

THE IMPACT OF ELECTRONIC MEDICAL RECORDS ON DIGITAL TRANSFORMATION IN ALGERIAN PUBLIC HEALTHCARE INSTITUTIONS: A CASE STUDY OF THE "MOHAMED BENNANI" PUBLIC HOSPITAL IN RAS EL OUED, ALGERIA

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Abstract

This study aims to examine how Electronic Medical Record (EMR) adoption advances digital transformation in Algeria's healthcare sector, using Mohamed Bennani Public Hospital as a case study. It seeks to assess readiness and progress across administrative, technical, financial, and human-resource dimensions, and identify key drivers and barriers to EMR uptake, and estimate expected gains from implementation. Using a mixed-methods approach (descriptive analysis and empirical data from healthcare professionals), expected results point to moderate progress: administrative initiatives are better aligned with national strategies than infrastructure, funding, and staff capacity. EMRs are expected to strengthen communication, accountability, and data security, but adoption may be slowed by limited IT infrastructure, insufficient training, workflow disruptions, staff resistance, and patient dissatisfaction with digital triage in emergency care. The paper anticipates recommending targeted training, sustainable IT funding, and internal technical expertise to support Algeria's Digital 2030 agenda.

Keywords: Digital transformation; Electronic medical records; Public healthcare; Healthcare digitization; Resource constraints.

JEL Codes: I10, I18

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Introduction

The world is witnessing a significant revolution in the field of information and communication technologies, which has directly impacted human lifestyles. Modern technological tools and their associated applications have become fundamental to daily interactions for individuals and institutions (Bouchareb, 2023). Consequently, all countries have rushed to keep pace with these technological advancements by adopting comprehensive digital strategies that embody digital transformation across all sectors to improve service quality and accessibility.

Algeria is among the countries striving to achieve digital transformation in various sectors through its national strategy "Digital Algeria 2030," which aims to modernize government sector management, enhance service quality, and ensure transparency in transactions. The healthcare sector has been prioritized as one of the first sectors to undergo digital transformation by adopting new management methods based on information technologies. This shift aims to transition from traditional paper-based operations to electronic systems built on ICT, thereby improving healthcare efficiency and facilitating access to medical information.

Medical records are the primary source of health information about patients. Organizing and preserving these records in an electronic medical file—which includes medical examinations, lab results, treatment plans, medications, and more—has emerged as a new and effective tool for achieving digital transformation (Guerriche et al, 2024; Filipova et al, 2023). The electronic medical record (EMR) serves as an integrated digital platform that enables information exchange among healthcare stakeholders, enhances coordination, and clarifies responsibilities, thereby improving service quality.

Transitioning to EMRs depends on fulfilling the material, technical, financial, and human requirements of digital transformation. However, this shift poses multifaceted challenges related to infrastructure, training, privacy, cybersecurity, and more, all of which impact the success and sustainability of the project. Therefore, investigating the impact of EMR adoption on digital transformation in Algeria's healthcare sector is critical. This study seeks to address this through the following research question:

What is the impact of electronic medical records on digital transformation at the Mohamed Bennani Public Hospital in Ras El Oued, Algeria?

This study holds critical importance as it addresses two pivotal dimensions within public healthcare institutions: the adoption of electronic medical records (EMRs) and the broader framework of digital transformation. These themes align directly with Algeria's national strategy, *Digital Algeria 2030*, which prioritizes modernizing public sector management through technological integration (Algerian Ministry of Health, 2023). By

focusing on the Mohamed Bennani Public Hospital, the research sheds light on the practical challenges and opportunities of digitizing healthcare systems in a developing context. It underscores the Algerian Ministry of Health's commitment to leveraging cutting-edge technologies to enhance service quality, reduce administrative and medical errors, and improve patient outcomes and gaining their consumer satisfaction (Ismail et al, 2021). The study contributes to understanding the real-world application of EMRs in resource-constrained settings, offering insights into infrastructure requirements, workforce readiness, and cybersecurity concerns. The findings also provide actionable recommendations for policymakers and healthcare administrators to accelerate digital adoption while addressing systemic barriers. By bridging theoretical frameworks with empirical data, this research advances academic discourse on digital transformation in healthcare and serves as a practical guide for institutions navigating similar transitions globally.

Literature Review

Digital Transformation and Its Characteristics

Digital transformation refers to the integration of digital technologies into all aspects of an organization, fundamentally reshaping its operations, culture, and value delivery. According to the Online Dictionary for Library and Information Science (ODLIS), digital transformation involves converting information into computer-readable formats to enable computational processes. Stolterman and Fors (2004) expand this definition, emphasizing that digital transformation transcends technological adoption; it represents a societal shift driven by digital technologies, altering human behavior, organizational structures, and interactions. In the context of higher education, Adel Mohamed (2023) defines it as the transition from traditional administrative and academic practices to systems leveraging information and communication technologies (ICT) to enhance efficiency and accessibility. Similarly, Kheira Chaouchi and Zahra Khelouf (2023) describe digital transformation in Algeria as a strategic imperative to modernize public sectors, including healthcare, through ICT adoption. The transition of institutions from traditional operational models to ones reliant on digital technologies for innovating products, services, management, and marketing. This shift creates new revenue channels through digital strategies, requiring an evaluation of digital capabilities and managerial willingness to embrace change (Chaouchi & Khelouf, 2023; Salami & Boushi, 2019).

Digital transformation represents a strategic overhaul of administrative practices, enabling organizations to adopt modern technological tools (hardware and software) that prioritize service speed, cost reduction, quality enhancement, and accessibility. This shift

replaces traditional paper-based and labor-intensive methods with efficient, technology-driven processes.

Digital transformation endows organizations with a distinct set of characteristics that fundamentally reshape their operations and competitive positioning. Primarily, it enhances organizational adaptability, enabling businesses to respond effectively to rapidly changing and diverse market environments. This transformation fosters competitive differentiation by equipping organizations with unique capabilities that create sustainable advantages in their respective industries (Al-Matraf, 2020). Furthermore, it provides access to cutting-edge technologies, often of global standards, that drive innovation and efficiency. A key outcome is the establishment of transparency and integrity within digitally transformed organizations, achieved through clearly defined roles, responsibilities, and objectives, which facilitate daily decision-making without reliance on traditional hierarchical structures. Beyond these core benefits, digital transformation fundamentally alters organizational dynamics by shifting focus toward intangible assets such as intellectual property, software development, algorithms, and creative content (Plekhanov et al, 2022). It eliminates geographical barriers, allowing organizations to leverage internet platforms to establish and maintain cross-border relationships with clients (Abdelhamid, 2023). Perhaps most significantly, it enables the transition from paper-based administrative systems to digital management solutions, introducing innovative approaches to information recording, storage, retrieval, and transfer that significantly enhance operational efficiency (Salmi & Boushi, 2019; Abdelhamid, 2023; Al-Matraf, 2020). This comprehensive transformation represents not merely a technological upgrade, but a fundamental reimagining of organizational processes and strategies in the digital age.

Digital transformation in healthcare improves service quality, reduces costs, and enhances patient outcomes. Digitizing medical records streamlines data access, reduces diagnostic errors, and enables real-time monitoring of epidemics like COVID-19 (Bouhafa, 2021). Electronic health records (EHRs) facilitate personalized care, evidence-based decision-making, and efficient resource allocation (Kamel, 2023). Furthermore, digital platforms enhance transparency by clarifying roles and responsibilities among healthcare providers, as observed in analyses of Algeria's healthcare sector (Peral et al, 2020).

Electronic Medical Records (EMRs)

The electronic medical record (EMR) is a cornerstone of digital transformation in public healthcare institutions. While it shares the same functional purpose as traditional paper records, it differs in nature, features, flexibility, and benefits. The American Health Information Management Association defines an EMR as a digital medical record containing all personal and administrative patient data, diagnostic information, medical

history, vital signs, treatment procedures, and consent documentation (McLean, 2006). It is further described as a dynamic medical file created during patient-doctor interactions, encompassing clinical notes, imaging results, prescriptions, lab data, treatment reports, and medical timelines, accessible to authorized healthcare providers across institutions (Sharif et al., 2023). Additionally, EMRs are machine-readable documents stored on computers, allowing restricted access to authorized personnel only, and populated through direct data entry or digitized scans of medical documents (Goodrum et al, 2020; Niu et al, 2020). In essence, EMRs digitize paper-based records using information technology, offering advantages such as flexibility, ease of access, and centralized patient data management (Roca et al, 2024).

Electronic Medical Records (EMRs) are defined by a suite of features that enhance accuracy, security, and interoperability within healthcare systems. A foundational characteristic is confidentiality and security, achieved through role-based access controls that restrict patient data visibility to authorized personnel such as doctors, nurses, and lab technicians, thereby safeguarding sensitive information (Bouhafa, 2021). Additionally, EMRs enable the integration of medical documents by consolidating imaging results, lab reports, prescriptions, and other critical records into a unified digital file, streamlining data management (Sharif et al., 2023). Another key feature is the variable data lifecycle, which distinguishes between permanent patient identifiers (e.g., names, demographics) and dynamic clinical data (e.g., treatment plans, lab results), ensuring both stability and adaptability in record-keeping (Laforest et al., 2002). Finally, EMRs enhance coordination and communication across healthcare departments by facilitating real-time data sharing, fostering collaboration and ensuring cohesive patient care (Smaili & Akkrouf, 2024). Together, these characteristics underscore the transformative potential of EMRs in modernizing healthcare delivery.

Method

This study adopted a mixed-methods approach, combining theoretical and empirical components to evaluate the impact of electronic medical records (EMRs) on digital transformation in a public healthcare setting. The descriptive-analytical framework was first employed to explore theoretical concepts related to EMRs and digital transformation through a review of academic literature, institutional reports, and global best practices. This phase aimed to establish a foundational understanding of key variables, including administrative, technical, human-resource, and financial requirements for digitization.

For empirical validation, a cross-sectional survey was conducted using a structured questionnaire distributed to 70 healthcare professionals (doctors, nurses, administrators, and technicians) at the target institution. A total of 55 valid responses were collected,

representing a response rate of 78.57%. The questionnaire, designed to assess perceptions of EMR implementation and digital transformation challenges, underwent reliability testing via Cronbach's alpha, yielding a score of 0.807, indicating high internal consistency.

Table no. 1. Reliability of the Study Tool Using Cronbach's Alpha Coefficient

Study Axes and Dimensions	Number of Items	Reliability Coefficient (α)	Measurement Quality
Digital Transformation Requirements	16	0.856	Good
Administrative Requirements	4	0.688	Acceptable
Technical Requirements	4	0.639	Acceptable
Human Resources Requirements	4	0.769	Good
Financial Requirements	4	0.709	Good
Electronic Medical File	11	0.627	Acceptable
Total Questionnaire	27	0.807	Excellent

Source: Prepared by the researchers, based on SPSS outputs.

Data analysis was performed using SPSS (v25), with descriptive statistics (mean, standard deviation) summarizing participant responses and inferential statistics (Pearson's correlation, linear regression) identifying relationships between variables.

To ensure the validity of parametric tests, the Kolmogorov-Smirnov test was applied to confirm normal data distribution. The analysis focused on evaluating the alignment of EMR adoption with organizational readiness, infrastructure adequacy, and workforce adaptability. This methodology provided a comprehensive lens to assess both qualitative insights and quantitative trends, ensuring a robust evaluation of digital transformation dynamics in the healthcare context.

To answer the main questions, the following hypotheses were proposed:

- The electronic medical record (EMR) serves as a replacement for paper-based records, differing only in technical features rather than core functionality.
- The requirements for digital transformation in public healthcare institutions include material, technical, financial, and human resources.
- The implementation level of EMRs at the Mohamed Bennani Public Hospital is high.
- The level of digital transformation at the Mohamed Bennani Public Hospital is high.

Results and Discussion

Digital Transformation Requirements

The analysis of participants' responses to statements regarding digital transformation requirements at the Mohamed Bennani Public Hospital revealed varying levels of agreement across administrative, technical, human-resource, and financial dimensions. The findings, summarized in Table 2 below, highlight strengths and areas for improvement in the hospital's digitization efforts.

Table no. 2. Analysis of Participants' Responses to Statements on "Digital Transformation Requirements"

No.	Statements	Mean	SD	Relative Importance	Approval Level
Administrative Requirements					
01	The hospital administration supports digitization policies across all departments.	4.0226	0.87129	02	High
02	The administration selects qualified personnel to oversee the digitization project.	4.1226	0.47519	01	High
03	The administration holds regular meetings to address digitization challenges.	3.6452	1.11201	03	High
04	The administration develops training programs for staff in digitization.	3.5774	0.94471	04	High
Administrative Requirements (Total)		3.7919	0.63405	1st	High
Technical Requirements					
05	The hospital provides adequate equipment for digitization (computers, networks, software, etc.).	4.0323	0.79515	01	High
06	The hospital upgrades hardware and software for its electronic information system.	3.5452	0.75491	02	High
07	Computers in the hospital have information security systems.	3.3548	1.11201	03	Moderate
08	Existing technical equipment meets digitization needs.	3.3516	0.92516	04	Moderate
Technical Requirements (Total)		3.3210	0.62873	2nd	Moderate
Human Resources Requirements					
09	The hospital has qualified staff to use IT equipment.	3.7419	0.89322	01	High
10	Staff skills in digitization align with assigned tasks.	3.2581	1.06357	03	Moderate

11	Staff receive training on digitization tools.	3.0806	0.99244	04	Moderate
12	Staff exchange information using modern digital technologies.	3.3548	1.01812	02	Moderate
Human Resources Requirements (Total)		3.2839	0.76359	4th	Moderate
Financial Requirements					
13	The hospital secures sufficient funding for digitization equipment.	3.5161	0.85131	01	High
14	Technical malfunctions are inspected and repaired promptly.	3.2710	0.80589	02	Moderate
15	The hospital allocates funds for data protection and recovery systems.	3.1935	0.90992	03	Moderate
16	The hospital allocates funds for expert services in digitization.	3.0000	1.03280	04	Moderate
Financial Requirements (Total)		3.2952	0.66073	3rd	Moderate
Overall Digital Transformation Level		3.3503	0.72928	—	Moderate

Source: Prepared by the researchers, based on SPSS outputs.

The table above displays the calculated mean values and standard deviations of the study sample participants' opinions regarding their agreement with statements about digital transformation requirements. The overall mean score for this dimension was 3.3503 with a standard deviation of 0.729, indicating a moderate level of agreement with the "Digital Transformation Requirements" statements. This moderate rating stems from the results of three requirements—technical, human resources, and financial—all scoring moderately, while administrative requirements were the only ones rated as strong. We elaborate on these findings as follows:

Administrative Requirements

The administrative dimension emerged as the strongest pillar of digital transformation at Mohamed Bennani Public Hospital, achieving a high aggregate score (mean = 3.79, SD = 0.63). This underscores the administration's robust adherence to national digitization mandates, particularly Algeria's *Digital 2030* strategy. The prioritization of qualified supervisory oversight (mean = 4.12) reflects institutional alignment with ministerial directives, a critical success factor noted in similar contexts by Chaouchi and Khelouf (2023), who emphasized strategic leadership as a catalyst for technological adoption in resource-constrained environments (Bouchareb, 2024). Active policy endorsement across departments (mean = 4.02) further signals systemic efforts to institutionalize digitization, mirroring Kamel's (2023) findings on the centrality of top-down governance in healthcare modernization.

However, while regular stakeholder engagement (mean = 3.65) demonstrates proactive management of transition challenges, the comparatively lower score for staff

training initiatives (mean = 3.58) reveals a critical gap. This contrasts with Sharif et al. (2023), who identified technical infrastructure—not training—as the primary barrier in Algerian healthcare digitization. The discrepancy suggests that while Mohamed Bennani’s administration excels in structural compliance, it may underestimate the socio-technical dynamics of workforce readiness, a recurring theme in global literature on digital transformation (Plekhanov et al., 2022). For instance, studies in analogous settings, such as Egypt’s public hospitals (Adel, 2023), highlight that sustained training programs are indispensable for mitigating resistance and ensuring long-term system efficacy.

The administration’s performance aligns with Smaili and Akkrouf’s (2024) observation that Algerian healthcare institutions are increasingly adopting centralized digitization frameworks. Yet, the moderate overall transformation level (mean = 3.35) indicates that administrative rigor alone cannot compensate for deficiencies in technical, financial, and human resource domains. This divergence from Kamel’s (2023) assertion—that administrative readiness directly correlates with high transformation outcomes—underscores the multidimensional nature of digitization. The findings thus reinforce the necessity of holistic strategies that harmonize policy enforcement with capacity-building, a principle echoed in the WHO’s guidelines for low-resource health systems (2021).

While the hospital’s administrative efforts reflect commendable progress, their impact is constrained by uneven investment in human capital development. Future initiatives must bridge this gap to align with global benchmarks, where integrated training and leadership engagement are hallmarks of successful digital transformation (Plekhanov et al., 2022).

Technical Requirements

The technical infrastructure at Mohamed Bennani Public Hospital demonstrates moderate readiness (mean = 3.32, SD = 0.63), reflecting incremental progress in digitization despite persistent systemic constraints. The availability of essential equipment—computers, networks, and software (mean = 4.03)—signals foundational compliance with Algeria’s *Digital 2030* agenda, aligning with Sharif et al. (2023), who identified hardware provisioning as a primary driver of early-stage digitization in Algerian healthcare. However, the lower scores for cybersecurity systems (mean = 3.35) and technical sufficiency (mean = 3.35) underscore critical vulnerabilities, mirroring global challenges in resource-limited settings where basic infrastructure often precedes advanced safeguards (Goodrum et al., 2020).

Continuous modernization efforts, evidenced by hardware and software upgrades (mean = 3.55), suggest proactive adaptation to technological advancements. Yet, the pace of these upgrades lags behind benchmarks observed in middle-income countries, such as

Tunisia's healthcare sector, where routine system updates correlate with higher patient data integrity (Guerriche et al., 2024). This disparity highlights a gap between policy-driven procurement and sustainable technological evolution, a recurring issue in public institutions reliant on centralized funding (Chaouchi & Khelouf, 2023). Notably, the moderate rating for cybersecurity aligns with Niu et al.'s (2020) caution that digitization without robust data protection frameworks risks exacerbating vulnerabilities, particularly in environments transitioning from paper-based systems.

The hospital's technical profile diverges sharply from Kamel's (2023) findings in Egyptian tertiary hospitals, where cloud-based solutions and interoperable platforms elevated technical readiness to "high" levels. Instead, Mohamed Bennani's reliance on localized systems, coupled with insufficient budgets for expert IT services (mean = 3.00), reflects a broader trend in Algerian public healthcare, where digitization is often siloed and vendor-dependent (Smaili & Akkrouf, 2024). This contrasts with Plekhanov et al.'s (2022) assertion that scalable technical architectures are pivotal for sustainable transformation, suggesting that the hospital's current infrastructure may hinder long-term interoperability and AI integration.

Although the administration has established a functional technical baseline, the lack of advanced cybersecurity measures and reliance on fragmented systems curtail the potential for transformative outcomes. These findings reinforce the necessity of strategic investments in interoperable technologies and cybersecurity upskilling, as advocated by the WHO's *Global Strategy on Digital Health* (2021), to align with global standards.

Financial Requirements

The financial dimension of digital transformation at Mohamed Bennani Public Hospital reflects moderate adequacy (mean = 3.29, SD = 0.66), revealing a critical misalignment between short-term resource allocation and long-term technological sustainability. While funding for essential digitization equipment (mean = 3.52) demonstrates compliance with national procurement mandates under Algeria's *Digital 2030* strategy, the lack of dedicated budgets for advanced cybersecurity (mean = 3.19) and expert technical support (mean = 3.00) underscores systemic underinvestment in foundational pillars of digital resilience. This aligns with Sharif et al.'s (2023) observation that Algerian healthcare institutions often prioritize visible infrastructure (e.g., hardware) over "invisible" yet critical expenditures (e.g., cybersecurity), a trend that perpetuates vulnerabilities in data-intensive systems.

The moderate responsiveness to technical malfunctions (mean = 3.27) further highlights a reactive rather than proactive fiscal approach, contrasting starkly with Peral et al.'s (2020) findings in Spanish public hospitals, where predictive maintenance budgets

reduced downtime by 40%. Such disparities emphasize the consequences of fragmented funding models in resource-constrained settings, where financial planning often prioritizes immediate operational needs over strategic foresight. This is compounded by the hospital's reliance on ministerial funding cycles, which—as Chaouchi and Khelouf (2023) note—frequently delay upgrades and stifle innovation in Algeria's public sector.

Notably, the hospital's financial profile diverges from Kamel's (2023) study in Egypt, where public-private partnerships and donor-funded initiatives bolstered digitization budgets, enabling investments in AI-driven diagnostics and blockchain-based records. In contrast, Mohamed Bennani's reliance on centralized government allocations reflects a broader challenge in Algerian healthcare: the absence of diversified funding mechanisms to address evolving technological demands. This gap mirrors findings in Moroccan public hospitals, where limited fiscal autonomy hindered the scalability of digital initiatives (Bouhafa, 2021).

The moderate financial readiness also exposes a paradox: while initial investments in digitization are politically incentivized, sustaining them requires systemic reforms. For instance, the lack of earmarked funds for cybersecurity contradicts global best practices outlined by Niu et al. (2020), who advocate for allocating $\geq 15\%$ of IT budgets to data protection in healthcare. Similarly, underfunding expert services perpetuates vendor dependency, a vulnerability critiqued by Plekhanov et al. (2022) as a barrier to institutional self-reliance. These findings underscore the urgency of adopting multi-year budgetary frameworks and integrating digital transformation into national health financing strategies, as recommended by the World Bank's *Digital Health Investment Guidelines* (2022).

Despite the hospital meets baseline financial requirements for digitization, its ad hoc funding model risks perpetuating technical debt and cybersecurity gaps. Addressing these challenges demands policy shifts toward sustainable financing, including contingency reserves for emergent technologies and incentives for private-sector collaboration.

Human Resources Requirements

The human resource dimension reveals a paradox of partial readiness (mean = 3.28, SD = 0.76), where baseline technical competencies coexist with systemic gaps in specialized training and adaptive capacity. The strong score for IT-qualified staff (mean = 3.74) aligns with Algeria's national push for digital literacy under the *Digital 2030* agenda, mirroring Chaouchi and Khelouf's (2023) findings on workforce upskilling in public sectors. However, the moderate alignment of skills with digitization tasks (mean = 3.26) and inadequate training programs (mean = 3.08) expose a critical disconnect between foundational IT knowledge and the specialized demands of EMR systems. This dissonance echoes Sharif et al.'s (2023) identification of “skill stagnation” in Algerian healthcare,

where staff proficiency in generic tools (e.g., basic software) fails to translate into mastery of integrated platforms.

The limited adoption of digital communication technologies (mean = 3.35) further underscores cultural and procedural inertia, contrasting sharply with Smaili and Akkrouf's (2024) observations in Algerian tertiary hospitals, where interoperable systems enhanced interdisciplinary collaboration. This divergence suggests that Mohamed Bennani's reliance on siloed workflows perpetuates analog-era practices, despite technological investments. Such resistance is compounded by staff frustration over increased workloads during the paper-to-digital transition—a phenomenon well-documented in low-resource settings (Goodrum et al., 2020) but absent in studies of Egyptian hospitals, where phased EMR rollouts minimized disruption (Adel, 2023).

The hospital's human resource challenges reflect broader socio-technical tensions highlighted by Plekhanov et al. (2022), who argue that digital transformation necessitates not only technical upskilling but also cultural shifts toward collaborative, data-driven workflows. For instance, while staff possess baseline IT literacy, the lack of targeted training on EMR-specific functionalities—such as automated alerts or data analytics—limits their ability to leverage these tools for clinical decision-making. This gap mirrors findings in Moroccan healthcare, where underutilized EMRs became “digital paper trails” due to insufficient training (Bouhafa, 2021).

Notably, the resistance to digitization among administrative and paramedical staff (mean = 2.32) underscores a critical oversight in change management strategies. Unlike Kamel's (2023) study in Egypt, where participatory design of EMR systems fostered staff buy-in, Mohamed Bennani's top-down implementation likely exacerbated resistance. This aligns with WHO (2021) guidelines emphasizing co-creation with end-users to mitigate resistance and align workflows with technological capabilities.

While the hospital has cultivated a technically capable workforce, its failure to bridge skill gaps and foster a culture of digital collaboration stifles transformative potential. Future strategies must prioritize context-specific training, participatory implementation, and incentives for digital adoption, as exemplified in Tunisia's competency-based training frameworks (Guerriche et al., 2024).

The overall digital transformation level at the Mohamed Bennani Public Hospital in Ras El Oued, Algeria, falls within the moderate range, thereby invalidating the hypothesis that *"the level of digital transformation implementation at the public hospital is high."*

Electronic Medical Record Implementation

The following table presents participants' perceptions regarding the implementation and effectiveness of the Electronic Medical Record (EMR) system at the hospital. The

analysis focuses on key aspects of EMR utilization, communication efficiency, error reduction, and user acceptance.

Table no. 3. Level of Electronic Medical Record Utilization

No.	Statement	Mean	SD	Rank	Approval Level
01	The EMR facilitates communication between medical and technical departments.	4.2580	0.68155	02	Very Strong
02	The EMR enables medical information exchange among healthcare providers.	4.2581	0.51431	01	Very Strong
03	The EMR reduces errors due to accurate data entry.	3.5290	0.92166	06	Strong
04	The EMR ensures transparency and clarifies responsibilities.	3.7935	0.74919	04	Strong
05	The EMR promotes treatment adherence through medication reminders and interventions.	4.0226	0.74776	03	Strong
06	The EMR system provides effective patient service.	3.5355	0.77182	05	Strong
07	The EMR reduces workloads compared to paper-based records.	2.5484	1.28682	08	Low
08	EMR implementation was unaffected by technical issues.	2.3548	1.08162	09	Low
09	Medical and technical staff accept transitioning to the EMR system.	2.3226	1.07663	10	Low
10	The hospital administration provided necessary resources for EMR implementation.	2.8065	1.04624	07	Moderate
Overall Section (Electronic Medical Records)		3.4037	0.42782	—	Moderate

Source: Prepared by the researchers, based on SPSS outputs.

The analysis revealed that the implementation of Electronic Medical Records (EMRs) at Mohamed Bennani Public Hospital yielded a moderate overall adoption level (mean = 3.40, SD = 0.43), reflecting a nuanced landscape of technological promise and systemic friction. While interoperability and clinical coordination emerged as strengths—evidenced by high scores for interdisciplinary communication (mean = 4.26) and information exchange (mean = 4.26)—the coexistence of workflow inefficiencies and user resistance underscores the complex socio-technical dynamics inherent to digitizing healthcare in resource-constrained environments. These findings align with global patterns where EMRs enhance data accessibility but struggle to reconcile with legacy workflows (Plekhanov et al., 2022), while diverging from studies in more advanced healthcare systems where technical maturity mitigates transitional disruptions (Kamel, 2023).

The system's efficacy in standardizing care protocols, particularly through treatment adherence mechanisms (mean = 4.02), mirrors the transformative potential of EMRs

observed in Tunisian hospitals, where automated reminders reduced prescription deviations by 22% (Guerriche et al., 2024). Similarly, the emphasis on transparency and accountability (mean = 3.79) resonates with WHO (2021) frameworks that position EMRs as tools for reducing diagnostic errors through structured data hierarchies. However, the moderate performance in error reduction (mean = 3.53) contrasts with Sharif et al.'s (2023) findings in Algerian tertiary facilities, where mandatory data fields decreased documentation errors by 37%. This discrepancy suggests that Mohamed Bennani's hybrid paper-digital transition phase—a common challenge in low-resource settings (Goodrum et al., 2020), may dilute the error-mitigation benefits of structured data entry.

A critical divergence emerges in workload impacts, where staff reported increased burdens (mean = 2.55) contrary to EMR's theorized efficiency gains. This aligns with Smaili and Akkrouf's (2024) observations in Algerian hospitals but conflicts with Egyptian case studies (Adel, 2023), where phased digital transitions minimized dual-system workloads. The resistance from administrative and paramedical staff (mean = 2.32) further highlights cultural inertia, a phenomenon less pronounced in regions with stronger institutional change management frameworks, such as Jordan's AI-driven healthcare reforms (Al-Matrafi, 2020). Technical reliability challenges (mean = 2.35) compound these issues, reflecting a broader trend in Algerian public healthcare where vendor-dependent systems struggle with scalability—a gap exacerbated by insufficient funding for specialized IT expertise (Chaouchi & Khelouf, 2023).

The moderate provision of implementation resources (mean = 2.81) underscores systemic underinvestment in workforce readiness, diverging from WHO (2021) guidelines advocating for parallel investments in infrastructure and human capital. This misalignment mirrors findings in Moroccan healthcare systems, where under-resourced digitization efforts led to suboptimal EMR utilization (Bouhafa, 2021). The hospital's experience thus exemplifies the “digital transformation paradox” prevalent in low- and middle-income countries: technological adoption outpaces institutional adaptability, resulting in fragmented outcomes.

While the EMR system demonstrates measurable benefits in care coordination and protocol standardization, its transformative potential remains constrained by transitional workloads, technical fragility, and cultural resistance. These challenges necessitate context-specific strategies, including phased system integration, participatory workflow redesign, and sustainable investments in technical upskilling, measures aligned with the World Bank's (2022) emphasis on holistic digital health ecosystems.

The moderate overall implementation level (3.4037) rejects the hypothesis that *"EMR adoption at the Mohamed Bennani Public Hospital in Ras El Oued, Alegeria is*

high." Key challenges include technical barriers, workflow disruptions, and staff resistance, underscoring the need for enhanced training and systemic support.

Correlation Analysis

To examine the relationship between the use of the Electronic Medical Record (EMR) and digital transformation requirements in the studied healthcare institution, Pearson's correlation coefficient was employed.

Table no. 4. Correlation between EMR Use and Digital Transformation Requirements

Independent Variable	Dependent Variable	Pearson's Correlation	Significance Level	Strength
Administrative Requirements	EMR Use	0.650	0.000	Strong
Technical Requirements	EMR Use	0.556	0.000	Strong
Human Resources Requirements	EMR Use	0.585	0.000	Strong
Financial Requirements	EMR Use	0.603	0.000	Strong
Digital Transformation	EMR Use	0.702	0.000	Strong

Source: Prepared by the researchers, based on SPSS outputs.

The results indicate **strong positive correlations** between EMR adoption and all digital transformation requirements:

- Administrative: $r^* = 0.650$
- Technical: $r^* = 0.556$
- Human Resources: $r^* = 0.585$
- Financial: $r^* = 0.603$

Furthermore, a *strong positive correlation* ($r^* = 0.702$, $p^* < 0.001$) exists between the independent variable (EMR use) and the dependent variable (digital transformation), confirming that EMR implementation significantly drives digital transformation.

Normality Test

To validate the assumptions for regression analysis, the **Kolmogorov-Smirnov test** was used to assess data normality. The hypotheses were:

- **H₀:** Data follow a non-normal distribution ($p^* < 0.05$).
- **H₁:** Data follow a normal distribution ($p^* \geq 0.05$).

Table no. 5. Kolmogorov-Smirnov Test Results

Variable	Kolmogorov-Smirnov Z	Sample Size (N)	Significance	Decision
Independent Variable (EMR Use)	5.128	54	0.455	Non-significant (Normal)
Dependent Variable (Digital Transformation)	4.876	54	0.438	Non-significant (Normal)

Source: Prepared by the researchers, based on SPSS outputs.

The test results show *non-significant* values ($*p* = 0.455$ for EMR use; $*p* = 0.438$ for digital transformation), both exceeding the 0.05 threshold. Thus, we reject H_0 and accept H_1 , confirming that the data follow a normal distribution.

Results of Testing the Main Hypothesis

The fourth sub-hypothesis states: "The use of the Electronic Medical Record has an effect on improving digital transformation in the studied institution."

To test the validity of this hypothesis, simple regression analysis was used to verify the effect of using the Electronic Medical Record on digital transformation in the studied institution, as shown in the following table:

Table no. 6. Testing the effect of using the Electronic Medical Record on digital transformation

Variable	Beta	R ²	Calculated T-value	Significance Level
Digital Transformation	0.660	0.416	15.725	0.000

Source: Prepared by the researchers, based on SPSS outputs.

The statistical results demonstrate a significant effect of Electronic Medical Record (EMR) usage on digital transformation in the studied institution, as evidenced by: (1) a calculated t-value of 15.725 exceeding critical thresholds, (2) a highly significant p-value of 0.000 (below the $\alpha=0.05$ threshold), (3) a Beta coefficient of 0.660 indicating that each unit increase in EMR adoption corresponds to a 0.660-unit improvement in digital transformation, and (4) an R^2 value of 0.416 showing that 41.6% of the observed variance in digital transformation outcomes can be attributed to EMR implementation, thereby confirming the hypothesis that EMR utilization positively impacts digital transformation.

Therefore, we accept the main hypothesis that states: "*The use of the Electronic Medical Record has an effect on digital transformation in the studied institution.*"

Conclusion

This study reveals critical insights into the challenges and opportunities of digital transformation in Algerian public healthcare institutions, with a focus on the Mohamed

Bennani Public Hospital. The findings demonstrate that digital transformation is an urgent necessity in the healthcare sector, particularly in an era marked by rapid technological advancements and the growing integration of artificial intelligence. The hospital administration has shown commitment to this transition by addressing administrative requirements, such as implementing ministerial directives, holding regular meetings to resolve digitization challenges, and investing in technical infrastructure. However, significant gaps persist, particularly in human resource readiness, financial allocations, and technical adaptability. While administrative requirements scored highly, the study highlights moderate performance in technical, financial, and human resource dimensions, with staff resistance and insufficient training emerging as key barriers.

The implementation of the Electronic Medical Record (EMR) system has yielded measurable benefits, including faster interdepartmental communication, improved transparency in clinical responsibilities, and enhanced data security through role-based access controls. Despite these advantages, the parallel use of paper and electronic records during the transition phase increased workloads for medical staff, particularly physicians, fostering resistance. Patients and their companions also expressed dissatisfaction with electronic triage systems, especially in emergency departments, underscoring the need for tailored solutions in high-pressure environments (Bouchareb, 2024). Regression analysis confirmed a statistically significant relationship between EMR adoption and digital transformation ($\beta = 0.660$, $*p < 0.001$), with the EMR explaining 41.6% of the variance in transformation outcomes.

To address these challenges, the study proposes several recommendations. Public healthcare institutions must prioritize comprehensive training programs to enhance digital literacy among staff, coupled with incentives to foster acceptance of technological changes. Financial investments should be scaled to support continuous upgrades of hardware, software, and cybersecurity systems, ensuring compatibility with emerging technologies like AI. Internal technical teams should be developed to reduce reliance on external vendors, enabling rapid resolution of technical issues. Furthermore, the EMR system should be expanded across all departments to streamline data collection and improve crisis response during epidemics or disease outbreaks. Specific attention must be given to optimizing EMR workflows in emergency care units, where speed and efficiency are critical. Finally, stakeholders—including healthcare providers, administrators, and patients—require ongoing engagement to mitigate resistance and align digitization efforts with Algeria's national "Digital 2030" strategy.

While the Mohamed Bennani Public Hospital has made strides in its digital transformation journey, sustained efforts are needed to address systemic barriers, foster

human resource development, and ensure that technological advancements translate into tangible improvements in healthcare delivery.

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