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The importance of health information technicians in the transformation of digital health

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***Abstract*---Background:** The "digital health" or "Healthcare 4.0 (H4.0)" movement has grown, especially after the COVID-19 pandemic. Digitalization promises better data processing and decision-making for efficiency, effectiveness, and patient care, yet research shows limitations. Many studies concentrate on individual digital technology or conceptual assessments, ignoring the larger influence of digital transformation on hospital administration and support workers. A few

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studies have examined the drivers and challenges to digital technology adoption in non-clinical professions like management and administration, which are essential for healthcare efficiency. This article aims to examine the impact of digital technologies on healthcare administration and highlight the essential role of health information. **Methods:** This literature review examined health information technicians in healthcare's digital revolution. Out of 150 papers found in PubMed, Scopus, and IEEE Xplore, 70 satisfied the inclusion criteria. Key data elements such study methodology, sample size, and noteworthy health information technician outcomes in digital health were extracted. Thematic analysis was used to discover themes and patterns in data management, patient information security, health information technicians in healthcare technology, and administrative efficiency. **Results:** Health information technicians are crucial to digital health's problems and prospects, according to the report. Electronic health records management, telemedicine system maintenance, health information exchange facilitation, and CDSS implementation are all health information technicians' tasks that improve data management, patient information security, and administrative efficiency. The results show that health information technicians streamline processes, reduce physician administrative load, and enable data-driven decision-making via data analytics and predictive modeling. The evaluation also found little empirical data on health information technicians' digital health transformation hurdles and facilitators. **Conclusion:** Digital health revolution requires health information technologists. Their competence in data management, information security, and administrative efficiency is essential for healthcare digital technology success. Future research should empirically investigate the factors that help or hinder health information technician integration in evolving digital healthcare environments to develop evidence-based strategies to improve patient care and organizational efficiency. Global digital health projects must address research gaps to maximize their effect.

***Keywords*---**Health information technicians, Digital transformation, Patient information security, Healthcare technology.

Background

Since the 1990s, when the term "e-health" was first used, digital technologies have played a significant role in healthcare organizations (1). Marques and Ferreira (2) posited that digital transformation in healthcare has increasingly gained significance over the last two decades. Ferrigno et al. (3) recognized digital transformation as a key future research field for Industry 4.0. The use of digital technologies to enhance current healthcare treatments and procedures or to create new ones is referred to as healthcare 4.0 (H4.0). The latter is marked by heightened interconnectedness and automation, facilitating a recontextualization of health care delivery within the cyber-physical realm. This impacts both patient treatment and administrative support systems (4). The COVID-19 pandemic

expedited the digital change of healthcare organizations, resulting in approximately 65% of these organizations augmenting the adoption of digital technologies to improve patient care (5-7).
Digitalization in healthcare is predicated on the premise that leveraging technological capabilities yields benefits for patients, healthcare professionals, and organizations, particularly in terms of improved efficiency and effectiveness (8, 9). Digital Technologies facilitate the interaction and specialization of medical care for patients and can fundamentally transform the decision-making processes of clinicians and managers by enhancing the automation of data processes (10-12). This is particularly pertinent in healthcare, where experts and administrators now possess access to a substantial volume and diversity of information from personnel records, digital patient records, clinical results, assessments, prescription medications, medical imaging techniques, and mobile health applications. The use of novel digital technologies may facilitate the collecting, processing, analysis, and administration of data to enhance comprehension and refine decision-making (13, 14).

Nonetheless, despite much research on this area, several gaps in scientific literature persist. Initially, researchers have generally embraced a limited viewpoint by investigating the use and acceptance of certain digital technologies (15, 16). Insufficient emphasis has been devoted to the overall extent of the digital shift and the factors influencing it within the healthcare sector (17). Secondly, the majority of studies examining digital transformation in healthcare have included a conceptual analysis and literature evaluation (1, 18). Empirical research on the effects of new digital technologies and their associated obstacles and facilitators is scarce. Third, the majority of research has concentrated on the implementation of digital technologies to meet certain clinical requirements and procedures (16).

Limited research exists on how the use of digital technologies may enhance administrative and management procedures, sometimes referred to as support processes or activities, which are vital in healthcare organizations (19).The implementation of managerial systems, methodologies, and tools was juxtaposed with the conventional framework for managerial organizations and necessitated the creation or enhancement of novel leadership and administrative positions, such as management control, risk administration, quality control, operations administration, human resource management, computer systems, and financial administration (20).

Healthcare services are public services, and a significant development is the growing permeability of borders and interdependence between the public as well as private sectors (21, 22). This is particularly applicable in nations where private providers are integrated into the healthcare system. The evolving landscape of corporatized public organizations has led to heightened demands on management and administration, particularly in contexts where governments have implemented quasi-market systems, allowing both public and private entities to be accredited for providing public healthcare services to patients (23, 24). In these situations, the growing intricacy of governmental mandates for healthcare service delivery and reimbursement necessitated private providers to cultivate management and administrative competencies.

The significance of administrative and management procedures in medical facilities is therefore well acknowledged. Nonetheless, there exists a global trend towards reducing "administrative intensity," which is defined as the resources allocated by a company to administrative support tasks instead of core services and manufacturing processes (25). Reduced administrative intensity may provide a long-term concern as it might hinder the support of primary activities via the advancement of new services and the enhancement of clinical procedures (26). In this regard, emerging digital technologies may support administrative and management activities (27).

Digitalization seeks to promote efficiency for patients, professionals, and organizations by optimizing data processing and decision-making (Fig. 1). Although much study has investigated the use of digital technology, deficiencies persist, particularly in understanding how digital tools improve administrative and managerial procedures. Research on the incorporation of digital technology into non-clinical roles, such as management and administration, which are essential for facilitating healthcare delivery, is limited. Furthermore, most research has been theoretical or conceptual in nature, with few empirical studies looking at the barriers to and enablers of the use of digital technology in healthcare (28).

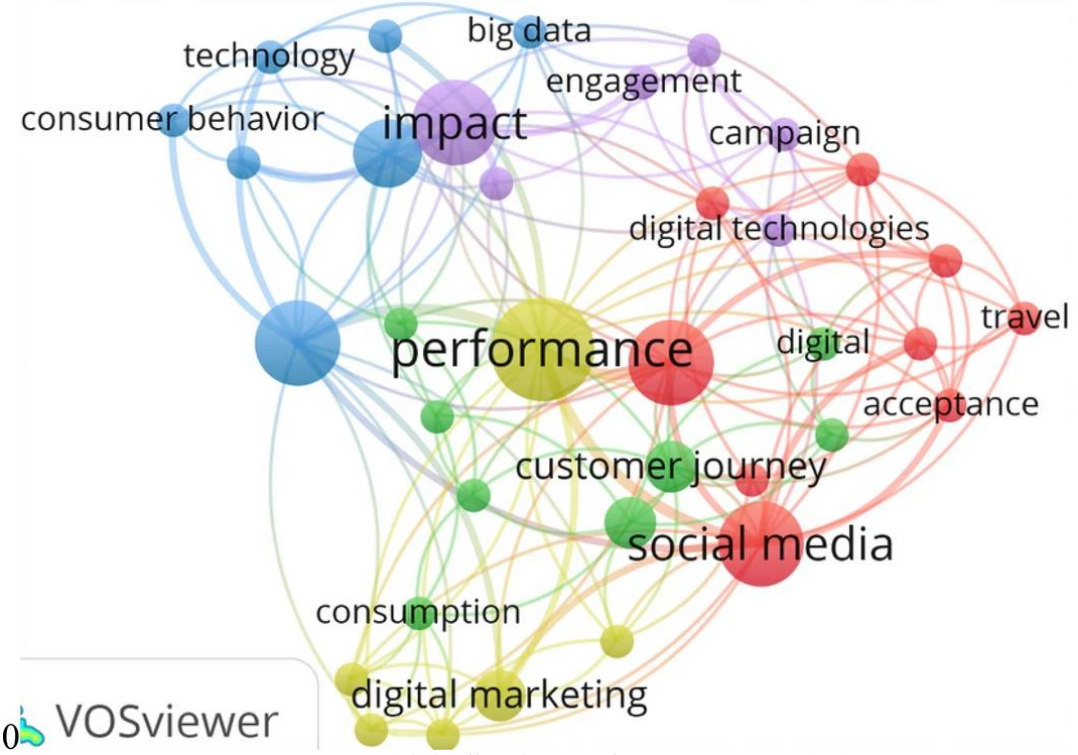

Fig 1. Digitalization and management (28).

This article aims to address these gaps by examining the impact of digital technologies on healthcare administration and highlighting the essential role of health information technicians in this transformation. Health information

technicians play a crucial role in data management and the protection of patient information, facilitating the digital health transformation by improving data governance and operational efficiency.

Methods

This literature analysis utilizes systematic methodology to assess the function of health information technicians in the digital revolution of healthcare.

Literature Selection

The review started with an extensive search across several databases, including PubMed, Scopus, and IEEE Xplore, to collect pertinent publications published from 2017 to the present. The search method included terms like "health information technicians," "digital health," "healthcare technology," and "patient information security." Boolean operators (AND, OR) were used to narrow the search and concentrate on certain issues pertaining to HITs and digital transformation.

The inclusion criteria for article selection were defined, emphasizing peer-reviewed publications, empirical research, and papers that specifically addressed the function of health information technologies in healthcare environments. Exclusion criteria were non-English publications, opinion articles, and works without a clear emphasis on the digital revolution of healthcare. Out of 150 found publications, 70 satisfied the inclusion criteria for further analysis.

Data Extraction

For each chosen paper, essential data points were retrieved, including the authors, publication year, research design, sample size, and significant results pertaining to the function of Health Information Technologies in digital health. The extraction procedure was directed by a standardized data extraction form to guarantee uniformity and reduce bias. Each publication was evaluated for its methodological rigor and pertinence to the study issue.

Thematic Analysis

Upon completion of data extraction, the subsequent phase included a thematic analysis to discern reoccurring themes and patterns within the literature. The research included qualitative coding approaches to group passages from the articles into categories like "data management," "patient information security," "role of health information technologies in healthcare technology," and "impact on administrative efficiency."

The theme analysis facilitated the integration of data from several research studies, offering a thorough comprehension of the role of health information technologies in the digital revolution of healthcare. This method also revealed deficiencies in the current literature, especially with empirical studies on the obstacles and enablers of Health Information Technologies in the adoption of digital innovations.

Digital Leadership

The phrase 'digital leadership' has been used for some years, arising from the growing impact of digital technology on several facets of companies and associations. The precise origin of the phrase remains elusive; nonetheless, it acquired significance in the beginning of the twenty-first century as digital technology became essential to corporate plans and managerial procedures (29). Digitalization and technical advancements are powerful influences that profoundly affect enterprises across all sectors (30). The ramifications of these developments extend beyond the mere adoption of novel instruments and systems; they need a thorough restructuring of several organizational facets. Digital leadership is essential for navigating enterprises through the problems and possibilities of the contemporary digital age. As technology evolves fast, firms must adapt and modify their strategies to maintain competitiveness and relevance (31).

Digital leaders utilize and optimize the digital assets to achieve business goals and facilitate the digital evolution, including learning management system, learning materials and digital assets, research knowledge databases, student data systems, websites and online platforms, and instructional technology tools (32). These assets are essential for facilitating learning, research, management, and collaboration within the educational community. Digital leaders exhibit unique competencies and viewpoints in contrast to conventional leaders, demonstrating their ability to navigate and use the possibilities afforded by the digital era (33).

Digital Technology

Digital technology is the use of technology that employs digital data or information expressed in binary format (0 and 1) (34). It encompasses a diverse array of tools, methods, and systems used for the processing, storage, transmission, and communication of information in a digital format. Digital technology has been extensively studied, influencing and permeating all facets of life (35-38). Digital Security encompasses a range of technologies and methodologies used to safeguard digital information and networks from security risks, including hacking, malware, and stolen identity (39). Digital technology has significantly transformed several facets of human existence, including interaction, learning, business, health, entertainment, and beyond. It is always evolving, creating new possibilities and introducing new obstacles in a dynamic digital landscape.

Digital Transformation

The phrase 'digital transformation' has markedly proliferated during the last twenty years (40). The notion became prominent as businesses in many industries acknowledged the significant influence of digital technology on their operations (41). Digital transformation refers to the tactical, corporate, and cultural modifications that firms do to properly use digital technology. Digital transformation denotes a comprehensive organizational change driven by the extensive use and integration of digital technology (42). This viewpoint enables us to clarify the phenomena of digital transformation and its administration in

company operations by using the comprehensive and diverse knowledge base about institutional innovation and transformation. Digital transformation involves a strategic reevaluation of an organization's goals, aims, and operational practices in response to the possibilities and difficulties posed by digital technology. It entails transitioning from conventional, isolated methods to more cohesive, collaborative techniques that use digital technology across the firm (43). Digital transformation fundamentally entails the extensive integration and use of digital technology within the firm (44).

Utilization of Digital Technology to Enhance Organizational Efficiency

Digital applications are technology-based tools that assist individuals in their tasks, enabling them to do work more efficiently and in a reduced timeframe. Numerous sorts of digital applications exist in the workplace, all designed to enhance employee performance. Performance acceleration refers to an employee's capacity to modify supporting circumstances to attain job outcomes punctually (45). The acceleration of performance pertains to an employee's optimal utilization of resources or variables during task execution. As the employee's output aligns more closely with the established company objectives, it indicates a high level of productivity and, consequently, a high degree of work effectiveness. Performance acceleration may serve as a work orientation if one can first produce products or services that emphasize quality and are delivered punctually, using all available resources, including financial assets and infrastructure (46). The standard for successful work is not just centered on rapid completion without regard for the quality of the output. Performance acceleration results from an employee's efforts aligned with company objectives (47).

Al Mashrafi (48) discovered a positive and substantial correlation between employee performance and the judicial system, as well as the significance of e-HRM. Hosain et al. (49) determined that the extent of HRIS use does not affect personal performance; nevertheless, organizational efficiency adversely impacts personal performance, whereas HRIS-oriented personal performance favorably affects personal performance. Ummi and Aldri (50) discovered that the deployment of SIMPEL enhanced work effectiveness and time efficiency, however challenges in using the program persisted.

The implementation of digital applications inside an organization is contingent upon workers' comprehension of the application and their preparedness to use and enhance it to achieve optimal outcomes. Saputra (51) attained achievement by the systematic organization of labor activities. This aligns with (50). Enhancing organizational health inside the institution is essential, since a strong organizational foundation fosters diverse success (52, 53). A successful organizational framework promotes an atmosphere suitable to leadership, collaboration, and resource optimization (54). This environment facilitates efficient information exchange, cooperation, and issue resolution, which are essential components for improving organizational well-being (55).

The Role of Health Information Technicians in Healthcare Technology

Health information technologists are integral to the healthcare sector, responsible for the development, management, and optimization of health information technology. Their efforts concentrate on optimizing healthcare delivery, augmenting patient care, and refining administrative procedures (56). Health information technologists lead in the implementation and maintenance of electronic health records, telemedicine systems, health information exchanges, and clinical decision support systems (CDSS) (57).

Electronic health records are computerized representations of individuals' medical histories and are vital in contemporary healthcare. health information technologies provide the appropriate integration and maintenance of electronic health record systems, facilitating healthcare practitioners' access to precise and current patient information. Electronic health records enhance communication and collaboration among healthcare workers, resulting in improved patient outcomes (58). Health information technologists are crucial in educating healthcare personnel to use electronic health record systems proficiently, facilitating a seamless and efficient shift from paper-based records to digital systems (59).

Telemedicine has been more vital, particularly during the COVID-19 epidemic, by enabling healthcare practitioners to provide distant treatment. Health information technologists are tasked for establishing and sustaining telemedicine systems, guaranteeing their security and user-friendliness. Telemedicine enhances access to healthcare services for patients in rural regions while alleviating the strain on healthcare institutions (60). By enabling virtual consultations, health information technologists enhance resource utilization and elevate patient happiness.

Health information exchanges facilitate the safe transmission of patient data across various healthcare entities. Health information technologists are essential for the development and management of health information exchanges systems, guaranteeing the precise and secure transmission of data. Health information exchanges enhance care coordination and decrease the probability of unnecessary testing and treatments, resulting in cost savings and improved patient care (61). Health information technologists also focus on developing standards and procedures for data interchange, so assuring interoperability across various healthcare systems.

Clinical Decision Support Systems (CDSS) are sophisticated instruments that aid healthcare professionals in making evidence-based clinical determinations. Health information technologists create and install CDSS that evaluate patient data and provide suggestions based on clinical standards and best practices. These solutions mitigate medical mistakes, augment patient safety, and elevate the overall quality of treatment (60). Health information technologists guarantee that CDSS is perpetually updated with the most current medical information and is easily incorporated into clinical processes.

The influence of health information technologists on administrative efficiency is significant. Health information technologists alleviate the administrative load on

healthcare personnel by automating regular activities and optimizing procedures. Electronic health records streamline paperwork, coding, and billing processes, enabling practitioners to concentrate more on patient care (58). Automated appointment scheduling and reminders reduce no-show rates and enhance the overall efficiency of healthcare institutions.

Health information technologists improve the precision and effectiveness of healthcare management with comprehensive data analytics capabilities. These instruments enable healthcare companies to monitor key performance metrics, discern patterns, and execute data-driven choices. Predictive analytics can anticipate patient admissions, facilitating improved resource allocation and personnel (61). Population health management tools evaluate data from several sources to identify at-risk groups and formulate targeted treatments. Table 1 represents the summary of the topic discussed.

Table 1. Summary of the topic discussed in the review

Topic	Summary
Digital Technology	• Entails the use of technology that employs digital data in binary form. • Includes instruments, techniques, and frameworks for the processing, storage, transmission, and communication of information. • Affects several aspects of life (interaction, education, commerce, health, entertainment). • Presents novel opportunities and obstacles within an evolving digital environment.
Digital Security	• Encompasses technology and procedures designed to safeguard digital information and networks from threats such as hacking, malware, and identity theft.
Digital Transformation	• Refers to the thorough transformation of an organization facilitated by the widespread implementation of digital technology. • It necessitates a strategic reassessment of objectives and operational methodologies. • Involves using digital technology across the company to shift to unified, cooperative methods.
Utilization of Digital Technology	• Digital applications improve workplace efficiency and employee performance. • Performance acceleration involves the efficient utilization of resources in accordance with organizational objectives, resulting in increased productivity. • Implementation challenges persist; effective utilization depends on employee comprehension and readiness. • Robust organizational health enhances leadership, fosters collaboration, and optimizes resource

Topic	Summary
	utilization.
Role of Health Information Technicians	• Essential to healthcare, emphasizing the management and optimization of health information technology. • Accountable for the management of electronic health records (EHR), telemedicine systems, health information exchanges (HIE), and clinical decision support systems (CDSS). • Enable effective shifts from paper documentation to digital platforms.
Electronic Health Records (EHR)	• Computerized medical histories are essential for healthcare. • Improve communication among healthcare professionals, resulting in enhanced patient outcomes. • Technicians provide training to staff on the effective utilization of electronic health records (EHR).
Telemedicine	• Facilitates remote healthcare, especially crucial during the COVID-19 pandemic. • Technicians maintain the security and functionality of telemedicine systems, enhancing patient access and resource efficiency.
Health Information Exchanges (HIE)	• Ensure secure transmission of patient data among healthcare entities. • Improve care coordination, minimize redundant testing, and enhance patient outcomes. • Technicians establish standards for data interchange to guarantee interoperability.
Clinical Decision Support Systems (CDSS)	• Support healthcare professionals in formulating decisions grounded in evidence. • Technicians develop and sustain Clinical Decision Support Systems (CDSS) that reduce medical errors and improve patient safety. • Update systems with the most recent medical information.
Administrative Efficiency	• Health information technologists streamline routine tasks, thereby minimizing administrative burdens. • Electronic Health Records enhance efficiency in documentation, coding, and billing, thereby facilitating greater emphasis on patient care. • Data analytics tools facilitate the monitoring of performance metrics, the anticipation of patient admissions, and the identification of at-risk populations for targeted interventions.

Conclusion

This literature review emphasizes health information technicians' vital and complex role in healthcare's digital transition. Our results show that health information technologists are active actors in this development, promoting efficiency, patient care, and healthcare organization effectiveness. This analysis concludes that health information technicians are crucial for digital health data management and patient data protection. Patient privacy and healthcare data integrity depend on their skill in managing electronic health records, enabling health information exchanges, and assuring data security. The growing use of digital technologies requires a competent workforce that can navigate complicated data governance challenges and mitigate dangers. Data security breaches may have serious legal and ethical repercussions for patient safety and trust in digital healthcare.

Second, health information technicians boost administrative efficiency. Health information technologists allow doctors to concentrate on patient care by automating mundane operations, optimizing processes, and using data-driven decision-making tools. Efficiency reduces expenses, improves resource allocation, and boosts organizational performance. The economic and operational advantages are significant, especially given rising healthcare costs and accountability expectations. Thirdly, integrating health information technicians with digital health technologies like telemedicine and CDSS improves healthcare quality and accessibility. They optimize these technologies' functioning and patient results by seamlessly integrating them into healthcare operations. This is important for reducing health inequalities and increasing treatment to marginalized groups.

Finally, this analysis reveals a crucial gap in the literature: the dearth of empirical research on the particular obstacles and facilitators to health information technology inclusion into digital health efforts. More research is needed to establish evidence-based ways to maximize health information technicians' contributions. Understanding health information technicians' concerns and adopting supporting policies and training programs can ensure the effective and fair deployment of digital health technology. Health information technician training is a strategic investment in efficient, effective, and patient-centered healthcare. These findings highlight the urgent need for a better understanding of health information technicians' role and focused interventions to maximize their potential in healthcare's digital revolution.

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أهمية فنيي معلومات الصحة في تحول الصحة الرقمية

الملخص

خلفية :شهدت حركة "الصحة الرقمية" أو "الرعاية الصحية 4.0 "(H4.0) نمواً ملحوظاً، لا سيما بعد جائحة كوفيد-19. يعد التحول الرقمي بتحسين معالجة البيانات واتخاذ القرارات لتحقيق الكفاءة والفعالية ورعاية المرضى، ومع ذلك تُظهر الدراسات وجود بعض القيود. تركز العديد من الدراسات على تقنية رقمية واحدة أو تقييمات مفاهيمية، متجاهلة التأثير الأكبر للتحول الرقمي على إدارة المستشفيات والعاملين في الدعم. درست بعض الدراسات المحركات والتحديات التي تواجه تبني التكنولوجيا الرقمية في المهن غير السريرية مثل الإدارة والإشراف، والتي تعتبر ضرورية لكفاءة الرعاية الصحية. يهدف هذا المقال إلى دراسة تأثير التقنيات الرقمية على إدارة الرعاية الصحية وتوضيح الدور الأساسي لمعلومات الصحة.

المنهجية :استعرضت هذه الدراسة الأدبيات المتعلقة بفنيي معلومات الصحة في الثورة الرقمية في الرعاية الصحية. من بين 150 ورقة بحثية تم العثور عليها في قواعد بيانات PubMed و Scopus وIEEE Xplore، استوفيت 70 منها معايير الإدراج. تم استخراج العناصر الرئيسية مثل منهجية الدراسة، وحجم العينة، والنتائج البارزة لفنيي معلومات الصحة في الصحة الرقمية. استخدم التحليل الموضوعي لاكتشاف الأنماط والموضوعات في إدارة البيانات، وأمن معلومات المرضى، ودور فنيي معلومات الصحة في تكنولوجيا الرعاية الصحية، وكفاءة الإدارة.

النتائج :أظهر التقرير أن فنيي معلومات الصحة يلعبون دوراً حيوياً في مواجهة تحديات وفرص الصحة الرقمية. تشمل مهام فنيي معلومات الصحة إدارة السجلات الصحية الإلكترونية، وصيانة أنظمة الطب عن بُعد، وتسهيل تبادل معلومات الصحة، وتنفيذ نظم دعم اتخاذ القرار السريري، مما يسهم في تحسين إدارة البيانات، وأمن معلومات المرضى، وكفاءة الإدارة. أظهرت النتائج أن فنيي معلومات الصحة يساهمون في تبسيط العمليات، وتقليل العبء الإداري على الأطباء، وتمكين اتخاذ القرارات المستندة إلى البيانات من خلال التحليلات والنماذج التنبؤية. كما أظهر التقييم قلة البيانات التجريبية حول العوائق والمحفزات لتحول فنيي معلومات الصحة في الصحة الرقمية.

الخاتمة :يتطلب تحول الصحة الرقمية وجود فنيي معلومات الصحة. إن كفاءتهم في إدارة البيانات وأمن المعلومات وكفاءة الإدارة ضرورية لنجاح التكنولوجيا الرقمية في الرعاية الصحية. ينبغي أن تركز الدراسات المستقبلية على استكشاف العوامل التي تساعد أو تعيق دمج فنيي معلومات الصحة في البيئات الرقمية المتطورة للرعاية الصحية، لتطوير استراتيجيات قائمة على الأدلة لتحسين رعاية المرضى وكفاءة المؤسسات. يجب أن تتناول المشاريع العالمية في مجال الصحة الرقمية فجوات البحث لتعظيم تأثيرها.

الكلمات المفتاحية :فنيي معلومات الصحة، التحول الرقمي، أمن معلومات المرضى، تكنولوجيا الرعاية الصحية.