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Beyond ISO Standards: What Really Drives EHRS Adoption in Developing Healthcare Systems

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Abstract. The Electronic Health Record Systems (EHRS) lie at the heart of digital transformation, however, in developing countries, their availability does not guarantee adoption. In Jordan, the EHR (Hakeem program) is facing different level of adoption between clinicians. This brings the necessity to understand the nature of interaction between socio-technical effects on adoption. Therefore, based on the theoretical underpinning of Socio-technical theory, the aim of this research is to examine whether and how the technical aspect of the software quality of ISO/IEC 9126 can be translated into the practical EHRS adoption and how the social effect of Perceived Usefulness (PU) reinforces or undermines these relationships. An explanatory mixed-method sequential design was used. Regression and moderation tests were used to analyze quantitative data of 201 clinicians, whereas thematic analysis of interviews with 10 clinicians enhanced the interpretation of statistical results. Results showed that the six dimensions of the software quality (Functionality, Reliability, Usability, Efficiency, Maintainability, Portability) were predictors of EHRS adoption (39% variance explained), with reliability and functionality being the most powerful predictors. Further, PU had a significant moderating effect on all the relationships. Qualitative findings revealed there are usability issues, use of hybrid paper based processes, a lack of system intelligence and external accessibility, and lack of efficiency in documentation workflows. Further extended emerging organizational conditions as compliance-based leadership, bureaucratic stagnation, insufficient training, and ineffective feedbacks were major limitations that influenced the engagement of users. Therefore, the results show that the ISO standards are necessary but not sufficient basis of EHRS adoption; as per the socio-technical systems theory, successful adoption will arise of the simultaneous optimization of technical quality, perceived clinical value by clinicians and favorable organizational configurations.

Keywords: Socio-Technical Theory; Electronic Health Records; ISO/IEC 9126; Software Quality; Technology Adoption; Perceived Usefulness; Healthcare Information Systems; Mixed Methods

1. Introduction

Healthcare is going digital and changing the way clinical data are generated, shared, and accessed, and electronic health records systems have been at the core of this transformation. Research found that systems improve the coordination of care, minimize errors and reinforce evidence-based decisions (Chance et al., 2024; Chen et al., 2023). However, the real implementation and continued use of electronic health records system is still low, especially in developing economies, despite the huge investments made in them globally (Mugauri et al., 2025). Most hospitals have technically sound procured systems that are not only utilized in an unproductive manner but also even abandoned, which manifest a root cause of non-congruence in system quality versus user acceptance (Abdullah et al., 2025; Mensah et al., 2024). In Jordan the national Hakeem e-health program was introduced in 2009, the Ministry of Health (2023) has been aiming at achieving complete digitalization of the public healthcare facilities. According to Al-Mamlaka TV (2026) reported that over 570 healthcare facilities had been linked to the national system technically, this transformation constitutes a strategic step in line with the 2023–2033 economic modernization vision, which has placed digital transformation among its priorities to build a more efficient and sustainable health sector. However, system utilization remains incomplete; physicians and nurses are inclined to use paper workflow, and integration of clinical data is disjointed (Bizzari, 2023). The gap between national ambition and day-to-day practice reflects a structural issue of technological advancements and the lack of appropriate behavioral and perceptual changes on the part of healthcare practitioners.

International Organization of Standardization (ISO) has suggested standards like ISO/IEC 9126 to guarantee the quality of software products including functionality, reliability, usability, efficiency, maintainability, and portability (ISO, 1991). These standards are critical safety and system reliability assurances of patient safety in healthcare (Attar, 2026). Yet, the high adherence to the ISO measures does not necessarily mean the high user adoption (Franchina et al., 2023). The software installed in hospitals can be technically perfect but practically ignored, which means that technical quality is not an adequate requirement of successful digital transformation. This is justified by the social-technical systems theory (Trist and Bamforth, 1951) that states that organizational performance is a result of the collective optimization of the technical and social subsystems. In this sense, the adoption of EHRS cannot be analyzed using the software quality only, but it is also influenced by human factors, organizational frameworks, workflow processes, and organizational culture. Further, this is supported by technology adoption theories, both the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and the Technology Acceptance Model (Davis, 1989) emphasize the idea that people make decisions which are guided by their perceived benefits and beliefs. Of these beliefs, Perceived Usefulness (PU), which is the extent a user believes that an interaction with a system will lead to improved job performance, proves to be the strongest predictor of intention to use technology. However, there are scarce of research that empirically investigate the role of PU in moderating the relationship between software quality and actual adoption especially in Jordanian context.

Therefore, this research seeks to contribute to fill the theoretical and empirical gap by examining the influence of ISO software quality standards on the adoption of electronic health records systems within Jordanian healthcare facilities, with an emphasis on the moderating influence of perceived usefulness. Further, it intends to answer the following questions:

- To what extent do ISO software quality standards influence the adoption of electronic health records systems?
- Does Perceived Usefulness (PU) moderate the relationship between software quality and the adoption of electronic health records systems?

2. Literature Review

2.1 Electronic Health Record Systems: Evolution and Impact

The development of Electronic Health Records Systems (EHRS) has transformed the simple digital filing system into a complex clinical information system that can facilitate holistic patient care, administration and health management of patients (Shen et al., 2025). The development can be tracked to generations: the first-generation systems (1960s-1980s) used to perform no more than the functions of the administration and billing. The second-generation systems (1990s-2000s) did add the possibility to include clinical documentation and some of the basic decision support features. The third-generation systems (2010s-present) now feature advanced analytics, interoperability, mobile access, and artificial intelligence features (Evans, 2016; Shen et al., 2025).

The first versions of EHR were developed in the major academic medical centres and government hospitals, where the necessity to handle large amounts of patient data predetermined the immense investment in the computing infrastructure that was both expensive and low-processing capacity in those days (Shen et al., 2025). The limiting feature of these early systems was that they could largely automate financial transactions, patient registration and inventory control but very little consideration was given to clinical utility or the needs of the frontline healthcare providers (Evans, 2016). The move to second-generation systems was a turning point, as healthcare organizations started to realize the possibility of digital platforms aiding clinical processes, such as the recording of patient encounters, the recording of laboratory findings, and the creation of simple alerts about drug interactions and allergies (Campanella et al., 2016). The key characteristic of the third generation of EHR systems is a fundamental change in their role, which is no longer the conversion of paper-based records into their digital forms, but the creation of intelligent clinical processes capable of processing complex patient data, conducting disease monitoring at population levels, and providing treatment advice to individual patients based on machine learning and language processing technologies and artificial intelligence (Zhu & Su, 2023).

Modern systems are becoming more and more AI-assisted, predictive models, and decision support systems collaborating with clinicians in real time; a significant shift away from systems that only stored data to those that actively help to inform the care provided with that data (Ahmed et al., 2023). Data fragmentation in healthcare has been an issue and standardized communication systems such as HL7 and FHIR have started to solve this by ensuring that hospitals, diagnostic labs, community pharmacies in which they can exchange patient data in a uniform and timely way (Bikkanuri et al., 2024). These organizations are no longer confined in isolated silos, but they have the ability to engage in a larger data ecosystem that facilitates coordinated care. Cloud computing and mobile connectivity has continued to redefine the manner in which clinicians communicate with patient records. Providers in facilities that work in more than one location or those who provide care at a remote location via telemedicine tools are able to access and update records in real-time (Sachdeva et al., 2024). In addition, patient portals have enabled people to have a more active role in their own health-care, whether it is to review test results and make appointments or to communicate with their care team (Aboumoussa et al., 2025).

2.2 EHR Challenges and Adoption patterns in Developing Countries

Comparative evidence in the developing countries depicts similar but context sensitive patterns of EHR adoption. Poor fit between system design and clinical workflows in Nigeria is associated with low adoption and, in part, because of insufficient clinician contributions in interface development (Onyeabor et al., 2025). On the same note, research in Saudi Arabia and Bangladesh suggests that physician resistance is not only an attitude issue, but also a functional problem and incompatible with the current documentation practices (Hossain et al., 2019; Woodman et al., 2022). In Latin America and Southeast Asia, the opposite results are shown, as it was found that an organizational culture and leadership play a critical role in expediting adoption despite resource limitations (Rajamani et al., 2022; Wang et al., 2024). According to Budd (2023), among healthcare professionals has been one of the most persistent obstacles because clinicians tend to view EHRS as the increased documentation burden instead of simplifying their clinical processes. Murad et al. (2024) found that the main factor leading to clinician burnout and dissatisfaction is excessive time on data entry and system navigation, particularly among the physicians who admitted to spending more time working with the system than patients. Therefore, work life balance is required (Situmorang et al., 2025). Al-hajj and Al-Sufyani (2026) noted that overwork in a high demand health care service can contribute to burn out and affect the quality of service. Furthermore, the increasing amount of artificial intelligence and algorithmic decision-making in EHRS has also brought about ethical implications of bias in clinical recommendation, non-transparency in automated processes, and accountability issues when system-generated suggestions lead to negative patient outcomes (Cross et al., 2024). Further, the adoption of electronic health records systems is nearly universal in developed countries, but the adoption in developing countries is challenging and difficult.

This gap in adoption can be attributed to several factors. The resource constraints such as insufficient budget to initially acquire and implement, insufficient technical infrastructure such as poor electricity and internet connection, lack of available IT professionals to install, maintain and support, and conflicting health care needs in resource-strapped environments are major challenges (Mwogosi & Kibusi, 2024; Taher et al., 2025). The lack of digital literacy of healthcare workers, lack of training programs and support, excessive staff turnover to create discontinuity are all human capacity factors that complicate adoption (Oudbier et al., 2024). Organizational barriers such as poor governance systems and accountability, deficiency in standardization within healthcare facilities, interoperability of the current systems, and supportive regulatory systems are also barriers to change (Dehghan et al., 2026). Also, other factors that contribute to the low rate of adoption are cultural obstacles to technology-related care, the fear of losing jobs and becoming deskilled, the preference of patients to the previous technology-free paper-based system, and the distrust towards technology (Ramadan et al., 2024).

In addition, there are also technological and implementation complications that contribute to the slow pace of EHR system adoption in developing countries. Research studies, like that of Kruse et al. (2024), suggest that the usability of the system, such as the absence of a well-designed interface, the inability to customize the system to fit the local workflow, and the lack of flexibility, have a significant negative impact on user acceptance and the ultimate use of the system (Cahill et al., 2025). Garber et al. (2023) highlight that the lack of user-centered design and stakeholder engagement when developing a system results in the incompatibility of system functionalities with the needs of healthcare providers. Moreover, the issue of data security and privacy are of high priority, as poorly developed cybersecurity systems and the absence of transparent data management policies can further contribute to breaches and make healthcare professionals and patients less trustful (Nemec Zlatolas, Welzer, & Lhotska, 2024).

2.3 ISO Software Quality Model

The ISO/IEC standards, which is a sub-set of the Systems and Software Quality Requirements and Evaluation (SQuaRE) series, offers a broad framework to software quality evaluation. In this research ISO/IEC 9126 is examined as a theoretical framework which defines six characteristics: functionality, reliability, usability, efficiency, maintainability and portability (ISO/IEC 9126, 2001). This model is further developed by ISO/IEC 25010:2011, which includes eight characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability (ISO/IEC 25010, 2011). The new ISO/IEC 25010:2023 model introduces safety as a ninth quality characteristic and clarifies definitions of the existing characteristics to accommodate advanced and complex systems like health care (ISO/IEC 25010, 2023).

Functional Suitability extent to which the system provides functions that meet stated and implied needs under specific conditions (ISO, 2024). It encompasses Functional completeness; Functional correctness; Functional appropriateness (ISO, 2024). Functional suitability of the EHR is a measure of system that fully and accurately addresses clinical functions like documentation, order entry, and management of results (Al Ani et al., 2022). Performance Efficiency refers to the Degree to which the system performs efficiently relative to the resources used and conditions specified (ISO, 2024). It encompasses Time behavior; Resource utilization; Capacity (ISO, 2024). In EHR it provides rapid response times, minimal processing delays, efficient data retrieval, and high system capacity to handle multiple users (Al Ani et al., 2022). Compatibility refers to the Ability of the system to operate with and exchange information among other systems in shared environments (ISO, 2024). It encompasses Co-existence; Interoperability (ISO, 2024). The interoperability of EHR will minimize medical errors, duplicate testing, and care coordination because it facilitates the sharing of data in real-time and securely among healthcare organizations (Torab-Miandoab et al., 2023). Usability refers to the degree to which the system is easy to use, learn, operate, and interact with effectively, efficiently, and satisfactorily (ISO, 2024). It encompasses Appropriateness recognizability; Learnability; Operability; Error protection; Interface aesthetics; Accessibility (ISO, 2024). Effective EHR systems are usable, with a high level of searchability, customization, simplified workflow, and easy instructions, thus, reducing errors and increasing clinician satisfaction (Cahill et al., 2025).

Reliability refers to the degree to which the system consistently performs its required functions under specified conditions for a specified period (ISO, 2024). It encompasses Maturity; Availability; Fault tolerance; Recoverability (ISO, 2024). EHR systems need to retain redundancy and backup systems to reduce unexpected downtimes and data accessibility at remote locations in case of system failures (Al Ani et al., 2022). Security refers to the degree to which the system protects data and ensures only authorized access, integrity, and accountability (ISO, 2024). It encompasses Confidentiality; Integrity; Non-repudiation; Accountability; Authenticity (ISO, 2024). In EHR it Safeguards patient information, prevents unauthorized access or modification, ensures user actions are traceable, and meets healthcare privacy and regulatory requirements (Mejía-Granda et al., 2025). Maintainability refers to the Degree to which the system can be modified efficiently by authorized personnel (ISO, 2024). It encompasses Modularity; Reusability; Analyzability; Modifiability; Testability (ISO, 2024). EHR systems show maintainability by being designed in a modular manner, which allows integrating specialized components, centralized updating deployment, and adapting to current clinical needs (Torab-Miandoab et al., 2025). Portability refers to the Degree to which the system can be transferred effectively to different environments (ISO, 2024). It encompasses Adaptability; Installability; Replaceability (ISO, 2024). Software-independent architecture ensures EHR portability and promotes data transformation and migration to different standards, which avoids the expensive system replacement cycles. (Pedrera-Jiménez et al., 2023).

The improvement of healthcare information systems by ISO quality standards has gained more importance over the last few years. The studies on quality dimensions of health IT show that there are some common trends in various studies. A systematic review of 40 EHR systems evaluations found by Al Ani et al. (2022) that the most commonly evaluated aspect of EHR systems was usability (25 studies), whereas security was the least commonly evaluated (two studies); performance efficiency was frequently described as problematic with the studies consistently identifying excessive time and clicks to complete tasks as a primary issue. Further, a systematic literature review by Noël et al. (2022) of 17 primary studies revealed that the majority of HIS quality measurement was conducted through a management lens, and few pragmatic studies on the mechanisms and tools required to translate quality standards into practice were available. Torab-Miandoab et al. (2023) reviewed 36 studies on the interoperability of heterogeneous health information systems and found out that the absence of integration mechanisms between the systems continues to negatively impact the quality of care and use unnecessary resources. The review established that the most common form of interoperability across the examined systems was semantic-level, and HL7 FHIR was the most popular transport standard, and complete interoperability between healthcare systems was yet to be realized.

2.4 Socio Technical Theory and Technology Acceptance in Healthcare Informatics

The socio-technical theory, which was first introduced by Trist and Bamforth (1951), is founded on the assumption that organizations consist of two mutually dependent subsystems (social subsystem and technical subsystem) that include people, roles, relationships, tools, technologies, and processes, and that the best performance in an organization is possible only when the two subsystems are jointly optimized. This theoretical view has found a lot of ground in the context of healthcare information systems as a theoretical framework to explain the nature of interactions between clinical staff, organizational frameworks, and digital technologies (Kapepo et al., 2025; Kemp et al., 2024; Rangel & Humphrey-Murto, 2024). EHR systems has been discussed as a socio-technical change that is not merely a technical initiative but in essence changes the clinical workflow, patterns of communication, and professional roles within healthcare organizations (Brunner et al., 2023; Mwogosi, 2025). In a socio-technical model that is specifically applied to health IT, Sittig and Singh (2010) suggested eight dimensions, which include hardware, software, clinical content, human-computer interface, people, workflow, organizational policies, and external environment, stating that failures in implementing EHR are seldom due to technology; instead, they are to be attributed to lack of alignments between technical concept and social contexts in which systems are. This view has been reflected in the literature since then, with multiple studies all showing that the issues with EHR, including clinician burnout, workflow interference, and resistance to adoption, are based on socio-technical rather than purely technical failures (Wosny et al., 2023; McBride et al., 2023).

The Technology Acceptance Model (TAM) which was postulated by Davis (1989) provides a complementary theoretical perspective on how and why healthcare professionals embrace or oppose EHR systems and other health management information systems. TAM assumes that the intention to use a technology is mainly conditioned by two perceptual constructs, perceived usefulness, which is the extent to which a person believes that the system will help them to improve their job performance, and perceived ease of use, which is the extent to which one believes that the system will not be straining (Davis, 1989). The TAM has been widely used in the healthcare industry to investigate clinician acceptance of EHR systems with research generally indicating that perceived usefulness and perceived ease of use are both important predictors of adoption intentions among physicians, nurses, and other allied health professionals (Senthilrajah & Ahangama, 2025; Xie et al., 2025). Aggelidis and Chatzoglou (2009) further developed the initial TAM in the context of hospital information systems by adding other constructs, including social influence, facilitating conditions, and training and concluded that the constructs greatly contributed to the predictive ability of the model in explaining the use of the systems by healthcare staff. The more recent literature has gone further to modify TAM to reflect the specifics of healthcare settings, such as patient safety issues, regulatory compliance needs, and the stakes of clinical decisions, and it is hypothesized that the standard TAM constructs are not adequate to adequately explain technology acceptance in health care environments (Ahmed et al., 2023; Guleria et al., 2024).

Even though both TAM and UTAUT have played an important role in understanding the process of adopting healthcare technology, each framework has its own limitation when used separately in a complex healthcare setting. Shachak et al. (2019) made the argument that the simplicity of TAM, though a benefit in terms of accessibility and ease of implementation, often causes it to miss important barriers to healthcare adoption, such as trust, cultural diversity, and domain-specific regulatory issues, and that no TAM-based study examined could operate effectively within the context of a complex healthcare setting without the inclusion of other variables. Further, Shachak et al. (2019) outlined that although UTAUT has a more detailed framework that can explain up to 70% of the variance of technology adoption behavior, observed that UTAUT is complex and therefore intensive in resources and challenging to implement without substantial expertise, and that the majority of UTAUT-based studies had to be adapted to suit the specific needs of a healthcare environment. In line with this opinion, Rangel and Humphrey-Murto (2024) stated that training medical professionals in EHR use is a very complex intervention that takes place within a dynamic socio-technical health system, and that the standard methods that rely on individual-level theories like TAM are not enough to model the entire scope of interacting factors. Based on this, both papers reach the same conclusion that no single theoretical framework suffices and that an integrated approach that leverages several other complementary frameworks is needed in order to attain a more holistic view of technology adoption and use within a healthcare setting.

Berg (1999) suggested that health information systems should be construed as socio-technical networks where the sense and usefulness of technology is constantly constructed through social practices and organizational settings in which they are embedded, a perspective that is quite consistent with the TAM acknowledgement of the importance of user perception in the adoption of technology. The empirical evidence on the topic of healthcare management information system more generally has revealed that successful implementations are typified by high degrees of congruence between system design, clinical workflow, organizational culture, and user perceptions of utility, which supports the complementary nature of both theoretical models (Tetik et al., 2024). Therefore, Socio-technical theory and TAM offer a solid theoretical basis by which the question of whether EHR systems are technically but not socially, contextually, or organizationally unacceptable is addressed.

2.5 Proposed Model and Hypotheses Development

Following the literature analysis, this paper suggests a theoretical framework integrating the software quality dimensions, socio-technical perspectives, and user acceptance factors to explain the adoption of Electronic Health Records Systems (EHRS). The model conceptualizes the system quality based on the key characteristics of the software quality framework defined by ISO/IEC 9126, namely functionality, reliability, usability, efficiency, maintainability and portability that are likely to have a direct effect on EHRS adoption. At the same time, the socio-technical theory provides a holistic view (it builds upon the interaction of technological systems and organizational, human, workflow issues) whereas the Technology Acceptance Model (TAM) identifies the significance of perceived usefulness in the development of user acceptance. Therefore, the current research hypothesizes that the perceived usefulness moderates the relationship between the quality of software and adoption of EHRS, which gives a more elaborate explanation of the process of transforming the technical quality into the real use of a system. Thus, the following hypotheses and theoretical model were developed:

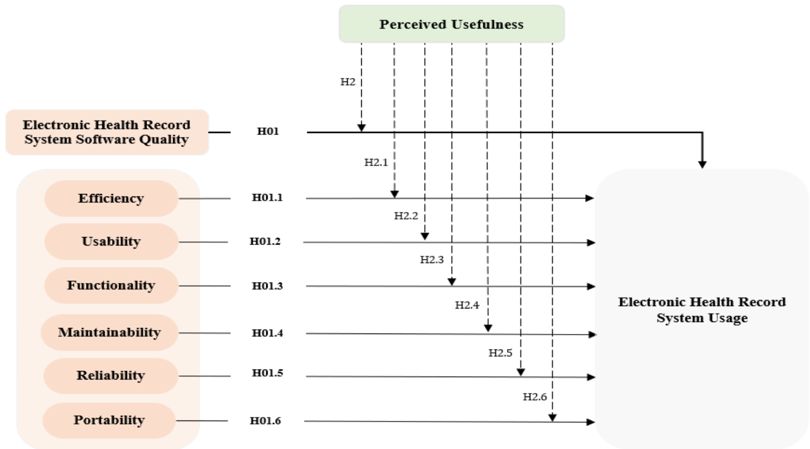

Fig. 1: Theoretical Model

3. Methodology

The research follows the pragmatic paradigm of philosophy which combines the assumptions on objectivism and the assumptions on subjectivism. The quantitative measure of software quality attributes and adoption behavior is based on objectivist principles whereas the interpretation of the experiences and contextual effects on the use of electronic health record systems are guided by the subjectivist perspective. In line with this position, the research employs a pluralistic mixed-methods, that integrates deductive hypotheses testing with inductive thematic inquiry. The research follows the sequential explanatory design by Creswell and Plano Clark (2017) sequential design that starts with priority quantitative, which investigates the correlation between the quality dimensions of ISO/IEC

9126, perceived usefulness and e-HRS adoption. Followed by qualitative interviews, which expounds and attributes context to the quantitative findings, demonstrating the mechanisms of adoption and aspects experienced.

A cross-sectional survey design applied in the quantitative phase is focused on healthcare professionals in the public health facilities of Jordan using Hakeem system: physicians, nurses, pharmacists, allied health staff and administrators. The Ministry of Health (2023) reported that about 14,500 professionals were working in 47 institutions. Purposive sampling was used to include the participants who had direct experience with the systems. A G*Power 3.1 analysis of a regression model having 14 predictors revealed that at least 135 respondents (a = 0.05; power = 0.80) would be required. The researchers received 201 responses that were valid, which is sufficient to have a strong statistical power. ISO/IEC 9126 quality items were adapted from (Abran 2003; Chua & Dyson, 2004), Perceived Usefulness from (Davis, 1989), and electronic health records system adoption from (Hossain, Quaresma, & Rahman, 2019; Venkatesh, Thong, & Xu, 2012; Davis & Venkatesh, 2004; Yoo et al., 2022) with validated 5-point Likert scales. SPSS v30 was employed to perform descriptive and inferential analysis.

The qualitative stage helped in explaining the quantitative results with the use of the thematic analysis (Braun and Clarke, 2006). A sample that was chosen on purposeful sampling consisted of ten doctors to represent first-hand experience with the Hakeem system usage. It was also voluntary; the respondents were assured of confidentiality, but the audio recording was not allowed; thus, notes were recorded in detailed handwritten form. Analysis of data was done according to six steps of Braun and Clarke familiarization, coding, theme development, review, refined, and definition using MAXQDA. The subsequent thematic framework was combined with the quantitative findings to clarify the reasons behind some of the software quality dimensions being more important, how perceived usefulness influenced user behaviour, and the contextual or organizational factors.

4. Results

4.1 Quantitative Findings

Table 2 shows the demographic characteristics of the participants of qualitative phase. The representation of males and females were (55.2% male, 44.8% female). The biggest age category was 30-40 years (39.3%), and the second category is under 30 years (25.4%). Education wise, most of participants had bachelors (57.7%), (37.3%) were masters and (5%) were doctoral. The experience shows that the majority of respondents had 6-10 years (31.3%). Regarding job positions, almost half were medical employees (47.3%), and the others were allocated to unit heads, specialists, consultants, and department heads.

Table 1. Demographics

Variable	Summary (n = 201)
Gender	Male (55.2%), Female (44.8%)
Age	<30: (25.4%); 30–39: (39.3%); 40–49: (23.4 %); ≥50: (11.9%)
Experience	≤5: (23.9%); 6–9: (31.3%); 10–14: (24.9%); ≥16: (19.9%)
Education	Bachelor (57.7%), Master (37.3%), Doctorate (5.0%)
Job Level	Med Staff (47.3%), Unit Head (18.4%), Dept Head (10.0%), Specialist (14.4%), Consultant (10.0%)

4.1.1 Measurement Model

Measurement model was measured through item loadings, Cronbach's alpha (α), composite reliability

(CR) and average variance extracted (AVE). Table 2 showed that all loading of items more than 0.70, CR more than 0.90 and AVE more than 0.50, meaning good convergent validity. The results in general are reliable and valid. The Software Quality (IV) construct has good item reliability with all factor loadings (0.722-0.930). It is also high in internal consistency with (α = 0.807-0.892) and (CR = 0.893 - 0.925) exceeding recommended values. Moreover, the values of (AVE = 0.735-0.859) proves good convergent validity. The construct of EHR (DV) has high factor loading (0.789-0.890), which shows high item reliability. It has a high internal consistency (α = 0.945) and (CR = 0.953) and a satisfactory convergent validity (AVE = 0.667), which proves that the construct is reliably measured. Perceived Usefulness (PU) moderator shows a high item reliability with the factor loading (0.853-0.922). It has a high level of internal consistency (α = 0.887) and (CR = 0.922) and a sufficient level of convergent validity
(AVE = 0.747), which proves that the items are reliable.

Table 2. Measurement Model

Construct	Dimension	No. of Items	Loading Range	α	CR	AVE
Software Quality	Functionality	4	0.853–0.922	0.892	0.925	0.755
	Reliability	3	0.722–0.826	0.820	0.893	0.735
	Usability	3	0.766–0.930	0.830	0.898	0.746
	Efficiency	2	0.823–0.835	0.807	0.912	0.838
	Maintainability	4	0.809–0.850	0.886	0.921	0.745
	Portability	2	0.789–0.793	0.835	0.924	0.859
EHR System Adoption	—	10	0.789–0.890	0.945	0.953	0.667
Perceived Usefulness	—	4	0.853–0.922	0.887	0.922	0.747

4.1.2 Hypotheses testing

Table (3) shows regression outcomes of the effect of Software Quality and its dimensions on EHRS Adoption. For H1, Software Quality has strong and significant effect on EHRS Adoption (β = 0.624, t = 11.278, p = .001). R^2 value is (0.390) that means that (39.0%) of EHRS Adoption variance is explained by Software Quality. Durbin-Watson value (2.053) shows that there are no cases of autocorrelation, and VIF (1.000) shows that there is no issue of multicollinearity. At the dimensional level, all the sub-hypotheses (H1.1- H1.6) are validated, and each dimension of Software Quality has a significant impact on EHRS Adoption. Usability (β = 0.512) shows the strongest effect, followed by Reliability (β = 0.477), Maintainability (β = 0.475), Efficiency (β = 0.468), Functionality (β = 0.449), and Portability (β = 0.423). t-values (6.589-8.418) and the p-values (.001) are all statistically significant. R^2 values of the dimensions are in the range between (0.179-0.263). Also, the values of Durbin-Watson (1.862-2.038) show that there is no problem with autocorrelation. The VIF values are all equal to 1.000, which proves the lack of multicollinearity. Altogether, the results show that Software Quality and all its dimensions are highly positive and significant to EHRS Adoption.

Table 3. Regression Analysis

Hypotheses	R^2	β	t	p	DW	VIF	Decision
H1 Software Quality → EHRS Adoption	0.390	0.624	11.278	.001	2.053	1.000	Supported
H1.1 Efficiency → EHRS Adoption	0.219	0.468	7.475	.001	1.972	1.000	Supported
H1.2 Usability → EHRS Adoption	0.263	0.512	8.418	.001	1.970	1.000	Supported
H1.3 Functionality → EHRS Adoption	0.201	0.449	7.080	.001	1.907	1.000	Supported

H1.4 Maintainability → EHRS Adoption	0.225	0.475	7.609	.001	1.862	1.000	Supported
H1.5 Reliability → EHRS Adoption	0.228	0.477	7.661	.001	2.038	1.000	Supported
H1.6 Portability → EHRS Adoption	0.179	0.423	6.589	.001	1.879	1.000	Supported

Table (4) shows the moderation analysis of perceived usefulness on the relationship between software quality and software dimensions and EHRS Adoption. H2, Software Quality and PU have a significant interaction effect on EHRS Adoption (β 0.142, t = 5.087). The confidence interval (LL = 0.139, UL = 0.316) excludes the value of zero, which proves that there is a significant moderating effect. This indicates that the correlation between Software Quality and EHRS Adoption is reinforced by increasing the perceived usefulness. All the interaction effects (H2.1- H2.6) are also significant at the dimensional level. Among them, Reliability × PU (β = 0.228) and Functionality × PU (β = 0.215) show the strongest moderating effects, followed by Usability × PU (β = 0.204), Portability × PU (β = 0.193), Maintainability × PU (β = 0.165), and Efficiency × PU (β = 0.157). The t-values (2.796 to 4.137) are statistically significant, and the confidence intervals are not equal to zero, which also proves the strength of the moderating effects. All in all, these results show that Perceived Usefulness enhances the effects of Software Quality and its dimensions on EHRS Adoption, which means that users tend to adopt the system more when they believe that it is useful.

Table 4. Moderation Analysis

Hypotheses	β	SD	t-value	LL	UL	Decision
H2 Software Quality × PU → EHRS Adoption	0.142	0.045	5.087	0.139	0.316	Supported
H2.1 Efficiency × PU → EHRS Adoption	0.157	0.042	2.796	0.035	0.202	Supported
H2.2 Usability × PU → EHRS Adoption	0.204	0.040	3.800	0.074	0.233	Supported
H2.3 Functionality × PU → EHRS Adoption	0.215	0.041	4.005	0.083	0.246	Supported
H2.4 Maintainability × PU → EHRS Adoption	0.165	0.043	2.900	0.040	0.211	Supported
H2.5 Reliability × PU → EHRS Adoption	0.228	0.043	4.137	0.093	0.262	Supported
H2.6 Portability × PU → EHRS Adoption	0.193	0.043	3.760	0.077	0.247	Supported

4.2 Qualitative Findings

The table (6) shows the thematic analysis of qualitative results, which demonstrate the main themes and subthemes, representative quotes provided by participants, and their corresponding interpretation as to the use of electronic health records systems.

Table 5. Thematic Analysis

Theme- Subtheme	Illustrative Participant Quote
Functionality (Hybrid paper use; Not Intelligent; Limited Offline Capability)	"We still sometimes use paperwork" (P1) "It shows lab results, but I can't view any trends over time" (P2) "When the network drops, we lose access to it" (P4)
Reliability (Minor slowdowns and no data loss; Network & load issues; Constant monitoring)	"It freezes occasionally, but no patient data loss" (P1) "Once a lot of us log in, the system slows noticeably" (P5) "We're told we have 95% uptime with nightly backups" (P6)
Usability (Complex layout; Peer-to-peer learning; Intuitive colors)	"There are too many tabs and the text is small; it strains the eyes" (P4) "We mostly learn the system by teaching each other" (P2) "The color-coded panels make it easier to follow the patient workflow" (P6)
Efficiency (Data Retrieval speed; Reduced duplication; User Experience Level; Reduced Costs)	"Finding results is quick, but entering notes is still slow" (P3) "We avoid duplicate orders everything updates instantly" (P4) "Younger doctors move faster in the system" (P5) "Monthly medications are fully tracked now, less waste stock" (P7)
Maintainability (Reactive maintenance; Limited training; Diagnosis Transparency; Weak Feedback Loops)	"IT fix issues but sometimes forget notify us about updates" (P1) "We were trained once when it launched—nothing since then" (P4) "IT just says it's a 'technical issue' with no details" (P5) "We report problems, but no updates on whether they were solved" (P2)
Portability (No remote access; Patient Mobile App)	"I can't review patient results from home" (P3) "Patients can see results, view their history" (P8)
Perceived Usefulness (Practical utility; Enhanced accountability; Safety assurance)	"It saves time and prevents losing documents" (P1) "Every action is recorded, who prescribed, who approved" (P7) "Allergies and past medications appear" (P5)
Organizational Context (Compliance over training; Bureaucratic inertia; Institutionalization)	"Hospital focuses on compliance more than actual training" (P3) "We report issues, but decisions take too long to happen" (P5) "Now the system is officially part of hospital strategy we depend on it" (P6)

4.3 Integration of Qualitative and Quantitative Findings

The thematic interpretation discussed in this study is based on a mixed-method design triangulating qualitative evidence and quantitative regression coefficients. The qualitative results describe the processes, why and how behind the quantitative coefficients (β) and show that statistical correlations are not abstract relationship but rooted in practice in clinical practices, organizational imperatives.

Theme 1: Functionality Drives Workflow Integration ($\beta = 0.468$; PU moderation $\beta = 0.215$)

The functionality affects the adoption of EHRS because it helps clinicians to achieve the necessary functions that include accessing results, reviewing histories. The qualitative results indicate that the core features are present, though incomplete system coverage requires a mixed workflow which still involves the use of paper documents to complement digital workflows. The lack of sophisticated features, like trend analysis of the laboratory data, restricts clinical awareness and minimizes the potential of the system to support the evidence-based decision-making. Also, the offline functionality is not available, and operations are disrupted by outages in the network, which makes operations reliant on at least some level of network connection. These difficulties describe the moderately high value of the path coefficient; where functionality is appreciated and applied extensively, but its partial disintegration does not allow it to become the most powerful predictor of adoption. With PU, clinicians are more likely to perceive the usefulness of the system's functionalities, hence more likely to adopt it, even if it is not fully functional.

Theme 2: Reliability Builds Trust and Continuity ($\beta = 0.512$; PU moderation $\beta = 0.228$)

The strongest predictor of quantitative attributes was reliability since clinicians are more concerned with stable system performance compared to any other quality attribute. Qualitative data indicates that occasional freezing is tolerable in the situation when patient data is safe, and continuity and data integrity are important. However, reliability is highly sensitive to infrastructure conditions; slowdown of the system into full utilization is a symptom of susceptibility to loads and network conditions. Such experiences describe the dominant path coefficient of reliability; where clinicians see consistent accessibility as something that cannot be done without. PU also moderates the relationship by enhancing clinicians' attention to system reliability; when clinicians perceive a system as useful to enhance efficiency of workflow, they are more sensitive to system stability and will be more likely to adopt and use the system when it provides reliable performance.

Theme 3: Usability Shapes Learning and Adoption ($\beta = 0.449$; PU moderation $\beta = 0.204$)

Usability affects adoption, as it is a factor that affects the level of ease clinicians have operating the EHRS. The qualitative results show contradicting experiences: the interface is overabundant, text is tiny, and too many tabs are a cognitive burden slowing down the performance of tasks. In addition, the clinicians with lack of formal training depend so much on peer-to-peer learning that their mastery is not consistent. Further, clinicians of a younger age are more adaptable, whereas those of an older age have difficulties navigating. Nevertheless, these difficulties can be lessened by the positive design features, including the color-coded elements of the workflow that enhance the understanding of the tasks and help facilitate the process of clinical decision-making. This is the reason behind the medium value coefficient: the usability influences the adoption but is limited by the obsolete visual design and imbalanced training systems. The PU increases adoption because it helps the clinicians to ignore the usability deficits when they see great practical value.

Theme 4: Efficiency as a Double-Edged Outcome ($\beta = 0.475$; PU moderation $\beta = 0.157$)

Efficiency is a positive factor to EHRS adoption, but the experience of clinicians proves that it has both advantages and disadvantages. Rapid access to test results and medical history accelerates the process of clinical evaluation and eliminates unnecessary records. Nevertheless, entry of notes and some data is still tedious and time consuming, particularly in times of high activity. The level of efficiency also depends upon the digital literacy of the clinicians: younger people can move through the system in a short period, whereas patients need to take more time to finish the common tasks. Also, the system controls order duplication and enhances medication traceability, which will create cost-saving and efficiency. These results confirm the moderate powerful coefficient. PU also adds to the effect, but with a minor contribution, because users perceive efficiency as an improvement but are still limited by documentation bottlenecks.

Theme 5: Maintainability Depends on Communication and Training (β = 0.477; PU moderation β = 0.165)

Maintainability is a major factor in adoption; however, it is felt by the clinicians as more of a communication issue than strictly a technical performance factor. The respondents indicated that IT teams fix issues but do not inform the users on the changes or updates made in the system thus restricting their readiness to adapt. Most clinicians do not have continued support to accommodate updates or new features because of the lack of refresh training since the system was launched. Users also complained that there was no clear explanation for failures of the system, this triggered lack of confidence in the system stability. These are weak feedback loops, in which reported issues are not followed up on, which also contributes to a lack of trust and engagement. The following conditions explain the moderate coefficient: maintainability has an impact on adoption, but it is diluted by communication gaps. PU has a slight effect since usefulness causes users to ignore maintainability deficiencies.

Theme 6: Portability Enables Continuity of Care (β = 0.423; PU moderation β = 0.193)

Portability has effect on adoption through allowing continuity of care between settings, although its effect is limited due to limited access to clinicians. According to qualitative data, the clinicians of state hospitals are not able to view the patient outcomes at home because of stringent network security regulations, which decreases the adaptability when operating on call. Such restrictions undermine the possibilities of portability to providers. On the contrary, patients will receive significant advantages: using a mobile application, the patient can independently obtain a test result, medical history, refill orders, and hand in requests. This will improve patient engagement and help in improving continuity of care. The moderate path coefficient demonstrates the imbalance in the portability benefits, which is great to the patients and rather scarce to the clinicians. PU augments this effect by emphasizing the usefulness of features provided in portable format.

Theme 7: Perceived Usefulness Shapes Commitment (Overall moderation β = 0.142)

Perceived Usefulness reinforces the effects of the software quality dimensions on the adoption by creating cognitive comparisons of the clinicians with the EHRS. The practical benefits mentioned in qualitative results comprise the avoidance of lost documents, the enhancements in accountability due to traceability, the increase in the safety provided by instant alerts about allergies, and the organization of the workflow. Such daily benefits encourage clinicians to continue with the system when it still has problems with functionality, usability, or maintainability. PU are limited by such restrictions as the use of hybrid papers, manual data entry, and limited remote access. Therefore, PU increases adoption but is unable to comprehensively offset structural or infrastructural limitations by which users are constantly confronted.

Theme 8: Organizational Context Determines Sustainability

Even though organizational context was not included in the theoretical model, the qualitative results show that institutional conditions have a major influence in the long-term adoption. The respondents pointed out that management focuses on compliance rather than capacity-building and there is minimal user empowerment. Delay in system improvement decisions which are bureaucratic undermine the motivation of users and responsiveness to complaints made. Further, the system has become institutionalized as part of the hospital strategy and embedded into hospital operations to ensure that the system is still in use. These results point to the fact that software quality is not the only factor that determines adoption; such aspects as organizational culture, leadership priorities, and strategic alignment influence it as well. This theme points to the socio-technical aspect of the implementation of a sustainable digital health system.

5. Discussion

The objective of the research was to investigate why the compliance with the ISO/IEC 9126 standards of software quality is not enough to indorse adoption of Electronic Health Report Systems (EHRS). Further understanding the effect of the six dimensions of software quality standards on the adoption of EHRS and the moderating role of Perceived Usefulness (PU) by focusing on the Hakeem system in the Jordanian public hospitals. The results provide evidence that the six ISO/IEC 9126 quality standards are effective predictors of the EHRS adoption. This confirms the value of the technical quality in the development of user attitudes and behavioral intentions (Uyen, Ly, & Kiet, 2022). However, despite the high predictability of software quality, the qualitative findings reveal that clinicians do not evaluate the system by the technical aspects only. Rather, they describe its value as a part of the flexibility of the workflow, the simplicity of the documentation, its reliability, its full functionality, and maintainability. It is representative of socio-technical theory, according to which systems may even be technically superior, but still fail to reach higher levels of practical and meaningful application. The reason behind this is that the adoption of a system can only be successful when it is technically good, as well as when the system is socially good in terms of user needs, workflow, organizational support, and even user acceptance.

Reliability was the strongest predictor of the adoption, as it would be expected based on the essence of trust, predictability, and constant availability of patient information in the clinical environment. One of the technical attributes that was constantly discussed by clinicians was reliability as an indispensable state of patient care safety and efficacy. This is in line with Catapan et al. (2025) and Wang et al. (2024) which also highlighted the fact that the desire to use it depends on trust of the digital systems by clinicians. The second predictor with the highest power that predicted adoption was functionality and it was highly crucial in workflow and clinical effectiveness integration. Clinicians were excessively utilizing the basic functions, like the capacity to review laboratory findings, medical history, and documents of patient interactions. However, qualitative observation also indicated that it had significant functional incompleteness such as absence of trend analysis, incomplete templates, no intelligent clinical decision support features, and too much manual input. These outcomes validate and build on the previous research findings by Onyeabor et al., 2025; Welzel et al., 2023, who all pointed out that functional alignment with clinical workflows is a leading success factor of digital health systems. The effect of usability on adoption was moderate but significant, and the clinicians often reported the interface as being aesthetically old. Although the system met ISO usability requirements in terms of navigability, responsiveness and interface consistency, it had too many tabs, the text size was too small and there was lack of personalization which complicated ease of use and increased cognitive load during a busy clinical process. These usability issues were also compounded by inadequate training which did not provide clinicians with the time to fully adjust to the system capabilities as time went on. Continuous training and user support are key elements to the success of adopting systems. These results are congruent to the findings of human-factors studies by Budd (2023) as well as the design criticism of Olakotan et al. (2025) who indicated that interface complexity and ineffective ergonomic design lower user satisfaction and impact negatively on adoption. The dependency on informal, peer-to-peer education also contributed to the increase of the difficulty in usability by leading to unbalanced user proficiency among clinicians. The younger clinicians were able to transition to the system easier as opposed to older clinicians who were experiencing an increased frustration rate, which is why Zhao et al. (2024) should be considered correct in their claim that digital literacy is a strong predictor of user experience.

Efficiency showed that the clinicians mentioned that the system has made it easy to access diagnostic information and clinical histories quickly and facilitated coordination of care and minimized duplication. But at the same time, they were having documentation inefficiency, slowness of note entry and delays in workflow- particularly at peak periods. Such opposing experiences confirm the idea that digital efficiency is unevenly distributed between various components systems, and such a position is corroborated by Azadi and García-Peñalvo (2025). Also, efficiency depends on the digital literacy of the clinic staff, their level of comfort handling technology, and the knowledge of the features of the system. Maintainability showed a positive but moderate effect on adoption, but the experiences of clinicians established that maintainability issues were due to technology less and communication more. System updates, fixes or changes would often be unknown to the users resulting in their lack of knowledge and the decrease of adaptability. This is aligned with (Buyantur et al., 2023) who showed that perceived system success goes hand in hand with the visible communication and constant training. The connection between IT teams and clinical users has a strong impact on the acceptance of the systems, which is also a similar argument by (Watkinson et al., 2021; Zhai et al., 2022). The least but the statistically significant effect was portability. Even though the Hakeem system has useful patient-facing features as demonstrated by the mobile application, clinicians have tight restrictions on remote access because of the national security policies. This limits the prospect of the system being used to facilitate continuity of care beyond hospital premises. The results are opposed to the ones in Western environments, where clinician remote access can increase adoption through decision-making on off-site consultations (Tabatabaei et al., 2025; Toll et al., 2025).

Perceived Usefulness (PU) played a moderating role in all the software quality standards. Qualitative data helped to understand that the usefulness of the device as perceived by the clinicians was based on operational benefits, including avoiding lost documentation, improving medication tracking, and improving patient safety, not more sophisticated features such as decision-support systems or predictive analytics. The same has been documented in low-resource or developing systems of health care in which PU is determined by the fundamental system reliability and workflow advantages instead of technical complexity (Ngugi et al., 2021). These studies also highlight the fact that perceived usefulness of EHRS in a limited environment is associated with stability, accessibility and the alleviation of administrative burden. Conversely, the moderating effect of PU tends to be stronger in case of studies in developed healthcare systems, further motivated by the more sophisticated digital infrastructures. Indicatively, Ford et al. (2021) and Upadhyay and Hu (2022) have discovered that intelligent functionalities like clinical decision support, interoperability, automated warnings, and data-driven recommendations often improve PU, capabilities that clearly increase the efficiency and level of diagnostic accuracy of clinicians. Organizational context was not a part of theoretical model, yet it was one of the determinants of long-term sustainability at the qualitative level. The clinicians believed that leadership was more about compliance and not capacity building and that bureaucracy was delaying the process of improving systems at the right time. These findings align with the socio-technical theories that emphasize the importance of organizational culture, the presence of leadership and preparedness to change in digital transformation. The study indicates that despite the presence of an EHRS of high technical quality and perceived usefulness, obstacles of adoption may emerge when there is a slow, top-down, and unresponsive organizational process. This is supported by Dehghan et al. (2026), who have indicated that organizational preparedness, leadership engagement, and situational aspects can be viewed as the key predictors of an effective implementation of electronic health records. Organizational leaders play an important role in creating a vision and motivating staff which in turn leads to sustainable development of human capital (Al-Kharabsheh, 2026).

Practically, policy makers, developers of EHRS, and the healthcare administrators may benefit from this research to demonstrate that technical compliance with the ISO/IEC 9126 standard does not guarantee the meaningful adoption unless it is adapted to the specifics of the clinician workflow, the needs of its work, and the limitations of the circumstances. Additionally, it demonstrates that maintainability needs to be improved by improving communication between IT departments and clinical departments, document interfaces to reduce cognitive load, and policy-constrained portability should be emphasized to support continuity of care. The findings to healthcare administrators indicate the importance of establishing an organizational environment that is supportive in nature i.e. responsive training, involvement of users and infrastructural investment to prevent socio-technical misalignment that is likely to stall the digital transformation initiatives.

6. Conclusion

This paper has investigated how the ISO/IEC 9126 software quality dimensions impact the adoption of Electronic Health Records System (EHRS) in the Hakeem program in Jordan and how Perceived Usefulness (PU) moderates these effects. These results affirm that six dimensions of software quality, including reliability, functionality, usability, efficiency, maintainability, and portability, are all statistically significant predictors of EHRS adoption, with a collective variance of 39% of the variance in adoption. The relationships were moderated significantly by perceived usefulness, and strongest relationships were found between quality and reliability as well as functionality. The qualitative results identified structural obstacles that the quantitative model did not identify such as leadership cultures that are compliance-based, reactive IT maintenance, insufficient continuous training, and limited remote access, which are all socio-technical impediments to sustainable digitalization. In theory, the research integrates the ISO/IEC 9126, TAM, and socio-technical theory to explain EHRS implementation. In practice, the results warn policy makers and health informatics professionals that sustainable EHRS requires simultaneous investment in the workflow congruence, perceived clinical value, responsive IT governance, and organizational capacity-building. The research limitation by its focus on the Jordanian healthcare setting, therefore, applicability or generalizability of findings to other healthcare settings is constrained. Future studies could include demographic moderators (age, professional role and digital literacy) and clinician perceptions of the artificial intelligence-enabled EHRS features, including predictive analytics and clinical decision support, to enable the inclusion of how emerging intelligent capabilities alter usefulness perceptions and long-term adoption patterns in digitally transitioning healthcare systems.

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