

Evaluating Digital Transformation in Saudi Health Insurance Management: A Multi-Stakeholder Survey on Adoption, Challenges, and Impact

¹*Abdelshafy Mahmoud Abdelshafy Mohamed, Mohamed Saber Abdelsamie Hassan, Haitham Ahmed Abdulraahman Elmasry

¹Dr Samir Abbas Hospital, Jeddah, Saudi Arabia.

Abstract

Background: In Saudi Arabia, health system reform under Vision 2030 has become digitised, and health insurance has been chosen as a key entry point among patients, providers, and payers. NPHIES and Sehaty are national platforms that should facilitate to increase the efficiency, interoperability, and transparency, but there is not much empirical data concerning the experience of frontline users.

Aim: The proposed study aimed to assess awareness, usage, perceived benefits, challenges, as well as impact of digital transformation activities in Saudi health insurance through the lens of a multi-stakeholder perspective.

Methodology: A survey was carried out as a cross-sectional study involving quantitative approaches with healthcare practitioners, insurance workers and people being insured. The digital awareness, usage, perceived challenge, perceived benefit, and perceived impact were measured using 5-point Likert-scale instruments. A total of 150 participants were recruited for the survey. Thematic analysis of open responses, regression models, correlation analysis, t-tests and descriptive statistics were used.

Findings: The average scores in all dimensions of digital transformation were less than the middle of the scale (2.282.34), which means that the perceived value is low despite a well-developed digital infrastructure. Perception of benefits and impact were most strongly predicted by awareness ($b = 0.40 - 0.50$) and challenges had positive effects on both, indicating that the barrier was experiential and not resistance-based. Statistically significant differences in sectors in percent differences in favour of the private institutions ($p = 0.001$). A significant ($r > 0.79$) and qualitative intercorrelation implied that the stakeholders view digital transformation as a sociotechnical process that is not scalable due to interoperability gaps, change management gaps, and equity issues.

Conclusion: The structural aspects of digital transformation in Saudi health insurance are underway, but are limited by the organisation preparedness, usability gaps and minimal development of human capacity. The success of policies needs to be achieved through technology-focused implementation and entire socio-organisational change based on frontline experience.

Keywords: Digital Health, Digital Transformation, Vision 2030, Health Information Systems, User Experience.

1. Introduction

Digital Transformation (DT) has become the key to modernisation of health systems across the globe, and in the Kingdom of Saudi Arabia (KSA) it is considered key to achieving the aspirations of its proposed program, i.e. Vision 2030 (Aldogher & Halim, 2025). In the health sector, Vision 2030 and the Health Sector Transformation Program underlie the focus on better access, efficiency, transparency, and care quality due to the systematic use of digital technologies, data-guided decision-making, and models of integrated care provision (Fitriani, 2025). Conveniently positioned, between the patients, providers, and payers, health insurance is an important area of

business where DT is likely to draw out quantifiable value through rationalisation of costs, service efficiency, and patient experience.

In the last decade, Saudi Arabia has allocated a lot of funds to national-level digital health infrastructures that support health insurance works directly and indirectly. The existence of platforms like the National Platform of Health and Insurance Exchange Services (NPHIES), Sehaty, and the upcoming Unified Health record (Badreldin et al., 2025). These are indicative of a larger policy implementation aimed at interoperability, automation, and real-time data transmission between the healthcare and insurance systems. More specifically, NPHIES is to standardise and simplify

Abdelshafy Mahmoud Abdelshafy Mohamed
Dr Samir Abbas Hospital, Jeddah, Saudi Arabia.
Email: abdelshafym5@gmail.com

Received: 3-Jan-2026

Revised: 20-Jan-2026

Accepted: 10-Feb-2026



©2025 Copyright by the Authors.

Licensed as an open access article using a [CC BY 4.0 license](https://creativecommons.org/licenses/by/4.0/).

claims submission, eligibility cheques and reimbursement procedures between providers and insurance firms to eliminate administrative strain, reduce coding and errors in billing, and improve turnaround rates (Bin Dehaish et al., 2025). Similarly, patient-facing apps like Sehaty are created with a focus on giving beneficiaries the ability to access their health data, appointments, and e-televisions, which can redefine the concept of transparency, responsiveness, and responsibility regarding insured care (Alshehri & Abduljawad, 2025).

In the context of health insurance, DT is not just digitising the present paper-based processes, but a more profound restructuring of organisational processes, positions, and relationships. Greater precision in risk evaluation, fraud detection and utilisation management can be achieved with advanced analytics, automation, and integrated platforms, and personalised benefits design and more responsive customer service can be supported (Alfalah et al., 2025). However, these benefits can only be realised with the successful interaction and coordination with various stakeholder groups, including healthcare professionals, insurance company employees, and patients/beneficiaries, whose experience and interactions day in, day out eventually determine the success or failure of DT initiatives. In the case of Saudi Arabia, where the health insurance market continues to gain influence in financing healthcare and where the development of the private sector as the future provider of services is anticipated to take on a larger role (Al-Kahtani et al., 2022). DT in health insurance is a strategic tool towards meeting the targets of Vision 2030 of financial sustainability of healthcare, enhanced satisfaction of citizens, and improvement in the quality of services offered.

The level of progression of DT in the Saudi health insurance beyond the obvious strategic intention and heavy infrastructural spending is still poorly comprehended. The current discourse is also commonly conceptualised at the policy or organisational level, covering the technology implementation, regulatory aspects reform score, and macro-level performance indicators (Sheerah et al., 2024). Relatively small amounts of empirical research have methodically summarised the perceptions, experiences, and issues faced by frontline users of key digital platforms, i.e. clinicians, administrators, claims processors, IT staff and patients (Alsadaan et al., 2024). In this regard, there is a dire need and urgency to have a rigorous, multi-stakeholder evaluation of the awareness and adoption of DT, perceived benefits, and barriers in Saudi health insurance so that the

digital aspiration of Vision 2030 is successfully integrated into practical use.

Although the idea of digital transformation in Saudi health insurance is well established as a strategic enabler to Vision 2030, there is a significant gap in the distance between the top-level policy discourse and empirically based wisdom regarding how DT is consumed by the various parties who engage with digital platforms daily. The national programs, like NPHIES and Sehaty, are supposed to facilitate the management of claims, enhance interoperability, and patient experience; the reality is, however, the trends of awareness, usage, and satisfaction with these tools in the spheres of healthcare workers, employees in insurance companies, and patients/beneficiaries have not been explored.

This empirical shortage at ground level generates a knowledge gap that limits the skills of policymakers, regulators and organisational leaders to evaluate the empirical impact of DT in health insurance effectively and to rank the corrective interventions. In the absence of strong, comparative data on adoption differences, the differences in challenge perceptions, and perceived impact, there is a risk that DT strategies could be excessively prioritising technological deployment at the cost of usability, change management and stakeholder involvement. As a result, the fundamental issue that the paper resolves is the lack of empirical knowledge on how digital transformation initiatives in the Saudi health insurance are adopted, experienced, and perceived at the level of major stakeholder groups and how such experiences are harmonic or not with the strategic objectives of the Vision 2030.

The practical and scholarly importance of this issue is significant. Policy and form of government Vision 2030 places DT in a central role of bringing about transformation in the health sector, but the sustainability and return on investment (ROI) of DT engagement within and among health insurance frontline users is determined by how well it produces value to them. The evidence obtained through the methods of the proposed study, which includes empirically mapping the awareness and usage trends, satisfaction rates and perceived impact of significant digital tools like NPHIES and Sehaty among healthcare workers, insurance people, and patients, will have a direct impact on the optimisation of national DT policies and measures. To regulators and national authorities that oversee digital health and insurance (e.g. Ministry of Health, Council of Health Insurance, digital agencies thereof), the results will give detailed, user-level information on areas where DT is

performing well and others where it is underperforming. Specifying particular issues of technical nature (e.g. system complexity, interoperability problems), organisational nature (e.g. workflows, resource constraints), and human nature (e.g. digital literacy, resistance towards change) will allow placing more pointed interventions such as target training programs, usability fixes, and data governance remedies, and communication plans, which are informed by real user experiences instead of guesses.

To hospitals and insurance companies, both in the public and the private sectors, the comparative outcomes provided by the study identified differences in adoption and perceptions that can be used to make specific change management and investment decisions. Learning about the perceptions of the various professional groups on the advantages and disadvantages of DT such as physicians, nurses, coders, claims processors, and IT staff can contribute to organisations creating a more responsive support system, incentives, and capacity-building programs. Furthermore, it can enhance workflow integration, resistive reduction and augment the usefulness of DT in the operational efficiency, billing precision, and services quality.

In patient and beneficiary perspective, the study will illuminate on the digital platform and service experience among insured people, their perceived ease of use, perceptions of transparency, effects on access and satisfaction. These kinds of insights will be instrumental in making sure that DT is not only optimising back-office operations but has also a tangible positive impact on customer experience and trust in the health insurance system an explicit priority at Vision 2030.

Following objectives are to be addressed: to measure the awareness, usage patterns, and satisfaction levels with key DT platforms (NPHIES, Sehaty, e-claims) among healthcare professionals, insurers, and patients. To identify and rank the perceived benefits and challenges (technical, organizational, human) of DT implementation across different stakeholder groups. To assess the perceived impact of DT on operational efficiency, data quality, customer experience, and progress toward Vision 2030 goals. To compare perspectives across stakeholder groups and institution types (public/private) to identify tailored intervention points.

2. Literature Review

2.1. Conceptual Pillars of DT in Health Insurance

DT in the health insurance sector entails more than the digitization of the current paper-based operations,

but rather it represents the essential overhaul of the value-generating processes through the payer-provider-patient spectrum (Renner-Micah, 2024). The latest published literature suggest conceptualises DT in health insurance in four interdependent pillars namely, automation, interoperability, advanced analytics, and customer experience (CX) (Hameed et al., 2024).

Health insurance automation mainly addresses some administrative and repetitive responsibilities like claims processing, claims adjudication, policy administration, policy verifications and prior authorisation. Research across the United States and Europe has shown that rule-based automation and robotic process automation (RPA) can significantly decrease the operational amounts of back-office claims processing, decrease the number of errors, and cut costs and can reduce 30 to 50 % of back-office activities in payers (Chaturvedi et al., 2023). Recent (since 2020) empirical research shows that those insurers adapting to end-to-end digital claims workflows that integrate provider electronic health records (EHRs) and payer claims engines (Tsai et al., 2020). It also reported shorter reimbursement periods and more provider satisfaction, especially with concise coding guidelines and policies (Elendu et al., 2023). However, Adeniyi et al. (2024) also caution that improperly implemented automation can produce a locking-in effect where only issues present in the existing ineffective and biases are not eliminated unless the rules are reviewed and adjusted with clinical and regulatory reforms regularly (Adeniyi et al., 2024).

Interoperability is regarded far and wide to be a requisite to successful DT in health insurance as it forms the basis of a smooth flow of data among the providers, payers, and patients. The same is emphasised in post-2020 literature, especially in the works of OECD and GCC nations with a lack of interoperability being described as one of the most long-standing delays in the implementation of a full set of the benefits of DT (Adegoke et al., 2025). Interoperability does not produce a narrow definition to technical standards (e.g. HL7 FHIR, ICD-10/11, SNOMED Ct) but extends these semantic persistence and governance frameworks that aim at creating trusted, secure data-sharing (Khalifa et al., 2021). Research indicates that the interoperable health information systems have been linked with decreased test duplication, improved coding accuracy and fraud detection rate in claims managing (Martens et al., 2024). Interoperable platforms can be used in insurance situations to conduct real-time checking of eligibility skills, electronic pre-authorisations, and integrated care paths that may help

to reduce delays and inter-provider payer conflict (Martens et al., 2024).

Within KSA, Customer experience in health insurance involves the overall experience of beneficiaries throughout the process, including the process of enrolment and understanding of benefit to submissions and approvals and receiving of service (Alzahrani et al., 2025). The results of the post-2020 studies are in agreement with the previous assertions by stating digital customer interfaces (mobile applications and portals, chatbots) substantially affect the level of trust, perceived fairness, and satisfaction with the health insurance offerings (Alagarsamy & Mehroliya, 2023). Carini et al. (2021) in its study observed correlation between higher levels of satisfaction and perceived transparency with the introduction of digital self-service features (viewing coverage details, tracking claims, scheduling appointments, and accessing telehealth), especially in times of increased demand on digital health and remote interaction caused by the COVID-19 pandemic.

2.2. Saudi Arabia's National DT Ecosystem: NPHIES, Sehaty, Unified Health Record

The Saudi Arabian national DT ecosystem has developed at a swift pace to conform to the national Vision 2030 and the Health Sector Transformation Program, which has certain implications on the performance of health insurance. Recent literature and policy documents highlight three major elements: NPHIES, Sehaty, and the new emerging issue of Unified Health Record (UHR).

NPHIES, which is managed by the Council of Health Insurance (CHI) and other national digital agencies, will be an open digital exchange between insurance payers and providers of healthcare (Alnajjar, 2024). Regarding NPHIES, post-2020 policy documents and initial implementation reviews present it as a core infrastructure in standardising transactions in insurance; such as, verifying eligibility, submitting of e-claims, pre-authorisation and reimbursement processes (Aldhafeeri et al., 2024). The platform aims to minimise administrative complexity, automate claims adjudication, and fraud support detection and utilisation review using consolidated transactional data.

Sehaty

Sehaty is a nationally-focused patient-friendly digital health platform and mobile app which combines a number of services: the personal health information, the appointment booking, the access to vaccination records,

and, as more and more integrated systems have become accessible to insurance-related services (Alzghaibi, 2025). It also includes eligibility and essentially-coverage information. Al Harrasi et al. (2025) particularly centred on digital health adoption throughout and after the COVID-19, mention the role of Sehaty in scaling of the telemedicine, e-prescriptions, and vaccination scheduling, which indirectly influence the experience of insured people with the health system (Al Edreesi & Alrabaily, 2025).

United Health record initiative aims at unifying patient health data among providers into a longitudinal record that may be accessed by any authorised stakeholder. Although the UHR itself is still in its infancy, national plans and recent technical texts have highlighted its key strategic role in clinical care and under health insurance (Finnegan & Mountford, 2025). To payers, an operational UHR can guarantee longitudinal clinical histories would be more accurately assessed and underwritten and improved population health management and preventive care analytics that have the potential to reduce the long-term costs.

The literature published after 2020 also warns that the achievement of such benefits is reliant on the effective data governance, privacy and consent models, and solid interoperability between the UHR and provider systems and with NPHIES (Williams et al., 2025). Issues of data fragmentation, inconsistent data entry habits and the necessity of having standardised terminologies are also raised so that the information provided by different providers cannot only be comparable but also analytically effective (Patel et al., 2025).

2.3. A Review Of Global And Regional Findings

Studies post-2020 in the global and regional setting (as represented by GCC, and other middle-income, reform-based health systems) give a deeper insights into the advantages and downsides of DT in health insurance. Several reports record the decreasing processing time and administrative expenses after digitalisation of claims and eligibility processes. Insurance organisations through adoption of e-claims, automated adjudication and integrated provider interfaces were associated with a reduction in reimbursements, a higher count of data entry, and decline of incomplete documentation (Chen et al., 2025). Preliminary results of research into GCCs indicate that e-claims systems conformed to minimise transaction costs to insurers and providers, but a significant portion of the literature remains in grey information and sectoral

publications as opposed to empirical journal publication (Mwangi et al., 2024).

Yeddula (2025)'s findings are similar to Mwangi et al. (2024) since it supports the notion that when properly governed and designed, digital systems enhance the completeness, timeliness and traceability of data. Studies conducted in international perspective such as Chen et al. (2021) also emphasise on increased accuracy of coding, decreased duplicate claims and increased auditability. To regulators, the collective digital claims data offer new possibilities of tracking the utilisation patterns, identifying anomalies and policy-making (e.g., the design of benefits, price negotiations). Regulators in a few countries have used the e contributions of the e-claims to create real time dashboards of cost dynamics and service utilisation in specific geographical areas or types of provider.

The COVID-19 era enhanced the utilisation of digital communication (apps, portals, telehealth), and some of the 2020-onwards rated studies indicate that beneficiaries have an increased appreciation of the digital access of such services, including policy information, status of claims tracking, teleconsultation and electronic prescriptions (Sharma et al., 2023). These services enhance the convenience, minimise travel and waiting time, and have the potential to enhance the perceived equity and transparency in management of insurance procedures.

Digital infrastructure would increase access; however, it might undermine disparities. According to global studies, older people, less educated and less income and rural people might not have access to digital insurance services because of inadequate or insufficient digital literacy or connectivity (Duanmu et al., 2025).

An important point to make in terms of the current reviews is a critique of the relative scarcity of rigorous, multi-stakeholder assessments, in spite of extensive rhetoric about the transformative effects of DT (Mehak & Jafree, 2025). Numerous DT programs are characterised with regard to their level of technical activity or the stage of implementation, although less research involves the purpose of striking and credible quantitative data on the relationship between DT and enhanced health results, financial security or systemic productivity. When such evidence is present, it is either context specific and can not be readily generalised.

These findings globally and regionally are very relevant to Saudi Arabia. They indicate that the effectiveness of projects like NPHIES and Sehaty cannot just be presupposed by the mere process of technical implementation, but

all the stakeholders should be cleverly considered, interoperability, governance, and equity.

2.4. Identification of the Research Gap

Although national documents and technical reports contain a descriptive sequence of the implementation of NPHIES, Sehaty and other services in the framework of DTs, the peer research literature profiles a severe dearth of empirical studies systematically describing the experiences and perceptions of various stakeholder groups -healthcare professionals, works by the insurance company and patients/beneficiaries- in Saudi Arabia. Majority of the analysis available seems to be either policy level accounts or one-stakeholder (e.g., provider IT views), or high level insurer preparedness (e.g., high level insurer preparedness). In turn, the comprehensive knowledge of the DT platforms, their utilisation and acceptance by various stakeholders within the environment of the Saudi health insurance are not documented in the academic literature with much detail.

Despite the core policy documents claiming the effectiveness of DT to enhance the efficiency of operations, data quality and customer experience, few systematic measurements of the outcome were made by viewing the issue through the lens of end users in Saudi Arabia. The research used tends to use high level measures (e.g. number of e-claims processed, number of app downloads) instead of validated scales which determine user satisfaction, perceived efficiency increase, reduction of errors or improvements in patient experience. Literature does not provide solid, large-scale survey data that measure perceived impact of key dimensions of interest to health insurance, which are claims processing, interoperability, transparency and beneficiary engagement.

2.5 Conceptual Framework

Figure 1 shows the independent (DT awareness, DT usage, and Perceived Challenges) and the dependent variables (Perceived Impact and Perceived Benefits)

3. Methodology

3.1. Research Design

The current research used a descriptive, cross-sectional, quantitative survey as it was necessary to get the views of frontline stakeholders on the concept of digital transformation (DT) in the Saudi health-insurance sector at a single time.

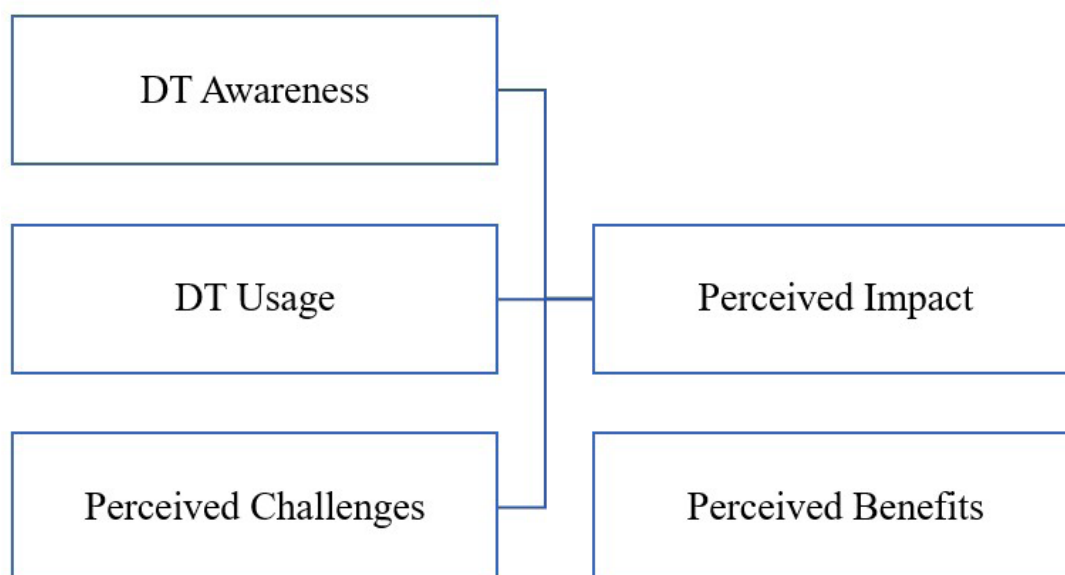


Figure 1 Conceptual Framework

3.2. Population & Sampling

Stratified purposive sampling was used to sample the professional strata to achieve sufficient coverage of roles and sector and the snowball and convenience sampling was applied to sample out a wide, heterogeneous sample of patients/beneficiaries. The size of the target sample used was at least 150 respondents in each stratum and 5 interview participants.

3.3. Data Collection

Both questionnaire and interviews were administered was done through survey in order to cover a wide geographical area and minimise logistical limitations. The surveys were to be distributed by the gatekeepers in hospitals and insurers, to respective staff within the organisations and in public for patients and beneficiaries. Questionnaire was developed by considering the literature about DT regarding health and insurance procedures. It included the demographics section, the awareness and usage of DT, the perceived benefits section, the perceived challenges section, and the perceived impact section, with the last three areas that were measured on a 5-point Likert scale. Items dealt with platforms like NPHIES, Sehaty, operational efficiency, data quality and customer experience.

Interview pre-tested on the representatives of each stratum to determine the clarity and relevance, and further modifications were conducted consequently. Cronbach alpha was used to determine the internal consistency of the scales

3.5. Data Analysis

Statistical software SPSS version 22 was used to analyse quantitative data. The descriptive statistics (frequencies, percentages, means, and standard deviations) were used to describe the characteristics and the main DT indicators of the respondents. Inferential tests were used to evaluate the difference and correlation among groups. $P < 0.05/ 0.01$ is considered significant value when reporting results. ANOVA and independent-samples -tests were used to compare the mean scores regarding awareness, perceived benefits, challenges and impact between stakeholder groups and types of institutions (public and private). The qualitative responses to the open-ended questions were imported into the analysis program and were coded inductively and underwent thematic analysis to arrive at recurring themes, circumstances, and recommendations.

4. Results

Quantitative Results

Reliability statistics

In Table 1, the internal consistency reliability of all five constructs was exemplary. Cronbach alpha coefficients were of the order of 0.886 which are significantly larger than the traditional level of .70. The six item scales of DT Awareness, DT Usage, Perceived Challenges, Perceived Benefits, and Perceived Impact reveal that the scales were consistently found to measure their constructs at a high degree of precision and reliability across the respondents.

Table 1: Reliability Statistics

Reliability Statistics		
	Cronbach's Alpha	N of Items
Perceived Impact	.894	6
Perceived Benefits	.895	6
Perceived Challenges	.904	6
DT Usage	.886	6
DT Awareness	.898	6

Demographic analysis

Table 2: Demographics

Demographics					
		Frequency	%	Valid %	Cumulative %
Age	18-24 years	54	35.8	36.0	36.0
	25-31 years	42	27.8	28.0	64.0
	32-40 years	54	35.8	36.0	100.0
	Total	150	99.3	100.0	
Gender	Male	101	66.9	67.3	67.3
	Female	49	32.5	32.7	100.0
	Total	150	99.3	100.0	
Experience	3 years	55	36.4	36.7	36.7
	5 years	52	34.4	34.7	71.3
	8 years	43	28.5	28.7	100.0
	Total	150	99.3	100.0	
Sector	Public	103	68.2	68.2	68.9
	Private	47	31.1	31.1	100.0
	Total	151	100.0	100.0	

In Table 2, the sample size (N = 150) is evenly distributed in terms of age, 36 % of the respondents aged 18-24, and 32-40, with 28 % of them between 25-31. Men make 67.3% of the respondents. The experience is also evenly spread: 36.7% have three years of experience, 34.7% have an experience of five years, and 28.7% have a minimum of eight years of experience. The majority portion (68.2) of the cohort is representative of the public sector, whereas the private sector is present in 31.1. This has a massive workforce of males that fit into the young-to-mid-career range, with a wide range of experience levels, that is mostly located in the public healthcare organisations- this is the existing system in the health insurance ecosystem in Saudi Arabia.

Descriptive Statistics

In Table 3, all five constructs are characterised with low-to-moderate mean scores (between 2.28 and 2.34 in a 5-point scale), meaning that they have lower perceptions that are positioned below the midpoint of the dimensions of digital transformation. This consistency is particularly important: the stakeholders report relatively low rates of having heard of digital transformation, using it, perceived advantages, obstacles, and the overall effect. Standard deviations (0.857-0.908) indicate that there is moderate variation indicating diversity of experiences within the sample and not agreement. Notably, the Perceived Challenges construct is also the most variable (SD = 0.908), meaning stakeholders have a heterogeneous implementation barrier.

Table 3: Descriptive Statistics

Descriptive Statistics						
	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
DT Awareness	150	1.0	4.8	2.283	.0722	.8842
DT Usage	150	1.2	5.0	2.343	.0700	.8571
Perceived Challenges	150	1.0	5.0	2.283	.0742	.9082
Perceived Benefits	150	1.2	5.0	2.340	.0720	.8823
Perceived Impact	150	1.2	4.8	2.340	.0725	.8880

Minor difference between the average values (the difference is 0.06) suggests that there is one regular pattern of restrained interaction and influence in all dimensions of digital-transformation. This uniformity is worrying, as it implies that frontline stakeholders do not realise increased awareness, adoption, and tangible benefit, despite the

deployment of digital infrastructure (NPHIES, Sehaty), and the perceived challenges rank with the same moderation rates as the perceived benefits.

Correlation

Table 4: Correlation

Correlations						
		DT Awareness	DT Usage	Perceived Challenges	Perceived Benefits	Perceived Impact
DT Awareness	Pearson Correlation	1	.847**	.825**	.852**	.833**
	Sig. (2-tailed)		.000	.000	.000	.000
DT Usage	Pearson Correlation	.847**	1	.851**	.794**	.817**
	Sig. (2-tailed)	.000		.000	.000	.000
Perceived Challenges	Pearson Correlation	.825**	.851**	1	.828**	.812**
	Sig. (2-tailed)	.000	.000		.000	.000
Perceived Benefits	Pearson Correlation	.852**	.794**	.828**	1	.793**
	Sig. (2-tailed)	.000	.000	.000		.000
Perceived Impact	Pearson Correlation	.833**	.817**	.812**	.793**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

In Table 4, the correlation among the five constructs is very very high with Pearson coefficients of between .794 and .852 (all p = 0.001) hence proving the presence of statistically significant and material correlations. Such results require attentive consideration in context of adoption of digital transformation. The correlations between DT Awareness and Perceived Benefits (r =.852) and DT Usage (r =.847) are the

strongest, indicating that the awareness of the digital platforms is more often associated with the sphere of their usage than with the acknowledgment of the benefits. This result is in line with the technology acceptance theories where awareness comes before significant interactions. In addition, the Perceived Challenges has positive correlations with all other variables (r =.812-851), which indicate that it is the opposite of the expectation.

Hypothetically, challenges may be projected to have negative relationships with benefits and impact. However, this trend implies that the more informed and actively involved stakeholders of the DT platforms are, the more aware they are of implementation obstacles, and it is actually the experience of learning, not confrontation. The stakeholders who are more a part of the system are aware of the opportunities and impediments better than the peripheral users.

The consistently high intercorrelations ($r > .79$) create the issue of methodological concerns in terms of construct discriminant-validity. Such strong relationships are

statistically significant, but can be a point of conceptual overlap or common measurement error, and so the perspective is that such dimensions are actually lived as parts of a single experience of DT and are not autonomous concepts, just as duration and expertise are. Such a holistic perception pattern corresponds to the interwoven nature of digital transformation, where awareness, usage, challenges, benefits and impact can be viewed as an interdependent system and not as independent phenomena.

Independent T-Test

Table 5: Independent Samples Test

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper	
DT Awareness	Equal variances assumed	250.724	.000	-8.865	147	.000	-1.1293	.1274	-1.3811	-.8775
	Equal variances not assumed			-6.358	48.754	.000	-1.1293	.1776	-1.4863	-.7723
DT Usage	Equal variances assumed	253.869	.000	-7.621	147	.000	-.9873	.1296	-1.2433	-.7312
	Equal variances not assumed			-5.417	48.259	.000	-.9873	.1822	-1.3536	-.6209
Perceived Challenges	Equal variances assumed	319.572	.000	-6.106	147	.000	-.8840	.1448	-1.1701	-.5979
	Equal variances not assumed			-4.366	48.577	.000	-.8840	.2025	-1.2910	-.4770

In Table 5, The independent samples t -test shows that the difference between healthcare professionals working in the public sector and the one in the private sector are statistically significant and substantively large in the three constructs investigated (all p less than .001). The private-sector respondents always gave higher scores

as opposed to the respondents in the public-sector. The test of equality of variances given by Levene discloses serious violations ($F = 250.724319.572$ all p 0.001), which shows that the distribution of variances are not equal among the sectors. The Welch-corrected statistics that would not show equal variances, thus, give more credible estimates.

The strongest sectoral disparity is Digital Transformation (DT) Awareness (Mean Difference = -1.13, 95% interquartile [-1.49-0.77], $t(48.754) = -6.358, p = .001$). The 1.13 point difference (out of 5 points) is almost a quarter of the scale range, which is a substantively significant difference that may indicate that there is an impressive difference in the knowledge of digital platforms like NPHIES and Sehaty that exists between the professionals in the private sector. The comparable pattern is observed in the DT Usage (MD = -0.99, 95% (-1.35, -0.62), $t(48.259) = -5.417, p = 0.001$) meaning that in the case of the private facilities technology infrastructure and digital maturity are likely to be stronger. Perceived Challenges take this direction in a somewhat

paradoxical way (MD -1.29 -0.48) ($t(48.577) = -4.366, p = .001$). Experiments with a higher level of awareness and usage find more challenges to why in the private-sector, though these barriers are likely to be considered more experientially and are unlikely to be viewed as a source of resistance. This observation is consistent with previous correlation findings: increased engagement translates to enhanced understanding of systemic barriers, such as interoperability opportunities, integration challenges and workflow interruptions.

Regression
Perceived Benefits

Table 6: Model Summary

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.881a	.776	.772	.4216	.776	168.791	3	146	.000

The regression model in Table 6, has a higher explanatory power, with the three independent variables (DT Awareness, DT Usage, Perceived Challenges) explaining 77.6% of the variance in Perceived Benefits ($R^2 = .776$, Adjusted $R^2 = .772$). This remarkably high R^2 is a sign that the model approximated four-fifths of the variation in the perceptions of the stakeholders regarding

the advantage of DT. F-test ($F(3,146) = 168.791, p = .001$) indicates that the overall fit of the model is very significant. The fact that the difference between the R^2 and Adjusted R^2 is negligible (.004) points to a strong generalizability outside of the current sample, which is to say that the predictive relationships are not fixed in the current sample.

Table 7: Coefficients

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	DT Awareness	.501	.079	.502	6.326	.000
	DT Usage	.061	.088	.060	.699	.486
	Perceived Challenges	.353	.078	.363	4.528	.000

In Table 7, the strongest predictor (b 0.502, t 6.326, p 0.001) is DT Awareness, which means that Perceived Benefits increase on average by 0.50 units when all other variables are held constant. This is a significant influence reiterating that, knowledge comes first before value recognition. The second predictor (b = .363, t 4.528, p 0.001) is Perceived Challenges, which is a theoretically fascinating

finding. The experience of difficulties, contrary to expectation, has a positive predictive value of benefit recognition; indicating that active users who overcome the barriers to implementation gain an in-depth, experiential experience of the value of DT. Using DT is non-significant (b = .060, t = .699, p = .486), which is strange; it means that the frequency of actual usage is not a significant predictor of benefit perception

when awareness and challenge experience are factored, *Perceived Impact* which may be due to multicollinearity.

Table 8: Model Summary (Perceived Impact)

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.869a	.755	.750	.4436	.755	150.339	3	146	.000

In Table 8, Perceived Impact regression model shows that the three predictors explain a large percentage of variance with the three predictors (R² = 0.755) explaining 75.5 per cent of the variance (Adjusted R² = 0.750). Such a large R² implies that the combination of DT Awareness, DT Usage, and Perceived Challenges explains a significant portion of the variance in the level of perceptions of the stakeholders regarding the organisational and operational

impact of DT. Strong overall model fit is ensured by the exceptionally high F -1 - statistic (F (3, 146) = 150.339, p = 001). The insignificant value of the difference between R² and Adjusted R² (.005) indicates that the model is very stable and can be generalised to wider populations, thus these predictive correlations will be the same in other larger populations than this sample.

Table 9: Coefficients (Perceived Impact)

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.218	.107		2.026	.045
	DT Awareness	.401	.083	.399	4.814	.000
	DT Usage	.253	.093	.244	2.733	.007
	Perceived Challenges	.269	.082	.275	3.279	.001

In Table 9, significant predictor is DT Awareness (b = .399, t = 4.814, p = .001), which suggests that initial knowledge can influence impact perceptions to a great extent. Notably, DT Usage has become a relevant predictor (b = -.244, t = -2.733, p = .007), which is not the case in the Benefits model, and indicates actual platform usage is an independent predictor of perceived operational implications on efficiency, data quality and customer experience in relation to DT. Perceived Challenges retains its importance (b = .275, t = 3.279, p = .001), which supports the counterintuitive trend: the perceived implementation barriers have a positive influence on the level of impact recognition. This observation implies that stakeholders with an intense interest in issues will have an empirically based view of reality in terms of impediments and opportunities to change. The large constant term (B = .218, p = .045) shows that there is an independent perception related to the effect of policy-level narratives or Vision 2030 talk that

shape the perceptions even of stakeholders who are not so engaged.

Qualitative results

Thematic analysis

Theme 1: Reality Gap Implementation in Digital Infrastructure

This theme finds a lack of congruence between digital aspirations at the policy level and operational realities at the ground level. Frontline stakeholders still face endemic issues of technical and integration problems defeating the efficiencies planned by digital transformation despite the heavy investment of platforms like NPHIES and Sehaty.

“NPHIES platform is designed to reduce the complexity of administration but has only covered a primary part in implementation with transitional issues: more initial issues with systems learning curves, interface and integration

with the already existing hospital information systems.”
“Providers and payers normally use non-homogeneous hospital information systems, claims platforms and legacy databases which are not wholly interoperable. This will require data entry to be done twice and usually a workaround to reconcile and incorporate the data manually”.

A basic contradiction veiling the literature is that being technologically sophisticated does not always result in operational enhancement. The very break-up of legacy systems creates workarounds, which negate the point of automation, and smaller facilities have an unfair share of integration costs. The fact that standardisation is given a focus by NPHIES is derailed by the fact that interoperability does not only require technical standards, but also semantic consistency and strong governance schemes. As such, the platform implementation in Saudi Arabia is potentially less digital events, yet the integration of the ecosystem is vastly underestimated.

Implementation-reality gap proves that whether to implement digital infrastructure is only technologically achievable, but the key here is to take the interoperability challenges in the system and inspire fairly equal preparation amid the various institutional environments.

Theme 2: Deficits in Organisational and Human Change Management

The theme highlights that, as opposed to thinking solely in terms of technological capability, the success of digital transformation (DT) is inherently conditional upon consideration of the human factors, including the digital literacy, sufficient training, resistance to change, and workforce engagement. The human dimension is thus the key factor in the outcome of digital tools in value development or more burdening ones.

“Clinical and administrative personnel resist DT initiatives due to the feeling that they are imposing more workload, autonomy is being stolen, monitoring fear and they are not being trained.”

“Transformation of e-claims or new DT platforms normally tend to initially restrain the process due to training its employees on new interfaces and workflow adaptations. Change fatigue and non-involvement of direct users in system design are commonly cited reasons of dissatisfaction and partial adoption.”

A consistent trend in literature is that DT implementations focus more on the technical implementation than user-friendly design and adequate change management. This do not seem to be because of technophobia but rather because

frontline personnel have real fears in the form of workload, insufficient training and lack of participation in the design process. The emphasis of change fatigue shows that there is a cumulative effect of repetitive implementations without proper support infrastructure. Notably, the lack of engagement in system design, by stakeholders, creates tools, which, though technically sound, may be practically incapable of use thus being an exemplar of top-down approach, which lacks the tacit knowledge of end-users. Thus, the noted gaps in the human and organizational potential reveal that technological solutions without other corresponding investments in training, participatory design and workflow integration come at a cost of being opposing instead of complying to the needs of the same stakeholders that they are expected to attend to.

Theme 3: Equity Disparities within Digital Health Services

The theme concerns the possibility of DT increasing healthcare inequities inadvertently by creating disparities grounded on digital literacy, connectivity, age, and socioeconomic background. The potential emergence of a two-level system threatens the inclusion of health goals that are fundamental to Vision 2030.

“The digital efforts can expand the access, however, it might also deepen the existing differences. According to the world-focused research, it is observed that the elderly population, poor people, and people living in rural areas will probably not receive digital-based insurance coverage because of the lack of required digital literacy or access to the internet.”

“Strategies offered by DTC operating with the aim of securing the efficiency of back-offices and ignoring the pro-user front-end experiences are destined to further usher in a digital divide in provision of insurance-related services.”

The critical thinking is that there is an appalling paradox to the literature: technologies that should create a better accessibility, in reality, may strengthen cinched inequalities. The focus on efficiency optimisation among insurers and providers overlooks the needs of vulnerable groups that are not digital literate or do not have the digital infrastructure to work through complicated websites. The creation of a stratified system through the setting of a line between digitally savvy beneficiaries who enjoy faster and more open interactions and marginalised groups goes against the idealism of universal healthcare. The presence of mobile applications and digital portals is already based on the assumption of basic technological access and

literacy that many members of the population, specifically, older people and rural communities, lack.

With no explicit emphasis on equity-based design, inclusive training programs, and comparable access options, the health insurance DT of Saudi Arabia is at risk of egalitarian systems to accord to those who are already advantaged, and increasing the marginalisation of the vulnerable demographics.

5. Discussion

The results of this research support and further confirm the literature that digital transformation in health insurance is not a singular technology upgrade, but is a multifaceted socio-organisational process that is determined by human behaviours, institutional preparedness, and regulatory environment. Even though the previous conceptual efforts have conceptualised the idea of digital transformation as a contact among automation, interoperability, analytics, and customer experience (Hameed et al., 2024), the present outcomes reveal that the frontline stakeholders do not regard these dimensions as distinct entities. Rather, awareness, usage, perceived obstacles, advantages, and impact represent an experience tightly-linked construct as indicated by the high levels of correlation that have been present in all five dimensions that were measured.

This is an empirical pattern that has a critical extension to technology-acceptance-based explanations that are often cited in the literature. Though the awareness and perceived usefulness are well-known antecedents of adoption as outlined in Tsai et al. (2020), the current data suggest that both positive redoubling of awareness and use are coincidentally correlated with the recognition of challenges but not with their mitigation. This is in opposition to linear adoption patterns implied in the more policy-focused accounts of Saudi digital health change with active involvement leads to more critical and more realistic assessment of systems constraints, as opposed to unconditioned support (Renner-Micah, 2024).

The positive correlation between the perceived challenges and the perceived benefits and perceived impact is especially interesting. Challenges are not an obstacle but instead seem to be a sign of the depth of experience. The more stakeholders engage and interact with systems like NPHIES and Sehaty, the better they would realise the potential of value-creation and structural limitations. This observation concurs with socio-technological views that underscore that technology application reveals

organisational tensions that cannot be realised at the policy or managerial scale (Finnegan 25 and Mountford, 25). It also questions the research that holds that the success of a system is measured by the volume of transactions or the degree of automation reported in multiple regional e-claims reviews (Mwangi et al., 2024; Yeddula, 2025).

In terms of national-systems, the findings are, to some extent, consistent with the assertions presented in the Saudi and regional literature with regards to the strategic alignment of platforms like NPHIES and Sehaty with models of interoperability-based reforms (Alnajjar, 2024). Nevertheless, the low average scores in the awareness, usage, benefits, and impact show that macro-level digital preparedness does not necessarily result in micro-level value. The identified finding can be discussed as the one in line with the international critiques according to which interoperability standards and medical technical infrastructure are not enough, and they should be accompanied by specific investments in the redesign of workflows, semantic alignment, and institutional governance (Martens et al., 2024).

The qualitative results also explain this gap in implementation. Although the insurance transactions were formally standardised with the help of NPHIES, the respondents still added that there were frequent workarounds, and data entry was duplicated and there was a lack of full integration with the existing hospital information systems. Those findings echo the caution provided in post-2020 literature those efforts counterproductively weaken the comprehensiveness of interoperability initiatives by taking inefficiencies into the digital realm (Patel et al., 2025). Notably, the analysis shows that these problems are not only technical, but they are organisational that manifest themselves in disproportional institutional readiness and dependency on legacy-systems between the public and the private structures.

The identified sectoral variations in awareness, use, and perceived difficulties become empirical evidence that the results of digital-transformation are determined by the organisational maturity and resource base (Al-Kahtani et al., 2022). The respondents in the private-sector domain had less critical-assessment but also had more awareness of constraints, which supports this interpretation of experience constituting critical assessment as opposed to optimism. The discovery adds a twist to the current Saudi-centric literature that depicts the digital uptake by the private-sector mainly as a success storey, without regularly considering the related operation-induced stress

or change exhaustion (Sheerah et al., 2024).

The research is also relevant to the existing literature on customer experience in digital health insurance because it shows the stakeholders that operational efficiency, data quality, and user experience are cognitively inseparable. Though such outcomes are typically studied as analytically independent as in Carini et al. (2021), the current results indicate that frontline users consider digital transformation as a whole. The system is not seen as effective in the case it is technically reliable and disrupts workflow or it is not properly trained, no matter how good it is in terms of administrative performance. This understanding is an indictment of the evaluation paradigms which give administrative measures a higher priority than experiential measures.

Regulatory wise, the findings criticise the implicit assumption made in some national policy documents that standardisation is transformation. Although NPHIES has evidently enhanced the quality of transactional uniformity, the evidence shows that the regulatory success is limited by the lack of role specific training, communication as well as the feedbacks between the regulators and the end users. This underlines more universal arguments of governance that digital health regulation should transform into less compliance-oriented enforcement into more adaptive and learning-oriented models that considers practical feedback of use (Aldhafeeri et al., 2024).

Its implications on hospitals and insurers are also very important. The findings indicate that homogenous digital implementations can increase organisational tension in which work flows and role assignments and support mechanisms are not transitioned simultaneously. This is consistent with global data that digital transformation has been successfully implemented when framed in larger organisational change projects as opposed to its being an IT project (Chen et al., 2021). The Saudi experience is therefore similar to the worldwide trend where initial digital reforms are concerned with the deployment of the systems but subsequent phases have to be concerned with learning, leadership, and confidence in the processes of automation to unleash long term value.

6. Conclusion & Recommendations

6.1. Summary of Conclusions

The present research concludes that the process of digital transformation of the Saudi Arabian health insurance ecosystem moves forward, but distribution remains unequal, and the consequences of changes are

limited by non-technical conditions. The alignment between national platforms and regulatory frameworks and Vision 2030 is quite high, but the use of these platforms and regulatory tools converting into the consistent values frontline is varying among different institutions and groups of stakeholders. Digital tools are typically viewed as helpful and their potential is not fully exploited because of differences in awareness and skills and lack of organisational preparation. Such results support the opinion that digital transformation is essentially a socio-technical process, where the human and institutional forces are as powerful as the technological infrastructure.

6.2. Strategic Recommendations

On the basis of these findings, some strategic suggestions are given. To begin with, there must be a national digital transformation literacy and skills-building program created to cover the healthcare and insurance workforce. The programs in such cases must be role specific, ongoing, and so entrenched in the professional developmental tracks as to build confidence, diminish resistance, and normalise digital practises throughout the system. Second, something formalised and unbroken feedback mechanism must exist between platform developers and end-users. The integration of frontline experience into a continuous process of platform improvements would advance usability, build trusting relationships, and help us to adjust to governance of the national digital systems more flexibly. Third, insurance companies are to be advised to build superior capabilities in data analytics and to enter into collaborations with health-technology start-ups. Such partnerships will be able to speed up innovation, assist in evidence-based decision-making, and match insurer resources with the wider transition to value-based and data-driven care.

6.3. Suggestions for Future Research

Longitudinal designs should be used to study how digital transformation changes over time as digital platforms mature and organisational learning becomes more entrenched in the future research. Moreover, case studies of effective digital change management, offered in greater detail, would provide useful details regarding leadership, governance, and contextual enablers. This type of research would augment the evidence pool needed to make sure that the digital transformation of Saudi health insurance not only ensures efficiency and sustainability, but inclusiveness and sustainability of the system over

time.

Acknowledgements

References

- Adegoke, K., Adegoke, A., Dawodu, D., Bayowa, A., & Adekoya, A. (2025). Interoperability in digital healthcare: Enhancing consumer health and transforming care systems.
- Adeniyi, A. O., Arowoogun, J. O., Chidi, R., Okolo, C. A., & Babawarun, O. (2024). The impact of electronic health records on patient care and outcomes: A comprehensive review. *World Journal of Advanced Research and Reviews*, 21(2), 1446-1455.
- Al-Kahtani, N., Alrawiai, S., Al-Zahrani, B. M., Abumadani, R. A., Aljaffary, A., Hariri, B., Alissa, K., Alakrawi, Z., & Alumran, A. (2022). Digital health transformation in Saudi Arabia: A cross-sectional analysis using Healthcare Information and Management Systems Society's digital health indicators. *Digital Health*, 8, 20552076221117742.
- Al Edreesi, T., & Alrabaily, H. (2025). Factors Affecting the Usage of Sehhaty Telehealth Services Among Young Adults in Riyadh. *Journal of Health Informatics in Developing Countries*, 19(02).
- Al Harrasi, A., Al-Mahrouqi, T., Al-Alawi, M., Al Lawati, A., Al Fahdi, A., Al Zaabi, A., & Al Sinawi, H. (2025). Arabic Mental Health Apps: A Narrative Review of Therapeutic and Engagement Features. *Saudi Journal of Medicine & Medical Sciences*, 13(4), 253-259.
- Alagarsamy, S., & Mehroliya, S. (2023). Exploring chatbot trust: Antecedents and behavioural outcomes. *Heliyon*, 9(5).
- Aldhafeeri, M. S., Alharbi, A. F. T., Aldhafeeri, B. H. M., Aldhafeeri, F. H., Alshammari, S. S., & Alshammari, M. H. (2024). The Role of Health Assistants in Implementing Saudi Vision 2030 Healthcare Goals: A Systematic Review of Current Evidence. *Journal of International Crisis and Risk Communication Research*, 7(S9), 2640.
- Aldogher, A., & Halim, Y. T. (2025). Customer Engagement in Digital Health Transformation as Strategic Change: Evidence from Saudi Arabia's Vision 2030. *Sustainability*, 17(18), 8468.
- Alfalsh, A. A., Abubakar, A. A., Al-Mamary, Y. H., Goail, M. M., Al-Samhi, N. M., Salisu, I., & Alhaidan, H. (2025). Bridging the digital divide: empowering Saudi Arabia's future through psychological resilience and digital literacy. *Humanities and Social Sciences Communications*, 12(1), 1-16.
- Alnajjar, M. I. (2024). The Impact of Unified Medical Insurance System Implementation (Nphies) on Healthcare Service Quality: Applied Research Case Study in Arrawdha General Hospital Dammam, Saudi Arabia. In.
- Alsadaan, N., Ramadan, O. M. E., & Alqahtani, M. (2024). From incivility to outcomes: tracing the effects of nursing incivility on nurse well-being, patient engagement, and health outcomes. *BMC nursing*, 23(1), 325.
- Alshehri, A. A., & Abduljawad, A. A. (2025). Impact of the Saudi Health Sector Transformation Program (SHSTP): A Mixed-Methods Evaluation of Patient-Centered Care and Digital Health Adoption. *Healthcare*,
- Alzahrani, A. A., Pavlova, M., Alsubahi, N., Ahmad, A. e., & Groot, W. (2025). Impact of the Cooperative Health Insurance System in Saudi Arabia on Universal Health Coverage—A Systematic Literature Review. *Healthcare*,
- Alzghaibi, H. (2025). Barriers to the utilization of the Sehatty mobile health application in Saudi Arabia: a cross-sectional survey of non-healthcare users. *Frontiers in Medicine*, 12, 1554078.
- Badreldin, H. A., Al-jedai, A., Alghnam, S., Nakshabandi, Z., Alharbi, M., Alzahrani, A., Alqadri, H., Almodeiheem, H., Alhazmi, R., & Althumairi, A. (2025). Sustainability and Resilience in the Saudi Arabian Health System.
- Bin Dehaish, S., Bin Marouq, A., Almalki, A., Yousef, M., Almuhawaf, F., Hagr, A., Mony, J., Albaqeyah, M., Alferaih, H., & Alqahtani, H. (2025). Cochlear Implants and Adult Patient Experiences, Adaptation and Challenges: A Survey. *Audiology Research*, 15(6), 166.

Carini, E., Villani, L., Pezzullo, A. M., Gentili, A., Barbara, A., Ricciardi, W., & Boccia, S. (2021). The impact of digital patient portals on health outcomes, system efficiency, and patient attitudes: updated systematic literature review. *Journal of Medical Internet Research*, 23(9), e26189.

Chaturvedi, R., Pavithra, P., Prathiksha, S., & Selvakanmani, S. (2023). Robotic Process Automation (RPA) in Healthcare. *Int. Res. J. Adv. Sci. Hub*, 5, 229-235.

Chen, C.-L., Deng, Y.-Y., Tsaur, W.-J., Li, C.-T., Lee, C.-C., & Wu, C.-M. (2021). A traceable online insurance claims system based on blockchain and smart contract technology. *Sustainability*, 13(16), 9386.

Chen, J. G., Lai, H. X., Wong, S. M., Pan, T. L. T., Lim, E. L., & Liau, Z. Q. G. (2025). Outcomes of an Advanced Epic Personalization Course on Clinician Efficiency through Use of Electronic Medical Records: Retrospective Study. *JMIR Formative Research*, 9, e68491.

Duanmu, X., Yu, J., Yuan, X., & Zhang, X. (2025). How Does Digital Infrastructure Mitigate Urban–Rural Disparities? *Sustainability*, 17(4), 1561.

Elendu, C., Amaechi, D. C., Elendu, T. C., Jingwa, K. A., Okoye, O. K., Okah, M. J., Ladele, J. A., Farah, A. H., & Alimi, H. A. (2023). Ethical implications of AI and robotics in healthcare: A review. *Medicine*, 102(50), e36671.

Finnegan, H., & Mountford, N. (2025). 25 years of electronic health record implementation processes: scoping review. *Journal of Medical Internet Research*, 27, e60077.

Fitriani, Y. (2025). Customer Engagement in Human and Veterinary Healthcare Marketing: A Systematic Literature Review. *International Student Conference on Business, Education, Economics, Accounting, and Management (ISC-BEAM)*,

Hameed, K., Naha, R., & Hameed, F. (2024). Digital transformation for sustainable health and well-being: a review and future research directions. *Discover Sustainability*, 5(1), 104.

Khalifa, A., Mason, C. C., Garvin, J. H., Williams, M. S., Del Fiol, G., Jackson, B. R., Bleyl, S. B., & Huff, S. M. (2021). A qualitative investigation of biomedical informatics interoperability standards for genetic test reporting: benefits, challenges, and motivations from the testing laboratory's perspective. *Genetics in Medicine*, 23(11), 2178-2185.

Martens, E., Haase, H.-U., Mastella, G., Henkel, A., Spinner, C., Hahn, F., Zou, C., Fava Sanches, A., Allescher, J., & Heid, D. (2024). Smart hospital: achieving interoperability and raw data collection from medical devices in clinical routine. *Frontiers in Digital Health*, 6, 1341475.

Mehak, F., & Jafree, S. R. (2025). Bridging the digital divide: Predictors of positive attitudes and functional use of AI among university students in Pakistan. *Social Sciences Spectrum*, 4(1), 617-632.

Mwangi, G., Musembi, M., Kamau, J., & Obunga, F. (2024). Digital transformation strategy and performance of e-claims systems at National Health Insurance Fund, Kenya. *The Strategic Journal of Business & Change Management*, 11(2), 1616-1640.

Patel, S., Mezzoff, E. A., & Rust, L. (2025). Foundations of Clinical Informatics for Generalists: Exploring the History, Core Concepts, and Current State of Informatics in Healthcare. *Medical Clinics*.

Renner-Micah, A. (2024). Digital Transformation of Health Insurance Services in A Developing Country: An Institutional Theory Perspective University of Ghana].

Sharma, P., Jindal, R., & Borah, M. D. (2023). A review of smart contract-based platforms, applications, and challenges. *Cluster Computing*, 26(1), 395-421.

Sheerah, H. A., AlSalamah, S., AlSalamah, S. A., Lu, C.-T., Arafa, A., Zaatari, E., Alhomod, A., Pujari, S., & Labrique, A. (2024). The rise of virtual health care: transforming the health care landscape in the Kingdom of Saudi Arabia: a review article. *Telemedicine and e-Health*, 30(10), 2545-2554.

Tsai, C. H., Eghdam, A., Davoody, N., Wright, G., Flowerday, S., & Koch, S. (2020). Effects of electronic

health record implementation and barriers to adoption and use: a scoping review and qualitative analysis of the content. *Life*, 10(12), 327.

Williams, T. B., Bimali, M., Garza, M. Y., Parker, P., Paladino-Vaden, C., Seker, E., Crump, A., Rice, R., Prince, L., & Massey-Swindle, T. (2025). Sociotechnical Needs of Registered Nurses in the Heart Failure Hospitalizations of African American Patients: Cross-Sectional Study. *JMIR nursing*, 8(1), e75080.

Yeddula, H. V. R. (2025). Leveraging SharePoint Cloud for Modern Insurance Claim Management: A Technical Overview. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 11(1), 2275-2285.