



Exploring the Landscape of Health Information Systems in the Philippines: A Methodical Analysis of Features and Challenges

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Abstract: A thorough analysis was conducted to evaluate Health Information Systems (HIS) in the Philippines utilizing the PRISMA approach. An initial pool of 313 potential articles, with 285 articles being excluded based on the exclusion criteria, resulting in a focused analysis of 28 articles. This analysis classifies the many HIS features while highlighting each one's distinct value inside the Philippine healthcare system. These features encompass scheduling and communications, record-keeping and prescription, knowledge and information management, and marketplace and payment systems. Common features to most HIS are the profiling of patient, notification system, membership verification, laboratory result generation, and electronic appointment and scheduling. Parallel to this, the study examined the many difficulties encountered in the adoption and application of HIS in the Philippines, tackling issues like a lack of human resources, infrastructure-related challenges, and the impact of regional strategies and policies. Additionally, financial issues were also found to be a major challenge hampering the successful development and maintenance of HIS within the hospital system. This methodical investigation, Philippine-specific, provides insights into the dynamic environment of HIS, providing a basis for wise choice-making and strategic planning adapted to the distinct healthcare context of the Philippines.

Keywords: HIS in the Philippines, Health Information Systems, EMRs in the Philippines, Challenges of HIS, Features of HIS

1. INTRODUCTION

"It bears stressing that the investment on building access to health services is a crucial requirement for the realization and success of the Universal Health Care for all Filipinos. Hence, investing in E-health is imperative to ensure equitable access to health care services, most especially those in geographically isolated and disadvantaged areas and particularly for the poor, disadvantaged, and vulnerable," Angelina Tan, Chairperson on the House Committee on Health. The Health Information Systems is a system that integrates the data gathering, processing, reporting, and use of information for improving the efficiency and effectiveness of health care through enhanced management at all levels of health services. It encompasses all sources of health data, including those related to health facilities and communities, electronic health records for patient care, population-based data, information about human resources, finances, supply chains, and surveillance, as well as how that information is used and disseminated. [1]. Electronic health records (EHR), electronic medical records (EMR), health information exchange (HIE), computerized physicians order entry (CPOE), hospital information systems, and telemedicine/telehealth/e-health have all developed acronyms over time to describe electronic HISs [2] [3] [4] [5] [6]. E-Health reinforces the delivery of service in the health sector

with the use of information and communication technologies (ICT). This is an emergent field between the medical informatics, public health, and business, referring to health services and information provided or developed through the Internet and related technologies [7]. E-information is today's game-changing market tool in all industry sectors [8]. A hospital or clinic's prompt and accurate dissemination of information to their patients is very vital. There are varying challenges seen by decision maker in order to deliver timely and accurate medical assistance. Few of these challenges are the delayed access to reliable, accurate and complete health information records due to disparate systems that use differing formats, lack of information harmonization and compromised data quality. Thus, e-health are often developed to reach geographically extended areas where healthcare providers can hardly go, and there is an access delay in accurate and timely information relevant to decision-makers. The application of ICT in the medical field has paved the way for opportunities to automate, digitize, simplify, and hasten the acquisition of medical records. Timely and accurate medical data is significant for effective diagnosis. HIS are significant tools for clinical interaction, patient learning, and remote tracking and monitoring of patients. In order to streamline procedures and enhance data collecting, processing, and analysis, many

nations realized the significance of implementing ICT in the health sector. This leads to the adoption and implementation of ICT as concrete foundation for health modernizations and investments. The Department of Health (DOH) in the Philippines, has vigorously developed plans to elevate the implementation and development of eHealth applications. The DOH has acknowledged the significant contribution of ICT in providing solutions to the current discrepancy of health services, delivery, and timely access to information but also supports the realization of Universal Health Care (UHC) goals in health financing and the health response system [9]. Consequently, the house of representatives has approved the appropriation on House Bills 61, 171, 665, and 4899, otherwise referred to as the proposed “National E-health System Act”, recognizing the need of the country to leverage the process in the healthcare sector [10]. “All for Health towards Health for All.” This has been the campaign of the Philippine Health Agenda for Healthy Philippines by 2022. One of the strategies seen in achieving the goal is to invest in Information Communications Technology (ICT). There is still insufficient data quality collected at health institutions and insufficient analytical and utilization capabilities to allow the kind of decision-making that can advance the attainment of universal health coverage. However, the increase in registered users does not fully reflect the system’s uptake. To learn how the system is used by the health facilities, it is necessary to delve deeper into utilization [11]. The method of implementing electronic health information systems has been regarded as difficult and complex. The purpose of HIS is to help the planning, development, and decision-making of the various parties involved in associated processes. And to create and arrange knowledge and information needed and generated in the healthcare industry [12] [13]. The comprehensive capabilities identified in this study will demonstrate the prospective strengths and functionalities of a modern healthcare management system. Specifically, this work uses a systematic review to address the following research objectives in three areas:

- How have publications on HIS developed over time in the Philippines?
- What are the features of HIS or EMRs applications developed in the Philippines setting?
- What kind of challenges and risks are considered in the implementation of HIS or EMRs in the Philippines?

2. METHODOLOGY

The objective of the study is to distinguish different kinds of eHealth applications, based on an inclusion and exclusion criteria. These criteria will determine what study samples can be included or excluded. The inclusion criteria consistently identify study population in an objective manner, while exclusion criteria comprise factors that makes the study population ineligible [14].The data is coded from

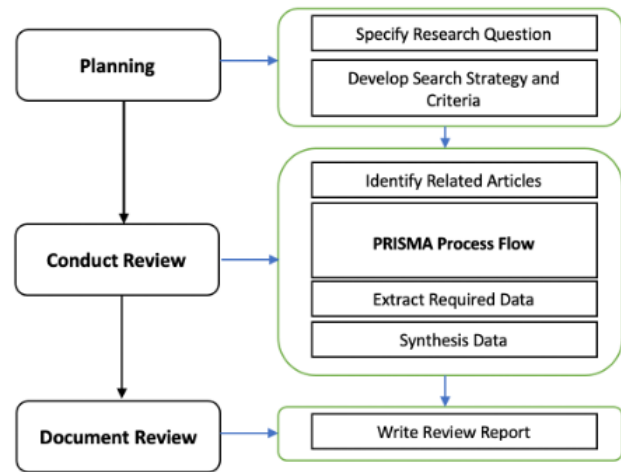


Figure 1. Process Diagram of the Systematic Review Conducted

contained studies, to synthesize result. Fig. 1 illustrates the process taken to conduct review.

To gather related articles about eHealth in the Philippines, inclusion and exclusion criteria were developed by the proponents. Table I shows the list of the inclusion and exclusion criteria used in considering what articles are to be included in the study.

TABLE I. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Published 2015 – December 2022	Published before 2015
English or Filipino	Other Languages than English and Filipino
eHealth application	Other countries than Philippines
Country setting is Philippines	The abstract does not describe one or more eHealth Applications
Study that develops one or more eHealth applications	Articles using an eHealth but not focused on the application system
Study that develops a new module of an eHealth Application	Papers that do not relate to the health sector
The system is implemented or prototype under development	Duplicate publication from multiple sources

The screening procedure is illustrated in the PRISMA flow diagram. It first reports the quantity of articles that were searched, and then it makes the selection process transparent by disclosing the choices that were made at different phases of the systematic review. Every stage included a record number of articles. The flow diagram also

included the reasons why certain items were excluded. To assess the two coders' (C1 and C2) coding choices, fifteen articles were chosen at random. Cohen's kappa (κ) (Cohen, 1960) was employed to determine the reliability between ratings. The level of agreement when a measurement is repeated among several raters under the same circumstances is known as inter-rater reliability [15]. Kappa has a range from 0-1.00, with larger values indicating better reliability. Kappa values of .40-.60 are characterized as fair, .60 to .75 as good, and over .75 as excellent [16]. The formula used to calculate the Cohen's Kappa of two raters is:

$$\kappa = \frac{P(A) - P(E)}{1 - P(E)} \quad (1)$$

where: $P(A)$ is the observed agreement probability, $P(E)$ is the expected agreement probability.

Relevant articles are reviewed in full text. Relevant information that supports the objective of the study were recorded and codes were developed. Codes included the nature of eHealth, type of application, features integrated into the software, and the challenges and risks encountered during development.

3. RESULTS

After the preliminary screening, 313 potential articles were left for full-text screening in Fig. 2. Nevertheless, 39 items could not be accessed by direct communication with the authors or the library's order system. As a result, 274 items were found, checked, and coded. The exclusion criteria resulted in the omission of 246 articles because they were written in languages other than English, country setting is not in the Philippines, or had no connection to an HIS or EMR systems, articles were published in the year 2014 or older, or the applications is intended to be deployed outside the Philippines.

Each review is constrained by the search approach used, but this one was carried out as thoroughly as possible. Despite the fact that the three specified research databases are huge and have an international scope, barely a small number of turnouts were considered based on the criterion of peer-reviewed articles released after 2015, and solely in English and in Philippine settings. As a result, the findings of this study apply to research in book chapters, conference proceedings, and papers that are not yet published in journals but are under consideration for indexing in the three databases investigated. In order to broaden the review's scope, future study may examine using a broader choice of databases, publishing platforms, and publication languages. There were only 28 articles taken into consideration for the final evaluation. The screening of the publications considered is summarized in Fig. 2.

A coding system was developed. Fifteen papers were selected at random to assess the coding judgments of two

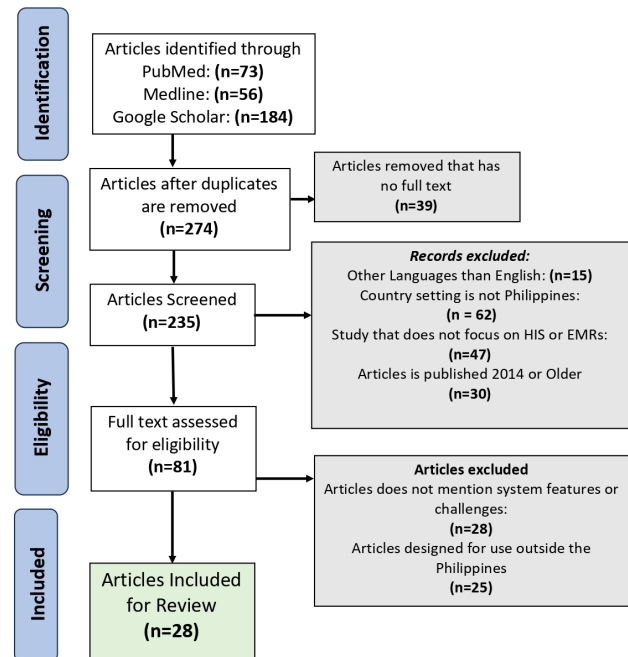


Figure 2. PRISMA flow of the systematic review conducted

coders (A and B) to assess the reliability between assessors using Cohen's kappa (κ). Article details (title, year of publication, publication detail, the author's name and system specifications or implementation issues) were included in the codes. According to [17] and [18], kappas between 0.40 and 0.60 are considered fair, 0.60 and 0.75 are good, and 0.75 and higher are exceptional. Coding consistency for articles included or excluded by raters A and B was $\kappa = 0.81$. As a result, excellent interrater reliability for the inclusion and exclusion coding can be said to exist.

The comprehensive features identified in Table II demonstrate the potential capabilities and functionalities of a modern healthcare management system. These features encompass various aspects of healthcare scheduling and communications, record-keeping and prescription, knowledge and information, and marketplace and payment.

In order to enhance healthcare management and delivery, the Philippines have made a significant investment in Health Information Systems (HIS). This approach has not, however, been without its share of challenges. The process of HIS integration in the Philippines has been hampered by a range of difficulties, from resource restrictions and infrastructure issues to interoperability problems, data security issues, and opposition to change. Table III explores some of the key challenges experienced throughout the implementation of HIS.



TABLE II. Summary of the Features Presented by every Articles Screened

Features	Description	Author(s)/Reference			
Scheduling and Communications					
Electronic Appointment scheduling	Enables users to schedule appointments electronically, streamlining the appointment booking process	Fuentes et.al. [19] Ancheta et.al. [20] De Guzman et. al. [21] Del Castillo et.al. [22] Pulmano et. al. [23] Dela Cruz et. al. [24] Ancheta et. al. [20] Del Castillo et. al. [22]	Notifications (covered SMS or Application Notifications)	Keeps users informed about appointments, test results, and other important healthcare updates.	Samonte et. al. [8] Fuentes et. al. [19] De Guzman et. al. [21] Dela Cruz et. al. [24] Roldan et. al. [25] dela Cruz [31] Custodio et. al. [32]
e-Consultation	Allows for remote consultations with healthcare practitioners, promoting accessibility to healthcare services.		Queuing	Receive service or access to a resource in a sequential manner	Custodio et. al. [32]
Record-keeping and Prescription					
Health Practitioner Selection	Aids users in selecting healthcare practitioners based on their preferences and needs	Samonte et. al. [8] Fuentes et. al. [19] Roldan et. al. [25]	E- Prescription	This feature facilitates electronic prescription generation, enhancing the efficiency and accuracy of medication management.	Ancheta et.al. [20] De Guzman et. al. [21] Del Castillo et. al. [22] Chan et.al. [33]
Follow-ups/ Monitoring	This feature enables healthcare providers to monitor patient progress and conduct follow-up assessments	Fuentes et.al. [19] Pulmano et. al. [23] Ongkeko et. al [26] Ateneo de Manila Univ. [27] Muin [28]	Profiling (Edit, View, Delete, Searching)	Encompasses patient profile management, including editing, viewing, deleting, and searching for patient records.	Samonte et. al. (2018) [8] Acacio-Claro et. al. [11] Fuentes et. al. [19] De Guzman et. al. [21] Pulmano et. al. [23] Dela Cruz et. al. [24] Chan et. al. [33] Roldan et. al. [25] Ongkeko et. al. [26] dela Cruz and Mendoza [29] Ridad et. al. [30] dela Cruz [31] Samonte et. al. (2022) [36] Ateneo de Manila Univ. [27] Ateneo de Manila University et. al. [37] Muin [28]
Patient's Tracking	Underscore the importance of tracking patient progress and movement within healthcare facilities	De Guzman et. al. [21] dela Cruz and Mendoza [29] Ridad et. al. [30] dela Cruz [31]			
Chatbot	A chatbot feature offers automated responses and assistance to user inquiries.	Ancheta et. al. [20] Roldan et. al. [25] Ateneo de Manila Univ. [27]			
Reminder System	Notifies users of upcoming events or tasks	Custodio et. al. [32]			



Remote Sharing of Medical Records	Emphasize the importance of sharing medical records remotely, enhancing collaboration among healthcare providers.	Samonte et. al. [8] Pulmano et. al. [23] Roldan et. al. [25] dela Cruz and Mendoza [29] Ridad et. al. [30] Muin [28] De Castro et. al. [34]	Knowledge Information Page (Health related page) Dashboard	Provides access to health-related information, promoting patient education and awareness. Offers a consolidated view of patient data and key healthcare metrics.	Acacio-Claro et. al. [11] Fuentes et. al. [19] Roldan et. al. [25] dela Cruz and Mendoza [29] Ateneo de Manila Univ. [27] Muin [28]
Hand writing recognition interface	Convert handwritten text or characters into digital or machine-readable text.	Dela Cruz et. al. [35]	Membership Verification	Enables verification of patient and practitioner memberships, ensuring accurate access to services.	Samonte et. al. (2018) [8] Fuentes et. al. [19] Pulmano et. al. [23] Roldan et. al. [25] dela Cruz and Mendoza [29] Ridad et. al. [30] dela Cruz [31] Samonte et. al. (2022) [36] Ateneo de Manila Univ. [27] Muin [28]
Lab Test Result Generation	Produces and documents the outcomes of medical laboratory tests. Ensures that healthcare providers have access to precise and timely information about a patient's health, aiding in diagnosis, treatment planning, and monitoring of medical conditions	Samonte et. al. [8] Fuentes et. al. [19] Dela Cruz et. al. [24] Chan et. al. [33] Ridad et. al. [30] Ateneo de Manila Univ. [27] Muin [28] De Castro et. al. [34]	QR Code Reader	This feature facilitates the scanning and interpretation of QR codes for various healthcare purposes.	Roldan et. al. [25] dela Cruz [31]
Medical Report Generation	Essential documentation for healthcare professionals to track patient progress, communicate with other providers, and make informed decisions about patient care.	De Castro et. al. [34]	Marketplace and Payment		
Laboratory Referrals	Allows healthcare providers to refer patients for laboratory tests	Ancheta et. al. [20] Ateneo de Manila Univ. [27]	Delivery Tracking	Allows tracking of medical deliveries, ensuring timely and accurate delivery of healthcare supplies.	Samonte et. al. (2022) [36]
	Knowledge and Information				
Mapping	Aids in location-based healthcare services.	Roldan et. al. [25] dela Cruz and Mendoza [29]	Medical Care Solutions Marketplace	Offers access to a marketplace for medical products and services.	Roldan et. al. [25]
			Home Service Delivery	Enables the delivery of healthcare services to patients in their homes	Roldan et. al. [25] Samonte et. al. (2022) [36]
			Online Payment	Facilitates online payment for healthcare services and products.	De Guzman et. al. [21] Del Castillo et.al. [22] Pulmano et. al. [23]



TABLE III. Summary of the Challenges in the Implementation of HIS in the Philippines Presented by every Article

Challenges	Author(s)/Reference	Frequency
Human Resource		
Inadequately Trained Personnel	Garcia et. al. [38]	1
Hesitant to Change/user resistance	Samonte et. al. (2018) [8] Gesulga et. al. [39] Ebarido and Celis [40]	3
Lack of computer skills	Gesulga et. al. [39] Chan et. al. [33] Ebarido and Celis [40]	3
Lack of education and training	Gesulga et. al. [39] Dela Cruz et. al. [41]	2
Lack of EMR awareness	Gesulga et. al. [39]	1
Preference of the Personnel over the manual process	Chan et. al. [33]	1
Limited workforce	Macabasag et. al. [42]	1
Age	Dela Cruz et. al. [41]	1
User confidence	Dela Cruz et. al. [41]	1
Low degree of cooperating, collaboration, and sharing across all sectors	Lu et. al. [43]	1
Widely differing levels of eHealth maturity	Lu et. al. [43]	1
ICT-Related		
Organizational limitations	Ongkeko et. al. [26]	1
lack of IT facilities and equipment	Gesulga et. al. [39] Ebarido and Celis [40] Lu et. al. [43]	3

Technical issues	Garcia et. al. [38] Ebarido and Tuazon [44]	2
hardware technicalities	Gesulga et. al. [39] Ebarido and Celis [40]	2
Poor interface design	Gesulga et. al. [39] Ebarido and Celis [40] Dela Cruz et. al. (2020) [35]	3
lack of Interoperability	Gesulga et. al. [39] Dela Cruz et. al. [24] Lu et. al. [43] Ebarido and Tuazon [44]	4
Designed to address individual needs	Ebarido and Tuazon [44]	1
No user feedback test	Dela Cruz et. al. [41]	1
Infrastructure		
Unstable internet connection	Garcia et. al. [38] Dela Cruz et. al. [24] Chan et. al. [33]	3
Lack of infrastructures	Macabasag et. al. [42]	1
Strategies and Policies		
Lack of planning and strategy	Gesulga et. al. [39] Lu et. al. [43] Ebarido and Tuazon [44]	3
Administrative policy support	Gesulga et. al. [39]	1
Regulation Compliance	Ebarido and Celis [40]	1
Reluctance of hospital to access live data	Samonte et. al. (2018) [8]	1
Lack of medical vision	Ebarido and Tuazon [44]	1
Evolving regulatory and legislative requirements for healthcare providers	Llamzon et. al. [45]	1



	Funding	
Implementation cost	Gesulga et. al. [39] Ebarido and Tuazon [44] Dela Cruz et. al. (2020) [35] Chan et. al. [33]	4
Uncoordinated investment in ICTs in health	Lu et. al. [43]	1
Limited public sector capacity to implement eHealth programs;	Lu et. al. [43]	1
Slow and uncertain financial payoffs	Dela Cruz et. al. (2020) [35]	1
Burden the hospitals with financial and educational incentives	Chan et. al.	1

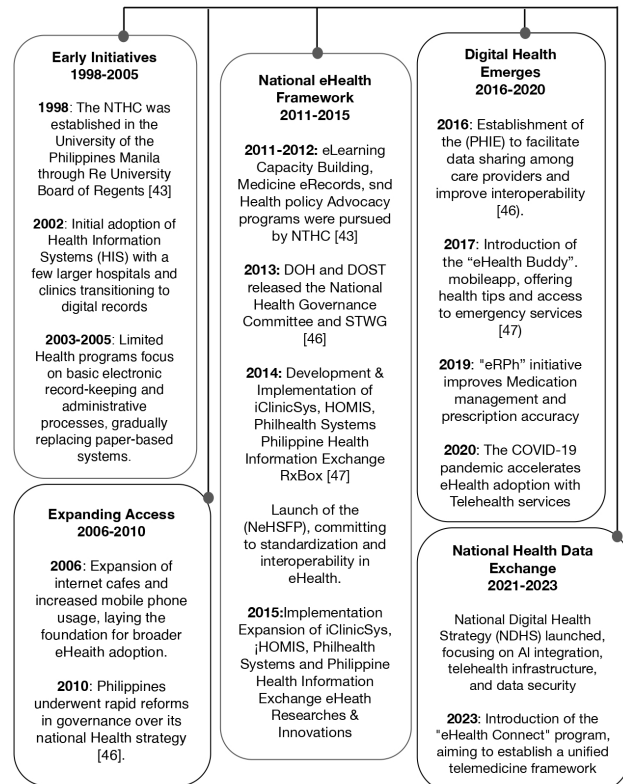


Figure 3. Milestone of the National eHealth Program Implementation

4. DISCUSSION

A. How have publications on HIS developed over time in the Philippines?

Despite having one of Asia’s fastest expanding economies, the Philippines continues to bear the triple burden of disease. It is a pioneer in business process outsourcing and exports software engineering professionals, however, the nation has not yet taken advantage of its ICT competence to benefit the health sector [46]. According to the DOH, 70% of Filipinos residing in rural regions continue to face challenges due to a lack of or restricted access to health care services. Accessibility to health care services and availability to real-time information for decision making are two major impediments to the Philippines’ health system [48]. Certain health organizations in the Philippines were making efforts to interconnect various health communities and the adoption and usage of eHealth or telehealth as one means of health delivery.

In terms of implementing its national eHealth initiative, the Philippines has accomplished a number of significant milestones reflecting the country’s journey toward a more digitally integrated healthcare system. In 1998, the National Telehealth Center (NTHC) was established at the University of the Philippines Manila, a foundational development in the eHealth landscape [43]. This marked the start of a larger change in the healthcare industry. In 2002, major hospitals and clinics adopted HIS, paving way for electronic health records. Between 2003 and 2005, the focused was to

transition from paper-based systems with simple electronic record-keeping and administrative procedures. With the rise in mobile phone usage and the expansion of internet cafes in 2006, this change paved the way for the widespread acceptance of eHealth. The groundwork for the digital revolution of healthcare in the Philippines was laid by these developments. In 2010, the Department of Health has formulated the National eHealth Strategic Framework with the mission of using ICT effectively to improve health delivery, health management and health communication. The framework envisioned to support Health care with ICT to increase health access, patient safety and satisfaction and support policy makers and communities to come-up with best possible health decisions. Under the initiative of DOH, the Philippine eHealth Strategic Plan (PeHSP) 2014- 2020 defines strategies to align and harmonize the implementation of various digital health initiatives as well as ascertain the proper management of ICT to achieve national health goals. The introduction of the Philippine Health Information Exchange (PHIE) in 2016, which aimed to ease data exchange and improve interoperability, was one of the significant developments in HIS that occurred from 2016 to 2020 [46]. The launch of the “eHealth Buddy” smartphone app in 2017 increased healthcare accessibility by providing access to emergency services and health advice [47]. In 2019, the “eRPh” project significantly boosted drug management and prescription accuracy, improving patient



safety and healthcare quality. The year 2020 brought an unexpected turning point as the COVID-19 pandemic accelerated eHealth adoption. The Philippine healthcare system's capacity for adaptation and agility was demonstrated by the crucial role that telehealth services, contact tracing apps, and digital vaccine passports played in crisis management [47]. The Philippines' healthcare system saw considerable changes between 2021 and 2023, with the formation of a National Health Data Exchange. An important turning point in the nation's eHealth journey occurred in 2022 with the introduction of the National Digital Health Strategy that placed a great emphasis on data security, the integration of artificial intelligence (AI), and the development of telehealth infrastructure. In addition, the launch of the "eHealth Connect" program in 2023 was an important step toward developing a uniform telemedicine framework across the country. This program sought to guarantee equal access to medical care, especially in isolated and underprivileged communities. These developments overtime lay the foundation for a more digitally connected and patient-centric healthcare system in the Philippines.

B. What are the features of HIS or EMRs applications developed in the Philippines setting?

In the context of healthcare in the Philippines, an understanding of the components and functionalities of health information systems (HIS) and electronic health management systems (EHMS) is crucial. These systems play a critical role in improving the overall quality and efficiency of healthcare delivery in the country. This study encompasses various features in healthcare scheduling and communications, record-keeping and prescription, knowledge and information, and marketplace and payment. In healthcare scheduling and communications, the integration of various scheduling and communication functions into HIS represents an essential part of the national healthcare infrastructure. Recent years have seen substantial improvements to these systems, especially in response to the difficulties brought on by the COVID-19. Electronic Appointment, e-scheduling, e-consultation, queuing system, and health practitioner selection promote greater accessibility to healthcare services. These technological developments are especially useful in geographically dispersed areas since they enable people to consult doctors from the comfort of their homes. Simultaneously, these features not only enhance service delivery but also mitigates patient wait times, improving overall patient satisfaction. Furthermore, the inclusion of follow-ups/monitoring, patient's tracking, reminder system, and notifications has demonstrated the potential to improve patient outcomes through continuous monitoring of patient progress and movement and follow-up assessments. By doing so, healthcare providers can optimize patient flow and ensure timely and efficient care delivery. According to [49] the PhilHealth has been aggressively investing in digital health technologies to enhance patient booking, tele consultations, and data exchange among healthcare providers. HIS had a number of functions that dealt with prescriptions and record-keeping. With a large and diverse population in

the Philippines, paper-based record-keeping systems might result in fragmentation, data loss, and challenges with acquiring patient information, which can impair the quality of service. Profiling functionalities allow for efficient patient profile management, editing, viewing, deleting, and searching. E-prescription substitutes handwritten into electronically generated prescriptions that optimizes accuracy and reduces errors while streamlining medication management. Remote medical record sharing facilitates smooth collaboration between healthcare professionals, ensuring all-around patient care. The generation of lab test results and medical reports enables prompt and accurate data access, assisting in diagnosis and treatment. When healthcare professionals have access to patient records and can send out electronic prescriptions, rural locations in particular can benefit from telemedicine and remote consultations. Patients may no longer have to travel as far for appointments, which is quite beneficial. Electronic records are also more resilient than paper records, which is important considering the Philippines' vulnerability to natural disasters like typhoons and earthquakes. The Philippines' archipelagic geography frequently causes discrepancies in healthcare access, with isolated areas finding it difficult to get to medical services. Electronic access to health information and knowledge are relevant features found in various health information systems. Mapping tools integrated into HIS by enabling patients and healthcare professionals to identify the closest healthcare facilities, boosting accessibility, and guaranteeing prompt medical attention. Mapping can also be a key component of disaster readiness, allowing medical personnel to react quickly to situations. QR Code Readers speed up medical procedures by cutting down on wait times and overhead while membership verification is critical for security and privacy purposes as medical records are sensitive information. Delivery tracking, medical care solutions marketplace, home service delivery, and online payment are features encompass the marketplace and payment which are not typical in most HIS. In a nation with over 7,000 islands, it is vital to track the movement of medical supplies like medications, medical equipment, vaccines, and etc. It is crucial to guarantee the prompt and precise distribution of healthcare necessities due to the abundance of remote places, notably in the archipelagic provinces. Patients now have more alternatives and opportunities to locate specialized care in a country with a diversified healthcare system through a Medical Care Solutions Marketplace feature. With a centralized medical marketplace, specialized care that patients need can solve healthcare inequities and the varied healthcare environment of the countries. Additionally, telemedicine and home care services might now be delivered to patients at their front doors. This can solve the problem of patients with limited mobility and transportation challenges. It is critical to emphasize that most HIS cited in the study have incorporated features in profiling, membership verification, lab generation, medical remote sharing, notifications, dashboard, electronic and e-scheduling, and lab generation. These features support the Philippines' dedication to addressing particular difficulties

in its healthcare system. The cornerstone of these advancements is patient-centered care, with membership verification and profiling enabling people to take an active part in keeping their health, and ensuring the security of access to health information. Features including lab generation, medical remote sharing, and notifications play a crucial role in supporting coordinated treatment and lowering healthcare disparities given the country's unique geography and the necessity for healthcare accessibility across areas. Additionally, by actively promoting eHealth projects and digital healthcare in the Philippines, the government has prepared the path for the adoption of features like computerized scheduling, which guarantees effective resource allocation. The Philippines' goal of using data to influence healthcare decisions facilitated by dashboard is in line with the emphasis on data-driven decision-making. Lastly, the Chatbot, QR Code Reader, Medical Care Solutions Marketplace, Home Service Delivery, Online Payment, and Notifications features represent the integration of modern technology and convenience into healthcare management. These qualities enable a flexible and patient-centered approach to healthcare delivery as they adjust to the changing requirements and expectations of patients and healthcare professionals. In conclusion, the study's wide range of findings serve as a roadmap for creating comprehensive healthcare solutions that put the needs of patients, accessibility, and operational efficiency. These features also reflect the current trends and challenges in healthcare management. The effectiveness, accessibility, and quality of healthcare services can be considerably improved with the inclusion of these functionalities.

C. What kind of challenges and risks are considered in the implementation of HIS or EMRs in the Philippines?

The implementation of HIS in the Philippines encountered into a number of challenges, many of which are human resource-related, ICT-related, infrastructure, strategies and policies, and funding. These difficulties have made it harder for the nation to fully embrace and use eHealth technology like electronic medical records (EMRs). Inadequately trained personnel, user resistance, and change reluctance are prevalent issues in many nations, but they are especially common in the Philippines. There are diverse healthcare workers in the Philippines, and not all of them have adequate training they need to utilize HIS efficiently. Additionally, the country's healthcare industry has always relied on manual procedures, so even while switching to electronic systems is efficient, it has faced opposing views. When requested to switch from manual record-keeping to electronic medical records (EMRs), healthcare providers in the Philippines exhibit hesitation, according to a Marcelo report [50]. A study by Carandang et al. (2015) [51] also found that many healthcare workers lacked formal training in health informatics, which hindered their ability to use EMRs effectively. Lack of staff has also been identified as a barrier to HIS implementation. In reality, the Philippines suffers a considerable scarcity of medical workers in distant and rural regions, as seen by

a physician-to-patient ratio of 0.6:1,000 [52]. Additionally, a structural problem that prevents the integration of HIS is the low level of cooperation, collaboration, sharing across all sectors and lack of awareness of EMR. Healthcare is delivered by a mix of public and private providers, and poor communication between these sectors prevents the efficient interchange of electronic health information. Information sharing and continuity of care are further complicated by the large variations in eHealth adoption maturity across various geographic locations and healthcare organizations. Various challenges related to ICT were also found thru this study. These challenges encompass organizational limitations, a lack of IT facilities and equipment, technical issues, and suboptimal design. Inadequate infrastructure is found to be a barrier to the adoption of EMRs and HIS across the nation, which is also supported by Torres and Marcelo (2018) [53]. The development and integration of these systems are often hindered by constrained funding, disjointed healthcare systems, and organizational resistance [54]. Hardware issues and technical issues are also major challenges in the Philippines. The viability of HIS and EMRs depends critically on the availability of dependable and durable IT infrastructure, hardware, and software. Inefficient or incompatible hardware can cause system failures and inefficiencies in many healthcare institutions, which lowers the level of patient safety and the quality of healthcare provided. In addition, the user experience and adoption of these systems can be negatively affected by bad interface design. The relevance of usability and user-friendliness is indisputable, and systems that are challenging to use or understand may discourage healthcare providers from using them [55]. According to Torres and Marcelo [53], other elements that might lead to fragmented treatment and inefficiencies in the healthcare industry include the lack of interoperability across multiple healthcare systems and a design that prioritizes individual needs over holistic healthcare management. Additionally, another major issue that may impede the successful integration of HIS and EMRs is the absence of key infrastructures including a reliable power supply, suitable hardware, and well-equipped healthcare facilities. Like many developing countries, the Philippines experiences resource shortages that limit access to vital healthcare technology infrastructure [54]. In particular, the absence of backup power sources might be problematic because it could result in data loss during power outages and interfere with healthcare operations. A stable internet connection is essential for accessing and updating EMRs. Inconsistent or slow internet connectivity can hinder the effectiveness of EMRs. In 2016, the Philippines' Internet infrastructure has been reported to falls behind that of other developing countries in Asia, particularly in terms of Internet connectivity, by contrasting the current global ICT situation with the current condition in the country [56]. Healthcare personnel may also have difficulty using digital systems efficiently in some locations due to limited availability to computer hardware and related equipment [55]. Support from administrative policy is essential for motivating healthcare organizations to use HIS and EMRs.



The adoption of these technologies must be encouraged while privacy, security, and interoperability concerns are addressed [57]. Furthermore, strong strategies are required to guarantee that institutions are compliant with changing rules due to regulatory compliance and evolving expectations for healthcare providers [58]. A major issue is hospitals' resistance to using real-time data. To improve patient care and healthcare decision-making, healthcare facilities must have the infrastructure and desire to communicate real-time information [59]. The adoption process might also be slowed down by leadership's lack of medical vision in particular. Since their support and vision are essential for a successful adoption, healthcare organization leaders must have a thorough understanding of the potential advantages of HIS and EMRs [60]. The Philippines' cybercrime legislation is based on the Republic Act [RA] No. 10175, the Cybercrime Prevention Act of 2012. There are provisions for prosecuting violations against data confidentiality and integrity, as well as offenses using computers (such as computer-related forgeries, fraud, and identity theft). Financial challenges must be addressed if eHealth projects are to be implemented and sustained successfully. Medical companies might find it hard to afford the high initial implementation costs [61], and uncoordinated ICT expenditures within the industry may result in inefficiencies [62]. The implementation of eHealth programs in the public sector may be hampered by a lack of capacity, particularly in terms of financial and technical resources [63]. Stakeholders may need to look beyond short-term advantages if financial returns on IT investments are slow and unclear [64]. It is imperative to boost government grants and cash set out expressly for hospital HIS upkeep and development. Further, the government may also consider splitting the cost of HIS implementation and upkeep, the government might also encourage collaborations between the public and private sectors. Hospital HIS projects can benefit from the additional funds, knowledge, and technology resources that the private sector can provide. Providing hospitals with incentives to meet certain HIS-related performance criteria, such as better patient outcomes, increased efficiency, or improved data accuracy, by using performance-based financing methods.

5. CONCLUSION

The demand for real-time information to make educated decisions and the difficulty of accessing high-quality healthcare services in remote places have encouraged attempts to link healthcare communities and encourage the adoption of HIS. The National Telehealth Center (NTHC) was founded in 1998, and it established the groundwork for further e-Health advancements in the Philippines. Health Information Systems (HIS) were introduced in 2002, while internet cafés and mobile phone usage increased in 2006. These milestones marked the shift in the healthcare industry from paper-based systems to basic electronic record-keeping over time. The COVID-19 pandemic in 2020 highlighted the flexibility of the healthcare sector and pushed for a more advance and sophisticated HIS in the country. The Philippines' HIS and EMRs offer a plethora of functionalities, ranging

from electronic appointment booking, lab result creation, and medical remote sharing, to patient profiling and membership verification. Such features try to address the nation's diverse healthcare environment and geographic challenges by placing a high priority on patient-centered care, accessibility, and data-driven decision-making. Notwithstanding, there are several obstacles associated with the adoption of HIS and EMRs in the country. These include a lack of cooperation and interoperability within the healthcare industry, opposition to change, and undertrained healthcare workers. Additional challenges include inadequate IT infrastructure, technical problems, and inadequate system architecture. The effective integration of eHealth technology is impacted by inadequate financing, administrative policies, and leadership vision; on the other hand, uncoordinated ICT expenditures and budgetary restrictions can hinder projects sustainability. With the launch of the National Digital Health Strategy and programs like the "eHealth Connect" program in 2023, the Philippines is moving forward with eHealth despite these obstacles. With a focus on data security, AI integration, and telehealth infrastructure, these advancements are aimed at unlocking up opportunities for the Philippines' healthcare system to become more patient-centered and digitally linked.

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