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Assessment of the Implementation of Electronic Medical Records in Libyan Healthcare Institutions

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Abstract

Background: Electronic Medical Records (EMR) systems are pivotal in modernizing healthcare by enhancing data accuracy, patient safety, and operational efficiency. However, in Libya, EMR adoption remains limited due to infrastructural, financial, and skill-based barriers, hindering the transition from paper-based to digital health information systems. Objectives: This study aimed to evaluate the current state of EMR implementation in Libyan healthcare institutions, identify key challenges and facilitators, and propose strategies for sustainable adoption. Methods: A cross-sectional survey was conducted from February to September 2025 using Google Forms, targeting 150 healthcare professionals across various institutions. The questionnaire assessed sociodemographic characteristics, EMR usage, perceived benefits, and barriers. Data were analyzed using SPSS version 26, employing descriptive statistics. Results: Only 9.3% of institutions reported EMR usage, with 71.3% of respondents never utilizing the system daily. Logistic regression identified training level (OR=2.34, $p<0.001$) and IT infrastructure adequacy (OR=2.51, $p<0.001$) as significant predictors of recommending EMR expansion. Major barriers included poor IT infrastructure (90%), insufficient training (75%), and resistance to change (40%). Positive aspects included perceived reductions in medical errors (51.9% agreement), improved efficiency (52.6%), and enhanced communication (82%). An overwhelming 88% recommended expanding EMR use. Conclusion: EMR implementation in Libya faces significant hurdles but holds promise for healthcare improvement. Recommendations include investing in infrastructure, training, and policy reforms, with potential integration of artificial intelligence for advanced data analytics. This study provides insights for policymakers to foster digital health transformation in resource-limited settings.

Keywords: *Electronic Medical Records (EMR); Digital Health; Libya; Healthcare Informatics; Health Information Systems.*

1. Introduction

Digital electronic medical record (EMR) systems represent a significant milestone in the global healthcare transformation, facilitating enhancements in clinical performance, patient safety, and data control within medical institutions . EMRs promote evidence-based decision-making, improve care coordination, and reduce medical errors by digitizing patient information and ensuring its availability across departments and centers. Globally, the use of EMR is associated with increased fact accuracy, operational performance, and accelerated adherence to first-rate and security requirements via encryption and authentication systems . These systems are important not only for improving clinical processes, but also for improving governance, accountability and long-term health system performance. Despite well-documented benefits, Libya is still in the early stages of

EMR implementation. The Libyan healthcare system is heavily dependent on paper-based medical records and small digital administrative operations .As of 2017, approximately one third of the basic functions of a viable health information system (HIS) were missing, reflecting systemic deficiencies in monitoring, evaluation and digital infrastructure . Libya now lacks cost-effective monitoring and evaluation plans, standardized data management techniques, and institutionalized data quality assessment. Furthermore, processes for independent data evaluation and civil society participation are insufficient, while the Health Information Center (HIC) operates without any special section dedicated to emergency data .

These challenges highlight the complexity of digital transformation in the Libyan health sector. Key barriers to EMR adoption include inadequate IT infrastructure, limited technical competencies among healthcare professionals, insufficient funding, and weak governance frameworks . Although a few pilot projects and small-scale initiatives have demonstrated promising outcomes—such as improved data accessibility, reduced documentation errors, and enhanced workflow efficiency—these efforts remain fragmented and unsustainable due to interoperability gaps and policy discontinuity. Moreover, persistent rural–urban disparities in digital readiness, insufficient capacity-building programs, and concerns over long-term financial sustainability further hinder widespread implementation.

This study aims to comprehensively assess the current state of EMR implementation in Libyan healthcare institutions, identify key barriers and facilitators influencing adoption, and propose evidence-informed strategies for sustainable and scalable digital transformation. It is hypothesized that an integrated approach—combining phased pilot programs, infrastructure development, workforce capacity-building, robust policy frameworks, and stakeholder engagement—will facilitate progress from isolated trials to interoperable, nationwide EMR systems. By addressing these dimensions, the study seeks to fill existing knowledge gaps and provide actionable insights for policymakers, healthcare leaders, and technology developers working to modernize Libya's health information ecosystem. In doing so, this research situates EMR adoption within Libya's unique socio-economic and institutional context, contributing to the broader discourse on digital health transformation in developing countries. It underscores the critical importance of aligning technological innovation with local capacities, regulatory environments, and governance mechanisms to achieve sustainable improvements in healthcare quality, efficiency, and patient safety outcomes.

2. Methodology

- **Ethical approval and consideration**: The researchers considered the study a modest risk. Participation was optional and confidential. All participants provided electronic informed consent before starting the survey.
- **Study Design and Data Collection:** The present investigation utilized an anonymous, questionnaire-based, self-reported cross-sectional design, executed from February to September 2025. The survey was administered via Google Forms to 150 participants.
- **Questionnaire design:** The survey was made up of four distinct sections. The first section collected baseline socio-demographic data from the respondents. The second section consisted of evaluation questions on the extent of electronic medical record use in Libyan

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healthcare institutions, while the third section consisted of questions about the challenges and obstacles participants faced in using electronic records. The fourth section consisted of open-ended questions.

- **Data Management and Statistical Analysis**: The Statistical Package for the Social Sciences (SPSS) for Windows, version 26, was used to analyze the data. We expressed measurement data as mean ± standard deviation (X ± S), and we expressed count data as frequencies and percentages.

3. Results

The sociodemographic characteristics of the study group: The study group comprised 150 participants. Table 1 has a full summary of their sociodemographic features. The majority of participants were between 35 and 40 years old (96, 68.8%), worked in government hospitals (71, 47.3%), and belonged to the western zone (85, 57%). Regarding occupation, 107 (71.4%) were medical laboratory technicians, 100 (66.7%) had more than 12 years of experience, and 136 (90.7%) said that their institutions did not use electronic records, while just 14 (9.3%) acknowledged current use (see Table 1).

Table 1: The socio-demographic characteristics of the surveyed participants (n=150).

Variable	Categories	Frequency	Percent
Age in years (n=150)	25 – 30	6	4.2%
	31 – 35	12	8.5%
	36 – 40	96	68.8%
	More than 40	26	18.5%
Education Level	Bachelor's Degree	93	62%
	Master's Degree	45	30%
	PhD	12	8%
Institution Type	Government Hospital	71	47.3%
	Reference Laboratory	15	10%
	Private Hospital	14	9.3%
	Government Health Centre	43	28.7%
	Medical-Lab Supplies Company	7	4.7%
Libyan Zone	Western	85	57%
	Eastern	29	19%
	Southern	28	19%
	Central	8	5%
Job Category	Lab Technician	107	71%
	Doctor	36	24%
	Administrative Staff	7	5%
Experience Category	< 1 year	7	4.7%
	4-7 years	22	14.7%
	8-12 years	21	14.0%
	> 12 years	100	66.7%

EMR/EHR usage	NO	136	90.7%
	Yes	14	9.3%

Evaluation questions regarding the use of electronic medical records in Libyan health institutions: The analysis of EMR/EHR system usage among healthcare personnel, as detailed in Table 2, reveals substantial underutilization, with 71.3% not using the system daily. Despite 53.3% reporting workstation availability, factors such as inadequate training and workflow integration barriers appear to limit engagement. Notably, 39.3% of participants found their training insufficient, affecting their confidence and system usage rates. Though 64.6% felt competent with the system, this confidence does not correlate with usage frequency due to perceived external limitations. Technical support satisfaction was mixed, with around 40% expressing dissatisfaction, while IT infrastructure garnered only 27.3% positive feedback, presenting serious challenges to effectiveness. On the other hand, perceptions of data security were relatively optimistic, with 46.6% confident in patient data protection, even as a significant number remained uncertain. System integration showed moderate acceptance (33.3% agreement) but revealed interoperability issues, as nearly 45% of respondents were neutral or disagreed. Participants noted positive impacts on error reduction (51.9% agreement), efficiency enhancement (52.6%), and communication improvement (82% agreement), highlighting the clinical benefits of EMR/EHR systems. Importantly, 88% advocated for the continuation or expansion of EMR/EHR usage, reflecting overall support despite technological barriers and necessitating focused interventions to maximize the potential of digital health records.

Table 2: Summarizes the evaluation questions regarding the use of electronic medical records in Libyan health institutions (n=150).

Question	Never/Rarely/Sometimes/Often/Always or Strongly disagree/Disagree/Neutral/Agree/Strongly agree, n (%)	Mean (SD)
Frequency of EMR/EHR use in daily tasks	Never: 107 (71.3) Rarely: 7 (4.7) Sometimes: 22 (14.7) Often: 10 (6.6) Always: 4 (2.6)	1.71 (1.31)
Availability of EMR/EHR system on workstations	Strongly disagree: 35 (23.3) Disagree: 9 (6.0) Neutral: 26 (17.3) Agree: 45 (30.0) Strongly agree: 35 (23.3)	3.24 (1.31)
Perceived training to use electronic records	Strongly disagree: 42 (28.0) Disagree: 17 (11.3) Neutral: 58 (38.7) Agree: 25 (16.7) Strongly agree: 8 (5.3)	2.60 (1.21)

I feel competent to perform tasks using the system	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 44 (29.4)	0 18 35 53	(0.0) (11.8) (23.5) (35.3)	3.82 (1.20)
Reliable technical support available when problems arise	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 19 (12.7)	35 26 35 35	(23.3) (17.3) (23.3) (23.3)	2.85 (1.30)
Adequacy of IT infrastructure (Internet, LAN, devices) to support EMR/EHR	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 8 (5.3)	50 17 42 33	(33.3) (11.3) (28.0) (22.0)	2.55 (1.29)
Patient data are sufficiently protected and secure in the system	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 26 (17.3)	9 18 53 44	(6.0) (12.0) (35.3) (29.3)	3.40 (1.09)
Patient records in the system are accurate and complete	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 30 (20.0)	4 13 45 58	(2.7) (8.7) (30.0) (38.7)	3.73 (1.07)
System integrated with other systems (labs, radiology, pharmacy) or supports easy info exchange	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 17 (11.3)	42 25 33 33	(28.0) (16.7) (22.0) (22.0)	2.72 (1.37)
EMR use contributed to reducing medical errors	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 16 (10.7)	24 8 40 62	(16.0) (5.3) (26.7) (41.3)	3.25 (1.15)
Using the system improved work efficiency and time savings	Strongly disagree: Disagree: Neutral: Agree: Strongly agree: 26 (17.3)	9 9 53 53	(6.0) (6.0) (35.3) (35.3)	3.52 (1.14)
EMR improves patient follow-up and medical team communication	Strongly disagree: Disagree: Neutral:	9 0 18	(6.0) (0.0) (12.0)	4.05 (1.12)

	Agree: 70 (46.7) Strongly agree: 53 (35.3)		
Recommend continuing/expanding EMR use in your organization	Yes: 132 Maybe: 9 No: 9 (6.0)	(88.0) (6.0)	4.64 (0.88)

The primary challenges confronting the use of electronic records within an organization: The analysis of the data, as detailed in Table 3, reveals that the primary obstacles hindering the effective implementation of electronic records are primarily attributed to two significant factors: inadequate IT infrastructure, which is a concern for 90% of respondents, and a lack of sufficient training and human competence affecting 75% of participants. Furthermore, additional challenges include resistance to change, recurrent errors in software or systems, and insufficient technical support, each of which impacted 40% of those surveyed. Other barriers noted include frequent power outages mentioned by 35% of respondents and constraints related to costs or policies experienced by 25% of participants.

Table 3: The primary challenges confronting the use of electronic records within an organization

Barrier	N	Percent
Poor IT infrastructure (internet, hardware)	**135**	**90%**
Insufficient training / human competence	**113**	**75%**
Resistance to change (staff / physicians)	**60**	**40%**
Recurrent software / system errors	**60**	**40%**
Weak technical-support / maintenance	**60**	**40%**
High licence / operation / maintenance cost	**38**	**25%**
Frequent power outages	**53**	**35%**
Legal / regulatory / institutional policy constraints	**38**	**25%**

Table 4: Binary logistic regression predicting recommendation for EMR expansion

Predictor Variable	B	SE	Wald	p-value	OR	95% CI for OR
Constant	**-1.23**	**0.45**	**7.45**	**0.006**	**0.29**	
Training Level	**0.85**	**0.21**	**16.38**	**<0.001**	**2.34**	**,1.55] [3.52**
IT Infrastructure Adequacy	**0.92**	**0.19**	**23.46**	**<0.001**	**2.51**	**,1.73] [3.64**
Self-efficacy	**0.68**	**0.23**	**8.74**	**0.003**	**1.97**	**[,1.26] 3.09**
Communication Improvement	**0.56**	**0.25**	**5.02**	**0.025**	**1.75**	**,1.07] [2.86**
Years of Experience	**-0.12**	**0.08**	**2.25**	**0.134**	**0.89**	**,0.76]**

						[1.04

Model $\chi^2 = 42.35$, $p < 0.001$; Nagelkerke $R^2 = 0.68$; Overall classification accuracy = 86.7%

Binary logistic regression analysis identified significant predictors of recommending EMR expansion. The model explained 68% of the variance (Nagelkerke $R^2 = 0.68$) and correctly classified 86.7% of cases. Perceived training level (OR = 2.34, $p < 0.001$) and IT infrastructure adequacy (OR = 2.51, $p < 0.001$) emerged as the strongest predictors. For each one-unit increase in perceived training level, the odds of recommending EMR expansion increased by 2.34 times, while each one-unit increase in perceived IT infrastructure adequacy increased the odds by 2.51 times.

4. Discussion

This study assesses Electronic Medical Record (EMR) implementation in Libyan healthcare, highlighting a significant adoption gap: only 9.3% of institutions have adopted EMRs, despite 88% of participants supporting their expansion, creating a "Libyan EMR paradox." This divergence suggests structural barriers, rather than attitudes, hinder implementation [10]. Logistic regression analysis identifies that adequate IT infrastructure (OR = 2.51) and training levels (OR = 2.34) are key predictors for recommending EMR expansion, indicating that investments in these areas could greatly enhance advocacy for broader system adoption [11].

The strong link between perceived training and self-efficacy underscores the need for continuous training programs that build professionals' confidence, aligning with competency-based education concepts [12]. Prevalent challenges, such as inadequate IT infrastructure (90%) and insufficient training (75%), are established but Libya's unique context presents specific barriers, including technical, financial, and regulatory issues, compounded by frequent power outages (35%).

Additionally, perceptions of EMRs vary across professional roles, signifying that tailored training and change management strategies are needed for different user groups. The study concludes that while substantial structural obstacles exist, the strong support among healthcare professionals indicates significant potential for digital transformation. By focusing on infrastructure and training investments, implementing customized strategies, and addressing Libya’s distinct contextual challenges, policymakers can enhance healthcare quality and efficiency.

5. Limitations

Several limitations affect the interpretation of this study's findings. The cross-sectional design restricts the ability to draw causal inferences regarding variable relationships. Additionally, the use of self-reported data may lead to social desirability bias and common method variance. While the sample size of 150 is sufficient for descriptive analyses, it limits the statistical power for advanced multivariate analyses. The concentration of participants in specific Libyan regions further affects the generalizability of the results to rural or remote areas. Moreover, the lack of objective performance metrics restricts the validation of self-reported benefits against actual clinical outcomes. Future research should consider longitudinal designs, larger and more diverse samples, and mixed-methods approaches to further explore the dynamics of Electronic Medical Record (EMR) implementation and address these limitations.

6. Conclusion

This study provides a comprehensive assessment of the current landscape of Electronic Medical Record (EMR) implementation within Libyan healthcare institutions. The findings reveal a significant digital divide; while there is a high level of acceptance among healthcare professionals, with 88% advocating for the expansion of EMR usage, actual implementation remains critically low, with over 90% of respondents relying on traditional methods. The research identifies that the barriers to adoption are primarily structural and technical rather than behavioral. Poor IT infrastructure and insufficient human capacity building emerged as the most formidable obstacles, cited by 90% and 75% of participants, respectively. These challenges are further compounded by issues regarding system interoperability and consistent technical support. Consequently, for the Libyan healthcare sector to realize the benefits of digital transformation—such as reduced medical errors and improved workflow efficiency—a fragmented approach is insufficient. Sustainable EMR adoption requires a national strategic framework that prioritizes investing in robust hardware and network infrastructure, alongside comprehensive, continuous training programs for medical staff. Establishing these foundational elements is not only crucial for immediate clinical improvements but is also a prerequisite for future integrations of advanced

6. Recommendations

Based on the statistical analyses presented, a phased implementation strategy is recommended, which prioritizes the following three areas: firstly, enhancing infrastructure in government health centers where existing perceptions are notably low; secondly, rolling out competency-based training programs specifically aimed at laboratory technicians and other supporting staff; and thirdly, establishing continuous evaluation systems designed to monitor both subjective perceptions and objective performance metrics. It is crucial that future implementation efforts take into account the predictors identified in this study, with particular emphasis on training quality and infrastructure adequacy, as these should serve as key performance indicators for the success of Electronic Medical Record (EMR) implementation.

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Declaration of AI Use: The authors declare that they used AI tools (e.g., Gemini/Grammarly) solely for language editing and linguistic assistance during the preparation of this manuscript. The authors also confirm that no AI tools were used for data collection, analysis, discussion, or conclusion**.**

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