

Privacy and Security in Healthcare Framework: a Review

Rabia Ali Alkhazmi ^{1*}, Hiba Abdullah Ateeya ², Ali Hasssin Mohamed ³
^{1,3} Department of Computer, Higher Institute of Science and Technology, Tarhuna, Libya
² Department of Computer, College of Technical Sciences, Derna, Libya

الخصوصية والأمان في إطار الرعاية الصحية: مراجعة

ربيعة علي الخازمي ^{1*}، هباء عبدالله عطية ²، علي حسين محمد ³
^{1,3} قسم الحاسوب، المعهد العالي للعلوم والتقنية، ترهونة، ليبيا
² قسم الحاسوب، كلية العلوم والتقنية، درنة، ليبيا

*Corresponding author: rabia.alkhazmi2016@gmail.com

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Abstract:

The healthcare framework is one of the components to secure patient information. The significance of the healthcare domains is actually focusing on privacy and security and accessibility of users. Cloud computing and the Electronic Health Records (EHRs) and the related reduction in cost cannot be disregarded as a component in the conveyance of medicinal services advantage. Be that as it may, decreased cost is one of the targets anticipated in the utilization of EHR, which is joined by potential dangers, either when clients utilize human services or circulation of the nation's part, to protection and safety. The structure for healthcare protection is a mix of established, statutory, and administrative law at the government and state levels to guarantee security and safety everywhere throughout the world. This study has an interest in observing the main advantages and showing the disadvantages of some healthcare frameworks as described by the authors. The result of this study, which is presented throughout tables of comparisons between healthcare frameworks, can be used as a guideline for other researchers and healthcare organizations.

Keywords: Healthcare, Privacy, Healthcare standards, Security, Data Privacy.

الملخص

يُعدّ إطار عمل الرعاية الصحية أحد مكونات تأمين معلومات المرضى. وتكمن أهمية مجالات الرعاية الصحية في التركيز على خصوصية المستخدمين وأمنهم وإمكانية وصولهم إليها. ولا يُمكن تجاهل الحوسبة السحابية والسجلات الصحية الإلكترونية والتخفيض المرتبط في التكاليف كعنصر في ميزة نقل الخدمات الرعاية الصحية. ومع ذلك، يُعدّ انخفاض التكلفة أحد الأهداف المتوقعة عند استخدام السجلات الصحية الإلكترونية، والذي يُصاحبه مخاطر محتملة، سواءً عند استخدام المرضى للخدمات الصحية أو عند توزيعها على مستوى الدولة، فيما يتعلق بالحماية والسلامة. ويتكون هيكل حماية الرعاية الصحية من مزيج من القوانين المعمول بها والتشريعية والإدارية على مستوى الحكومة والولايات لضمان الأمن والسلامة في جميع أنحاء العالم. وتهتم هذه الدراسة برصد المزايا الرئيسية وإظهار عيوب بعض أطر الرعاية الصحية كما وصفها المؤلفون. ويمكن استخدام نتائج هذه الدراسة، المعروضة في جداول مقارنات بين أطر الرعاية الصحية، كدليل للباحثين ومؤسسات الرعاية الصحية الأخرى.

الكلمات المفتاحية: الرعاية الصحية، الخصوصية، معايير الرعاية الصحية، أمن، خصوصية البيانات.

Introduction

Electronic healthcare (e-health) is a promising development that attracts the contemplations of various ventures and, likewise, the academic world. Healthcare system is a term that refers to any system used in the healthcare field (Rezaeibagha, 2013). Various establishments around the world are endeavoring to make electronic health protection structures in light of the fact that customary helpful records are insufficient in meeting the necessities

of present-day drug (Ali, 2008). Building a safe EHR sharing condition has pulled in an impressive measure of thought in both the healthcare protection industry and academic gatherings. Comprehensively, it may be described as the use of media communications innovations to give helpful information and administration (Hu, 2011). Data insurance is of most extraordinary noteworthiness as controlled by laws in countries with broad people (Andreu-Perez et al., 2015). Immovably related to the insurance issue is that data must be associated with the ideal individual to ensure redress, assurance, and treatment (Meingast et al., 2006). Implementations of data innovation (IT) arrangements and improvements in healthcare administrations are falling behind when diverging from various parts. Developing of the masses realized new challenges; customary helpful records are insufficient in meeting the necessities of present-day drug (Ali, 2008). Building a safe EHR sharing condition has pulled in an impressive measure of thought in both the healthcare protection industry and academic gatherings. Comprehensively, it may be described as the use of media communications innovations to give helpful information and administration (Hu, 2011). Data insurance is of most importance for the overall population and healthcare administration systems (Ali, 2008). Surrounding Assisted Living (AAL), which depends endlessly on a supply of Internet of Things (IoT), offers assistance to the hindered people and sponsorships so their essential regular day-to-day existence works out and access to therapeutic information via cloud computing.

II. Background and Motivation

Likewise, concerns extend past sparing patient security, moreover consolidating guaranteeing the characterization and reputation of the data provider. Particular masters may not require numbers to be associated with their practice. In various conditions, general medicinal services perception requires interfacing quiet level data transversely over data sources from different affiliations and making the quantifiable reports for examination (Andreu-Perez et al., 2015). Constantly, the helpful researcher needs to take in the connection between a couple of characteristics in light of a Results and discussion consolidated, composite point of view of a single patient whose data is arranged in various and unique data sources. Regardless, the spread data sources are not allowed to share data in the perspective of patient character (Villeneuve et al., 2016).

A. Healthcare as a Structural Framework

The virtual joint exertion structure could allow healing center offices to efficiently improve quality by picking up from an ensured and confidential data base using a vigilant proposition system to pick which segments to test next in their own specific foundations. While this work was specifically influenced to prompt quality change in human services structures Such a system is a basic walk toward engaging machine seeing of the client's medicinal services and development once every day has pronounced that medicinal services benefit from long-haul seeing in a private space, notwithstanding the way that the thought will connect with various aspects of human development and improvement estimation and assessment.

B. Healthcare and Difficulties

(Gavrilov & Trajkovik, 2012) has proclaimed that there are two key troubles in today's human services administration structure: one is the basic cost weight on healthcare frameworks and transport, and the second is the quick improvement of the field of helpful informatics and E-wellbeing, continuously using including and unavoidable advances.

C. Healthcare and Cloud Computing

In the health services administrations organization field, circulated figuring (Cloud Computing) offers impossible potential for speedy access to remedial security data (Rao, 2013). The IT structure in the helpful assurance is especially mind-boggling, and hence the United States Congress has taken extra measures to secure the patient's private information under HIPAA (Health Insurance Portability and Accountability Act) (Rao, 2013). Dispersed figuring can help patients to get to their remedial information from wherever on the planet by techniques for the Internet (Collins et al., 2016). The well-being organization's space needs amplified security and confirmation levels. To satisfy these necessities, circulated processing progression should be more painstakingly coordinated. The matter is not so hugely particular but rather greater and truer blue (Gariépy-Saper & Decarie, 2021).

On the worldwide present, the ISO (Rao, 2013) and the Health Level 7 Consortium (HL7) portray e-health foundations. The circulated figuring model contains five attributes, three movement models, and four association models. The five key characteristics of dispersed processing are range self-sufficient resource pooling, on-demand self-advantage, speedy on-request self-advantage, brisk versatility, sweeping system access, and measured association.

In the IaaS cloud illustration, the therapeutic administration's application designers hold full obligation with respect to guaranteeing patients' security and assurance. PaaS: This kind of cloud organization illustrates that two levels of protection for security and assurance are required. SaaS, this sort of cloud organization illustrates, is a vital bit of the SaaS for the medicinal services area customers. Disseminated figuring is offered in four unmistakable structures:

- **Private trusts** are controlled by a lone association and are being used just in that affiliation.
- **Community cloud** having a place with a few associations and permitting access just to those worried for certain activities;
- **The cloud in public** is held by an association offering cloud organizations to the general populace (Rao, 2013).
- **Hybrid cloud**: an arrangement of at least two sorts of clouds (private, open, or group) that stay remarkable elements; however, are connected by standard development that empowers conveyability of utilizations (Rao, 2013).

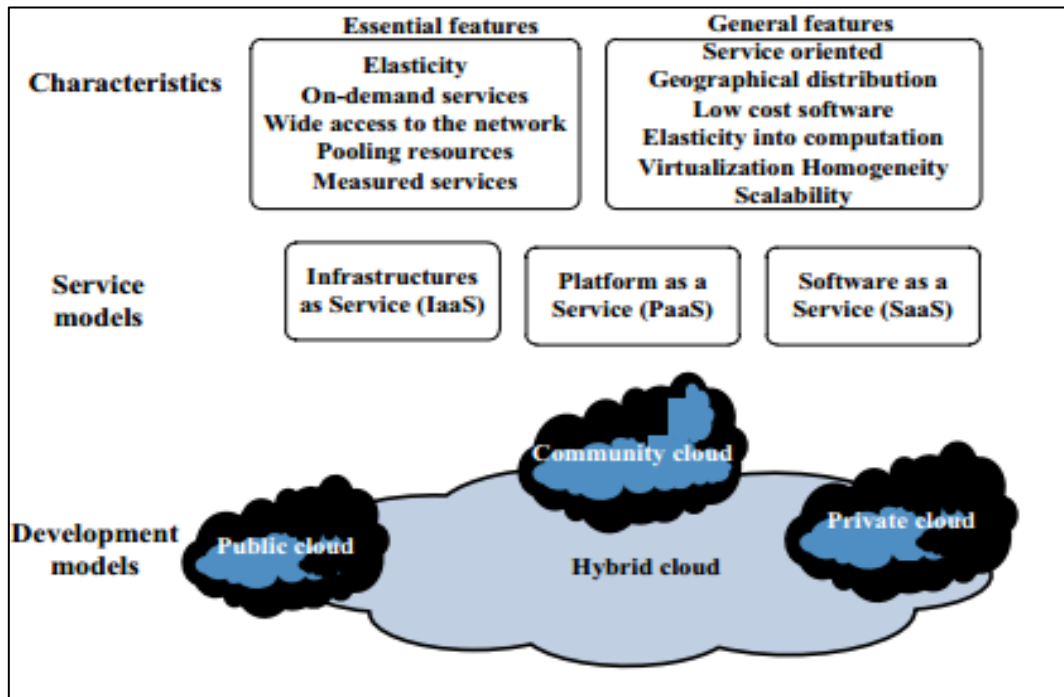


Figure 1. Element and characteristics of the cloud adapted from (Rao, 2013).

D. Electronic Healthcare Services (EHS)

With the prevalence of data and correspondence advances, Electronic Health Services (EHS) are usually used by patients, masters, and other restorative administrations specialists to reduce healthcare protection expenses and give compelling human administrations shapes. Thousands of patients are treated due to the lack of medical errors in nursing rooms (Gostin et al., 1995). The healthcare affair and transmission of huge measures of well-being data in automatized casing will occur with or without change of the human services framework. A medicinal services framework encountering noteworthy change will make a prerequisite for additional data for checking understanding of thought and studying well-being data foundation. A front-land therapeutic administrations framework requires the sharing of a generous volume of point-by-point medicinal services among framework players. The well-being data foundation that is being produced will have the accompanying components that are basically critical in giving top-notch, financially savvy healthcare, yet require thorough protection shields (Shahid et al., 2022).

E. Healthcare and Internet of Things (IoHT)

The administrative strategy and direction are required to guarantee security amid information transmission and capacity and amid resulting information investigation errands. Investigating a lot of information can be helpful in the human services area.

Manufacture nitty-gritty, unthinking models for individual patients. Huge information investigations can be easily consolidated with VPH advancements to create hearty and powerful in silico medication arrangements. Cloud-based healthcare benefits with the Internet of Healthcare Things (IoHT).

For remote monitoring of medical conditions, different devices at different layers communicate with each other via multiple protocols and connect to mobile phones with sensors using short-range protocols and healthcare servers with the help of the Internet. The servers help doctors take action for rapid response (Magnusson, 2002), as shown in Figure 2.

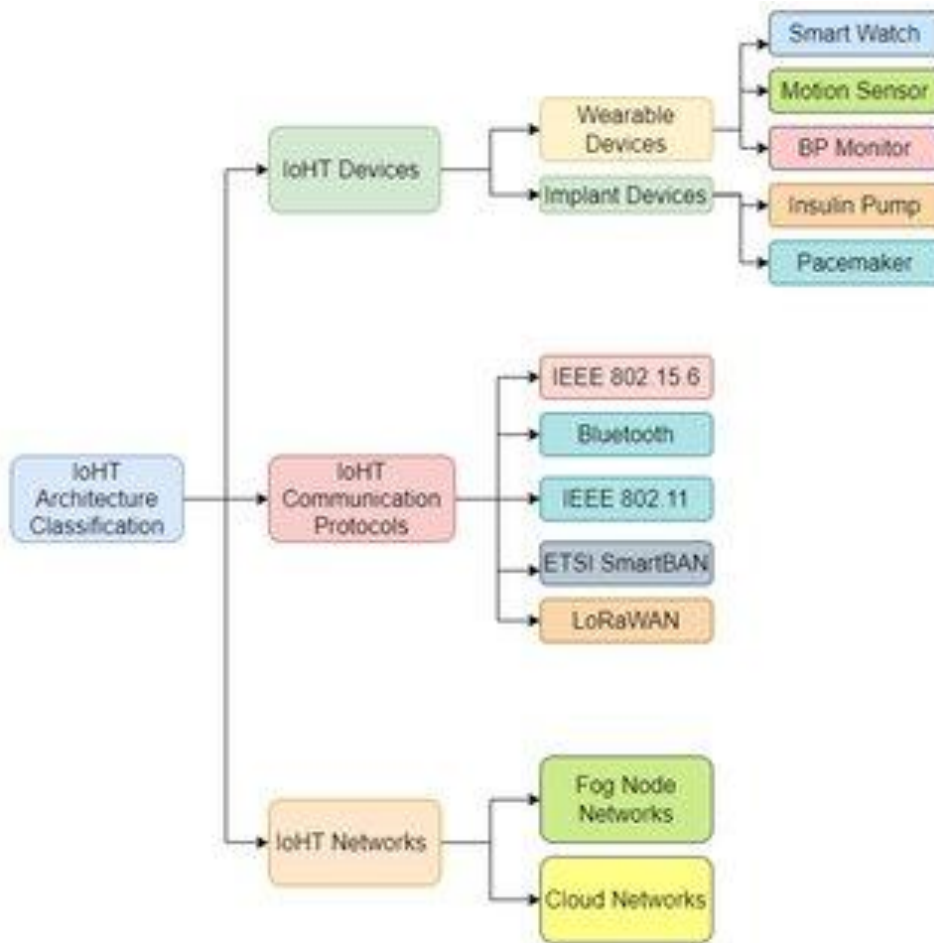


Figure 2. IoHT Architecture Classification (Magnusson, 2002).

F. Healthcare Systems as Framework Advantages and Limitations

This study aims to show the medicinal services and security that are depicted in Table I which portrays healthcare as indicated by each author, which sort of structure has been depicted by the researcher, and which framework is connected to utilizing protection in human services. The author portrayed the upsides of utilizing such a sort of human services system, and drawbacks were likewise exhibited in this area. To make fully known the space that is utilized and depicted by the creators, additionally to guide analysts or organizations or associations, likewise nations, in their identity beginning to utilize such a sort of protection in the human services framework. The ad justification of tables can be beneficial for many organizations or countries to use as a guideline or as a notarized reference. This table will also help researchers who are interested in studying such a kind of framework to make a good decision and gain more knowledge.

III. DISCUSSION

A. Privacy and Security by Utilizing Healthcare Data Framework

The studies (Villeneuve et al., 2016) and (Elmisery et al., 2016) have introduced that the advantages of the health information system are awesome correspondence among patients and their masters to guarantee protection and security, encountering brisk changes to western countries, helping the healthcare domain come about, using measures of western countries, securing the consequences of individual autonomy and opportunity, quick change of restorative advancement, and reducing peril by using current human services information structures in Australia to guarantee security and security by using the health information system. The disadvantages of this protection information system can fly up when there is a cut down of the Wi-Fi. While (Office for Civil Rights, 2002) has exhibited the essential target of the used structure, which is Healthcare Things (IoHT), to guarantee security and safety in urban locales by using a model of healthcare domain protection, Web organizations, and cloud establishments, and present the crucial issues of this framework as partner patients and providers wherever and at whatever point to upgrade the way of care.

VI. Tables of the used framework for healthcare

A. Health Information System and Privacy

One of the advantages of this framework is that it helps improve the security and privacy of medical data and ensures the protection of patient privacy and confidentiality of health information. One of its disadvantages is the difficulty of adapting to changes and the fear of data breaches. The optimal solution is networks, and it is implemented in Australia. See Table (1).

Table (1). Health information system and privacy in Australia.

Country	Australia
Optimal solution	Networks
Advantages	<ol style="list-style-type: none"> 1. Good correspondence amongst patients and their specialists and security 2. Undergoing fast changes to western nations 3. Increase wellbeing results 4. Use models of western nations 5. Secure the results of individual self-sufficiency and opportunity 6. Rapid improvement of therapeutic innovation 7. Reduce hazard by utilizing present day health- data frameworks 8. Data access efficiency and improved data
Disadvantages	<ol style="list-style-type: none"> 1. Cut down on the Wi-Fi uneducated people complex to change 2. Fear of data breach
The used framework	Health information system to ensure privacy
Publications	(Villeneuve et al., 2016; Magnusson, 2002; Elmisery et al., 2016; Reeve et al., 2007; Roehrs et al., 2017)

B. Internet of Healthcare Things (IoHT)

This framework improves healthcare quality by connecting patients and providers anywhere, anytime. It ensures data privacy, reduces costs, and offers remote monitoring, but faces limitations like restricted communication resources and high infrastructure costs. The optimal solution uses healthcare web services and cloud infrastructure to ensure privacy in urban areas, Table (2) summarizes these features.

Table (2). Internet of Healthcare Things (IoHT) in urban areas.

Country	Urban areas
Optimal solution	Model of healthcare Web services, cloud infrastructure to ensure privacy
Advantages	<ol style="list-style-type: none"> 1. Connect patients and providers anywhere and anytime to improve the quality of care 2. Report any variations from the norm to the significant medicinal services supplier 3. Best private medicinal services data assurance 4. Healthcare transportability and responsibility 5. Remote case monitoring 6. Personal portals toward the end-clients 7. Increasing the acknowledgement of wellbeing and wellbeing gadgets among different patients 8. IoHT gadgets to give flexible chances to quality human services outside of the conventional healing centers to guarantee protection 9. Reduce cost and decreases customer acquisition costs. 10. The framework permits a fine-grained requirement of security strategies 11. Ensure privacy
Disadvantages	<ol style="list-style-type: none"> 1. Communication resources due to the limited energy budget 2. Cloud computing paradigm and Internet of Healthcare Things are reshaping the healthcare domain 3. Costly infrastructure
The used framework	Healthcare Things (IoHT) to ensure privacy
Publications	(Villeneuve et al., 2016; Magnusson, 2002; Office for Civil Rights, 2002; Reeve et al., 2007; Roehrs et al., 2017; Huda et al., 2016)

B. Hypothesized Model ensuring privacy of patients

Healthcare technology solves major problems, improves care, saves time, and increases patient connections. However, it faces challenges like resistance to new systems and inadequate care for the poor and middle class. The optimal solution involves better policies and understanding to enable healthcare innovation while ensuring privacy and security, as seen in China's healthcare system and listed in Table (3).

Table (3). Hypothesized Model ensuring privacy of patients in China

Country	China
Optimal solution	Better policies and understandings to enable healthcare innovation to ensure privacy
Advantages	<ol style="list-style-type: none"> 1. Help solve large persistent problems such as how to innovate healthcare service delivery using emerging technologies 2. Recovery after Surgery. 3. Save time 4. Privatization has led to innovation and better care 5. Low cost and great access 6. Increases direct patient connections 7. Useful for designing future policy
Disadvantages	<ol style="list-style-type: none"> 1. Key problems faced in implementing healthcare technologies are getting the members of an organization to understand, accept, and value the usage of a new system 2. Lack of care for the poor and even the middle class 3. Individuals may not accept the technology
The used framework	System of the healthcare to ensure privacy and security
Publications	(Thomas et al., 2014)

C. Electronic Health Records and Privacy

Electronic Health Records (**EHR**) are electronic systems that contain patients' health information and medical history. These systems provide many benefits, such as improving the quality of care, increasing work efficiency, and reducing medical errors. However, there are also some drawbacks, such as high costs, risk of cyber-attacks, and the need to ensure patient privacy. Healthcare providers should take these drawbacks into consideration when implementing EHR systems.

Table (4). Electronic health records and privacy.

Country	Sydney Australia
Optimal solution	Morphometric analysis of histopathological images to ensure privacy
Advantages	<ol style="list-style-type: none"> 1. Increased accessibility 2. More informed decisions providing improved quality of care 3. Better outcome 4. Data access efficiency and improved data 5. Reducing medical errors 6. Improving communication among teams
Disadvantages	<ol style="list-style-type: none"> 1. Black box technique is highly unlikely to be accepted by the practitioners in a healthcare system 2. Electronic records may be vulnerable to hacking. 3. Fear of data breach 4. High cost of implementing and updating EHR systems.
The used framework	Standard in diagnosing oligodendroglioma is histopathological classification to ensure privacy and security
Publications	(Villeneuve et al., 2016; Huda et al., 2016; Shojaei et al., 2024; Raza et al., 2023; Haapalainen, 2024; Vinayasree & Reddy, 2024)

D. Electronic Health Records Utilizing Blockchain

Blockchain-based Electronic Health Record framework ensures patient data confidentiality and access control (Vinayasree & Reddy, 2024; Tahir et al., 2024), offering numerous benefits over traditional EHR systems. As seen in most Asia health systems. See Table (5).

Table (5). Electronic health records utilizing blockchain in Asia.

Country	Asia
Optimal Solution	IPFS Based storage solution for Electronic Health Records
Advantages	1. Data control: Users have control over their data 2. Transparency: Transparent transactions and data storage. 3. Decentralization: Decentralized network on single control. 4. Trusted platform: provides a trusted platform for data and transactions. 5. Secure Data: Sharing Between Users
Disadvantages	1. Scalability Problem 2. High Energy Consumption
The used framework	Block chain-Based Healthcare Records Management
Publications	(Shahnaz et al., 2019; Ghosh et al., 2023; Hossain et al., 2021; Abunadi & Kumar, 2021)

V. Conclusion

In spite of the way that the use of conveyed figuring has promptly amplified, dispersed figuring security is yet seen as the important issue in the circulated processing condition, particularly as for supportive information. Clients would lean toward not losing their private data as a necessity because of hurtful insiders in the cloud. Similarly, the loss of preferred standpoint openness is accomplished by different issues for unending beginnings and late starts. Execution of the protection and security benchmarks that are eventually a work ahead of time inside the cloud gathering, including business-related ones that choose auditable, enforceable execution estimations and sharing of liabilities, ought to permit such a structure to complete consistency with government security and security heading. assurance. Spread preparation is another model of expecting that accreditations give more noteworthy adaptability, less cost, and yet rather more prominent productivity in IT associations to end clients. It offers potential open passages for enhancing EHR gathering, human organizations associations, and investigation.

A. The Study Limitation

This study has an interest in observing healthcare frameworks in many different areas throughout screening the electronic database. Also, the main target of this study is to find out the main advantages of the used healthcare and show the differences of these frameworks, which can be helpful for other researchers and for the healthcare domain. Also, this study used related articles such as conference papers and journals. This study also has reviewed the main issues of using electronic healthcare records, which are privacy and security.

B. Future Research Directions

This study is interested in studying the main advantages and disadvantages of many kinds of healthcare domains; some ideas for future studies are to study the main improvements of the electronic healthcare record and personal healthcare record. How can these records improve the privacy, security, and performance of the healthcare domain? In addition, this study can be moved forward by using decision support systems (DSS) in the healthcare domain and showing the differences between using DSS in personal healthcare records and healthcare domains.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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