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The Implementation Challenges and Success Factors of Health Information Systems in Low-Resource Settings: A Comprehensive Review

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Abstract

Background: Health Information Systems (HIS) play a crucial role in enhancing healthcare delivery, particularly in low-resource settings. However, their implementation often faces significant challenges that hinder effective utilization and management. Understanding these challenges is essential for improving health outcomes.

Methods: This review synthesizes findings from a comprehensive analysis of literature published between 2010 and 2023, focusing on the barriers and facilitators of HIS implementation in developing countries. Databases such as PubMed, Web of Science, Science Direct, and Scopus were utilized, employing keywords including "health information system," "challenges," "success," "failure," and "developing countries."

Results: The review identified several critical challenges affecting HIS implementation, including inadequate infrastructure, limited financial resources, lack of skilled personnel, and cultural barriers. Specifically, issues such as data quality, user resistance, and insufficient training were prevalent. Conversely, factors contributing to successful implementation included strong leadership, stakeholder engagement, and tailored training programs. Recommendations suggest that improvements in policy frameworks, investment in infrastructure, and enhanced education for healthcare professionals are vital for overcoming these barriers.

Conclusion: The successful implementation of Health Information Systems in low-resource settings is contingent upon addressing multifaceted challenges that encompass technological, organizational, and

human factors. By understanding these barriers and implementing targeted solutions, healthcare systems can leverage HIS to improve service delivery and patient outcomes.

Keywords: Health Information Systems, developing countries, implementation challenges, healthcare delivery, data quality.

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1. Introduction

In recent years, the World Health Organization (WHO) has designated the health information system (HIS) as a fundamental element in realizing the objective of "health for all." The WHO report from 2010 identified enhancements in management as being linked to advancements in the information system (1,2). Furthermore, from a technical perspective, a system can be defined as a collection of components involved in the acquisition, maintenance, and processing of data and disseminated information to facilitate decision-making and organizational monitoring. Additionally, supporting decision-making, coordination, and oversight can aid managers and employees in analyzing challenges, elucidating complex issues, and developing innovative products (3).

In the healthcare system, Health Information Systems (HISs) are defined as the aggregated components and organized processes for generating information that enhances decision-making across all levels of health system management (4,5). The primary objective of HIS is not merely to acquire information, but also to enhance health system performance. Consequently, over the past decade, there has been significant activity and innovation in the development of HISs, driven by advancements in technology. Numerous organizations in both private and public sectors, in both developing and developed nations, have adopted Health Information Management systems to address the growing demand for improved efficiency and effectiveness in health services (6).

In developing countries, the majority of health service providers utilize information systems that incorporate registration forms containing patients' names, addresses, and disease-related information, which are filled out weekly or monthly and submitted without sufficient feedback (7). Furthermore, the data collected is frequently inadequate for decision-making regarding management issues due to its incompleteness, inaccuracy, irrelevance, and lack of alignment with the priorities of health staff functions and task lists. Consequently, information systems in these nations are predominantly data-centric rather than performance-oriented. As a result, the implementation of Health Information Systems (HISs) in these regions is perceived as an impediment to management rather than a beneficial tool (8).

An evaluation of the Health Information Systems (HISs) in each nation should not be confined just to data typically gathered and reported by service providers. Conversely, the efficacy of the HIS must be evaluated in relation to the quality dimensions of the generated data, which should also be used to enhance the performance and condition of the health system. To attain this objective, all elements of the HIS, including the determinants of success and failure, as well as the obstacles associated with these systems, programs, and strategies, must be acknowledged (9-13). The initial step in the advancement of any national project involves examining the experiences of other nations globally, particularly those with economic, political, cultural, and regional alliances, and subsequently utilizing their resources and documentation to cultivate a more comprehensive perspective and enhance profitability in the formulation of the development strategy. The objective of this research is to investigate the experiences of developing nations about the factors contributing to the success and failure of Health Information Systems (HISs), as well as the problems encountered in their use.

2. Methods

To examine the issues and obstacles faced by developing nations regarding the utilization of Health Information Systems (HISs), as well as the factors contributing to their success and failure, relevant studies published in the PubMed, Web of Science, Science Direct, and Scopus databases were analyzed. The primary

keywords employed for content extraction in these databases included: "health information system," "challenges," "success," "failure," "developing country," and "low- and middle-income country."

3. Challenges and Determinants of Success and Failure of Health Information Systems in Developing Nations

Multiple studies have identified many problems and factors contributing to the success and failure of Health Information Systems in developing nations (15-38). Sidek and Martinez (24) highlighted the lack of trust among clinical workers in the new system as the primary hurdle to the effective adoption of electronic health records at a dentistry facility. The adherence to change management principles and the dedication of the center's top managers to implement changes are important to the success of this system. Additionally, research by Mayston et al. (34) categorized the difficulties and possibilities for the effective deployment of an information system for chronic mental health care into three categories: behavioral, organizational, and technological variables. Furthermore, inadequate data quality in decision-making was a primary factor contributing to the system's failure. They have also identified the high adaptability of the acquired data to stakeholder demands as a significant factor in the success of the HIS. Ebne Hosseini et al. (31) identified three critical variables for the performance of the hospital information system: usefulness, system quality, and net profit. In a comprehensive study on the success aspects of Health Information Systems (HISs), deRiel et al. (27) established five types of success variables: functional, organizational, political, technological, and educational. Furthermore, they underscored that the critical aspects for the sustained success in constructing intricate Health Information Systems (HISs) include optimizing investment in hardware and software, enhancing user infrastructure, and ensuring data quality control.

ChePa et al. (28) identified 36 difficulties in executing hospital information systems projects, categorized into four fundamental areas: human factors, technology and infrastructure, software limitations, and support. Additionally, 14 hurdles were identified as pertaining to human issues, including workload, preparedness, priority, skill, mindset, desire, attitude, emotion, initiative, perception, commitment, awareness, personal interest, and user reliance. Additionally, there were six obstacles pertaining to service and technology, along with twelve challenges related to software limitation issues. Alipour et al. (25) highlighted functional, ethical, and cultural elements as determinants of success, whereas behavioral, organizational, and educational aspects were acknowledged as system shortcomings. Afrizal et al. (32) identified human factors, infrastructure, organizational support, and processes as significant determinants in the adoption of the primary health care information system. Additionally, research by Kpobi et al. (29) identified increased staff effort and data recording rework as factors contributing to the failure of the mental health information system, while insufficient infrastructure was recognized as an obstacle to implementation.

Mohamadali and Aziz (26) identified the absence of system integration as the primary barrier to the introduction of hospital information systems in healthcare facilities in their review paper. In this context, the quality of information and system quality were identified as additional elements influencing the system's success. In a separate research, Abbas and Singh (33) identified the absence of financial assistance as the primary barrier to the effective adoption of information technology in healthcare, according to the viewpoints of both consumers and vendors. The deficiency in general understanding about information technology is a significant hurdle to the adoption of PACS systems, compounded by inadequate management and changes in management that hinder the project's implementation and training processes.

Furthermore, research conducted on the Health Management Information System identified by Asangansi (13) highlighted obstacles such as inadequate access to quality data, unclear data and system ownership issues, as well as instability and a lack of confidence in servers that impede the implementation of this system. His research indicated the insufficient time available to provide services to patients after the implementation of the hospital information system, but high safety and information security were identified as critical aspects for the system's performance. Khalifa (17 years old). In his research, he sought to mitigate the barriers to Health Information Systems (HISs) and classified them into six categories: human, financial, legal, organizational, technological, and professional. This research identified several

hurdles, including the substantial expenses associated with establishing and maintaining the system, prevalent misunderstandings about its usage, and the apprehension of information loss.

In comprehensive research examining the variables affecting the progression and decline of hospital information systems, Sadoughi et al. (18) discovered many aspects in both emerging and developed nations. Consequently, these aspects were categorized into 12 domains: functional, organizational, behavioral, cultural, managerial, technological, strategic, economic, educational, legal, ethical, and political factors. Aziz et al. (19) investigated the influence of human variables, namely the users of the hospital information system, on the success or failure of these systems. The findings indicate that doctors are the primary influencers in the adoption of hospital information systems inside healthcare facilities. Verbeke et al. (23) identified 14 failure variables and 15 success factors for hospital information systems in sub-Saharan Africa in their research. The identified failure causes were ambiguous objectives, ineffective management, insufficient skills, and inadequate training. Additionally, key success aspects were honest communication, timely execution, and the management of incremental modifications.

The results revealed that the obstacles faced by developing countries in using Health Information Systems (HISs) are shaped by the social, cultural, economic, geographical, and political contexts of these nations. The high population density, coupled with low literacy rates and unequal access to information technology services, as well as limited information technology proficiency in numerous developing nations, significantly impacts the utilization of information technology and information systems within their healthcare systems. Challenges specific to developing countries include socioeconomic constraints; issues related to technical and operational infrastructure; insufficient business and inadequate business space; limited private sector involvement in health information; non-standardized equipment and facilities; absence of a coherent vision; and poor integrity among health information systems at both health facility and management levels. Moreover, the heightened effort resulting from the transition of Health Information Systems from manual to electronic formats has contributed to user resistance to these systems (39, 40).

Based on the experiences of industrialized nations, it seems that a fundamental reason of the failure of Health Information Systems (HISs) is the presence of cultural elements and the deficiency of cultural competencies necessary for the acceptance and use of these systems. The researcher highlights the deficiency of information and communication technology (ICT) infrastructures in these nations as a significant cause. Information and Communication Technology (ICT) is pivotal in the development of information systems inside enterprises. Conversely, a significant problem of using these systems in these nations is the organizational complexity within the health sector, which poses a substantial obstacle to both governmental and commercial sectors in executing growth strategies. It is necessary to address these issues by implementing adaptable standards for the design and implementation of Health Information Systems (HISs) (41).

The study results indicate that inadequate data quality and integrity significantly influence the advancement or decline of Health Information Systems (HIS) in developing nations. Numerous factors contribute to the inadequate quality of data across various sources. In several developing nations, there is a scarcity of technical and professional skills required for effective communication of information among professionals. A further cause is the lack of motivation among healthcare professionals. The absence of feedback mechanisms is an additional factor contributing to the substandard quality of data (42-43). A primary cause for the failure of information systems in developing nations was the irrelevance of the acquired data to professional activity. The majority of data documented and conveyed by health sector personnel in these nations lacks practical use for assisting managers in decision-making and overseeing delivery procedures. Conversely, valuable data obtained often bolster objectives pertaining to disease control and seldom reinforce administrative objectives. A contributing factor to the deficiencies in these nations is the inadequate agreement about information requirements between clinicians and consumers across various levels of healthcare (44).

Diverse solutions exist to address obstacles and challenges in achieving Health Information Systems (HISs) in developing countries. These include the development of strategic plans and policies for information

systems in both national and private sectors, the establishment of laws for the reporting of communicable diseases across governmental and private entities, the formulation of confidentiality and data retrieval policies, the enhancement of knowledge management capabilities, and the utilization of health information by users and service providers. Additionally, creating networks for knowledge sharing, establishing coordination and integration among information gathering systems, strengthening disease surveillance and reporting mechanisms, ensuring periodic reporting of information needs, safeguarding health information system components, and advancing the use of information and communication technologies are essential measures for improving the transmission, access, and sharing of health information. (14, 26, 29-30, 33-34, 45) A significant number of suggested solutions to eliminate obstacles to the development of Health Information Systems (HISs) in developing nations have concentrated on enhancing policy in this domain. A significant restriction faced by the researchers in this study was the dispersion of success and failure factors of Health Information Systems (HISs) among several investigations, resulting in instances where just a single problem or element was identified. Researchers aimed to pick papers that identified a variety of characteristics by broadening the keyword scope to enhance the thoroughness of the search process.

4. Conclusion

Numerous sources have identified multiple causes contributing to the failure of information systems, including insufficient skilled and experienced people and financial resources, cultural influences, and inadequate infrastructure. Flexible guidelines must be established for the design and implementation of HISs to tackle these challenges. Ultimately, numerous solutions exist to tackle the challenges confronting health information systems in developing nations, such as devising strategic plans and policies essential for the advancement of national HISs, enacting legislation on disease reporting and data collection from both public and private sectors, establishing information privacy and disclosure policies, and formulating maintenance and retention policies. Improving the capability of knowledge management and the usage of health information by consumers and suppliers of health care. Establishing a network for knowledge exchange, fostering coherence and integration among information collection systems, enhancing disease surveillance and reporting mechanisms, performing regular assessments of information requirements, and providing support for health information system components, augmenting the utilization of information and communication within the health sector, employing suitable ICT technologies, and reinforcing the application of information technology in the dissemination and sharing of health information systems.

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تحديات تنفيذ نظم المعلومات الصحية وعوامل النجاح في البيئات منخفضة الموارد: مراجعة شاملة

الملخص

الخلفية :تلعب نظم المعلومات الصحية (HIS) دورًا حيويًا في تعزيز تقديم الرعاية الصحية، خاصةً في البيئات منخفضة الموارد. ومع ذلك، تواجه عملية تنفيذها تحديات كبيرة تعيق الاستخدام والإدارة الفعالة. يُعد فهم هذه التحديات ضروريًا لتحسين النتائج الصحية.

الطرق :تُجَمّع هذه المراجعة نتائج تحليل شامل للأدبيات المنشورة بين عامي 2010 و2023، مع التركيز على الحواجز والعوامل المساعدة في تنفيذ نظم المعلومات الصحية في الدول النامية. تم استخدام قواعد بيانات مثلPubMed ، وWeb of Science، وScience Direct، وScopus، مع الاعتماد على كلمات مفتاحية تشمل "نظام المعلومات الصحية"، "التحديات"، "النجاح"، "الفشل"، و"الدول النامية."

النتائج :حددت المراجعة عدة تحديات أساسية تؤثر على تنفيذ نظم المعلومات الصحية، بما في ذلك البنية التحتية غير الكافية، والموارد المالية المحدودة، ونقص الكوادر المؤهلة، والحواجز الثقافية. على وجه التحديد، كانت القضايا مثل جودة البيانات، ومقاومة المستخدمين، والتدريب غير الكافي منتشرة. بالمقابل، تضمنت عوامل النجاح قيادة قوية، ومشاركة أصحاب المصلحة، وبرامج تدريب مخصصة. تشير التوصيات إلى أن تحسين الأطر السياسية، والاستثمار في البنية التحتية، وتعزيز تعليم المتخصصين في الرعاية الصحية أمر ضروري لتجاوز هذه الحواجز.

الخلاصة :يعتمد النجاح في تنفيذ نظم المعلومات الصحية في البيئات منخفضة الموارد على معالجة التحديات متعددة الأوجه التي تشمل العوامل التكنولوجية والتنظيمية والبشرية. ومن خلال فهم هذه الحواجز وتنفيذ حلول مستهدفة، يمكن لأنظمة الرعاية الصحية الاستفادة من نظم المعلومات الصحية لتحسين تقديم الخدمات والنتائج الصحية للمرضى.

الكلمات المفتاحية :نظم المعلومات الصحية، الدول النامية، تحديات التنفيذ، تقديم الرعاية الصحية، جودة البيانات.