Journal of Pioneering Medical Sciences
Received: October 18, 2025 | Accepted: April 02, 2026 | Published: April 05, 2026
Volume 15, Issue 03, Pages 31-36

DOI https://doi.org/10.47310/jpms2026150305

Impact of AI-Based Operational Systems on Employee Performance in Healthcare

Badr Alnasser[1*]
[1]Department of Health Management, College of Public Health and Health Informatics, University of Ha'il, Ha'il, Saudi Arabia

Author Designation: [1]Associate Professor

*Corresponding author: Badr Alnasser (e-mail b.alnasser@uoh.edu.sa).

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Abstract: **Background:** Globally, artificial intelligence (AI) is changing healthcare processes. It has upgraded decision making, efficiency, and accuracy in this sector. Digital health transformation is national priority for Saudi Arabia (SA) as per Vision 2030. However, empirical evidence lacks for how AI-based operational management systems (AI-OMS) affects employee performance (EP) for SA healthcare sector. **Objective:** This research aims to examine the impact of AI-OMS on EP for healthcare professional in SA. Moreover, the study also investigates the mediating role of technology readiness (TECHR). **Methods:** The study considered quantitative and cross-sectional research design. For this purpose, the data was collected using close-ended survey questionnaire from 574 respondents. These includes the healthcare professionals such as doctors, allied health staff, nurses, administrators, etc. Validated scales from prior studies were adapted for 31 items of three constructs; AI-OMS, TECHR, and EP respectively. The analysis of data was executed using SPSS version 27 which includes demographic summary, descriptive statistics, and regression using Hayes process. **Results:** AI-OMS significantly predicted EP and TECHR ($\beta_1 = 0.5985$, p-value <0.001, $\beta_2 = 1.0792$, p-value <0.001). Additionally, TECHR predicted EP ($\beta_3 = 0.4662$, p-value <0.001). Moreover, a partial mediation was confirmed using TECHR ($\beta_4 = 0.5032$, p-value <0.001). **Conclusion:** The study concludes a positive effect of AI-OMS on EP. This positive impact is partially mediated through TECHR. Hence, digital transformation is empirically confirmed in healthcare sector of SA which also meets their national priority as per Vision 2030.

Key Words: Artificial Intelligence, Healthcare Professionals, Operational Management Systems, Employee Performance, Technology Readiness, Saudi Arabia

INTRODUCTION

Globally, artificial intelligence (AI) is changing healthcare processes. It has upgraded their decision making, efficiency, and accuracy. Additionally, these upgradations include patient care, clinical diagnostics, human resource and other processes. The upgradations have improved the patient safety, work efficiency, and process accuracy in healthcare [1]. The benefits of AI-OMS are not limited to the outcomes related to patients only. These also impacts the employee as well as organizational output. Furthermore, these benefits optimize healthcare professionals for better decision making and improved patient care. The existing studies recognize the importance of readiness and technical capability of healthcare employees for considering the AI integration into their process [2]. However, the literature lacks empirical evidence on how AI integration into the operational process of healthcare impacts their employee's output such as adaptability, task efficiency, and technical readiness.

Vision 2030 has prioritized digital health transformation in SA which has made this under-examined context more relevant for studying the AI integration in healthcare sector. Prior studies indicated that a significant investment has been made for AI adoption in clinical practices and operational process of healthcare worldwide [3]. This initiative at global level has augmented the use of AI for the operational process of healthcare in terms of their clinical practices and administrative roles. These usage of AI include the application of diagnostic tools, and healthcare records electronically for a steady and faster workflow of hospitals. Additionally, the literature is well documented for policy reforms and infrastructure development for AI use. However, prior studies lack theoretical and empirical evidence for how the use of AI for automating the operational practices in healthcare affects their professionals. Additionally, a significant gap existed on how the readiness of healthcare professional of AI adoption explain its impact on their performance.

The theoretical review demonstrates a robust explanation of technology adoption in response to innovation at organizational and individual level. For example, technology acceptance model (TAM) identified perceived ease of use, and perceived usefulness as the two motivators for individual's intention to adopt a technology [4]. Additionally, a subsequent theory broadens the scope of TAM with the title of unified theory of acceptance and use of technology (UTAUT) at individual and at organizational level. Both models considered the intention to adopt technology, therefore both applicable in healthcare sector for AI adoption too for optimizing their operational process. However, the opponents have a point of view different from majority of studies. They indicate that acceptance of such technologies is the initial step towards technology adoption. It is important to note, how such digital transformation may impact the productivity, adaptability, and working quality of organization and their staff [5]. Therefore, it would be an important theoretical contribution to consider TAM, and UTAUT for explaining EP in healthcare sector of SA. Consequently, this study would help the decision maker in healthcare sector to consider a unique approach of accepting a new technology such as AI.

The readiness to adopt a new technology demonstrate a suitable pathway for linking AI-OMS with EP. An individual's inclination to apply and adopt a new technology such as AI may be referred to as TECHR [6]. Additionally, it includes innovativeness and optimism as enabling factors. Furthermore, insecurity, and discomfort are considered its inhibiting factors for the purpose of TECHR. However, the healthcare sector has a number of complexities such as task urgency and ethical constraints, therefore, its readiness for adopting such technologies is critical [7]. The literature indicates that the adoption of such technologies is beneficial only when employees of an organization are supported and adequately trained. For example, the performance of employees improves only when they have the confidence and technical capability to use their organizational system in an effective manner [8]. Moreover, AI-OMS plays a significant role in enhancing TECHR and as a result it may improves EP. However, the literature in healthcare sector lacks empirical and theoretical evidence for such mediating pathway. Moreover, the literature provides evidence of AI adoption and employee performance with a particular focus on non-western context. Therefore, this study fills this significant gap by providing empirical and theoretical contributions through the following aims:

- This research aims to examine how AI-OMS affects EP for healthcare professionals of SA
- Furthermore, the research also investigates the mediating role of TECHR

This study addresses a theoretical, empirical, and contextual gap by considering the healthcare professional in SA. It significantly contributes towards the continuing debate on EP in healthcare using digital transformation and readiness. Theoretically, this study extends the basic assumptions of relevant theories such as TAM and UTAUT. Contextually, this study provides empirical evidence for an under-examined setting of healthcare in non-Western nation such as SA. Finally, the study provides practical implications for healthcare professionals for maximizing the advantages of using AI in their operational process.

METHODS

Study Design

The study used a quantitative research design based on surveys on closed ended format. It investigated how AI-OMS affects EP among healthcare professionals in Saudi Arabia. TECHR was tested as a mediating variable. The cross-sectional design was appropriate because it enabled simultaneous collection of data on predictor, mediator, and outcome variables. This research design enables a well-organized way for testing mediation pathways in case of diverse and large number of participants [9]. It is time-saving and cost-effective design which allows a researcher to reach respondents from various organizations in a particular point in time. Moreover, it is particularly a suitable design where the purpose is to investigate the link between variables rather than to form a causality. Therefore, this design has a widespread adoption in case of technology integration in healthcare.

Participants

The healthcare professionals such as admins, allied health professionals, nurses, and physicians from SA are the target population of this study. These healthcare professionals are directly involved in the use and adoption of AI based technologies. Therefore, they were chosen as the participants of this study. Additionally, the performance of these healthcare professionals determines whether the AI intervention is successful or not. Moreover, the acceptance and readiness of these professionals impacts how the usage of Ai achieves its aims of quality improvements and efficiency [10,11]. Digital health transformation is national priority for SA as per Vision 2030. Therefore, this commitment highlights the importance of AI integration into their healthcare by assessing its impact on their workforce [12].

Sampling

This research considered item response theory [IRT] for finalizing its sample size by choosing 10 respondents per item of questionnaire [13]. There are 31 items in survey questionnaire, therefore, the minimum sample required for this study is 310 participants. Nevertheless, the survey was distributed among 620 potential participants by doubling the minimum required sample in order to get robust and reliable estimates. Finally, the researchers were able to obtain complete responses from 574 participants by achieving a response rate of 92.58%. The researcher adopted purposive sampling method that considered only those participants who can provide the relevant information as per the aims of the study.

Inclusion and Exclusion Criteria

The respondents were considered as per the defined criteria. At first, it considered professionals serving the healthcare centres in SA including admin staff, allied health staff, nurses, and doctors, etc. Secondly, these respondents should have at least one-year professional experience in healthcare centres of SA. Thirdly, they should have active participation in the operations related to hospitals and clinical practices where AI is most likely used. However, a number of respondents were not considered. These were temporary staff, volunteers, and interns and those who didn't have direct exposure or inexperience towards AI-OMS.

Survey Instrument

There were four parts of survey instrument used for this study. The first section contains the questions related to personal attributes of respondents; gender, age, education, experience, and departments. The second part contain 4 validated scale items related to AI-OMS adapted from prior study [14]. The third part contains 12 validated scale items related to TECHR index adapted from Parasuraman and Colby [15]. Finally, the fourth part contains 15 validated scale items related to EP adapted from R.J. Singh, Sharma [16]. All of these items were measured using five-point type of Likert scale from strongly disagree-strongly agree.

Pilot Testing

Initially, the questionnaire survey was distributed among 30 target respondents excluded from final sample of 574 healthcare professionals. At this stage, a number of refinements were made in the questionnaire items based on the suggestions received from these participants. It confirmed the items clarity, comprehensibility, and face validity before administrating final survey. Moreover, a reliability analysis was performed on collected data and found Cronbach alpha exceeding threshold of 0.70 as suggested in prior studies [17]. These results confirmed that the instrument, along with constructs and their items are valid and reliable before final data collection from healthcare professionals.

Ethical Consideration

The participants of the study provided with an information sheet that confirms their confidentiality, volunteer participation, and aims of this study. Additionally, before starting the questionnaire survey, an informed consent was taken in written form. Moreover, before initiating this research, a formal approval was also taken from University of Hail's research ethics committee in SA.

Statistical Analysis

The statistical analysis of this study includes the summery of respondents, descriptive statistics and reliability analysis of study constructs. Additionally, basic assumptions such as multicollinearity, and normality were assessed before formally testing hypothesis. Finally, the hypotheses were tested for direct and indirect impact through PROCESS by Hayes model 4. This method is statistically credible to provide improved version of robust estimates [18].

RESULTS

Participant's Summary

Table 1 reports the summary of attributed for final sample of 574 respondents. It indicated male majority as 61% male, and 39% females. Most of the participants were from an age group of 31-35 years containing 44.3%. A large proportion of these respondents has Bachelor's degree representing 62%. Approximately 51.9% of respondents have professional experience between 6-10 years in healthcare sector of SA. Finally, 48.1% of these respondents were serving Cardiology department. For detail distribution of gender, age, education, experience, and departments, Table 1 can be further referred.

Descriptive Statistics

The descriptive statistics of constructs, their interna reliability and validity including correlation analysis is reported as summary in Table 2. The descriptive statistics indicated that the average value of all the construct is close to 5 which indicates strong satisfaction for responses of survey items. Additionally, all constructs achieved Cronbach alpha values above their recommended 0.70 threshold (AI-OMS α = .88; EP α = .89; TECHR α = .89), suggesting internal validity and consistency. Finaly, AI-OMS correlated with EP (r = .94, p_{value} <0.01) and with TECHR (r = .89, p_{value} <0.01). TECHR correlated with EP (r = .94, p_{value} <0.01).

Regression Analysis

Using Hayes' PROCESS in SPSS version 27, the proposed mediation model explained a substantial proportion of

Table 1: Sample Characteristics

Characteristics	Categories	N	%
Gender	Male	350	61.0
	Female	224	39.0
Age (years)	20-25	22	03.8
	26-30	140	24.4
	31-35	254	44.3
	36-40	128	22.3
	> 40	30	05.2
Education	Diploma	96	16.7
	Bachelor	356	62.0
	Master	58	10.1
	PhD	64	11.1
Experience (years)	≤ 5	180	31.4
	6-10	298	51.9
	11-15	82	14.3
	16-20	10	01.7
	> 20	4	00.7
Departments	Cardiology	276	48.1
	Emergency and Critical Care	22	03.8
	Medical Imaging and Diagnostics	48	08.4
	General and Medical Services	162	28.2
	Nursing and Medical Support	34	05.9
	Administration and Technical Support	32	05.6

Table 2: Descriptive Statistics, Reliably, and Correlation Analysis

Descriptive Statistics						Reliability		Correlation		
-	N	Mean	Std	SK	KRT	Items	CA	AIOMS	EP	TECHR
AIOMS	574	5.00	1.59	-1.06	0.03	4	0.88	1	-	-
EP	574	4.92	1.85	-1.09	-0.42	15	0.89	.94**	1	-
TECHR	574	4.96	1.92	-0.96	-0.67	12	0.89	.89**	.94**	1

**Refers to the significant of correlation coefficient at 0.01 level (2-tailed)

Table 3: Regression Analysis (Process by Hayes)

Variables	Coefficients	SE	T-value	p-value
AIOMS->EP	0.59	0.026	22.95	0.000
TECHR -> EP	0.46	0.021	21.65	0.000
AIOMS->TECHR	1.07	0.022	47.04	0.000
AIOMS->TECHR->EP	0.50	0.035	14.05	0.000
Constant	-0.38	0.062	-06.13	0.000
R^2	0.94	-	-	-
F	4580.90	-	-	-
Sig-F (P-value)	0.000	-	-	-

***Correlation is significant at less than 0.01 level (2-tailed). AIOMS = AI based Operation Management System, EP = Employee Performance, TECHR= Technology Readiness

variance in EP. The model accounted for R^2 = 0.9413, omnibus F = 4580.90, p-value<0.001. This result indicates excellent explanatory power.

First, the AI-OMS showed a positive and significant direct association with EP. This effect remained after accounting for TECHR, β = 0.5985, S_E = 0.0261, t = 22.95, p-value <0.001. Independently, TECHR also demonstrated a strong positive association with EP. The effect was β = 0.4662, S_E = 0.0215, t = 21.65, p-value <0.001. These findings suggest that higher levels of AI-OMS engagement contribute to improved EP. Greater TECHR also enhances performance when both factors are considered simultaneously.

AI-OMS was also strongly and positively related to TECHR and coefficient was β = 1.0792, S_E = 0.0229, t = 47.04, p_{value} <0.001. This result indicates that exposure to AI-OMS substantially increases professionals' readiness. It also shows that such exposure improves the effective adoption and use of technology in their work. Finally, the indirect pathway reports a partial mediation between AI-OMS and EP via TECHR (β = 0.5032, S_E = 0.0358, t = 14.06, p_{value} <0.001). These results confirmed a direct and indirect pathway for considering a positive impact of AI-OMS on EP via TECHR.

DISCUSSION

The research aims to examine how AI based OMS affect EP for healthcare professionals in SA. Moreover, the research also considered to investigate the mediating pathway to TECHR. The findings revealed a statistically significant direct positive impact of AI-OMS on EP. Furthermore, it was also revealed that AI-OMS has a positive and statistically significant role in enhancing the TECHR. Moreover, the study also found a positive effect of TECHR on EP. Finally, the findings confirmed an indirect pathway for the positive impact of AI-OMS on EP via partial mediation of TECHR.

Existing studies demonstrated that health-related technologies can only realize their true potential when employees are adequately trained and confident [19,20]. The findings of our study are aligned with these evidences. Moreover, results also indicated that TECHR substantially contributes to performance outcomes. It is aligned with studies supporting the impact of readiness on innovation adoption in healthcare [21]. Moreover, the partial mediation found in this study highlights the dual role of AI-OMS. It infers that the systems directly enhance performance by automating tasks and streamlining operations. It also fosters performance indirectly by increasing employees' readiness for technology adoption.

The under-examined contextual setting of SA provides a unique contribution of this study. For example, SA is rapidly adopting technology based tools in their healthcare for enhancing patient care and efficiency in health service as per Vision 2030 [14]. The results of this research recommend investment in such initiatives can produce significant advantages for their healthcare professionals. However, Alqurashi, Mohammed [22] and Alrasheeday, Alshammari [23] argued that the healthcare professionals in SA have behavioural variation in the use of digital tools. However, this study indicates a partial mediation for the positive impact of AI-OMS on EP via TECHR. It emphasized the importance of considering workforce culture and attitudes in the success of digital initiatives.

This study extends the theoretical scope of technology adoption by considering both TAM, and UTAUT models for this study. Both theories supported the partial mediation of TECHR as an indirect pathway for this study. The integration of both theories clarifies how readiness and acceptance of technology translate into performance. Although, some of the prior studies also argued that TAM and UTAUT focus too narrowly on adoption intentions rather than on performance [24, 25]. Moreover, the findings highlight the need to consider readiness for AI integration in healthcare processes for policymakers and admins in SA. Furthermore, investments in training programs, continuous professional development, and change management initiatives are essential. These initiatives may help to ensure that employees are confident and motivated to use AI systems effectively in their healthcare settings.

The study has a number of limitations. For example, the design (like "cross-sectional") confines the ability to draw causal inferences. Longitudinal research could examine how readiness and performance evolve as AI systems mature. Second, the study depends on adapted measures which are basically self-reported. Although reliability was strong and statistical methods minimized bias, future studies could add supervisor ratings or objective performance indicators. Third, the study focused only on healthcare professionals in Saudi Arabia. This may limit generalizability to other contexts. Cross cultural studies could determine whether readiness functions in similar ways across different cultural and organizational environments. Finally, the high correlations among constructs suggest possible overlap. Future studies should explore this issue through structural equation modelling with discriminant validity testing.

Future research could explore potential moderators of the relationship between AI-OMS and employee performance. Examples include organizational culture, leadership style, or perceived organizational support. Expanding the scope to include other mediators would also be valuable. Possible mediators include job satisfaction or innovation climate. These factors could provide a more nuanced understanding of the mechanisms linking technology and performance. Comparative studies between developed and developing countries would also be useful. Such studies could yield important insights into contextual differences.

This study concluded that AI-OMS directly and indirectly enhance employee performance via TECHR. Additionally, the study contributes with a coherent theoretical framework of technology adoption by extending TAM and UTAUT to EP in healthcare. Moreover, the study offers some practical guidance for healthcare centres seeking to maximize the benefits of digital transformation. Consequently, AI-OMS is not sufficient for enhancing EP. Readiness is a critical factor that determines whether technological investments lead to improved performance for healthcare professional or not.

Informed Consent

The respondents were informed about the study objective and they were ensured about confidentiality and anonymity of their provided data. A voluntary consent was taken electronically before collecting actual responses.

Data Availability

A reasonable request can be made to corresponding author for obtaining the survey data collected and analysed for this study.

Ethical Approval

An approval was obtained from University of Hail's committee for research ethics as a prior requirement before conducting this research. No. H-2025-856 dated September, 8, 2025.

Acknowledgement

We acknowledge the active and voluntary participation of healthcare professionals in SA.

Conflict of Interest

The authors confirm that they have no conflicts of interest to disclose.

Funding

This research did not receive external funding.

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