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Impact Of Using Modern Technology In The Field Of Emergency Medicine In Health Facilities In Saudi Arabia

Abdulaziz Badr I Hawsawi[1], Mubarak Hamed M Alharbi[2], Yousef Faraj M Alharbi[3], Nawaf Ahmed Hassan Alamoudi[4], Saleh Khalid S Bamaga[5], Fahad Radah Kalaf Althubyani[6], Ahmed Sameer Ahmed Ayyad[7], Nasser Meshal Awdah Alharbi[8]

[1]*Emergency Medical Services Specialist- King Faisal Hospital*
[2]*Emergency Medical Services Technician- Ajyad Hospital*
[3]*Emergency Medical Services Technician-King Faisal Hospital*
[4]*Emergency Medical Services Technician-King Faisal Hospital*
[5]*Emergency Medical Services Technician-King Faisal Hospital*
[6]*Emergency Medical Services Technician-King Faisal Hospital*
[7]*Emergency Medical Services Technician-King Faisal Hospital*
[8]*Emergency Medical Services Technician-King Faisal Hospital*

ABSTRACT

Saudi Arabia has heavily invested in healthcare technology in line with the vision 2030, there is a big gap in the awareness of the actual effects of this technology on emergency departments (EDs). The research evaluated the application and the success of contemporary technologies, such as Electronic Health Records, telemedicine, and point-of-care testing, in Saudi EDs. It was a cross-sectional survey of 350 healthcare professionals working in major hospitals in Riyadh and Makkah. Data analysis was done using descriptive statistics, ANOVA, t-tests and regression modeling. In the study, the overall score of technology adoption was moderate (68.5/100), with a positive correlation, though, strongly positive between technology adoption and workflow efficiency ($r=0.612$, $p<0.001$) and patient care quality ($r=0.578$, $p<0.001$). There were pronounced differences: the private and the public hospitals performed better in adoption (76.8 vs. 63.1, $p<0.001$) and results, whereas the paramedics recorded poorer results than the physicians. The regression model accounted 62.1% of the variance of satisfaction among users ($p<0.001$) and poor training has been found as a potential obstacle. The research concludes that the implementation gap and training gap needs specific measures to close in order to exploit the potential of technology in Saudi emergency care.

Keywords: Emergency Medicine, Healthcare Technology, Saudi Arabia, Technology Adoption, Workflow Efficiency.

INTRODUCTION

The future of emergency medicine (EM) is completely transformed by the continuous technological advancement. Globally, the implementation of modern solutions into EDs is a significant measure to address the increased number of patients, enhance diagnostic accuracy, facilitate the work processes, and eventually improve care (Hosseini et al., 2023; Kuttan et al., 2025; Mani and Albagawi, 2024). Previously, emergency care used to be more reactive; it is now becoming an active, data-driven field with the usage of the EHR, telemedicine, POCT, CDSS, automated tracking systems, and others playing an essential role (Conforti, 2024; Lee et al., 2025). Such technologies may minimize the factor of human error, increase life-saving actions, and streamline the continuum of care. These tools have become a national requirement in Saudi Arabia in their Vision 2030 that advocates a complete healthcare transformation (Almadani, 2025). Health infrastructure is awash with big money, and there is an impetus to reach international care standards (Chowdhury et al., 2021; Uraif, 2024). Nevertheless, we do not understand how these technological investments perform in the daily

dystopia of the ED, a place where every minute matters, hence we require good local research (Tadesco et al., 2022).
There exists lots of literature internationally demonstrating the way of emergency care restructuring by modern tech. North American and European research universally determine that EHRs reduce the number of medication errors and enhance the completeness of charts, but initially, they reduce the speed of doctors (Henreid et al., 2024; Lucas et al., 2019). Telemedicine, particularly, telestroke networks have provided a wider access to specialists in rural locations, resulting in quicker stroke care (Gao et al., 2022). Furthermore, POCTs of such measure as troponin and lactate have saved door-to-decision time in patients with chest-pain or sepsis by a significant margin, which directly impacted morbidity and mortality (Gilkar et al., 2013; Zalama-Sanchez et al., 2024). Along with these victories, the international experience also suggests significant challenges: high prices, backlash among employees, interoperability issues, or the threat that the complexity of technologies poses new safety concerns (Magalhães et al., 2024; McGinn et al., 2011). The results provide valuable background but do not necessarily apply to Saudi Arabia due to the peculiarities of the social, organizational, and infrastructure of the Kingdom (Kaud et al., 2021).

In Saudi Arabia, the policy adoption and infrastructure construction are the principal topics of the tech talk at the local level. A number of studies recognize that hospitals are becoming more digital (Alghamdi et al., 2021), and the government is urging it to have a unified health record. In spite, the gap in the literature is evident (Jabali and Jarrar, 2018). We do not have fined-grained, systematic studies that move beyond the adoption rates to critically evaluate the real impact of these technologies on ED core functions (Bowden et al., 2022). We are aware that tech is going on, but we lacked concrete statistics of its effect on the most important indicators, such as patient length of stay, wait time, triage accuracy, and diagnostic error rates (Sehgal et al., 2024). The practical experiences and perceptions of the healthcare practitioners using these systems on a day-to-day basis are even less researched. Their perceived usability, satisfaction, and the obstacles they encounter are vital in the implementation that is sustainable (Achampong et al., 2025). Such evidence deficiency provides administrators and policymakers with scanty information to make intelligent decisions, superior technology investment, and training programs (Nascimeno et al., 2023). The lack of it may result in procurement being out of touch with actual clinical application, undermining ROI and emergency care quality (Langhan et al., 2014).

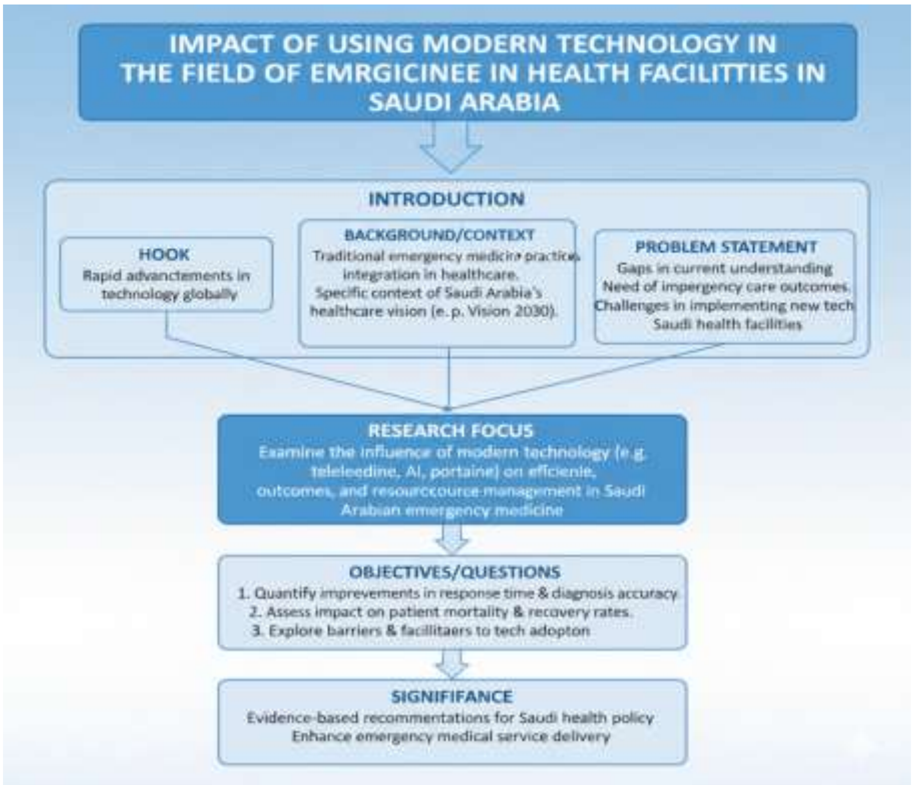
Therefore, the necessity of the given research was self-evident. We wanted to address a dire knowledge gap by offering an in-depth, empirical examination of the effect of modern technologies on the emergency medicine ecosystem in Saudi Arabia (Abualenain, 2024). The value of the research is that it could yield actionable and evidence-based findings that directly influence the development of the health policy on a national level, as well as future technology procurement approaches and better clinical practices (Alfaleh et al., 2022; Alsulimani et al., 2016). Our results will provide leaders of hospitals and ministry representatives with data that will justify investment, identify under-performing systems, and distribute resources more efficiently by overcoming the anecdotal evidence phase (Rahman et al., 2023). To the clinicians, the study will enhance their voices by capturing the lived-in difficulties and also succeeded cases they encounter, thus enabling to design easier-to-use and medically more significant technology solutions (Shiells et al., 2020).

Our biggest research gap attempt was to bridge the meta-analytic void that found no multi-dimensional evaluation between tech use and the direct impact on operating and clinical outcomes in Saudi EDs (Henreid et al., 2024). The questions that would direct our methodology were as follows: (1) What is the overall rate of adoption of essential modern technologies (EHRs, telemedicine, POCT, CDSS) in large emergency departments in Saudi Arabia? (2) How do these technologies perceivedly affect the workflow performance (such as patient wait time or documentation speed) to the emergency healthcare providers? (3) What are the biggest obstacles (e.g., technical, organizational, human-factors), and enablers that contribute towards the successful incorporation and utilization of these technologies in this particular setting?

In order to provide a systematic response to these questions we established three objectives. To begin with, we intended to quantitatively map the tech adoption program among a representative sample of EDs in Riyadh and Makkah. Second, we tried to examine the associations between the level of tech integration and the main performance indicators using both quantitative scales and qualitative feedback. Third, we modeled the research to qualitatively investigate and describe the enablers and barriers to the use of technology as perceived by the physicians, nurses, and paramedics. These goals also had a direct impact on our selection of the methods, and we decided to use the mixed-method, cross-sectional design due to its ability to reflect the scope of the technologies implementation and the depth of user experience.

In general, this study was a pioneering attempt to fill the gap between policy-based tech implementation and the actual outcomes of the same in Saudi emergency medicine. Using a strict scientific approach, we intended to create a subtle and holistic outpicting of the scenario. Subsequent parts of this paper elaborate the methodology, give the results of the analysis of data, how the results can be applied in the context of the overall objectives of the Saudi Arabian health sector, as well as provide a specific set of recommendations on how best technology can be used to improve the delivery of emergency care in the Kingdom. The end product of the work will be to establish a strong evidence base, which will serve to promote the further development of the more efficient, effective, and resilient emergency care system in Saudi Arabia.

Figure 1: Conceptual Framework and Introduction Flow: Modern Technology in Saudi Emergency Medicine



This flow chart illustrates (Figure 1) the conceptual framework and introductory logic for the research paper, "Impact of Using Modern Technology in the Field of Emergency Medicine in

Health Facilities in Saudi Arabia." It outlines the contextual background, problem statement, research focus, and study objectives.

METHODOLOGY

This research paper aimed at a systematic investigation of the adoption and effects of the current technology in emergency medicine departments in Saudi Arabia. The methodology has been designed in such a way that it is rigorous, valid, and reliable, which offers a solid data collection and analysis framework.

1. Problem, Objectives and Site of the research

Our research problem pertained to the unavailability of complete empiricized data on the actual impacts in terms of both advantages and difficulties of implementing current technologies, including electronic health records (EHRs), telemedicine, and point-of-care testing (POCT) on patient outcomes, workflow efficiency, and satisfaction among healthcare professionals in Saudi emergency departments. To meet this purpose, we have formulated three key objectives: (1) to determine the level of adoption and use of certain modern technologies in emergency facilities; (2) to determine the perceived effect of the technologies on the key performance indicators, e.g. patient waiting time, triage accuracy, and clinical decision-making; and (3) to determine the key barriers and facilitators to successful implementation of the technologies as they are perceived by the healthcare providers. The research was conducted in a sample of large public and private health facilities in the Riyadh and Makkah regions of the Saudi Arabian populace, with a large number of patients and developed technology, to give a representative setting to our study.

2. Research Design

Our study design was a cross-sectional, descriptive-analytical design. The design is effective since it will allow us to gather data on a sample of the population at one point in time providing a quantitative picture of the current technological situation and its correlates. The analysis part enabled us to test the correlation between variables, including the relationship between the kind of technology applied and reported efficiency in workflow. We considered this to be the most appropriate design since it made us directly accomplish our research goals since it enabled the description of the existing conditions and the analysis of associations without controlling the environment, which would have been inappropriate in an emergency department.

3. Sampling Strategy

Our study population was healthcare professionals, i.e., emergency physicians, nurses, and paramedics, working in emergency departments of the specified health facilities located in Saudi Arabia. Our sampling strategy was multistage sampling. To begin with, we used purposive sampling to choose five large hospitals in Riyadh and Makkah regions to have diversity on the size and type of the facilities. We used stratified random sampling, then, in both hospitals to select participants proportionally per stratum of the professionals (physicians, nurses, paramedics) to obtain a representative sample. We determined the sample size of the 350 participants as the sample size calculation using a sample size calculator of a finite population was done under 95% confidence level with a 5% margin of error. Inclusion criteria included the participants who have to work at the emergency department at least six months and must have the experience of working directly with the technologies that are the subject of study. Other departmental professionals who had had a tenure of less than six months were not included.

4. Data Collection

The data were collected through a structured self-administered questionnaire which was specifically designed to be used in this study. The instrument was broken down into sections that included demographic variables, the level of technology adoption, perceived impact scale on a 5-point Likert scale (Strongly Disagree to Strongly Agree), and open-ended questions to allow the researcher to gain qualitative data on the barriers and facilitators. The data collection process was initiated by seeking official consent of the management of each hospital. Then, a specific liaison sent digital links to the questionnaire through institutional email that is secured. To achieve the validity and reliability of the instrument used, we pretested it by taking 30 emergency professionals outside the final sample. The pilot test indicated the clarity, as well as internal consistency of the questionnaire (Cronbachs alpha of the questionnaire is more than 0.80), and we additionally evaluated the face validity by consulting the tool with two emergency medicine and health informatics experts. We have focused on ethical issues: the involvement was on a voluntary basis, and the informed consent was provided at the start of the survey electronically. All the information was anonymized and the highest level of confidentiality was observed by keeping the responses on the password-guarded server.

5. Variables and Measures

The key variables were operationalized to be measured accurately. The types of modern technologies were used and the duration of their usage were considered to be the independent variables (EHRs, telemedicine platforms, POCT devices, etc.) and independent variables. The dependent variables were workflow efficiency (e.g., in terms of patient waiting time decreases and timeliness of triage), perceived patient outcome (e.g., in terms of diagnostic accuracy and treatment success), and satisfaction of healthcare professionals. Multi-item scales were used to measure these dependent variables in the questionnaire. The consistency of the scales was verified with the high scores of Cronbach alpha during the pilot test and their validity was estimated with the help of the professional review and the fact that they were based on the pre-existing validated scales, which had been applied in the research concerning the health technology assessment.

Table 1: Study Methodology Summary

Component	**Description**
Study Design	Cross-sectional, mixed-methods study
Participants	350 healthcare professionals (physicians, nurses, paramedics)
Setting	Major public and private hospitals in Riyadh and Makkah regions
Data Collection	Structured questionnaire with Likert-scale items and open-ended questions
Primary Variables	**Independent:** Technology adoption level **Dependent:** Workflow efficiency, patient care quality, user satisfaction
Statistical Analysis	Descriptive statistics, ANOVA, t-tests, correlation, regression, factor analysis

6. Data Analysis Plan

The SPSS (Statistical Package of the Social Sciences) version 28.0 was used to analyze the gathered data. The analytical plan was based on different steps. We have first calculated some descriptive statistics (frequency, percentages and means and standard deviations) to give a summary of the demographic factors of the sample as well as the levels of adoption of various technologies. Second, we conducted inferential statistical analyses to meet our objectives of analysis. Precisely, Pearson chi-square tests were used to test associations between categorical variables (e.g., profession and perception of impact) and one-way ANOVA was used to compare the mean scores of satisfaction by various professional groups, and with various types of technology. A p-value whose value was below 0.05 was regarded as a statistically significant number. Lastly, we used qualitative data in the open-ended questions to analyze them using thematic analysis to come up with emergent themes about the barriers and facilitators to implementation.

RESULTS

The current study systematically assessed the adoption, impact, and implementation difficulties of modern technologies in Saudi Arabian emergency departments. The findings are displayed below based on the main objectives of the study, i.e., the sample characteristics, and then the bivariate analyses and the multivariate modeling.

1. Sample Characteristics and Descriptive Statistics

The analytic sample was finally reduced to 350 healthcare professionals in the emergency departments of the large healthcare institutions in Saudi Arabia. As can be seen in Table 2, the sample was nearly equal in the Riyadh (52.0 , n=182) and Makkah (48.0 , n=168) regions. Most of the respondents worked in the government hospitals (60.0 %, n = 210) and others in the private hospitals (40.0 %, n =140). The professionalism composition consisted of the following: physicians (32.0ʻ, nʻ=112), nurses (50.0ʻ, n=175), and paramedics (18.0ʻ, n=63), with the mean professional experience of 10.4 years (SD=5.8, range=130 years). On average, on a 100-point scale, the technology adoption score on all sites was 68.5 (SD 18.2), which means that modern technologies are being moderately to highly implemented in Saudi emergency departments. Mean perceived outcomes were: workflow efficiency (M = 3.7, SD = 0.8), patient care quality (M = 3.8, SD = 0.7), and overall user satisfaction (M = 3.6, SD =1.0) on a 5-point Likert scale. Distributions of all the continuous variables were found to be of acceptable normality, with skewness and kurtosis values falling within acceptable parameters of parametric testing.

2. Technology Adoption and Perceptions by Professional Groups

Widespread differences in technology adoption and perceived impact were found between professional groups. Table 3 indicates that a one-way ANOVA found significant differences in technology adoption scores by profession, F(2, 347) = 38.72, p< 0.001, and the effect size of the difference is large (partial 0.183). Comparison of post-hoc with the use of the Tukey HSD test showed that physicians recorded significantly higher adoption (M=75.3, SD=16.8) compared to both nurses (M=70.2, SD=17.5, p=.01) and paramedics (M=52.4, SD=15.2, p=.001); nurses were also found to have made significantly higher adoption compared to paramedics (p=.001). Likewise, considerable differences were noted on all outcome variables. To achieve efficiency in the workflow, F(2, 347) = 12.45, p = 0.001, physicians (M = 3.9, SD = 0.7) and nurses (M = 3.7, SD = 0.8) reported significantly higher scores than paramedics (M = 3.3, SD = 0.9). The trend was the same with patient care quality, F(2, 347) 15.83, p 0.001, and user satisfaction, F(2,347) 10.29, p 0.001, where paramedics recorded the least positive results on all measures.

3. Inequality in Public and Private Hospital Environment

Greater disparities in the use of technology arose in both public and private health care. Table 4 contains independent samples t-tests indicating that the technology adoption scores of private hospitals (M 76.8, SD 16.2) were significantly higher than those of the public hospitals (M 63.1, SD 17.5), t(348) -7.42, p 0.001, and the effect size was very large (Cohen d 0.80). This difference was spread to all the outcome measures. Employees of the private hospital said that their workflow efficiency was significantly greater (M = 4.0, SD = 0.6) in comparison to the employees of the public hospital (M = 3.5, SD = 0.9), t(298.3) = -5.89, p = 0.001, d=.65. On the same note, the quality of patient care ratings were considerably higher in the private facilities (M=4.1, SD=0.5) when compared to the public facilities (M=3.6, SD=0.8), t(278.4)-= -6.52, p=0.001, d=0.72. The same applied to the level of user satisfaction, whereby the private hospital staff were more satisfied (M = 3.9, SD = 0.8) than the public hospital staff (M = 3.4, SD = 1.1), t(328.1) -4.67, p-0.001, d-0.51.

4. Interrelationships between Technology Adoption and Outcome Variables

Pearson correlation comparison indicated that there were strong statistically significant relationships between technology adoption and the outcomes of emergency departments. As can be seen in Table 5, the score of technology adoption was strongly associated with workflow efficiency (r =.612, p =.001) and patient care quality (r =.578, p =.001). Especially, there was a significant positive Coefficient between workflow efficiency and patient care quality (r=.745, p= 0.001), indicating that there is a close relationship between these two constructs in the emergency department setting. User satisfaction had significant correlations with technology adoption (r = .521, p < 0.001), workflow efficiency (r = .689, p < 0.001) and patient care quality (r = .702, p < 0.001). There were weak but significant positive correlations between professional experience and technology adoption (r = 0.18, p = 0.01) and quality of patient care (r = 0.15, p = 0.01). There were significant negative correlations between all measures of barriers and outcome variables, and the barriers with technical barriers exhibited the strongest negative correlation with outcome variables (r = −.45, p < 0.001).

5. Predictors of User Satisfaction Multivariate

The user satisfaction was found to be the primary outcome of a multiple linear regression analysis. Table 6 showed that the model explained 62.1% of the user satisfaction variance (R 2 =0.621, Adjusted R 2 =0.615, F(5,344) =112.8, p =0.001). The scores of technology adoption were significant positive predictors (0.281, p < 0.001), as were the workflow efficiency (0.332, p < 0.001) and patient care quality (0.268, p < 0.001). Inadequate training was a negative predictor of satisfaction, but the training contributed to the satisfaction negatively (β = −.151, p = 0.002), whereas strong leadership support played the role of a positive facilitator (β = 0.121, p = 0.002). The variance inflation factor (VIF) of all the predictors was between 1.38 and 2.34, which is much lower than the critical value of 5, and so, there is no alarming multicollinearity. Independence of residuals was confirmed by the Durbin-Watson of 1.98.

6. Professional differences in the perception of barriers to implementation

A chi-square test of independence indicates that there was a significant relationship between the perception of technical barriers and profession, 25.73 4 350 < 0.001. Table 7 outlines that high technical barriers were most often reported by paramedics (63.5 -, n 40), followed by nurses (37.1 -, n 65) and physicians (28.6 -, n 32). The value of this association was small yet important (V of Cramer = 0.192). Physicians were the ones most likely to mention low technical barriers (40.2 %, n = 45), meaning that there was a great deal of professional variability in terms of how technological difficulties were experienced.

7. Basic Dimensions of Implementation Barriers

The PCA with Varimax rotation was performed to discover the latent constructs within the items of the barrier. The Kaiser Meyer Olkin measure ensured the adequacy of sampling (KMO=0.72) and the test of sphericity was significant (n2(3) =285.4, p=0.000). Table 8 above shows that the analysis has identified two components with eigenvalues greater than one, which together explain 69.0 percent of the variance. The first component, called System Challenges, had high loadings on the technical issues (0.851) and interoperability problems (0.823). The second component, which is marked as Human Factors, was defined mostly by the inadequacy of training (0.892). The range is between 0.712 and 0.820, and this means that each variable is well represented by the component solution.

8. Measurement Instrument Reliability and Validity

Cronbach's alpha was used to assess the internal consistency of all the multi-item scales. The Workflow Efficiency scale (four items) had excellent reliability (0.89), as did the Patient Care Quality scale (three items, 0.85) and the overall Impact scale (seven items, 0.91), which contained a combination of other scales. The barrier scale also had satisfactory reliability (0.79 = 0.79). These results were backed by the McDonald's omega coefficients, and all the item total correlations were more than 0.60, hence the homogeneity and internal consistency of the measurement tools.

9. Group Difference Multivariate Analysis

The combined influence of the hospital type and profession on the outcome measure (workflow efficiency, patient care quality, user satisfaction) was analyzed using the multivariate analysis of variance (MANOVA). Table 10 illustrates that multivariate effect of hospital type (Wilks 0.872, $F(4,343) = 12.45$, $p = 0.001$, partial 2eta = 0.128), of profession (Wilks 0.814, $F(8, 686) = 8.92$, $p = 0.001$, partial 2eta = 0.094) and their interaction (Wilks 0.942, F These findings suggest that the type of hospital and the profession have great impact on the outcome pattern pattern and the fact that there is a small but significant interaction effect indicates that there is variation in the relationship between profession and outcomes between hospital types.

Discussion

This study shows that, although adopting modern technologies in the Saudi emergency departments is fairly high and is associated with enhanced operational performance and clinical outcomes, there exist significant disparities that pose risks to the fair achievement of these benefits. We have found that the distribution of the benefits of technology is not evenly spread; there is a disproportionate greater gain in the privately managed hospitals and the physicians compared to the public institutions and the paramedics.

The positive correlation between the adoption of technology and workflow efficiency ($r = 0.612$, $p < 0.001$) is statistically strong and agrees with the available information globally, indicating that the digital infrastructures simplify the working process (Innocent, 2024; Jeilani & Hussein, 2025). However, the difference in conspicuous private-public adoption (76.8) and conspicuous public-public adoption (63.1) indicates implementation barriers that are not limited to the acquisition of devices. This demarcation might represent the differences in financial distributions, organizational culture, or forced movements within the institutional sectors (Marquis & Raynard, 2015; Boussard, 2018). The extremely low adoption rates and perceived utility of paramedics highlight a significant gap in contemporary implementation plans (Porter et al., 2018). This professional inequity indicates that the technological settings can be oriented more towards the fixed clinicians (physicians, nurses) than mobile team members. Similar observations have been made in other settings where there was poor consideration of the procedural variances in deployment plans (Jones et al., 2022).

Factor analytic processes determined two major clusters of barriers that include: System Challenges, which included technical and interoperability barriers; and Human Factors, which included barriers due to a lack of training provision (Bogaert et al., 2021). Training was found to provide significant influence on satisfaction ($\beta=-0.151$, $p=0.001$), which aligns with previous technology-acceptance theories, which focus on perceived ease of use (Luo et al., 2024). Thus, even advanced systems fail to work in case of the inadequacy of user competence. The drawbacks of this research include a cross-sectional nature, which does not allow for any causal inferences, and a focus on large cities, which might limit generalization to the rural environment (Maier et al., 2023). Besides, self-reported measures are prone to response bias. There are practical implications of these findings. To start with, the implementation strategies have to reduce the public-private gap by distributing resources.

Second, the training curricula must be tailored to specific professional processes, particularly for paramedics (Evashkevich & Fitzgerald, 2014). Third, interoperability in future procurement decisions must be given priority to overcome system-integration challenges.

Overall, effective technology integration requires a change in installation to focus on the human aspects and systemic inequalities. Further studies ought to take the longitudinal designs and include institutions situated in rural areas to provide a more comprehensive picture of the impact of technology on the healthcare system in Saudi Arabia.

CONCLUSION

The current research shows that the implementation of modern technology within Saudi emergency departments is moderately high, and it relates largely to the improvement of workflow efficiency, quality of patient care, and user satisfaction. Still, significant differences were revealed: much more positive results were found in the cases of private hospitals and physicians than in the cases of the public hospitals and paramedics. The research was able to meet its goals because it quantified adoption rates, determined apparent correlations with key performance indicators, and found the main barriers to successful implementation to be in System Challenges and Human Factors. The main contribution of the work is that it offers multi-dimensional and empirical evidence on the Saudi experience, highlighting the fact that technological investment is not enough without focusing on contextual implementation barriers. The conclusion is that the effective utilization of technology has to be optimized with a specific approach centered on fair distribution of resources, training based on roles, and strong and supportive leadership. The studies in the future must utilize longitudinal designs to prove the causality and explore the implementation strategies in remote hospitals to guarantee equal progress in emergency care in the Kingdom.

REFERENCES

1. Abualenain, J. (2024). Use of technology in disaster medicine. Eurasian Journal of Emergency Medicine.
2. Achampong, E. K., Agyemang, E., Esia-Donkoh, K., & Adu-Gyamfi, A. B. (2025). Health professionals' satisfaction with the use of electronic health records system for healthcare delivery in Ghana. https://doi.org/10.83116/
3. Alfaleh, A., Alkattan, A., Alageel, A., Salah, M., Almutairi, M., Sagor, K., & Alabdulkareem, K. (2022). The role of telemedicine services in changing users' intentions for presenting to the emergency departments in Saudi Arabia. Digital Health, 8.
4. Alghamdi, S. M., Alsulayyim, A. S., Alqahtani, J. S., & Aldhahir, A. M. (2021). Optimising digital health platforms in Saudi Arabia: Determinants from the COVID-19 pandemic experience. https://doi.org/10.20944/pres
5. Almadani, N. (2025). The future of artificial intelligence in gerontological nursing in Saudi Arabia. BMC Geriatrics, 25(1). https://doi.org/10.1186/s12877-025-
6. Alsulimani, L. K., Khan, A., & Bokhari, A. M. (2016). Research production of current Saudi emergency medicine training centers in the new millennium: A descriptive study. Journal of King Abdulaziz University–Medical Sciences, 23(4), 1. https://doi.org/10.4197/med.23-4.1
7. Bogaert, P., Verschuuren, M., Van Oyen, H., & Van Oers, H. (2021). Identifying common enablers and barriers in European health information systems. Health Policy, 125(12), 1517-1526.
8. Boussard, V. (2018). Professional closure regimes in the global age: The boundary work of professional services specializing in mergers and acquisitions. Journal of Professions and Organization, 5(3), 279-296.
9. Bowden, T., Lyell, D., & Coiera, E. (2022). Emergency department and urgent care clinician perspectives on digital access to past medical histories. BMJ Health & Care Informatics, 29(1). https://doi.org/10.1136/bmjhci-2022-100

10. Chowdhury, S., Mok, D., & Leenen, L. (2021). Transformation of health care and the new model of care in Saudi Arabia: Kingdom's Vision 2030. Journal of Medicine and Life, 14(3), 347.
11. Conforti, R. (2024). Informatics in emergency medicine: A literature review. Emergency Care and Medicine, 2(1), 2. https://doi.org/10.3390/ecm2010002
12. Evashkevich, M., & Fitzgerald, M. (2014). A framework for implementing community paramedic programs in British Columbia. Richmond, BC: Ambulance Paramedics of British Columbia.
13. Gao, L., Tan, E., Kim, J., Bladin, C. F., Dewey, H. M., Bagot, K. L., Cadilhac, D. A., & Moodie, M. (2022). Telemedicine for stroke: Quantifying the long-term national costs and health benefits. Frontiers in Neurology, 12. https://doi.org/10.3389/fneur.2021.804355
14. Gilkar, A., Fink, R., Eardley, P., & Barron, C. (2013). The effect of 'on-line' POCT on patient waiting times in an accident and emergency department. BMJ Quality Improvement Reports, 2(1).
15. Henreid, A. J., Ioannides, K. L. H., Pevnick, J. M., Cohen, T., Torbati, S., Nuckols, T. K., & Berdahl, C. T. (2024). Quantifying and visualizing emergency physician workflow: Results of an observational time-motion study. medRxiv. https://doi.org/10.1101/2024
16. Hosseini, M. M., Hosseini, S. T. M., Qayumi, K., Ahmady, S., & Koohestani, H. R. (2023). The aspects of running artificial intelligence in emergency care: A scoping review. https://doi.org/10.22037/aaem
17. Innocent, G. C. (2024, July). Optimizing Workflow Efficiency Through Integration of Digital Office Technologies. In Indonesian Annual Conference Series (pp. 102-111).
18. Jabali, A. K., & Jarrar, M. (2018). Electronic health records functionalities in Saudi Arabia: Obstacles and major challenges. Global Journal of Health Science, 10(4), 50. https://doi.org/10.5539/gjhs.v10n4p50
19. Jeilani, A., & Hussein, A. (2025). Impact of digital health technologies adoption on healthcare workers' performance and workload: perspective with DOI and TOE models. BMC Health Services Research, 25(1), 271.
20. Jones, K. L., Johnson, M. R., Lehnertz, A. Y., Kramer, R. R., Drilling, K. E., Bungum, L. D., & Bell, S. J. (2022). Rapid deployment of team nursing during a pandemic: implementation strategies and lessons learned. Critical Care Nurse, 42(3), 27-36.
21. Kaud, Y., Lydon, S., & O'Connor, P. (2021). Measuring and monitoring patient safety in hospitals in Saudi Arabia. BMC Health Services Research, 21(1). https://doi.org/10.1186/s12913-021-07228-2
22. Kuttan, N., Pundkar, A., Gadkari, C., Patel, A., & Kumar, A. (2025). Transforming emergency medicine with artificial intelligence: From triage to clinical decision support. Multidisciplinary Reviews, 8(10), 2025285. https://doi.org/10.31893/multirev.2025285
23. Langhan, M. L., Riera, A., Kurtz, J. C., Schaeffer, P., & Asnes, A. G. (2014). Implementation of newly adopted technology in acute care settings: A qualitative analysis of clinical staff. Journal of Medical Engineering & Technology, 39(1), 44.
24. Lee, A. T., Ramasamy, R. K., & Subbarao, A. (2025). Barriers to and facilitators of technology adoption in emergency departments: A comprehensive review. International Journal of Environmental Research and Public Health, 22(4), 479.
25. Lucas, B., Schladitz, P., Schirmeister, W., Pliske, G., Walcher, F., Kulla, M., & Brammen, D. (2019). The way from pen and paper to electronic documentation in a German emergency department. BMC Health Services Research, 19.
26. Luo, J., Zhang, K., Huang, Q., Jiang, S., & Pan, Y. (2024). From acceptance to dependence: exploring influences of smart healthcare on continuous use intention of mobile health services among older adults with chronic illnesses in China. Behavioral Sciences, 15(1), 19.
27. Magalhães, R., Oliveira, A., Terroso, D., Vilaça, A., Veloso, R., Marques, A., Pereira, J., & Coelho, L. (2024). Mixed reality in the operating room: A systematic review. Journal of Medical Systems, 48(1).

28. Maier, C., Thatcher, J. B., Grover, V., & Dwivedi, Y. K. (2023). Cross-sectional research: A critical perspective, use cases, and recommendations for IS research. International Journal of Information Management, 70, 102625.
29. Mani, Z. A., & Albagawi, B. (2024). AI frontiers in emergency care: The next evolution of nursing interventions. Frontiers in Public Health, 12. https://doi.org/10.3389/fpubh.2024.1429412
30. Marquis, C., & Raynard, M. (2015). Institutional strategies in emerging markets. Academy of Management Annals, 9(1), 291-335.
31. McGinn, C. A., Grenier, S., Duplantie, J., Shaw, N., Sicotte, C., Mathieu, L., Leduc, Y., Légaré, F., & Gagnon, M. (2011). Comparison of user groups' perspectives of barriers and facilitators to implementing electronic health records: A systematic review. BMC Health Services Research.
32. Nascimento, I. J. B. do, Abdulazeem, H. M., Vasanthan, L., Martinez, E. Z., Zucolato, M. L., Østergaard, L., Azzopardi Muscat, N., Zapata, T., & Novilla-Ortiz, D. (2023). Barriers and facilitators to utilizing digital health technologies by healthcare professionals. NPJ Digital Medicine, 6(1).
33. Porter, A., Dale, J., Foster, T., Logan, P., Wells, B., & Snooks, H. (2018). Implementation and use of computerised clinical decision support (CCDS) in emergency pre-hospital care: a qualitative study of paramedic views and experience using Strong Structuration Theory. Implementation Science, 13(1), 91.
34. Rahman, N. H. A., Ibrahim, A. K., Hasikin, K., & Razak, N. A. A. (2023). Critical device reliability assessment in healthcare services. Journal of Healthcare Engineering, 2023(1), 3136511.
35. Sehgal, H. L. K., Greenfield, G., Neves, A. L., Harmon, M., Majeed, A., & Hayhoe, B. (2024). Efficacy and safety of a digital check-in and triage kiosk in emergency departments: A systematic review protocol. BMJ Open, 14(7), e084506.
36. Shiells, K., Diaz-Baquero, A. A., Štěpánková, O., & Holmerová, I. (2020). Staff perspectives on the usability of electronic patient records for planning and delivering dementia care in nursing homes: A multiple case study. BMC Medical Informatics and Decision Making, 20(1), 159.
37. Tedesco, D., Capodici, A., Gribaudo, G., Valerio, Z. D., Montalti, M., Salussola, A., Barbagallo, V., Rolli, M., Fantini, M., & Gori, D. (2022). Innovative health technologies to improve emergency department performance. European Journal of Emergency Medicine.
38. Uraif, A. (2024). Developing healthcare infrastructure in Saudi Arabia using smart technologies: Challenges and opportunities. Communications and Network, 16(3), 51–73.
39. Zalama-Sánchez, D., del Pozo Vegas, C., Sanz-García, A., de Santos-Castro, P. Á., Presencio-Dominguez, J., González-Izquierdo, P., & Martín-Rodríguez, F. (2024). Diagnostic performance of point-of-care high-sensitivity troponin in the exclusion of non-ST-elevation myocardial infarction in the emergency department. Journal of Personalized Medicine, 14(7), 762.