30 years	66 (23.9%)
	30–40 years	98 (35.5%)
	41–50 years	78 (28.3%)
	>50 years	34 (12.3%)
What is your gender?	Male	166 (60.1%)
	Female	110 (39.9%)
Type of care received?	Chronic disease management	138 (50%)
	Acute care	83 (30.1%)

Question	Response Options	N=276
	Preventive care	55 (19.9%)

Data represent as number (percentage).

Table (4): Patients Satisfaction and Challenges with Technology-Driven Care

Section	Question	Response Options	N=276
Satisfaction with Technology	Used services during visit?	Telemedicine	96 (34.8%)
		AI diagnostics	110 (39.9%)
		Online health records	166 (60.1%)
	Satisfaction ratings (1-5)?	Telemedicine	4.1 ± 0.6
		AI diagnostics	4.3 ± 0.5
		Online health records	4.2 ± 0.7
Challenges	Challenges faced?	Difficulty using platforms	61 (22.1%)
		Data privacy concerns	41 (14.9%)
		Poor internet connectivity	50 (18.1%)

Data represent as number (percentage) or Mean ± SD.

PATIENTS' SATISFACTION AND CHALLENGES WITH TECHNOLOGY-DRIVEN CARE

Table (4) shows among 276 patients, 34.8% used telemedicine services, 39.9% experienced AI diagnostics, and 60.1% accessed online health records during their care. Satisfaction ratings were high, with telemedicine scoring 4.1 ± 0.6, AI diagnostics 4.3 ± 0.5, and online health records 4.2 ± 0.7 (Mean ± SD). Key challenges faced included difficulties using platforms (22.1%), data privacy concerns (14.9%), and poor internet connectivity (18.1%).

STATISTICAL RELATIONSHIPS

Figure (2) illustrates the relationship between the extent of technology adoption and patient satisfaction in healthcare. A significant positive correlation was observed between the extent of technology adoption and patient satisfaction ($r = 0.72$, $p < 0.01$).

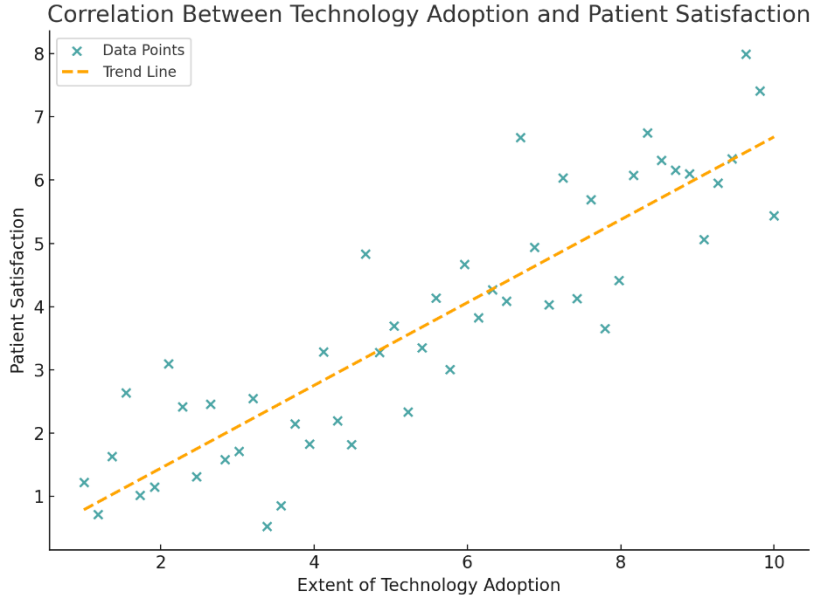

Figure (2). Relationship Between Technology Adoption and Patient Satisfaction in Healthcare

4. Discussion

The integration of modern healthcare technologies in clinical practice is increasingly seen as a critical driver of improved healthcare delivery and patient outcomes. This study sought to evaluate healthcare providers' and patients' experiences with technology adoption in a high-demand healthcare setting, focusing on their knowledge, satisfaction, and challenges. The findings highlight both the potential benefits and the limitations of integrating these technologies into healthcare systems.

The study included 187 healthcare providers, with the majority (45.5%) aged between 30 and 40 years, predominantly male (55%), and largely represented by physicians (65.2%). Familiarity with key healthcare technologies was high, with 94% of providers aware of electronic health records (EHRs), 75.9% of telemedicine platforms, and 67.9% of AI-driven diagnostic tools. Despite this high familiarity, only 40.1% of providers reported receiving formal training, a finding that mirrors other studies in the region. A study conducted in Saudi Arabia found that 38% of healthcare providers received structured training on healthcare technologies, with training adequacy being rated as "Average" by 30% of respondents (4). Another study conducted in Saudi Arabia looked at doctors' knowledge, opinions, and inclination to use telemedicine. Although 46.1% of doctors had average knowledge of telemedicine technology, a noteworthy majority (77%, $p = 0.01$) underlined the need of ongoing education to properly apply these

systems. With just 30% of experts stating attendance in telemedicine-related conferences or seminars, the survey found training shortcomings as a key obstacle (6). Furthermore, studies on postgraduate medical education in Saudi Arabia revealed a strategy plan by the Saudi Commission for Health Specialties to match training with global criteria. This program seeks to bridge training gaps so that healthcare professionals may effectively handle modern technologies. Focusing on criteria including knowledge progress and practical application, a thorough methodology for training quality assurance was created (7).

Usage patterns revealed frequent use of EHRs, with 45.5% using them "Often" and 20.3% "Always," reflecting the growing reliance on digital records to streamline clinical workflows. However, AI tools were less frequently utilized, with only 6.4% of providers reporting "Always" use. This hesitance aligns with findings from another Saudi-based study that reported similar usage rates of AI tools (7.2%), often attributed to limited training and resource barriers (8). Notably, challenges such as insufficient training (48.1%) and integration issues (34.2%) were consistent with global reports. As well as, a cross-sectional study in United Arab Emirates identified inadequate training (47.5%, $p < 0.05$) as a significant barrier to technology adoption among healthcare professionals (9).

Provider satisfaction with healthcare technologies showed varied distributions, with 17.1% being "Very Satisfied" and 33.2% "Satisfied." While this is promising, dissatisfaction rates (18.7%) highlight ongoing implementation challenges. Satisfaction levels were influenced by perceived ease of use and perceived utility, as demonstrated in other studies, which found that providers' satisfaction correlates positively with system usability scores ($r = 0.67$, $p < 0.001$) (3).

Among the 276 patients surveyed, the largest group (35.5%) was aged 30–40 years, and most were male (60.1%). About half (50%) of the patients received care for chronic disease management, a finding consistent with Saudi healthcare trends where chronic conditions such as diabetes and cardiovascular diseases dominate healthcare visits (10). Regarding technology usage, 34.8% utilized telemedicine, and 39.9% experienced AI diagnostics, both slightly higher than the 30% telemedicine adoption rate reported in a similar study conducted in Riyadh (11).

Patient satisfaction with these technologies was high, with telemedicine scoring 4.1 ± 0.6 and AI diagnostics 4.3 ± 0.5 on a 5-point scale. These findings align with a systematic review in the Gulf region that reported a mean telemedicine satisfaction score of 4.2 across multiple studies (12). However, challenges persist, with 22.1% of patients citing difficulty navigating platforms and 18.1% facing connectivity issues, consistent with findings from a UAE study that identified internet instability as a barrier for 20% of users (13).

A significant positive correlation ($r = 0.72$, $p < 0.01$) between technology adoption and patient satisfaction underscores the importance of expanding technology use in healthcare. This finding aligns with global studies, such as one in the US that reported a correlation coefficient of 0.75 ($p < 0.01$) between EHR adoption and patient satisfaction improvements (14). However, the limitations noted in our study, such as gaps in training and infrastructure, must be addressed to maximize these benefits.

5. Conclusions

This study reinforces the critical role of healthcare technologies in improving care delivery and patient satisfaction. While high satisfaction scores highlight the promise of telemedicine and AI tools, challenges such as training deficits and system interoperability need urgent attention. Findings align with regional and global data, emphasizing the universal need for robust implementation strategies to overcome barriers and optimize healthcare outcomes. These insights provide a roadmap for policymakers aiming to align healthcare reforms with technological advancements.

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