DIGITAL MATURITY MODELS AND PERFORMANCE OF HEALTHCARE INSTITUTIONS IN ABAKILIKI, EBONYI STATE

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ABSTRACT
The study assessed the Digital Maturity Models and Performance of healthcare institutions in Abakiliki, Ebonyi State. Its specific objectives were to investigate the relationship between Electronic Health Records (EHR) and institutional output, and to determine the relationship between Patient-Centered Technologies and clinical outcomes within these healthcare institutions. Primary data were collected through questionnaires administered to a total population of 297 employees familiar with and utilizing digital infrastructure in healthcare. Due to the relatively small population, all employees were included in the study. Out of the questionnaires distributed, 240 were returned, representing an 81% response rate, while 50 were not returned, accounting for 19%. This indicates a high level of participation. The data were analyzed using mean scores and standard deviations on a Sprint Likert Scale, and hypotheses were tested using the Z-test statistical method. Results showed that Electronic Health Records (EHR) had a significant positive relationship with the output of healthcare institutions in Abakiliki, Ebonyi State, with Z(8.327, $p < .05$). Patient-Centered Technologies had significant positive relationship with Clinical Outcomes of healthcare institutions in Abakiliki, Ebonyi State, Z(10.393, P. <. 05). The study found that Electronic Health Records (EHR) and Patient-Centered Technologies are significantly and positively associated with the performance and clinical outcomes of healthcare institutions. The study recommended among others that Healthcare institutions are encouraged to fully implement integrated and interoperable Electronic Health Record (EHR) systems that enable real-time documentation, access to patient histories, lab results, medication management, and clinical decision support.
Keywords: Digital Maturity, Performance, Electronic Health Records (EHR), output, Patient-Centered Technologies

INTRODUCTION
In today's fast-changing digital landscape, healthcare institutions are increasingly adopting digital technologies to improve service delivery, patient outcomes, and operational efficiency. The impact of these technologies on healthcare performance depends significantly on the institution's digital maturity the ability to adapt and effectively use digital tools to meet strategic goals (Gill et al., 2020). Digital maturity represents a continuum from initial digital adoption to full integration across clinical and administrative functions. Digital Maturity Models (DMMs) provide structured frameworks that help healthcare organizations assess, benchmark, and advance their digital capabilities. These models, such as the HIMSS Digital Health Indicator and EMRAM, offer staged guidance for digital transformation by identifying current strengths and areas needing improvement (Mettler & Pinto, 2018; Kruse et al., 2018). Studies have shown that higher digital maturity correlates with improved clinical workflows, enhanced patient experiences, better data-driven decisions, and overall efficiency (Mao et al., 2022). Additionally, digitally mature institutions tend to be more agile and resilient during crises, as seen during the COVID-19 pandemic when they rapidly deployed telehealth and digital communication tools to maintain care continuity (Shen et al., 2021). Thus, digital maturity influences not only everyday performance but also institutional responsiveness and adaptability.

Healthcare performance extends beyond clinical outcomes to include the delivery of timely, safe, and patient-centered care within resource constraints (WHO, 2018). Arah et al. (2006) describe healthcare performance through three core dimensions: health improvement, responsiveness to population needs, and financial fairness. Comprehensive performance assessment frameworks incorporate efficiency, care quality, and equity to support ongoing monitoring and strategic decision-making (Smith et al., 2009). Moreover, healthcare institutions are evaluated on their capacity to implement evidence-based practices, integrate technological advancements, and sustain a resilient workforce capable of handling public health emergencies (Kruk et al., 2018). Tools like Key Performance Indicators (KPIs), Balanced Scorecards, and Health System Performance Assessments are widely used to standardize performance monitoring, identify gaps, and promote quality improvement (Murray & Frenk, 2010). High-performing institutions meet clinical standards while ensuring equitable access, optimal resource utilization, and high patient trust (Bates et al., 2018). However, challenges such as resistance to change, skill shortages, inadequate infrastructure, and limited funding can hinder digital maturity progress (Alami et al., 2019). Therefore, achieving meaningful performance gains requires a holistic approach addressing people, processes, and technology (Vimalananda et al., 2020). In developing countries like Nigeria, the use of DMMs is still emerging, with a critical need to study how digital maturity affects healthcare performance indicators such as patient satisfaction, quality of care, and efficiency in resource-limited settings (Ojo et al., 2021). Understanding this relationship can provide valuable guidance for strengthening digital healthcare infrastructure in such environments.

The Problems and Significance of the Present Study

Digital maturity models serve as essential tools for enhancing the performance of healthcare institutions by offering structured frameworks to assess digital capabilities, guide digital transformation, and promote efficient, secure, and patient-centered care. Institutions that adopt these models tend to perform better in key areas such as patient service delivery speed, streamlined workflows, and optimal use of resources. The integration of digitized patient records and information systems reduces redundancies, minimizes errors, and alleviates administrative burdens, thereby improving overall institutional efficiency and quality of care.

Conversely, the absence or ineffective implementation of digital maturity models can result in significant setbacks. Institutions without a clear digital roadmap often experience fragmented systems, reliance on manual processes, and delays in service delivery. These issues can lead to longer patient wait times, poor electronic health record (EHR) management, suboptimal clinical decisions, and an inability to effectively monitor outcomes or engage in strategic planning. Furthermore, such institutions may face increased risks of data breaches and compromised patient confidentiality, leading to legal liabilities. In many developing regions, including Nigeria, the challenges are intensified by outdated or inadequate IT infrastructure, which hampers efforts to achieve digital transformation. These unresolved issues contribute to technological stagnation, poor service delivery, operational inefficiencies, and diminished clinical outcomes. Against this backdrop, the present study set out to assess the relationship between digital maturity models and the performance of healthcare institutions in Abakaliki, Ebonyi State.

The present study is essentially of benefit to three key stakeholders which include:

a. Healthcare Institutions: Hospitals, clinics, and health centers will benefit by understanding how digital maturity models impact operational efficiency, service delivery, and patient outcomes. They can use findings to adopt appropriate digital tools, improve data management, and enhance patient engagement.

b. Healthcare Administrators and Managers: These stakeholders can use the study to guide strategic planning, resource allocation, and policy-making for digital transformation within their institutions. Helps in assessing current digital maturity levels and setting realistic targets for improvement.
c. Researchers and Academicians: Provides a framework for further studies on healthcare digitalization, digital maturity, and performance evaluation. Adds to academic discourse and supports curriculum development in health informatics and healthcare management.

STUDY OBJECTIVES

The primary aim of this study was to assess the impact of digital maturity models on the performance of healthcare institutions in Abakaliki, Ebonyi State. Specifically, the study sought to:

i. Investigate the relationship between Electronic Health Records (EHR) and the operational output of healthcare institutions in Abakaliki, Ebonyi State.
ii. Determine the relationship between Patient-Centered Technologies and the clinical outcomes of healthcare institutions in the same region.

RESEARCH QUESTIONS

This study was guided by the following research questions:

i. What is the nature of the relationship between Electronic Health Records (EHR) and the operational output of healthcare institutions in Abakaliki, Ebonyi State?
ii. How do Patient-Centered Technologies relate to the clinical outcomes of healthcare institutions in Abakaliki, Ebonyi State?

RESEARCH HYPOTHESES

The study was also anchored on the following hypotheses:

i. There is a significant relationship between Electronic Health Records (EHR) and the output of healthcare institutions in Abakaliki, Ebonyi State.
ii. Patient-Centered Technologies are significantly related to the clinical outcomes of healthcare institutions in Abakaliki, Ebonyi State.

REVIEW OF RELATED LITERATURE

Conceptual Review

Digital maturity models Digital Maturity Models (DMMs) serve as essential tools that enable organizations to evaluate their current level of digital transformation while identifying critical areas for development. In healthcare institutions, these models are vital for planning, implementing, and refining digital innovations such as Electronic Health Records (EHR), telemedicine, and artificial intelligence. By understanding their digital maturity stage, hospitals can better allocate resources and establish attainable targets for future advancements (Flott et al., 2016). Higher levels of digital maturity are correlated with improved healthcare performance, including faster patient service delivery, more efficient workflows, and optimized resource usage. For example, digital patient records and integrated IT systems minimize duplication and errors, reducing administrative overheads and enhancing overall institutional productivity (Castro et al., 2021). Furthermore, digitally advanced institutions are more capable of delivering patient-centered care through features like real-time analytics, AI-supported diagnostics, and remote health monitoring, all of which contribute to improved patient outcomes and satisfaction (Alami et al., 2020).

Components of Digital Maturity Models Used in the Study

Electronic Health Records (EHRs) EHRs are digital, real-time records of patients' medical histories that provide secure, instant access to authorized users across various healthcare settings. Unlike Electronic Medical Records (EMRs), which are limited to single practices, EHRs facilitate information sharing among hospitals, labs, pharmacies, imaging centers, and more. These systems improve clinical workflows, enhance documentation accuracy, and enable more coordinated and effective care (Menachemi & Collum, 2011; HealthIT.gov, 2020).

Patient-Centered Technologies (PCTs) These digital tools are designed to empower patients by giving them greater control over their healthcare. PCTs include mobile apps, wearable health devices, patient portals, and remote monitoring systems, which enhance health literacy and encourage active patient participation. According to Osei and Boateng (2020), PCTs support shared decision-making and strengthen communication between patients and providers, particularly in managing chronic conditions. Ancker et al. (2018) also noted that patient portals and secure messaging systems improve care coordination and clinical outcomes by fostering timely access to personal health information and collaborative treatment planning.

Concept of Healthcare Performance

In the context of this study, healthcare performance refers to the ability of healthcare systems and providers to achieve optimal results in service delivery, quality of care, and resource management. Key performance indicators include patient satisfaction, service accessibility, clinical effectiveness, and responsiveness to patient needs. Arah et al. (2023) emphasized that performance also depends on equity and adherence to evidence-based practices. High-performing systems are typically characterized by low mortality rates, high safety standards, and consistently positive health outcomes (Osei & Boateng, 2022). Thus, evaluating healthcare performance requires a holistic and ongoing review of service quality, efficiency, and the effectiveness of implemented policies.

Components of Performance of healthcare

Output In the healthcare context, output refers to the tangible and measurable results generated by healthcare services, systems, or interventions. These outputs may include metrics such as the number of patients attended to, treatments administered, diagnostic procedures conducted, or medications dispensed. Output also encompasses the quality of care provided, making it a critical indicator of a healthcare institution's efficiency, productivity, and effectiveness in meeting patient needs. Scholars have approached healthcare output from both quantitative angles—like treatment volume—and qualitative perspectives, including patient satisfaction and treatment outcomes. Evaluating healthcare system performance often involves comparing these outputs to the resources utilized. Understanding healthcare output is essential for guiding resource distribution, shaping policy, and improving service delivery. Research has shown a link between higher output levels and better hospital performance, particularly in terms of patient recovery rates and operational efficiency (Gouda et al., 2023). However, it has also been emphasized that quality indicators such as patient-reported satisfaction and health outcomes should take precedence over purely numerical output figures (Chung & Lee, 2022).

Clinical outcomes On the other hand, refer to the health-related results experienced by patients as a consequence of medical treatments or interventions. These may include measures such as mortality and survival rates, symptom improvement, recovery durations, and overall enhancement in physical or mental well-being. Clinical outcomes are crucial for determining the efficacy and safety of medical care and for aligning treatments with patient needs and expectations. Modern studies have broadened the scope of clinical outcome assessments to include aspects like long-term health effects, patient satisfaction, and the cost-effectiveness of healthcare interventions. Furthermore, clinical outcomes serve as key indicators for evaluating the performance of healthcare professionals and institutions, fostering greater accountability and continuous quality enhancement in healthcare

Empirical Review

Electronic Health Records (EHR) and Output of healthcare institution

Elikwu et al. (2020) study explored how electronic health information systems (eHIS) impact medical records management in Nigeria's public healthcare institutions. Using both survey and case study methods across four Federal Medical Centres in North Central Nigeria, the findings revealed that although traditional paper records are still dominant, adopting eHIS could reduce treatment errors, minimize patient waiting time, improve communication among practitioners, and protect patient data, thereby enhancing overall service delivery.

Upadhyay and Fen Hu (2022) qualitative study investigated clinicians' experiences with Electronic Health Records (EHR) and their effect on healthcare quality and safety. Through interviews and exploratory factor analysis involving various clinical roles across different healthcare facilities, findings revealed mixed perceptions. While nurses reported efficiency gains, other professionals found EHRs time-consuming. Common benefits included reduced medical errors due to improved data access, but issues like data accuracy and system interoperability were major concerns.

Enahoro et al. (2023) review analyzed the impact of EHRs on healthcare delivery and patient outcomes, identifying both advantages and challenges. EHRs were found to enhance care efficiency, support clinical decision-making, and promote better collaboration and patient outcomes, such as fewer readmissions and improved chronic disease management. However, challenges like data privacy, interoperability, and the digital divide remain. The study emphasized the need for continuous innovation in health informatics.

Ondogan et al. (2023) conducted in a Turkish university hospital; this study examined how electronic medical records (EMRs) affect communication and information sharing among healthcare professionals. Survey data from physicians and nurses indicated moderate EMR use and communication-sharing behavior. A significant positive correlation ($r = 0.442$) was found between EMR usage and effective communication. Despite this, paper forms are still commonly used due to legal mandates and distrust in electronic systems.

Motsi and Chimbo (2024) focusing on South Africa, this quantitative study assessed how EHRs influence the adoption of evidence-based healthcare practices (EBHP). Data from 300 healthcare professionals were analyzed using structural equation modeling. Results showed EHRs significantly improved information quality, reduced errors, enhanced diagnosis and treatment, and supported care coordination. EHR-based clinical decision support was found to be key in promoting EBHP and improving healthcare quality, especially in disease management and preventive care.

Patient-Centered Technologies and Clinical Outcomes

Kwame and Petrucka (2021) literature-based study examined the dynamics of patient-centered care and communication in nurse-patient interactions, identifying barriers such as institutional policies, environmental factors, and personal behaviors. The study emphasized that effective communication is vital to achieving individualized care, aligning with core nursing values. To guide clinical practice, the authors proposed the PC4 Model—a continuum that links care practices, communication strategies, and contextual elements to enhance or hinder patient-centered outcomes.

Yu et al. (2023) through a large cross-sectional survey of over 5,200 inpatients in China, this study explored the link between patient-centered care (PCC) and healthcare outcomes. Results showed PCC significantly improved self-reported physical and mental health, validated the

necessity of hospitalization, and reduced unnecessary physician-induced behaviors (e.g., extra prescriptions or tests). Logistic regression revealed strong associations, highlighting PCC's potential in enhancing care quality and reducing healthcare inefficiencies.

Stewart et al. (2000) in an observational cohort study involving 39 physicians and 315 patients, this research assessed how patient-centered communication affected health outcomes and medical service use. Using audio recordings and patient surveys, findings showed that perceived patient-centered visits were linked to improved recovery, better emotional health, and reduced use of diagnostic tests and referrals. The study concluded that establishing "common ground" between doctors and patients is key to both better outcomes and more efficient care.

Gavin (2023) meta-narrative review explored the evolution of patient-centered care (PCC) in acute hospital settings between 2012 and 2021. Analyzing 124 relevant studies, the review identified three types of interventions—staff-focused, patient/family-focused, and environment-focused—mostly implemented at the clinical level with positive outcomes. Five core themes emerged: facilitators, threats, outcomes, elements, and conceptual expansion of PCC. The study highlighted a persistent gap between policy and practice and called for more cohesive, context-sensitive frameworks to support PCC in acute care.

Gap in Empirical Review

The existing studies were conducted outside the context of digital maturity models and the performance of healthcare institutions in Abakiliki, Ebonyi State. To the best of my knowledge, none of these studies specifically addressed the relationship between Electronic Health Records (EHR), patient-centered technologies, and clinical outcomes within healthcare facilities in that location. Most of the reviewed literature employed data analysis techniques such as descriptive and inferential statistics, including Pearson's correlation, Kendall's correlation, the Kruskal-Wallis test, Partial Least Squares Structural Equation Modeling (PLS-SEM), Multiple Regression Analysis (MRA), exploratory factor analysis (EFA), semi-structured interviews, as well as thematic analysis and synthesis. In contrast, the current study utilized the Z-test to test its hypotheses. Thus, this research seeks to bridge the identified gap by examining digital maturity models and the performance of healthcare institutions in Abakiliki, Ebonyi State.

THEORETICAL FRAMEWORK

The study was anchored on two theories below:

i. The Capability Maturity Model Integration (CMMI) Theory by Paulk, C., Curtis, B., Chrissis, M. B., & Weber, C. (1993), and
ii. The Gartner Healthcare Maturity Model: Gartner (2017).

The Capability Maturity Model Integration (CMMI) Theory by Paulk, C., Curtis, B., Chrissis, M. B., & Weber, C. (1993)

The theory initially developed for software engineering, has been adapted for use in healthcare to assess the maturity of digital systems such as electronic patient records, clinical decision-making tools, and telehealth platforms. The theory is grounded in a continuous improvement framework, progressing from the basic level—characterized by unstructured and reactive processes—to the most advanced level, where processes are data-driven, standardized, and innovative. In healthcare, CMMI emphasizes aligning technological advancements with both clinical outcomes and operational effectiveness. Digital maturity models based on this theory serve as structured tools for evaluating how effectively healthcare institutions adopt, integrate, and leverage digital technologies to enhance service delivery, care quality, and operational performance.

The Gartner Healthcare Maturity Model (Gartner, 2017)

This model provides a strategic perspective on digital transformation in the healthcare sector. It evaluates an organization's ability to drive, manage, and implement digital initiatives effectively. This model outlines a progression from the initial stage—marked by sporadic use of digital tools—to the optimized stage, where technology is seamlessly embedded across all operations and yields measurable benefits in patient care and institutional efficiency. Gartner's approach highlights the importance of aligning digital strategies with the dynamic needs of healthcare, emphasizing the role of advanced analytics, innovation, and patient-centered technologies in achieving transformational outcomes.

METHODOLOGY

The study was conducted in Ebonyi State and focused on three healthcare institutions: Alex Ekwueme Federal Teaching Hospital (AEFUTHA), Ebonyi State University Teaching Hospital (EBSUTH), and the National Obstetric Fistula Centre (NOFIC). A descriptive survey research design was adopted, and primary data were collected using structured questionnaires. The target population comprised 297 employees from these institutions who are knowledgeable about and utilize digital infrastructure in healthcare services. Due to the relatively small population size, the entire group was surveyed. A total of 240 questionnaires were successfully retrieved, reflecting a response rate of 81%, while 50 were not returned, representing 19%. This indicates a strong participation rate. Data were analyzed using mean scores and standard deviation based on a 5-point Likert scale, while the study's hypotheses were tested using the Z-test statistical method.

RESULTS/FINDINGS

The relationship between Electronic Health Records (EHR) output of healthcare institutions in Abakiliki, Ebonyi State.

Table 1: Responses on the relationship between Electronic Health Records (EHR) output of healthcare institutions in Abakiliki, Ebonyi State.

		5 SA	4 A	3 N	2 DA	1 SD	∑FX	- X	SD	Decision
1	Electronic Health Records (EHRs) systems that are interoperable create a network where patient data can be securely shared across hospitals, clinics, labs, and pharmacies.	515 103 42.9	272 68 28.3	81 27 11.3	58 29 12.1	13 13 5.4	939 240 100.0	3.91	1.229	Agree
2	EHR facilitates coordinated care, reduces duplication of tests, and ensures continuity of care when a patient visits multiple providers.	570 114 47.5	260 65 27.1	42 14 5.8	34 17 7.1	30 30 12.5	936 240 100.0	3.90	1.393	Agree
3	Adopting green practices encourages innovation in materials, processes, and business models and leads to more efficient and resilient operations.	515 103 42.9	260 65 27.1	72 24 10.0	42 21 8.8	27 27 11.3	916 240 100.0	3.82	1.366	Agree
4	EHRs support collaborative care by allowing seamless sharing of medical histories between institutions which leads to faster referrals, reduced treatment delays, and improved patient satisfaction.	530 106 44.2	300 75 31.3	36 12 5.0	48 24 10.0	23 23 9.6	937 240 100.0	3.90	1.324	Agree
5	EHR helps Data Standardization which Facilitates accurate data exchange, supports analytics, and improves data integrity.	590 118 49.2	284 71 29.6	24 8 3.3	54 27 11.3	16 16 6.7	960 240 100.0	4.03	1.257	Agree
	Total Grand mean and standard deviation							**3.912**	**1.3138**	

Source: Field Survey, 2025

According to Table 1, 171 out of 240 respondents (71.2%) agreed that interoperable Electronic Health Records (EHRs) create a secure network for sharing patient information among hospitals, clinics, laboratories, and pharmacies, with a mean score of 3.91 and a standard deviation of 1.229. Additionally, 179 respondents (74.6%) agreed that EHRs enhance coordinated care, minimize test duplication, and ensure continuity of care when patients consult multiple healthcare providers, with a mean score of 3.90 and standard deviation of 1.393. Furthermore, 168 respondents (70.0%) agreed that the adoption of sustainable practices fosters innovation in materials, processes, and business models, resulting in more efficient and resilient healthcare operations, reflected by a mean score of 3.82 and a standard deviation of 1.366. A total of 181 respondents (75.5%) believed that EHRs facilitate collaborative care by enabling smooth exchange of medical records across institutions, leading to quicker referrals, fewer treatment delays, and enhanced patient satisfaction, with a mean of 3.90 and standard deviation of 1.324. Lastly, 189 respondents (78.8%) agreed that EHRs promote data standardization, which supports accurate data exchange, strengthens analytics, and ensures better data integrity, as indicated by a mean score of 4.03 and a standard deviation of 1.257.

The relationship between Patient-Centered Technologies and Clinical Outcomes of healthcare institutions in Abakiliki, Ebonyi State

Table 2: Responses on the relationship between Patient-Centered Technologies and linical Outcomes of healthcare institutions in Abakiliki, Ebonyi State

		5 SA	4 A	3 N	2 DA	1 SD	∑FX	- X	SD	Decision
1	Patient-centered technologies such as mobile health (mHealth) apps, patient portals, and wearable devices promote active patient participation in their care and leads to better medication adherence	505 101 42.1	316 79 32.9	12 4 1.7	70 35 14.6	21 21 8.8	924 240 100.0	3.85	1.339	Agree
2	Patient-centered tools often include features for educational resources and risk/benefit visualization, allowing patients to make informed decisions	545 109 45.4	448 112 46.7	15 5 2.1	10 5 2.1	9 9 3.8	1027 240 100.0	4.28	.906	Agree
3	By facilitating preventive care and early interventions, patient-centered technologies help reduce emergency room visits	630 126 52.5	416 104 43.3	12 4 1.7	10 5 2.1	1 1 .4	1069 240 100.0	4.45	.677	Agree
4	Digital tools enable real-time data collection and analytics which helps healthcare providers deliver personalized, proactive care by tracking patient progress remotely	565 113 47.1	432 108 45.0	12 4 1.7	8 4 1.7	11 11 4.6	1028 240 100.0	4.28	.943	Agree
5	Technologies like telehealth platforms and secure messaging systems foster better patient-provider communication, leading to improved trust and satisfaction	465 93 38.8	476 119 49.6	12 4 1.7	28 14 5.8	10 10 4.2	991 240 100.0	4.13	1.000	Agree
	Total Grand mean and standard deviation							**4.198**	**0.973**	

Source: Field Survey, 2025

Table 2 shows that 180 out of 240 respondents (75.0%) agreed that patient-centered technologies, including mobile health (mHealth) applications, patient portals, and wearable devices, encourage active patient involvement in their care and improve medication adherence, with a mean score of 3.85 and a standard deviation of 1.339. Additionally, 221 respondents (92.1%) agreed that patient-centered tools often provide educational resources and risk/benefit

visualization features, enabling patients to make informed choices, reflected by a mean score of 4.28 and standard deviation of 0.906. Moreover, 230 respondents (95.8%) agreed that patient-centered technologies support preventive care and early intervention, contributing to fewer emergency room visits, with a mean score of 4.45 and a standard deviation of 0.677. The same percentage (92.1%) of respondents also agreed that digital tools facilitate real-time data collection and analytics, helping healthcare providers offer personalized and proactive care by remotely monitoring patient progress, with a mean score of 4.28 and standard deviation of 0.943. Lastly, 212 respondents (88.4%) agreed that technologies such as telehealth platforms and secure messaging systems improve patient-provider communication, enhancing trust and satisfaction, as shown by a mean score of 4.13 and standard deviation of 1.000.

TEST OF STUDY HYPOTHESES

Hypothesis 1: Electronic Health Records (EHR) has relationship with output of healthcare institutions in Abakiliki, Ebonyi State.

One-Sample Kolmogorov-Smirnov Test

		Electronic Health Records (EHRs) systems that are interoperable create a network where patient data can be securely shared across hospitals, clinics, labs, and pharmacies.	EHR facilitates coordinated care, reduces duplication of tests, and ensures continuity of care when a patient visits multiple providers.	Adopting green practices encourages innovation in materials, processes, and business models and leads to more efficient and resilient operations.	EHRs support collaborative care by allowing seamless sharing of medical histories between institutions which Leads to faster referrals, reduced treatment delays, and improved patient satisfaction.	EHR helps Data Standardization which Facilitates accurate data exchange, supports analytics, and improves data integrity.
N		240	240	240	240	240
Uniform Parameters[a,b]	Minimum	1	1	1	1	1
	Maximum	5	5	5	5	5
Most Extreme Differences	Absolute	.463	.496	.450	.504	.538
	Positive	.054	.125	.113	.096	.067
	Negative	-.463	-.496	-.450	-.504	-.538
Kolmogorov-Smirnov Z		7.165	7.681	6.971	7.811	8.327
Asymp. Sig. (2-tailed)		.000	.000	.000	.000	.000

a. Test distribution is Uniform.

b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e$Z_{cal} > Z_{critical}$), reject the null hypothesis and accept the alternative hypothesis accordingly.

Result

With Kolmogorov-Smirnon Z – value of 7.165 < 8.327 and on Asymp. Significance of 0.000, the responses from the respondents as display in the table is normally distributed. This affirms the assertion of the most of the respondents that Electronic Health Records (EHR) had significant positive relationship with output of healthcare institutions in Abakiliki, Ebonyi State.

Decision

Furthermore, comparing the calculated Z- value of 7.165 < 8.327 against the critical Z- value of .000

(2-tailed test at 95percent level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states that Electronic Health Records (EHR) had significant positive relationship with output of healthcare institutions in Abakiliki, Ebonyi State.

Hypothesis 2: Patient-Centered Technologies has relationship with Clinical Outcomes of healthcare institutions in Abakiliki, Ebonyi State.

One-Sample Kolmogorov-Smirnov Test

		Patient-centered technologies such as mobile health (mHealth) apps, patient portals, and wearable devices promote active patient participation in their care and leads to better medication adherence	Patient-centered tools often include features for educational resources and risk/benefit visualization, allowing patients to make informed decisions	By facilitating preventive care and early interventions, patient-centered technologies help reduce emergency room visits	Digital tools enable real-time data collection and analytics which helps healthcare providers deliver personalized, proactive care by tracking patient progress remotely	Technologies like telehealth platforms and secure messaging systems foster better patient-provider communication, leading to improved trust and satisfaction
N		240	240	240	240	240
Uniform Parameters[a,b]	Minimum	1	1	1	1	1
	Maximum	5	5	5	5	5
Most Extreme Differences	Absolute	.500	.671	.708	.671	.633
	Positive	.088	.038	.004	.046	.042
	Negative	-.500	-.671	-.708	-.671	-.633
Kolmogorov-Smirnov Z		7.746	10.393	10.973	10.393	9.812
Asymp. Sig. (2-tailed)		.000	.000	.000	.000	.000

a. Test distribution is Uniform.
b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e$Z_{cal} > Z_{critical}$), reject the null hypothesis and accept the alternative hypothesis accordingly.

Result

With Kolmogorov-Smirnon Z – value of 7.745 < 10.393 and on Asymp. Significance of 0.000, the responses from the respondents as display in the table is normally distributed. This affirms the assertion of the most of the respondents that Patient-Centered Technologies had significant positive relationship with Clinical Outcomes of healthcare institutions in Abakiliki, Ebonyi State.

Decision

Furthermore, comparing the calculated Z- value of 7.745 < 10.393 against the critical Z- value of .000 (2-tailed test at 95percent level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states that Patient-Centered Technologies had significant positive relationship with Clinical Outcomes of healthcare institutions in Abakiliki, Ebonyi State.

DISCUSSION OF FINDINGS

The results of hypothesis one showed a significant positive relationship between Electronic Health Records (EHR) and the output of healthcare institutions in Abakiliki, Ebonyi State, supported by a Z-value of 7.165 and a critical value of 0.000. This aligns with findings from Elikwu et al. (2020), who noted that adopting electronic health information systems reduces treatment errors, shortens patient wait times, improves communication, protects patient data, and enhances service delivery. Similarly, Motsi and Chimbo (2024) found that EHRs positively influence information quality, reduce medical errors, improve diagnosis and treatment, and better coordinate patient care.

For hypothesis two, a significant positive relationship was found between Patient-Centered Technologies and clinical outcomes, with a Z-value of 7.745 and critical value of 0.000. Supporting literature from Yu et al. (2023) highlighted that patient-centered care improves patients' physical and mental health and the perceived necessity of hospitalization. Gavin (2023) identified key themes around facilitators, threats, outcomes, and elements of patient-centered care, broadening the understanding of its role in acute hospital settings

SUMMARY OF FINDINGS

- **i.** Electronic Health Records (EHR) had significant positive relationship with output of healthcare institutions in Abakiliki, Ebonyi State, Z (8.327, P. <. 05)
- **ii.** Patient-Centered Technologies had significant positive relationship with Clinical Outcomes of healthcare institutions in Abakiliki, Ebonyi State, Z (10.393, P. <. 05)

CONCLUSION

The study concluded that Electronic Health Records (EHR) and Patient-Centered Technologies (PCTs) have a significant positive impact on the output and clinical outcomes of healthcare institutions. Digital maturity models serve as structured frameworks to assess how well healthcare organizations adopt and integrate digital technologies, evaluating areas like IT infrastructure, digital strategy, data management, interoperability, and workforce skills. Institutions with higher digital maturity tend to be more efficient, achieve better patient outcomes, and respond more effectively to emergencies. Key digital tools such as EHRs, telemedicine, and data analytics contribute to streamlined operations, cost reduction, and improved decision-making.

RECOMMENDATIONS

The study recommends fully adopting integrated and interoperable EHR systems for real-time documentation and improved care coordination, and prioritizing patient-centered technologies like mobile health apps and telemedicine to enhance patient engagement and timely clinical interventions.

CONTRIBUTION TO KNOWLEDGE

The study also fills a research gap by focusing on the relationship between digital maturity models and healthcare performance in Abakiliki, Ebonyi State, an area previously underexplored regarding EHRs and patient-centered technologies. Unlike prior studies that used various statistical methods, this study applied the Z-test to test its hypotheses.

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