The Contribution of Health Management Information Systems to Enhancing Healthcare Operations

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***Abstract*—Various strategies for enhancing quality have been implemented by developed and developing countries in light of the worldwide emphasis on bolstering healthcare systems. Many nations are currently directing their attention towards bolstering their existing information systems or establishing new ones, recognizing the critical role of information in the functioning of healthcare systems. The study aimed to assess the impact of leadership style, organizational factors, technology, and healthcare provider behavior on the implementation of health management information systems in healthcare organizations. While the study was informed by the performance framework of routine information systems, it was primarily based on system theory. After conducting the analysis in Python and SPSS, the data was presented using descriptive statistics, such as means and standard deviations, and inferential statistics including regression analysis. The study observed that information timelines significantly moderated the connection between the technical factor and the integration of health management information systems.**

Keywords*—Health management information system; cronbach alpha; moderator; information timelines

I. Introduction

Various forms of innovations have emerged due to the heightened international emphasis on reinforcing health systems to guarantee the delivery of higher-quality healthcare services. However, the objective has not been completely achieved. The [WHO], 2007 defines health system strengthening as a collection of programs and strategies that enhance one or more core elements of the health system, resulting in improved health. Each element within the World Health Organization framework holds significance. Conversely, rapid, precise, and relevant information is vital for effectively bolstering the health system to enhance its performance. It can also facilitate the sharing of common data and practices and enable the production and access of information in a real-time environment, as indicated by [1].

The objective is to furnish decision-makers with up-to-date information. Thus far, large-scale organizations, particularly in the manufacturing industry, have incorporated integrated ERP systems. These systems have been employed to streamline various business operations, encompassing sales, finance, production, and dispatching. It also facilitates the segmentation of healthcare functions in terms of information exchange and flow. A well-executed integrated information system offers numerous potential benefits and might even be indispensable for the survival and efficiency of an organization. The integration of IHMIS can assist healthcare organizations in managing their operations more efficiently, offering advantages such as inventory reduction, improved coordination in the supply chain, streamlined process flow, enhanced data analysis, decision-making using quality data, and improved patient care services [2]. Over the next decade, the ERP market is anticipated to be one of the application software industry's most rapidly expanding and crucial segments. Currently, it stands as one of the swiftest-growing software markets.

This remains true even though about sixty percent of information system implementation initiatives fail globally and across all organizations [3]. The author in [4] emphasizes that managers should take a proactive approach and actively encourage other users and staff members to adopt the system. Successful adoption would likely lead to improved patient care coordination and an elevated standard of care across all areas [5].

The health management information system (HMIS) initiative in India seeks to encourage healthcare professionals across various government levels about the potential of high-quality data to enhance patient care, representing an effort to leverage technology for public health improvement. Similarly, countries like Iran, Malawi, Kenya, and Uganda have adopted web-based systems to facilitate data access for decision-making. According to research, the management information provided by DHIS2, an open-source program that can be customized to include HIM functions, is found to be ineffective [6].

The methodology employed in this study is highly valuable. In this approach, the author utilized Independent Variables (IV), a Moderator, and a Dependent Variable (DV).

The structure of the remaining article is outlined as follows: Section II is Literature Review, Section III is Hypotheses, Section IV is Descriptive Statistics, Section V is Methodology, Section VI is Results and Discussion, and Section VII is Conclusion.

II. Literature Review

The idea of integrating information systems facilitates more efficient coordination and control of organizational activities and healthcare delivery was emphasized by Finnish researcher [7]. However, [7] does not delve into the facilitation of the integration process. A study conducted in African countries Ghana and Tanzania identified obstacles to HMIS integration, including limited capacity for data analysis and decision-making, redundant and parallel reporting, and communication channels. Establishing amicable connections and partnerships is crucial for the effective implementation of

IHMIS, as it necessitates the cooperation and commitment of numerous stakeholders. Previous studies have highlighted the benefits of information-sharing within healthcare partnerships [8].

A study conducted in China highlighted seven primary factors crucial to the success of the HMIS. These factors encompass strong motivation, a shared vision, a multidisciplinary implementation team, seamless integration with internal information systems, advanced legacy information systems and infrastructure, and adherence to industry standards [9]. To record and track population health data, most low-income nations still mostly rely on paper-based systems [10]. In regions with little infrastructure and resources, paper-based systems are frequently the most economical and useful modern option accessible. Coordinating data collection among government agencies can be challenging, especially when dealing with local healthcare service providers that perform similar tasks. However, donor policies typically encourage the implementation of vertical programs that support their own information systems and administrative structures [6].

Embracing modern technology represents just one of the various approaches healthcare organizations can utilize to enhance productivity and reduce costs. This investigation examines the technical aspect in line with the conceptual framework, considering:

1) IT infrastructure, comprises two distinct yet interrelated components: Technological infrastructure and human infrastructure. The technical infrastructure supports business applications (hardware, software, and data) with a collective set of tangible IT resources. b) Organizational and human skills, knowledge, expertise, commitments, values, and norms are all included in the human infrastructure. It is crucial to evaluate the sufficiency and accessibility of the human and technology infrastructure. It tackles the essential question of whether the information system would technically work, as mentioned by [11]. c) System interoperability. The primary emphasis of the laissez-faire approach is on organizational performance. Under laissez-faire leadership, employees are granted the autonomy to operate as they deem appropriate with minimal intervention. Leaders in this model assign responsibilities and make decisions, staying informed about corporate affairs and available for consultation as needed. However, they adopt a hands-off approach, enabling team members to work autonomously while meeting established organizational goals [12].

Data quality is delineated by four attributes: accuracy, timeliness, completeness, and consistency. Consistency refers to the level of correspondence between patient data recorded on patient cards and the registry. Meeting the reporting deadlines is the criteria used to gauge timeliness, as highlighted by [13]. The assessment of data quality is currently widely embraced in standard public health practices to ensure the reliability of data in Health Information Systems (HIS). To make evidence-based decisions, there is a need for both the demand and utilization of information. During their working hours, healthcare professionals collect a great deal of patient data; However, at the time of gathering, this data is hardly evaluated or utilized [14]. Therefore, an effective Health Management Information System (HMIS) should ensure that data collection is closely aligned with user requirements, encompassing only relevant data, and should possess processing capabilities that enable the easy retrieval of information, requiring only the essential data for expeditious analysis [13].

The results showed that Brazil does not use information effectively enough for planning or decision-making [13]. A prevalent deficiency in effectively using data to monitor service usage trends over time, thereby evaluating the impacts of policy and service delivery changes, is a significant vulnerability that impacts the entirety of the Sub-Saharan Africa [15].

An effective HMIS streamlines reporting by advocating for unified reporting to development partners and discouraging the implementation of parallel reporting systems whenever possible (WHO & ROWP, 2004). According to [16], work was classified into two main categories: (i) the type, capacity, specialization, and skills required for a specific task; and (ii) the diversity of knowledge and expertise from different individuals. This distribution of tasks highlights the potential to optimize the diverse talents and expertise of various healthcare workers, fostering the development of specialization. It also minimizes the time lost in duplicating tasks that could be efficiently handled by individuals based on their specific skill sets.

An organization's capacity to embrace technology was evaluated based on its utilization of Information and Communication Technology (ICT) and the promptness of information delivery, denoting the immediate and simultaneous exchange of information among all users. ICT facilitates electronic communication, information processing, and transmission, fostering the sharing of knowledge. This encompasses all forms of digital and analog information and communication technology, excluding non-electronic technologies. Examples of ICT in this context include computers, radios, televisions, phones, digital texts, and audio-video recording. The absorption and dissemination of innovation have served as the central analytical framework in investigating the adoption of information technology (IT) and information systems (IS). In their report, [17] underscores the significant role of an organization's technological proficiency and resources in its ability to adapt to new technologies.

According to study [18], healthcare professionals encounter challenges in implementing IT systems due to their complexity, resulting in a reliance on manual paper filing systems that compromise and mismanage information. According to study [19], information technology use and application are new ideas in modern developing-nation organizations. In situations involving emerging diseases and urgent health crises, where timely notification, investigation, and response can prevent widespread outbreaks and even global pandemics, as well as save lives, the need for precise information is particularly crucial [20]. The Government of [21], states that the main goals of the IHMIS are to improve

clinical outcomes, decrease redundancy, boost efficiency, improve access and coordination, and strengthen connections between various care tiers and support services. Moreover, integrated healthcare harnesses the diverse skills and expertise of various healthcare professionals, along with crucial support services such as information management. Many people consider healthcare to be one of the foremost concerns for humanity, encompassing both societal and personal life objectives.

The correlation between information technology and healthcare is symbiotic. Accurate information is indispensable for the healthcare sector, and achieving precision in information is contingent on a person's mental, physical, and psychological well-being [22]. The study in [23] objective is to aid both administrators and medical managers by elucidating the influence of the health information system on the decision-making process and highlighting the system's importance in facilitating these decisions.

III. Hypothesis

A hypothesis must be put to systematic testing or observation to see if it is true or not (Bradford, 2015). Only then can it be deemed scientific. The following hypotheses were examined in the study:

(H1): Behavioral factors play a substantial role in the integration of HMIS within the healthcare sector.

(H2): The leadership style of the health system is crucial to the successful integration of HMIS in healthcare facilities.

(H3): Healthcare organization's HMIS integration is significantly impacted by technical aspects.

(H4): The timely delivery of information has a significant impact on the interaction between HMIS integration in healthcare organizations.

IV. Descriptive Statistics

An overview of the study's conclusions and descriptive statistics based on the data gathered are given in this section. There were 219 questionnaires distributed in total; 214 were collected, and five were discarded because the responses were not complete after the 214 surveys' data were processed, analyzed, and thoroughly examined for any missing values or anomalies.

According to the data presented in Table I, approximately 47% of the samples fell within the age range of 25 to 35, while 35% were aged between 35 and 45, with the remaining 18% being over the age of 45.

Table II indicates that 51% of the samples are male, while 49% are female.

Table III displays the sample's perspectives on the questionnaire statements regarding the data collection strategy. The average data collection strategy in the table is 3.38, indicating that the assessment of the data collection strategy was at a moderate level. The findings indicate that the statement means ranged from 3.28 to 3.49.

Table IV presents the sample's viewpoints on the questionnaire statements regarding the influence of the health system's leadership style on IHMIS. The average score for the impact of the health system's leadership style on IHMIS is 3.432, indicating a moderate level of influence. According to these findings, the statement means ranged from 3.15 to 3.74.

On the other hand, Table V displays the results of the Means & Sd. analysis for the statements concerning the Integrated HMIS Model.

Regarding the Integrated HMIS Model (Dependent variable), the statements were assessed using Means & Sd. The results are displayed in Table V.

The data in Table V reflects the sample's perspectives on the questionnaire statements related to the Integrated HMIS Model. The average for the Integrated HMIS Model was recorded as (3.635), indicating a moderate level of estimation. The results indicate that the statement means ranged from (3.37 to 3.95). Concerning the Information Timeliness (Moderating variable), Means & Sd. were used to evaluate the statements. Table VI presents the findings.

TABLE I. The Age Distribution of Participants' Frequency

Age	Frequency	Percent
25-35	100	46.7
35-45	75	35.0
45 & Above	39	18.2
Total	214	100.0

TABLE II. The Distribution of Participants' Gender Frequencies

Gender	Frequency	Percent
Male	109	50.9
Female	105	49.1
Total	214	100.0

TABLE III. Means and STD. Deviation of Data Collection Strategy

S#		Mean	Std. Deviation
1	All caregivers are committed to recording all collected information, whether manually or electronically.	3.41	1.236
2	Data collection adheres to the guidelines outlined in the templates.	3.29	1.166
3	Essential data is collected at each service point using the provided templates.	3.28	1.197
4	To ensure effective service delivery, each patient undergoes a series of well-organized processes.	3.39	1.115
5	The available HMIS enables seamless information exchange within the facility.	3.46	1.116
6	Multiple data sources are accessible within the premises.	3.49	1.056
7	HMIS is perfectly aligned with organizational structure.	3.36	1.064
Total		3.38	1.14

TABLE IV. MEANS AND STD. DEVIATION OF EFFECT OF THE HEALTH SYSTEM'S LEADERSHIP STYLE ON IHMIS

S#		Mean	Std. Deviation
1	Consistently provide basic outpatient care.	3.27	1.218
2	Deliver top-notch surgical services.	3.26	1.185
3	Focus is solely on promotive/preventive care.	3.26	1.056
4	Ensure satisfactory patient services.	3.3	1.156
5	Curative services meet the needs adequately.	3.48	1.091
6	Hospital operations are guided by established plans and objectives.	3.17	1.093
7	Consistently achieve targets within the designated time frame.	3.15	1.296
8	The available HMIS facilitates seamless information sharing with national referral hospitals.	3.56	1.004
9	Regularly exchange medical records with neighboring institutions throughout the county.	3.59	0.992
10	Hospital management team maintains regular communication with staff members.	3.71	1.027
11	Hospital's established structures enable easy access to healthcare for patients.	3.74	1.001
12	Each department within hospital has an adequate number of staff members.	3.56	1.002
13	Knowledgeable and proficient individuals are staffed at every service point within hospital.	3.56	1.076
Total		3.432	1.092

TABLE V. MEANS AND STD. DEVIATION INTEGRATED HMIS MODEL

S#		Mean	Std. Deviation
1	The data collected is consistently comprehensive.	3.75	1.053
2	Regular data audits ensure data quality.	3.65	1.062
3	Data collection, analysis, and utilization are integrated across all departments in the facility.	3.74	1.046
4	At facility, there is a significant demand for information to aid in decision-making processes.	3.73	0.988
5	The management frequently seeks evidence to validate the accuracy of reports used for decision-making.	3.61	1.099
6	Timely identification and correction of any deviations from planned activities is our norm.	3.64	1.01
7	Management team has implemented control mechanisms to ensure optimal organizational performance.	3.51	1.074
8	Willingly share information to aid disease prevention and control efforts.	3.38	1.012
9	Effective information-sharing has significantly improved cost savings within facility.	3.37	1.002
10	Relevant feedback for corrective action is promptly disseminated.	3.38	0.98
11	Management team at the facility often engages in benchmarking activities.	3.52	0.948
12	Consistently prepare reports meticulously and ensure they are well-organized.	3.4	0.962
13	Reports in facility meet the standards provided by the Ministry of Health.	3.43	0.926
14	HMIS-generated reports are instrumental in effecting changes within facility.	3.41	1.056
15	Via the different capabilities of HMIS, we receive abundant information from sub-county hospitals.	3.41	1.109
16	They remain informed about the local health situation and needs through frequent meetings with the county health department.	3.78	1.116
17	Maintain close cooperation with hospitals in sub-counties and health centers.	3.84	1.054
18	All sections, departments, and divisions work collaboratively to achieve organizational goals.	3.92	1.017
19	Submit regular reports to the sub-county Ministry of Health every week.	3.95	1.008
20	Facility utilizes one of the top HMIS programs available in the market.	3.93	1.027
21	The system conducts regular data backups.	3.88	0.959
22	Eectronic medical record management solution simplifies the process of record-keeping.	3.74	1.024
23	The data collected is consistently comprehensive.	3.64	0.986
Total		3.635	1.023

TABLE VI. MEANS AND STD. DEVIATION OF INFORMATION TIMELINESS

S#		Mean	Std. Deviation
1	Patients can easily access necessary information.	4.41	1.096
2	HMIS enables rapid reporting to DMIS.	4.31	1.053
3	Facility has established a dependable system for collecting and disseminating data.	4.38	1.118
4	HMIS primarily aids clinical healthcare workers in timely task completion.	4.54	1.051
Total		4.41	1.08

The findings in Table VI illustrate the perspectives of the respondents on the questionnaire statements related to Information Timeliness. The data demonstrates that the means of the statements ranged between 4.31 and 4.54, with Information Timeliness averaging at 4.41, signifying a high estimation level for Decision Making.

V. METHODOLOGY

Given that it aligns with the research objectives, the exploratory factor analysis approach is chosen for this study. Two main factors go into this decision. First of all, it seeks to reduce a large number of variables—132 in total—into a more manageable group of elements. Second, it follows the recommendations made by [24] in an attempt to preserve as much of the original variance as feasible.

Additionally, a more theoretical reason is considered when favoring EFA in the decision-making process. This reason relates to the correlation structure among measured variables, which is distinct from the goal of data reduction. It's worth noting that exploratory factor analysis is considered a data-driven approach because the researcher lacks a predetermined notion of the number of factors [25], It provides techniques for determining the appropriate number of factors and the configuration of factor loadings to be employed in subsequent hypothesis testing. When conducting an EFA, three fundamental steps are followed: assessing item correlations, extracting components, and rotating factors [26]. These aspects are elaborated upon in the following sections:

A. Rotated Factor Extraction

Fig. 1 illustrates that the number of elements obtained through rotation techniques is equivalent to those derived from the principal components method. Table VII presents the Kaiser-Mayer-Olkin measure of sampling adequacy, yielding a value of 0.765, which surpasses the suggested cutoff point of 0.6 (Hair et al., 2010). Moreover, Bartlett's Test of Sphericity yielded a significant result with a p-value of .000. Patterns with loadings exceeding 0.3 were identified using an analytical approach.

TABLE VII. KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.765
Bartlett's Test of Sphericity	Approx. Chi-Square	29348.966
	df	9045
	Sig.	.000

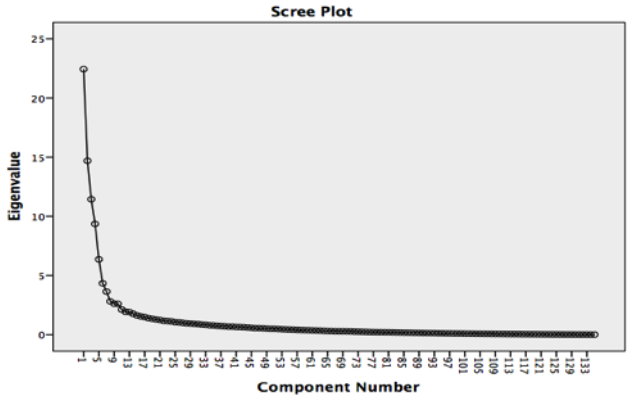

Fig. 1. Factors derived from the varimax and promax techniques with loadings exceeding 0.3.

B. Examining the Variables Associated with the Efficacy of Information Systems

Setting a loading cut-off threshold at 0.4 resulted in the successful extraction of nine components (see Fig. 2), with the essential output tables presented below. Notably, an impressive cumulative variance explanation of 83% is achieved, as indicated in Table VIII, and the KMO measure of sampling adequacy (see Table VII) is notably favorable. In conclusion, Table VIII pattern compilation distinctly identified nine components that underwent further in-depth examination.

TABLE VIII. KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.832
Bartlett's Test of Sphericity	Approx. Chi-Square	10740.155
	df	1830
	Sig.	.000

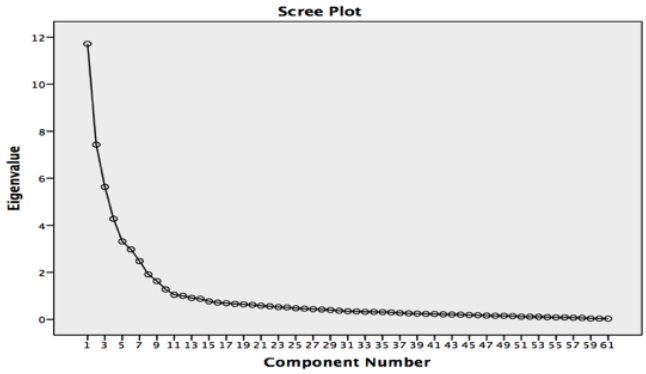

Fig. 2. Nine factors for integrated HMIS model.

C. Discussion on the Solution - Assigning Names to the Factors of the Independent Construct

The factor analysis results showed the extraction of nine factors that could be related to the independent construct's five dimensions. Four of the items in the pattern matrix had loadings that were less than 0.4, indicating that the original 132 variables were condensed to 51. Here is a list of these particular items.

TABLE IX. FACTORS AND VARIABLES ASSOCIATED WITH THE INTEGRATED HMIS MODEL

Dimensions	Factors 9	Variables 51
Information Quality	5	5
Effect of the Health System's Leadership Style on IHMIS	2	7
	5	6
Integrated HMIS Model	10	3
	1	11
	6	5
	7	4
Information Timeliness	9	4
Technical factor affecting IHMIS	3	9

Table IX provides a summary of the number of variables and factors retained for use in the study. Each extracted element underwent an individual evaluation to determine its characteristics and suitability for inclusion in the subsequent study. The pattern matrix revealed the distinctiveness of the factors, facilitating the identification of the weaker ones: Factor 8 encompassed five variables; Factors 2 and 5 comprised 7 and 6 variables, respectively. Factors 10, 1, 6, and 7 contained 3, 11, 5, and 4 variables, respectively. Lastly, Factors 3 and 9 included 4 and 9 variables, respectively.

D. Reliability Analysis

Data was collected and compiled using SPSS for analysis purposes. To ascertain the internal consistency reliability of the Health Management Information System (HMIS) integration, Cronbach Alphas were calculated. According to Nunnally (1978), an acceptable Cronbach Alpha level of at least 0.70 was defined for internal consistency reliability. Throughout the evaluation process, it was identified that several elements needed to be removed to enhance the instrument's reliability. Table X describes the findings of the factor's reliability.

TABLE X. FINAL FACTORS RELIABILITY FINDINGS

Constructs	Factor Name	Cronbach Alpha
Information Quality	Data Collection Strategy	0.906
Effect of the Health System's Leadership Style on IHMIS	Transformational Leadership	0.787
	Laissez-Faire Leadership	0.877
Integrated Hmis Model	Data And Information Quality	0.741
	Information Use	0.923
	Teamwork	0.879
	Technology Adoption	0.853
Information Timeliness	Information Timeliness	0.902
Technical Factor Affecting IHMIS	Technical Factor	0.732

E. The Research Model

Commonly referred to as a conceptual model, a conceptual framework is a visual representation that assists researchers in illustrating the anticipated cause-and-effect relationships [27]. The dimensions comprise Information Quality, Transformational Leadership, Laissez-Faire Leadership, and System interoperability as independent variables, Information timelines as a moderator, while Integrated HIMS serves as the dependent variable [28] and [29]. Using a multiple regression model, this study sought to determine the impact of the three independent variables (P_1, P_2, and P_3) and the single moderating variable (Q) on the dependent variable (R) through HMIS integration efforts. The study's objectives were met through the hierarchical examination of variables, following the procedures outlined in the Fig. 3 conceptual framework proposed by [30].

$$R = \beta_0 + \beta_1 P_1 + \beta_2 P_2 + \beta_3 P_3 + \beta_4 Q + \beta_5 P_1 Q + \beta_6 P_2 Q + \beta_7 P_3 Q$$

Let Y represent the HMIS integration, where β0 stands for the intercept, and β_1, β_2, and β_3 represent the slope coefficients, indicating the relationship between the respective independent variables and the dependent variable. P_1 denotes the behavioral component of health professionals, P_2 represents the influence of the health system's leadership style on IHMIS, and P_3 corresponds to the technical factor. Each hypothesis was carefully tested and evaluated to ensure its alignment with the study's objectives.

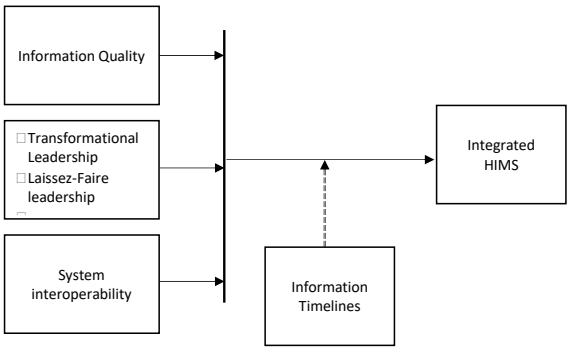

Fig. 3. Conceptual framework.

The model examined the influence of the independent variables (P_1: healthcare professionals' behavior, P_2: the influence of the health system's leadership style on IHMIS, and P_3: the technical aspect) on the dependent variable (R: Integrated HMIS Model). Before considering any moderating effects of information timeliness, the model included the standard predictors of integration in healthcare organizations.

VI. RESULTS AND DISCUSSION

The multiple regression model presented in Table XI indicated that Information Quality (β2 = -0.1053, P > .005) and Technical factor (β4 = 0.0834, P > .005) are not significant contributors to the integration of HMIS in a combined relationship. However, Health System's Leadership Style (β3 = 0.4654, P < .005) emerged as a significant influence on HMIS integration in a combined relationship. This implies that the crucial factor predicting HMIS integration is leadership style, with other factors being less impactful.

The presented results outline the outcome of an Ordinary Least Squares regression analysis in Table XII. The purpose of the model is to predict the values of the dependent variable by considering the independent variables (IV1, IV2, IV3) and their interactions with the moderator (IV1_M_interaction, IV2_M_interaction, IV3_M_interaction). Assuming that all other variables stay constant, the coefficients for each variable show how the dependent variable is expected to vary for every unit change in the associated independent variable.

The model explains 69.9% of the variance in the dependent variable, indicated by an R-squared of 0.699.

The model demonstrates overall statistical significance, as evident from the low p-value of 2.36e-50 and the high F-statistic of 68.48. IV1 does not appear to be statistically significant, indicated by its high p-value of 0.614 and a coefficient of -0.1053. IV2 is deemed statistically significant due to its coefficient of 0.4654 and a relatively low p-value of 0.005. IV3 does not exhibit statistical significance, as indicated by its high p-value of 0.572 and a coefficient of 0.0834.

The interaction terms IV1_M_interaction, IV2_M_interaction, and IV3_M_interaction are denoted by coefficients of 0.1181, -0.1320, and -0.0395, respectively. IV1_M_interaction, IV2_M_interaction, and IV3_M_ interaction were found to be statistically significant in the context of the provided data, however, IV3_M_interaction was not, based on their respective p-values. These findings imply that the moderator variable has a significant impact on how the independent variables affect the dependent variable. Furthermore, the research shows that IV2 has a significant and unique effect on the dependent variable, in contrast to IV1 or IV3.

DV=IV1_M_interaction - 0.1320 * IV2_M_interaction - 0.0395 * IV3_M_interaction + 0.1181 * Moderator + 0.0804 - 0.1053 * IV1 + 0.4654 * IV2 + 0.0834 * IV3 + 0.7164 * Moderator.

The link between the dependent variable and multiple independent variables (IV1, IV2, and IV3), as well as their corresponding coefficients, are shown in the regression equation. The influence of the Moderator variable on the relationship between the independent and dependent variables is also accounted for in the equation.

TABLE XI. SUMMARY OF THE TESTED HYPOTHESES' OUTCOMES

No.	Variable	p-value	Direction	Deduction
1	Information Quality	0.614	Negative	Do not reject Null
2	Effect of the Health System's Leadership Style on IHMIS	0.005	Positive	Reject Null
3	Technical Factors affecting IHMIS	0.572	Positive	Do not reject Null
4	Information Timeliness	0.000	Positive	Reject Null
5	Information Quality* Information Timeliness	0.026	Positive	Reject Null
6	Effect of the Health System's Leadership Style on IHMIS * Information Timeliness	0.004	Negative	Reject Null
7	Technical factor affecting IHMIS* Information Timeliness	0.327	Negative	Do not reject Null

TABLE XII. ORDINARY LEAST SQUARES REGRESSION ANALYSIS

	coef	std err	t	P>ltl	[0.025	0. 9751]
const	0.6804	0.643	0.125	0.901	-1.188	1.348
IVI	-0.1053	0.208	-0.506	0.614	-0.516	0.305
IV2	0.4654	0.162	2.872	0.005	0.146	0.785
IV3	0.0834	0.147	0.566	0.572	-0.207	0.374
Moderator	0.7146	0.190	3.752	0.000	0.339	1.09
IVI_M_interaction	0.1181	0.052	2.25	0.026	0.015	0.222
IV2_M_ interacion	-o.1320	0.046	-2.874	0.004	-0.223	-0.041
IV3_M_interaction	-0.0395	0.040	-0.982	0.327	-0.119	0.04

The anticipated change in the dependent variable for a one-unit increase in the associated independent variable, assuming other variables remain the same, is displayed by the coefficients for each independent variable (IV1, IV2, IV3). Moreover, IV1_M_interaction, IV2_M_interaction, and IV3_M_interaction are interaction terms that show how the moderator changes the associations between the independent and dependent variables. Positive coefficients point to an amplification impact, whilst negative coefficients point to a damping effect.

The investigation unveiled a strong and positive connection between the timeliness of information and the integration of HMIS. Furthermore, it was observed that a powerful leadership style notably improved the functionality of health management information systems, leading to enhanced patient outcomes.

VII. CONCLUSION

In terms of the organizational dimension, it was imperative to enhance, endorse, and adjust data collection methods to meet the dynamic requirements of the healthcare system. At that time, the healthcare system used a lot of different data collection tools, which led to laborious work and weariness among data and information workers. The integration of HMIS was notably associated with the Health System's Leadership Style, suggesting that healthcare organizations could achieve operational efficiency by refining their health system leadership style to align with environmental shifts. The results of the study showed a strong and positive association between information timeliness and HMIS integration. Overall, the study's model explained 69.9% of the variability in HMIS integration, demonstrating its efficacy in answering important questions about the critical elements of HMIS integration in healthcare facilities. It was observed that a strong leadership style greatly enhanced the functionality of health management information systems, which in turn improved patient outcomes.

In future work, the current study can also be mapped with two important independent variables named as Information Sharing and Complexity of Project Management.

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