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Reevaluating the DeLone and McLean Model for EHR Success and Knowledge-Sharing in a Saudi Public Medical Complex

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Abstract

This paper investigates the success of the EHR system and its impacts on the knowledge-sharing process by healthcare professionals in a public medical complex in Saudi Arabia. It aims to reexamine and evaluate the usefulness of the updated DeLone & McLean IS success model considering IS in the healthcare context. The study is based on a quantitative methodology conducted at a public medical complex in Saudi Arabia. The data analysis was performed by combining descriptive and exploratory analysis. SPSS was used to test the constructs' validity and scale reliability. Additionally, using AMOS to test the model fit and examine the direct and indirect relationships among dependent and independent variables, structural equation modeling was performed. The results support the role of EHR use in enhancing knowledge-sharing practices within the medical care complex. The findings show that EHR users appreciate knowledge transfer and collaboration between medical staff. The findings suggest that the EHR's characteristics of information quality, system quality, and service quality promote medical care knowledge-sharing through system satisfaction and use. This study helps medical staff and health decision-makers to understand the EHR benefits and the medical digital innovations that may contribute to improving the work conditions at care organizations. It shows that healthcare organizations can identify various benefits from the use of the EHR**, ** especially in terms of knowledge management and sharing to propose better medical services. The paper contributes to the existing empirical literature by

demonstrating the confirmation of the D&M Model as a relevant instrument for IS success within the healthcare sector.

Keywords: HER, DeLone and McLean Model, Knowledge sharing, Saudi Arabia.

Introduction

Saudi Arabia is embarking on a national transformation program to develop the required infrastructure to achieve the Saudi Vision 2030 by investing in technology and electronic systems such as e-health. Healthcare transformation is one aspect that aims to improve the delivery and operations of health services and their infrastructure to facilitate better access, increase geographical coverage, and enhance the utilization of technologies (Walraven et al., 2022; Hadoussa, 2022; Guerrazzi & Feldman, 2020; Kirk et al., 2019; Altuwaijri, 2012). Technologies in the healthcare sector play an important role in improving healthcare services (Lemire, 2010). With the continuously increasing adoption of medical technology in Saudi Arabia, available studies are scarce, along with a few studies on EHR adoption (Alsulame et al., 2016; Bah et al., 2011). The EHR system is also known as an electronic medical record or a computer-based patient record, and it is used to serve the information needs of healthcare professionals (Narattharaska et al., 2016).

EHR systems typically record the clinical information of patients visiting the institution in a longitudinal format. Modern EHR systems include multiple components such as clinical notes and laboratory results (Jetley & Zhang, 2019). Providing health services requires that knowledge be transferred among various dispersed parties within and across the boundaries of the health system (Almalki et al., 2011). Thus, EHR systems are implemented to achieve efficiency and effectiveness in operational costs (Wu et al., 2020). They play a crucial role in improving performance through better decision-making that manifests in well-documented, shared, and transferred knowledge (Hadoussa, 2022; Guerrazzi & Feldman, 2020; Wu et al., 2020; Wu et al., 2019). Moreover, EHR data are essential for research efforts that promote a continuously learning health system (Krumholz et al., 2016). EHR data are used for research in hospital workflow, disease management, clinical decision support systems, and patient-centric care (Jetley & Zhang, 2019). Thus, EHR systems are key enablers of the data revolution transforming the health sector, offering a wide range of benefits to health professionals (Walraven et al., 2022; Janssen et al., 2021).

This study highlights the importance of adopting medical IT in the context of the digital transformation of the health sector in Saudi Arabia. This study is applied in a context where the Saudi government is driven by a strong need to meet the demands and citizens' needs regarding the overall quality of public services, especially those of public health. Hospital digitalization, like other public institutions, has been accelerated by the COVID-19 crisis. It is no longer a matter of a mere desire for technological progress or an e-government project but a societal medical emergency, making it possible to upgrade health and medical care services

(Soomro et al., 2024). The purpose of this research is to raise awareness among practitioners and decision-makers in the medical and healthcare sectors of the importance of using medical IT, which is now essential in the post-COVID-19 era and with the proliferation of diverse smart technologies (AI, IoT, etc.) (Branellec & Hadoussa, 2020; Ohannessian et al., 2020).

Particularly, there is limited research that examines the impact of EHR on knowledge-sharing practices among medical staff within the Gulf region, especially in the context of Saudi Arabia. Consequently, in this paper, we shed light on evaluating the success of the EHR system and investigating the impact of such a system on the knowledge-sharing process by healthcare professionals in a public medical complex in Saudi Arabia. Thus, the aim of this study is to evaluate the usefulness of the updated D&M IS success model in light of the evolving ubiquity of IS in the healthcare context. Hence, this study aims to answer the question, "How does EHR use impact medical staff knowledge sharing?"

To answer this research question, the DeLone and McLean (2003) IS Success Model is applied. Specifically, in this research, we are interested in understanding how EHR use at a Saudi medical complex can foster and facilitate knowledge sharing. Thus, the paper is organized as follows: the next section presents an overview of related literature. A research model on the effect of EHR use and its benefits will be proposed. The subsequent sections describe the research methodology, the data analysis, and the findings. We wrap up the paper with a discussion, conclusion, and potential directions for future research.

Literature Review

EHR diffusion and impacts on knowledge sharing

EHR systems are a costly IT investment, with widespread implementation worldwide, varying in functionality and level of success. Measuring and evaluating the success of EHR is critical to understanding the organizational value of such investments, the extent to which they fulfill their objectives, and their impact on influencing decision-making processes, knowledge management practices among medical staff, and various levels with the aim of providing better health services (Chimbo & Motsi, 2024; Bashiri et al., 2023; Hadoussa, 2022; Wu et al., 2020; Mazur et al., 2019; Jetley & Zhang, 2019).

Nguyen, Bellucci, and Nguyen (2014) note a lack of studies on EHR benefits from such IT investments. They conducted a systematic review from 2001 to 2011 to evaluate the impact of EHR, showing both its benefits and drawbacks. Previous studies show that EHR is a cross-professional and cross-departmental system (Nguyen, Bellucci, & Nguyen, 2014; Bossen et al., 2013). It is a cross-professional system in which it is used by various user groups, ranging from health professionals such as physicians and nurses to medical secretaries, information technology staff, nutritionists, physiotherapists, and technicians. Thus, the perception of EHR would vary among these various groups of users. Hence, EHR

contributes to enhancing operational efficiency in terms of decreasing patient waiting time and improving patient flow (Bushelle-Edghill et al., 2017). It is also a cross-departmental system and needs to be integrated with other systems and medical technologies to facilitate physicians' productivity. It manages data coming from different medical services within the healthcare structure (Bossen et al., 2013). Moreover, EHR is an inter-organizational system that facilitates health information exchange networks (Walraven et al., 2022; Heart et al., 2017). These networks provide interoperability between various entities, thus facilitating the sharing and exchanging of patients' medical and health history.

The literature review shows the existence of some studies that focus on EHR success and organizational consequences. For example, Zhang et al. (2012) conducted a qualitative interview study in nine Australian residential aged-care facilities to identify the benefits of the EHR system. Their findings show that after using the EHR system, there is an increasing working knowledge because care staff could learn from each other by consulting the records. The authors also noticed the development of particular user groups, allowing knowledge sharing and experience feedback between the different residential aged care institutions. Moreover, Zhang et al. (2012) found that the care staff felt able to learn more information with the EHR system than they did with the paper-based record system because of the ease of access and information accessibility. Hence, the importance of this study focuses on the EHR evaluation and its contribution to knowledge sharing and tries to enrich the existing literature regarding medical technologies' use in the GCC context (Hadoussa & Louati, 2023).

Application of DeLone & McLean Model

Many previous studies used the DeLone and McLean Model to evaluate the EHR in different countries and contexts (Chimbo & Motsi, 2024; Bashiri et al., 2023; Hadoussa, 2022; Shim & Jo, 2020; Ojo, 2017; Tubaishat, 2017; Nguyen et al., 2014). The literature review stresses the relevance of the D&M IS success model in different studies and contexts to investigate the implications of IS/IT use. This model was originally developed by DeLone and McLean in 1992 by reviewing the literature published in 1981–1987 to identify IS/IT success factors (Hadoussa, 2020). The authors identified six factors as follows: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact. In 2003, DeLone and McLean (2003) revised their model and proposed the updated D&M IS success model that incorporates Service Quality as a factor for IS success. Also, they merged the "Individual Impact" and "Organizational Impact" into a single factor of "Net Benefits" as a response to the criticism that IS/IT benefits transcend to other levels beyond individuals and organizations (Petter & McLean, 2009). The updated D&M IS success model is an established measure to evaluate IS success (DeLone & McLean, 2003; Petter & McLean, 2009). As DeLone and McLean (2003, 1992) suggested, the IS/IT success model could be used and adapted for any IT. Previous studies adapted the model variables and items to

evaluate the EHR system in different contexts (Hadoussa, 2022; Shim & Jo, 2020; Ojo, 2017; Tubaishat, 2017; Bossen et al., 2013; Khan et al., 2013).

Khan et al. (2013) conducted the first study using survey research methods to measure key DeLone and McLean constructs in the context of EHR research in the United States. They developed a survey instrument designed to measure multiple dimensions of medical care providers' perceptions and beliefs about the quality of their clinic's EHR system and its impact on patient care. Their research model included four measures of the determinants of EHR use (system quality, IT support, ease of use, user satisfaction) and five indicators of provider beliefs about the impact on an individual's clinical practice. Their model was tested on 460 primary care providers. The findings reported a high level of inter-correlation between the four scales measuring determinants of EHR use. All four variables had a positive association with each of the five individual impact measures. In the same vein, Bossen, Jensen, and Udsen (2013) adopted the updated D&M IS success model to evaluate the EHR two months after implementation in a medium-sized hospital (regional hospital in Denmark) with four clinical groups: physicians and nurses, medical secretaries, and physiotherapists. Moreover, the model has been applied in the healthcare context to evaluate the e-prescription system at Turkish hospitals (Sebetci & Çetin, 2016) and to evaluate the hospital system success in a developing country such as Nigeria (Ojo, 2017). In addition, Tubaishat (2017) conducted a study at 17 different hospitals in Jordan regarding EHR use by 1,648 nurses. The author used the D&M IS Success Model (2003) to evaluate and examine the EHR system's uses, practices, quality of the system, overall satisfaction, and benefits. The study shows that nurses were generally satisfied with the EHR use and the system quality. The study confirms the positive correlation between the model constructs. Thus, the author suggests EHR implementation at hospitals to improve nurses' efficiency. The table below summarizes the main findings and major results of previous studies that used the D&M IS Success Model. These studies serve as a theoretical basis to answer the research question and to build the questionnaire.

Table 1. Summary of studies based on DeLone and McLean (1992, 2003) applied to EHR

Study	Theory and Model	Methodology	Main results
Chimbo et Motsi (2024)	Adaptation of DeLone and McLean Model (2003)	300 healthcare professionals were given a self-administered questionnaire, including doctors, dentists, pharmacists, physiologists, and nurses at a public academic hospital in Pretoria South Africa. Quantitative. Regressions and ANOVA.	No significant correlation was found between medical error reduction (MER) and knowledge quality (KQ). A nonsignificant negative relationship existed between Medical Error Reduction (MER) and information quality. However, a significant positive relationship was observed between Medical Error Reduction and electronic health records (EHR).
Bashiri et al. (2023)	DeLone and McLean Model (2003)	Based on a nationwide cross-sectional study conducted in 2021 in	The study shows that "system quality" was the most influential factor in SEPAS success. The least influential factor was

		public hospitals in Iran. 468 health information management personnel who had working experience with Iran Electronic Health Record System SEPAS. Quantitative. ANOVA.	SEPAS "benefits." The Iranian EHR has not been very successful in providing net benefits, such as the provision of electronic services that place patients at the center and improve the delivery of care to them.
Hadoussa (2022)	Adaptation of DeLone and McLean Model (2003)	137 EHR users at the national health insurance of Tunisia. Quantitative. Structural Equation Modeling.	EHR has an interesting positive impact on the national health insurance of Tunisia in terms of knowledge sharing (net benefits). Knowledge sharing depends more on EHR use than satisfaction. The results show that system quality, information quality, and service quality impact positively and respectively EHR use. The study findings show that user satisfaction depends only on information quality and service quality. The study illustrates that there is no impact of EHR use and service quality on user satisfaction.
Shim and Jo (2020)	Adaptation of DeLone and McLean Model (2003)	506 EHR users at public hospitals in South Korea. Quantitative. Structural Equation Modeling.	User satisfaction depends on service quality. The results offer theoretical and practical insights into the importance of system quality.
Ojo (2017)	Adaptation of DeLone and McLean Model (2003)	442 EHR users at 5 Nigerian public hospitals. Quantitative. Structural Equation Modeling.	Importance of the effect of the system quality and the use of the EHR on its success. The EHR reduces the use of paperwork and appreciates the quality of service to patients. Users perceive an improvement in the access to medical information, knowledge sharing, and communication between medical staff and decision-making.
Tubaishat (2017)	Adaptation of DeLone and McLean Model (2003)	1648 EHR users at 17 public hospitals in Jordan. Quantitative. Structural Equation Modeling.	General satisfaction regarding the EHR is perceived. The EHR use improves knowledge sharing and acquisition by nurses.
Erlirianto, Ali, and Herdiyanti, (2015)	Adaptation of DeLone and McLean Model (2003)	67 EHR users at a public hospital in Indonesia. Quantitative. Structural Equation Modeling.	The quality of information and the quality of service impact and determine user satisfaction. EHR impacts positively the communication and knowledge sharing between medical staff.
Nguyen, Bellucci, and Nguyen, (2014)	Systematic literature review for a period of 10 years (2001-2011) on studies related to the evaluation of the EHR and medical IT based on the DeLone and McLean IS Model.	50208 research papers from 56 international journals removed from Scopus, Embase, Informit, Midline, ProquestHealth, and Medical Complete. Qualitative. Content Analysis.	Results show positive and negative implications following EHR use through the application of the DeLone and McLean Model (1992, 2003). Importance of contingency factors and study context for deep results analysis.
Bossen, Jensen and Udsen (2013)	Adaptation of DeLone and McLean Model (2003)	244 ER users at a regional hospital in Denmark. Quantitative. Structural Equation Modeling.	Overall EHR users' satisfaction and perceived improvement in their individual performance (information access, availability, time saving, productivity), and collective performance (information exchange and team support). The administrative assistants find some difficulties when using the EHR.

The study conceptual model is based on the updated D&M IS success model which is an established measure to evaluate IS success (DeLone & McLean, 2003). The original constructs of D&M model and their operationalization are summarized in Table 1. In this study, we modified the operationalization of those constructs to fit the healthcare setting and EHR. Constructs and their operationalization are defined as follows:

- System Quality measures the desired characteristics of EHR. This variable focuses on the performance of EHR in terms of technical aspects: availability, ease of use, speed, and functionality (Bashiri et al. 2023).

- Information Quality captures the EHR content issue. This variable focuses on the quality of information (semantic aspects and the quality of EHR output) provided by EHR in terms of timeliness, and the extent of the quality of format, content, accuracy, and the degree of its sufficient to fulfil the healthcare professional needs with up-dated information (Chimbo & Motsi, 2024).

- Service Quality is focused on support provided to EHR end-users in terms of online support, documentation, interaction with technical staff, and speed of their response and solving problems (Ojo, 2017).

- Use is focused on the use of EHR and the degree of reliance on it, including information retrieval and performing functional operations.

- User Satisfaction measures end-users' opinion of EHR, and is focused on positive attitudes towards EHR, degree of satisfaction with the medical technology, and its usefulness.

- Net Benefits – Knowledge Management captures the balance of positive and negative impacts of EHR on end-users (medical staff). This variable determines the output of EHR use through the medical staff's perceptions. Previous studies measured Net Benefits in terms of work productivity and quality, sharing and exchange of information, the degree of knowledge transfer among healthcare professionals, and the extent of improving decision-making for medical purposes (Tubaishat, 2017). In this study, we extend Net Benefits to focus on knowledge management practices. The purpose is to investigate the effect of EHR systems on knowledge sharing, medical coordination, and collaboration between hospital services.

The research model is presented in Figure 1. Thus, the following hypotheses are addressed to be tested:

H1: Information quality will positively affect the use of EHR.

H2: System quality will positively affect the use of EHR.

H3: Service quality will positively affect the use of EHR.

H4: Information quality will positively affect user satisfaction with EHR.

H5: System quality will positively affect user satisfaction with EHR

H6: Service quality will positively affect user satisfaction with EHR.

H7: Use will positively affect user satisfaction with EHR.

H8: Use will positively affect perceived net benefit in terms of medical decision-making by using EHR.

H9: User satisfaction will positively affect perceived net benefit in terms of medical decision-making by using EHR.

In order to avoid the complexity of the research model, the feedback links are not included in this study.

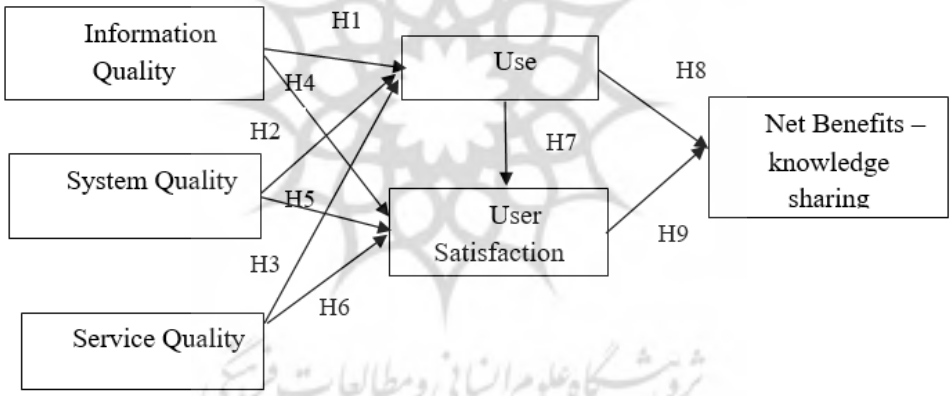

Figure 1. Research Model (adapted from DeLone and McLean, 2003)

Methodology and Results

This study is based on a quantitative methodology conducted at a public medical complex, one of the biggest public sanitary structures in KSA. The medical complex employs 2200 employees. A research agreement was established between the research group and the medical complex. The study sample is composed of EHR users to explore the medical IT success and medical perceptions regarding the EHR effects at the workplace. An online survey will be conducted at the medical complex from June 2022 to September 2022. To optimize participation, two reminders were sent by email by the medical complex IT Direction to EHR users. The questionnaire items were adopted from previous similar studies.

Study sample and data collection

The survey was conducted with 600 medical staff using the EHR. Due to the COVID-19 context, the Medical Complex management restricted the survey distribution to some medical services (general medicine, neurology, radiology, ophthalmology, orthopedics, internal medicine, urology, dermatology, and nutrition). Participation in the survey was anonymous and voluntary. After receiving 422 responses and eliminating the invalid ones, a final sample of 282 valid complete responses (47% response rate) was retained. The sample is composed of 83.3% female and 16.7% male employees. Table 1 illustrates the respondents' demographic profiles. The sample's median age was in the range of 25–35 (75.5%). Additionally, 79.1% of the respondents are nurses with experience ranging from one to three years using the EHR system. Therefore, 46.7% of the respondents confirmed they continually use the EHR.

Table 2. Sample Description

Criteria	Frequency	Percentage
Gender		
Male	47	16.7%
Female	235	83.3%
Age		
Below 25 years	5	1.8%
Between 25 – 35 years	213	75.5%
Between 35 – 45 years	47	16.7%
More than 45 years	17	6%
Occupation		
Resident	14	5%
General Doctor	8	2.8%
Specialist Doctor	8	2.8%
Consultant Doctor	2	0.7%
Nurse	223	79.1%
Medical Technician	12	4.3%
Medical Administrative	15	5.3%
Academic level		
Diploma	21	7.4%
Bachelor	215	76.2%
Master	30	10.6%
Doctorate	13	4.6%
Other	3	1.1%
Training on EHR		
Yes	231	81.9%
No	51	18.1%
Experience of EHR use		
Less than 1 year	39	13.8%
1 to 3 years	110	39%
3 to 5 years	67	23.8%
More than 5 years	66	23.4%
Frequency of EHR use		
Sometimes	45	16%
About half the time	16	5.7%
Most of the time	89	31.6%
Always	201	46.7%
Total	282	100%

Measures

The survey was designed by adapting items from previous studies (Hadoussa, 2022; Shim & Jo, 2020; Ojo, 2017; Tubaishat, 2017; Bossen et al., 2013; Khan et al., 2013). The 5-point Likert scale is used to evaluate the EHR users' perceptions and contributions to knowledge sharing. The questionnaire was administered in both English and Arabic. The data analysis was performed by combining descriptive and exploratory analysis. Thus, two statistical software programs were used to fulfill the relevant quantitative analysis. SPSS v.28 was used to test the constructs' validity and the scale's reliability. Additionally, structural equation modeling was performed using AMOS v.28, which allowed the researcher to test the model fit and examine the direct and indirect relationships among dependent and independent variables (Allen, 2017; Kline, 2016; Byrne, 2001).

Constructs validity and scales' reliability

The evaluation and verification of the construct "convergent validity" need to apply a scale purification of different items. The Cronbach's alpha and item-to-total correlations have been used to remove weak items, as suggested by Churchill (1979). The adjusted item-to-total correlations were displayed in decreasing order. Therefore, items with commonalities below 0.4 were deleted. The two eliminated items measuring the System Quality (SYSQ) variable are item 6 and item 7 (SYSQ6, SYSQ7), presenting item-to-item correlation values below 0.4 (0.221 and 0.227). Furthermore, Cronbach's alpha is used to evaluate the scale's reliability. The findings reveal that the coefficient of Cronbach's alpha is acceptable since it is above 0.70 (Nunnally, 1978). Moreover, an exploratory factor analysis was performed to explore the scale's factorial structure. Also, to evaluate the discriminant validity, the principal component factor analysis was applied as an extraction approach. Thus, a Varimax rotation, also called Kaiser-Varimax rotation, was used to maximize the sum of the variance of the squared loadings. This orthogonal rotation is a statistical technique applied at one level of factor analysis as an attempt to clarify the relationship among different factors. The Varimax rotation is an adjustment process that simplifies the loading of items by removing the middle ground and identifying the factor upon which the data loads (Allen, 2017). Hair et al. (1998) suggest that a factor loading with a minimum of 0.45 could be considered acceptable. Furthermore, Table 3 summarizes the findings of the exploratory analysis. Table 3 indicates that six factors (system quality, information quality, service quality, system use, satisfaction, and net benefit) are identified and retained as latent variables to evaluate the impacts of the EHR at the medical complex.

Table 3. Exploratory Factor Analysis – factors loading

Variables	Items	Principal component analysis	Factors loading	AVE	Composite reliability	Cronbach's α
SYSQ				0.663	0.847	0.907
	SYSQ1	,805	,647			
	SYSQ2	,849	,720			
	SYSQ3	,712	,507			
	SYSQ4	,808	,652			
	SYSQ5	,844	,712			
	SYSQ8	,796	,633			
	SYSQ9	,807	,651			
INFOQ				0.667	0.866	0.920
	INFOQ1	,818	,670			
	INFOQ2	,879	,772			
	INFOQ3	,887	,787			
	INFOQ4	,855	,732			
	INFOQ5	,681	,464			
	INFOQ6	,850	,723			
	INFOQ7	,725	,525			
	INFOQ8	,872	,760			
SERVQ				0.707	0.877	0.927
	SERVQ1	,771	,595			
	SERVQ2	,846	,716			
	SERVQ3	,850	,722			
	SERVQ4	,790	,624			
	SERVQ5	,858	,735			
	SERVQ6	,867	,751			
	SERVQ7	,880	,774			
USE				0.783	0.827	0.712
	USE1	,868	,754			
	USE2	,758	,574			
	USE3	,787	,619			
SATIS				0.902	0.929	0.914
	SATIS1	,918	,843			
	SATIS2	,924	,855			
	SATIS3	,929	,862			
BENEF				0.786	0.890	0.838
	BENEF1	,834	,695			
	BENEF2	,778	,605			
	BENEF3	,816	,667			
	BENEF4	,768	,590			
	BENEF5	,735	,541			

Model Fit

To test the theoretical EHR success model, structural equation modeling was used. The AMOS 28 package was used to calculate goodness-of-fit indices and the factor loadings of different paths. Mediating effects and moderating effects were also used to analyze the relationship between latent variables. Therefore, the following indicators were used: chi-

square/df ratio, GFI, AGFI, RMSEA, NFI, CFI, IFI, RFI, and the maximum likelihood method adopted in the structural equation model to test hypotheses (Kline, 2016; Byrne, 2001). The results are all within a reasonable range, which suggests an acceptable general fit for the model. The results show the following: $\chi 2$ / df = 4.372, which is lower than the recommended value of 5; GFI = 0.935, AGFI = 0.939, NFI = 0.955, CFI = 0.957, IFI = 0.952, which are higher than the recommended value of 0.9, and RMSEA = 0.056, less than 0.08. Thus, these findings highlight the acceptance of the structural model. Table 4 summarizes the fit indices.

Table 4. Adequation indices – AMOS V.28 Output

Fit indices	Observed indices	Recommended values
Absolute Fit Indices		
Discrepancy (χ^2)	17.488	–
P (χ^2)	0.112	–
ddl	4	–
GFI	0.958	> 0.90
AGFI	0.936	> 0.90
RMSEA	0.054	0.05 to 0.08
Incremental Fit Indices		
NFI	0.968	> 0.90
CFI	0.970	> 0.90
IFI	0.971	> 0.90
Parsimony Indices		More possible weak
Normed χ^2 (χ^2/ddl)	4.372	<5

The path analysis was used to test the relationship between the latent variables. Based on the standardized regression coefficient "β," "t-value," and "p" significance value, the findings show that system quality (β = 0.261, t-value = 3.630, p < 0.001), information quality (β = 0.250, t-value = 3.420, p < 0.001), and service quality (β = 0.247, t-value = 3.905, p < 0.001) have a positive impact on EHR satisfaction. Accordingly, as shown in Table 5, only information quality has a positive impact on EHR use (β = 0.415, t-value = 5.395, p < 0.001). Thus, hypotheses H2, H3, H4, and H6 are accepted as they have significant values (p < 0.001). H1 and H5 are not supported in this study as they have significant values (p > 0.05 and p > 0.01). These results corroborate previous studies (Cho et al., 2015; Sebetci & Çetin, 2016; Bossen, Jensen, & Udsen, 2013; Petter & Fruhling, 2011) and contradict others (Ojo, 2017; Tubaishat, 2017; Tilahun & Fritz, 2015). Moreover, H7 (USE → SATIS) is not supported as the p-value is 0.107. Therefore, the findings show that EHR has a positive perceived impact on knowledge sharing. The results highlight that perceived satisfaction regarding the medical tool (β = 0.487, t-value = 9.999, p < 0.001) and EHR use (β = 0.349, t-value = 7.080, p < 0.001). Thus, H8 and H9 are supported. These findings corroborate previous studies that emphasize the positive impact of EHR use and satisfaction on net benefits in terms of work efficiency (Ojo, 2017; Bossen et al., 2013), collaboration (Tubaishat, 2017; Alkureishi et al., 2016), and knowledge sharing (Hadoussa, 2022; Tubaishat, 2017; Ojo, 2017). The results of the tested hypotheses are summarized in Table X.

Based on the accepted hypotheses and the observed values from the EHR success structural model path analysis, the optimal model is presented in Figure 2.

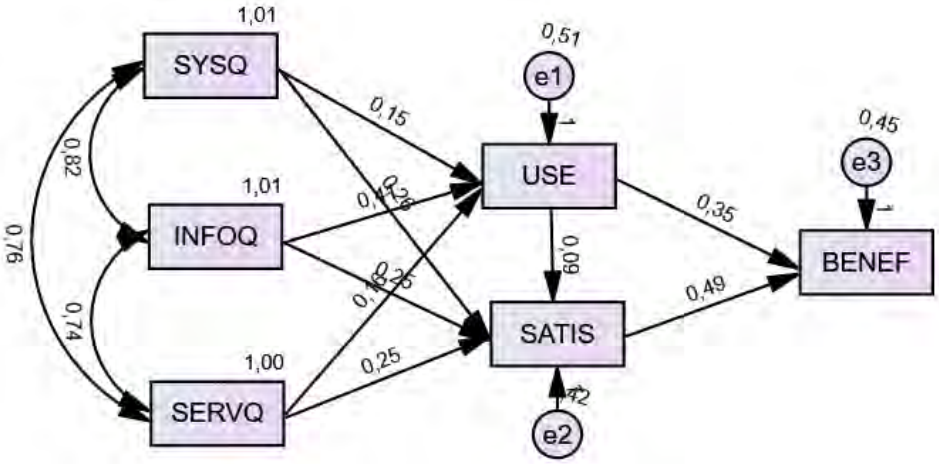

Figure 2. Research Optimal Model – AMOS V.28 Output

Table 5. Results of the structural model – Hypothesis Test

Hypothesis	*Correlation relationship*	*β*	*t-value*	*p*	*Result*
H1	SYSQ→USE	0.153	1.939	.053	Infirmed
H2	SYSQ→SATIS	0.261	3.630	***	Confirmed
H3	INFOQ→USE	0.415	5.395	***	Confirmed
H4	INFOQ→SATIS	0.250	3.420	***	Confirmed
H5	SERVQ→USE	0.158	2.277	.023	Infirmed
H6	SERVQ→SATIS	0.247	3.905	***	Confirmed
H7	USE→SATIS	0.087	1.612	.107	Infirmed
H8	USE→BENEF	0.349	7.080	***	Confirmed
H9	SATIS→BENEF	0.487	9.999	***	Confirmed

Discussion

Digitalization in the medical care sector has led to significant improvements in hospitals' work practices and especially knowledge management. The integration of medical technologies and specifically the EHR system has, in turn, enabled medical structures to modernize their knowledge management system and provide them with better conditions and opportunities to share appropriate medical knowledge for better medical service (Mazur et al., 2019). Based on the adaptation of DeLone and McLean's taxonomy (2003), this study aims to find out the impact of EHR use on knowledge sharing practices in a Saudi medical public complex located in Jeddah city. Overall, this study validates the D&M IS Success Model in the Saudi context. The results revealed that all the main hypotheses are supported except for system quality and service quality, which were found to have an insignificant relationship

with EHR use (H1 and H5). Also, an insignificant relationship is pointed between EHR use and EHR satisfaction (H7), which means that the assumption of the effect of the technical characteristics of the medical tool has no impact on system use. Hence, according to many users, the use of the medical tool is necessary and not voluntary, and some users, especially nurses, are not familiar with the EHR since they did not receive any training period to get familiarized with this medical technology. Therefore, the results of this study support the role of EHR use in promoting knowledge-sharing practices within the medical care center. The findings show that EHR users perceive a promotion of communication and knowledge transfer between medical services and staff. This implies that the EHR system has the potential to promote knowledge sharing among medical staff. This result is consistent with previous studies (Guerrazzi & Feldman, 2020; Wu et al., 2020; Mazur et al., 2019). Therefore, the study results support previous findings, which suggest that the EHR's characteristics of information quality, system quality, and service quality promote medical care's knowledge sharing through system satisfaction and use (Hadoussa, 2022; Ojo, 2017; Tubaishat, 2017; Alkureishi et al., 2016; Bossen et al. 2013).

Previous studies show that EHR appreciates electronic documentation, which has a positive impact on reducing doctors' dependence and trust in memory to save patient data (Shachak et al., 2009). In the same vein, Moody et al. (2004) reported that 75% of nurses participating in a survey study agreed that EHR resulted in improved quality of documentation. Also, previous studies showed that EHR improved communication due to patient-focused interactions and improved information access and sharing (Alsulameet al., 2016; Yau et al., 2011). Besides, with increased quality of care, EHR reduced medication-related errors, improved follow-up of test results, and enhanced care communication and coordination within the medical staff (Chimbo & Motsi, 2024; Ayaada et al., 2019; Alkureishi et al., 2016).

Therefore, the study results show that the EHR system resulted in better adherence and synergies between medical staff. It also fosters access to up-to-date knowledge and collaboration (Guerrazzi & Feldman, 2020). Consequently, the growing adoption of EHR by interdisciplinary care teams has led to the need to share information between different providers to facilitate care coordination and communication (Hadoussa, 2022). For Nguyen et al. (2014), it is important to guarantee the quality of shared data. This should involve ensuring the accuracy and completeness of all data, as well as excellent information access and availability of data. Especially, with the current trend towards system interoperability and integration within other systems and data sources, privacy and confidentiality are top priorities while ensuring patients receive continued quality of care (Guerrazzi & Feldman, 2020).

Following the recommendation of DeLone and McLean to continuously test and adapt their model in different contexts, this study has validated the model in the context of a public

medical care center in Saudi Arabia. This study shows that system use, and system satisfaction are important measures of perceived net benefits, which ultimately drive success and better implications of knowledge sharing. Furthermore, the study results revealed that information quality has the most influence on system use and satisfaction. This result joins the previous findings of Shim and Jo (2020) who demonstrated that EHR users trust in the information quality especially of a public hospital. The authors found that information quality is very likely to affect users' satisfaction and willingness to use the medical tool and perceive its benefits. Therefore, it follows that hospital administrators and EHR managers should pay particular attention to information quality. Also, the study results highlight some unsatisfaction regarding system quality characteristics and service quality that seem to be negatively perceived by EHR users. Consequently, EHR managers need to pay more attention to such technical characteristics. In the same vein, previous studies consider that the implementation of EHR is a difficult process, and medical staff are sometimes unsatisfied with what they perceive to be a time-consuming system since they consider that this medical tool is designed to respond more to bureaucratic demands than to the real needs of the medical practice (Narattharaska et al., 2016). Consequently, to cope with the complexity of EHR success, it is crucial for the EHR managers to adopt a managerial culture suitable to digital transformation avoiding a potential mismatch that could expose major implementation to some difficulties and even failures (Kirk et al., 2019). Furthermore, effective EHR success requires an abandonment of hierarchical modes of implementation through communication and horizontal collaboration that would generate positive outcomes for the medical staff who will use the system (Hadoussa, 2022; Walraven et al., 2022; Mazur et al., 2019; Narattharaska et al., 2016).

Theoretical implications

This study offers theoretical contributions especially for academics and practitioners in Management Information Systems and public management. First, with an adaptation of the DeLone and McLean taxonomy (2003), a research model is developed to explore the effect of EHR use at a medical care complex on medical staff knowledge practices. The specific findings of this research contribute to the existing empirical literature by demonstrating the confirmation of the DeLone and McLean Model as a relevant instrument of IS success within the medical care sector. Therefore, the findings of this study contribute to theoretical assumptions showing the positive impact of medical technologies and especially the EHR on knowledge-sharing practices.

Moreover, this study found interesting results regarding the impact of each of the three dimensions of an IS success. While some researchers studied the acceptance of the EHR or its impacts through a specific case study, this research examined the IS success dimensions (information quality, system quality, service quality, system use, and system satisfaction) within the medical care sector to emphasize the implications on medical knowledge sharing

practices. Few empirical studies examined and tested the DeLone and McLean taxonomy in the medical care sector, especially in the MENA Region (Hadoussa, 2022). The main theoretical contribution of this research is the clarification of the main important IT dimensions and EHR characteristics that may affect the knowledge-sharing practices in a Saudi medical care center. This research contributes also by clarifying the benefits of the EHR system in terms of knowledge sharing.

Managerial implications

The findings of this study offer also important practical implications to EHR developers and managers, health professionals, and policymakers in the medical care sector by expanding the notion of the EHR and digital medical tools. The findings show the importance that EHR users give information quality as a crucial factor in determining user satisfaction and EHR use in the medical center. Information accuracy, reliability, completeness, relevance, clarity, availability, etc. are important to optimize the knowledge sharing and medical service provided to patients. Consequently, the EHR and health IT tool–generated data need to be standardized, assembled, and easily accessible in structured, computer-readable formats for data analysis and proper comparisons of results across different medical systems (Wu et al., 2020). To optimize the knowledge-sharing benefits of EHR use, previous studies suggest combining and/or integrating other medical tools into EHR. Thus, additional digital health tools, such as patient portals, practice management systems, and MHealth tools or apps, have become integrated components of an EHR for enhancing patient care or collecting additional patient medical information (Wu et al., 2020; Lai and Afseth, 2019; Waldren, Agresta, and Wilkes, 2017). However, accurate information on these medical tools and applications is not enough, and more efforts must be made and placed on how to motivate medical staff, especially physicians, to show more commitment and continue using the EHR. Hence, developers need to consider varying features in the EHR to enhance users' feeling of being cared for, emotional support, and trust (Shim and Jo, 2020). Thus, the use of real-world data from patient care collected by the EHR and related health IT tools for study participant recruitment and/or clinical outcome measures is integrally pertinent to the medical care organization's mission within suitable technical conditions (Wu et al., 2020). Such data consolidation can provide opportunities for medical care continuity, improving care quality, and analyzing and monitoring medical care service delivery and patient health outcomes (Hadoussa, 2022). Conversely, this may create challenges related to the management and extrapolation of the voluminous and complex amalgamation of data (Guerrazzi & Feldman, 2020). The growing interest in the application of data analytics in healthcare, or health analytics, may reflect the need to address these challenges. In general, the drastic growth and availability of digital data are often referred to as 'Big Data' that could be studied in future research.

Conclusion

In conclusion, this study's results have both theoretical and managerial implications for healthcare organizations. The study contributes to the medical care management and MIS literature by reexamining the D&M IS Success Model to the context of the EHR of a Saudi public medical complex. The findings of this study help medical staff to understand the digital health landscape especially the EHR benefits and the medical digital initiatives that may contribute to performing the work conditions at care organizations. Firstly, the study shows that healthcare organizations can identify various benefits from the use of the EHR, especially in terms of knowledge management and sharing to propose better medical services (Guerrazzi & Feldman, 2020; Wu et al., 2020; Jetley & Zhang, 2019; Wu et al., 2019, Mazur et al., 2019). In Saudi Arabia, there is an interest in emphasizing digital health diffusion and use at medical centers and hospitals within the Saudi Vision 2030. The Saudi government invests massively in digital medical tools and tries to develop a knowledge economy culture to replace the oil-based economy (Hadoussa & Louati, 2023; Altuwaijri, 2012; Bah et al., 2011). Secondly, other medical centers and hospitals can learn from the medical complex experience and make similar investigations by adapting the DeLone and McLean taxonomy to evaluate the success of the medical technology to better explore and perform the use of digital health innovations. The findings of this study should be discussed considering some limitations. First, data collection was limited to one public medical care center and limited to a specific period of the organization's life and one medical tool. Furthermore, although the sampling method and the use of structural equation modelling provide interesting data, considering the use of additional sources of data, such as interviews and focus groups can cross-validate the results and emphasize the importance of the EHR benefits in terms of knowledge-sharing. The limitations of this study suggest a future research development considering social and cultural aspects dealing with the Saudi and Arab cultures regarding the use and impacts of the EHR. Future research may also consider comparing the perceived benefits from different group users' perspectives (nurses vs physicians).

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Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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