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DATA SECURITY ASPECTS OF ELECTRONIC MEDICAL RECORDS IN THE SOCIETY 5.0 ERA IN INDONESIA: A SYSTEMATIC LITERATURE REVIEW

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Abstract

The sharing and accessing of data in the Electronic Medical Records (EMR) utilization raises concerns about the privacy and integrity of medical record data. Therefore, healthcare facilities should know the security aspects of electronic medical records in hospitals to maintain electronic medical record security. This study analyzed the security aspects of EMR data in the era of Society 5.0 in Indonesia. This systematic literature review used the PRISMA method. Article inclusion criteria were articles published in 2017-2022, research in Indonesia, original research, and known sources. The article search database uses Google Scholar, Crossref, and Semantics Solar Search with the following keywords: security, electronic medical records, and Indonesia. Then five articles selected for this review. The result shows that the privacy factor of EMR should have a different username and password for each unit. In the integrity aspect of RME, data must be complete and have an officer's electronic signature. In the authentication aspect, data was accessed only by users who have passwords. Aspects of access control in EMR, users could access EMR according to their jobs and using their respective usernames and passwords to log in. The availability aspect of EMR connects with the related stakeholders. The non-repudiation aspect of EMR relates to the identification of the party filling in and changing information. To implement EMR, healthcare facilities must consider the security aspects of EMR, specifically in the integrity aspect where officers must complete data, the system should provide electronic signatures, and have logfile functions.

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Introduction

The development of technology of information brought us into change from the industry of revolusion 4.0 to the era of 5.0 society. Where the 5.0 society is the continuation of 4.0 industri where which requires society to be able solve the complex problems, critical thinking and creative, so human can live side by side with technology that already exist for works and activities.(Rahayu et al., 2022) The role of technology in health sector which one is health services in medical record unit that made by electronic. This is accordance to Ministry of Health Indonesia in a book entitled Digital Transformation Health 2024 states that to reach Indonesian Health, one aspect that must be improbed is integrated data and a simple services

system.(Kemenkes RI, 2021) Based on The Minister of Health Regulation Number 24 of 2022 concerning Medical record which states that health services require the implementation of medical records using elekctronic. Electronic medical record in their implementation are used as data collection, writing, fata processing, and storage of medical services to patients with electronically.(Kemenkes RI, 2022)

Based on the Ministry of Health Regulation Number 24 of 2022 clause 12 verse 2 states that storage of electronic medical record must maintaining the confidentialy, security, and avaibility of electronic medical record data.(Kemenkes RI, 2022) The security aspects of the information include privacy or confidentialy that is opened, with the existence of a username and password to protect unauthorized parties, integrity or data integrity that cannot be deleted. Aunthetication proof by personal identity number (PIN) when accessing data. Avaibility provision of information system ehen requested by the relevant. Access Control for organizing who can access the information system, and non repudiation, is a identification implementer of information, so there is no denial changes of information.(Sabarguna & Farian, 2008)

According to Setiawan, electronic medical recprd can improve and facilitate sharing and accessing data for patient care. (Setiawan et al., 2020) Activities to share and access data in the use of electronic medical record raise concern about the privacy and integrity of medical record data. (Kemenkes RI, 2022) Based on Anjani's research, it was found that the use of access rights to electronic medical records, namely they never changes the password. Officers did a share log in with fellow medical record officers who were not authorized managed to enter the SIMRS database and make data changes.(Anjani et al., 2014) The existence of these activities can be said that the security of electronic medical records is still low because there are activities that can lead to leakage of medical record data, even though medical records are medical notes that must be kept the confidential. Therefore, health service facilities must know what securitu aspects of electronic medical records are in hospital. Based on the above backgroynd, the formulation of the problem in this study is "How Aspects of Electronic Medical Record Security in Indonesia in 5.0 of Society Era". This research purpose to analyze security aspects electronic medical record data in 5.0 of society era.

Methods

The method use in this research namely, systematic literature review based on the method PRISMA by summarizing, identifying, summarizing literature empiris or theoretical literature to provides comperehensive understanding, this will provides a conclusions. Research data use application name POP (Publish or Perish) to make it easier to search for journals that which is souced form databse google scholar, crossref and sematic scholar search with keywords are (Security), (Privacy) or (Integrity), or (Avaibility), or (Access Control) or (Authentification), or (non-reputation), and (Electronic Medical Record) and (Indonesia). The result of the research journal which was obtained then screening and identified based on onclusion criteria in this study are, year published 2017-2022, trusted journal sources, discussing the security of electronic medical fecords and research in Indonesia

Based on the result of screening of journal, it is then analyzed based on research guantions, where research guation is a list of questions that researchers want to find out based on certain topics.(Apriliani et al., 2020) Which becomes a research are:

Table 1. Research Question

Id	*Research Question*
RQ1	How is the privacy aspect of privacy electronic medical record in 5.0 of society in Indonesia?
RQ2	How is the privacy aspect of integrity electronic medical record in 5.0 of society in Indonesia?
RQ3	How is the privacy aspect of authentication electronic medical record in 5.0 of society in Indonesia?
RQ4	How is the privacy aspect of acess control electronic medical record in 5.0 of society in Indonesia?
RQ5	How is the privacy aspect of avaibility electronic medical record in 5.0 of society in Indonesia?
RQ6	How is the privacy aspect of repudation electronic medical record in 5.0 of society in Indonesia?

After determining the research question of the researcher, then research making the Quality Assesment of the data that has been founf, to be evaluated based on the list of the question.(Apriliani et al., 2020) Quality Assesment of this research are :

Table 2. *Quality Assement*

ID	Quality Assement
QA1	Does the journals publish within the time span on 2017-2020
QA2	Does the journals talk about security of electronic medical record?
QA3	Does the journals are nationals research?

From the questions above, the paper will be asscessed based on a) Yes : If the journal is in accordance with the Quality Assement, b) No : If the journal is not in accordance with the Quality Assement.

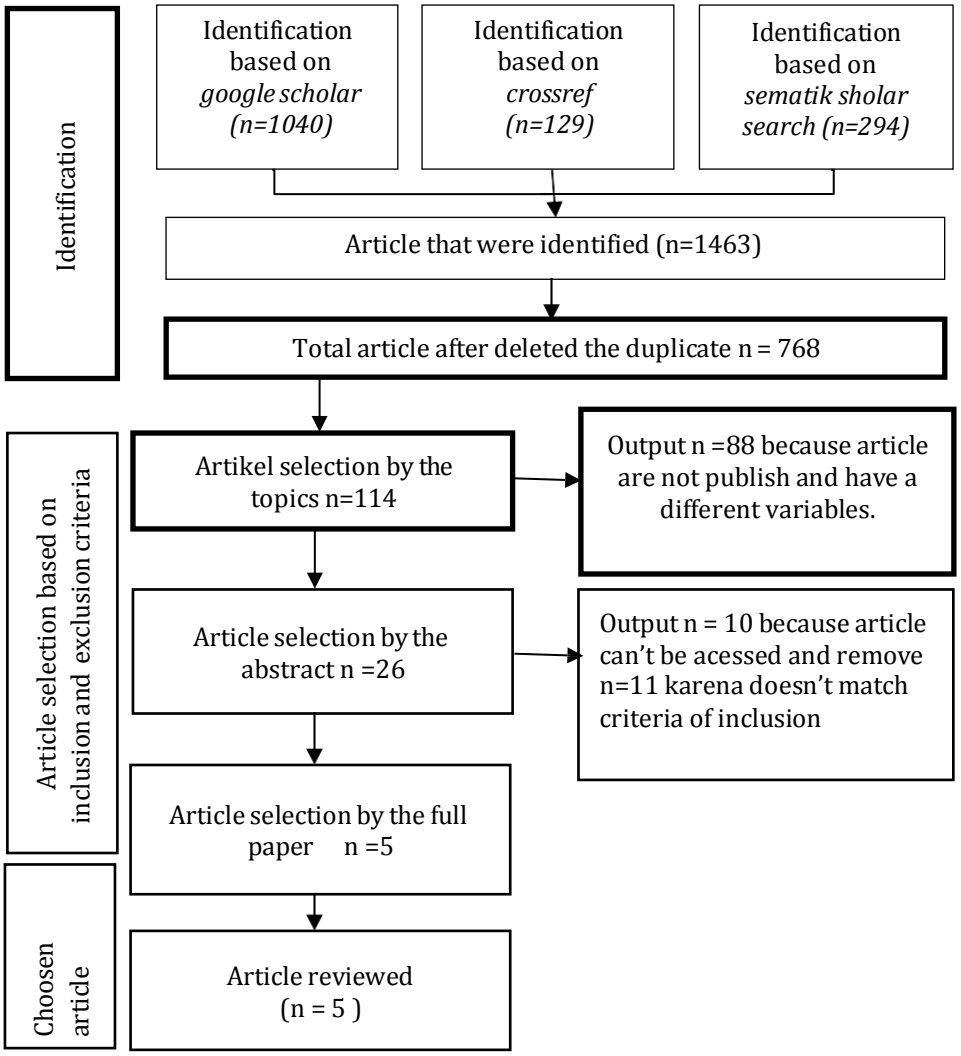

Figure 1. PRISMA Diagram of Inclusion and Exclusion Process

Results

Selection Study

This research was conducted by searching for POP (Publish or Perish0 application articles that are sourced om the google scholar database, crossef and sematic scholar search. This research selects by method PRISMA, which is a tool and guide for evaluating systematic review.(Sari, 2021) Here's the view of stages of journal search.

The results of identification of article research in POP application obtained 1,463 articles that were selections, therefore produce 768 articles, and then article reselected again by selection by the topics, obtained 114 articles, from 114 articles that fit the topic, 106 were excluded because the articles were not published and the variables were different, after being excluded the results obtained 26 articles that fit the

abstract, from 26 articles were selected by full paper by excluding 10 articles because they could not be accessed, 11 because they did not fit the inclusion criteria, resulting in total of 5 articles that fit the inclusion criteria,

Literature Characteristic

The result of search process are based on journal data that has been screened, in this research there are five journal that fit the inclusion criteria :

Table 3. Literature Characteristic Based on Result of Search Process

No	Researcher (Year)	Journal Name	Title	Variabel	Output
1	(Irlaili L.D & Rohmadi RMD, 2017)	Jurnal Rekam Medis and Manajemen Informasi Kesehatan	Tinjauan Keamanan Sistem Informasi Manajemen Rumah Sakit Berdasarkan Aspek *Privacy, Integrity* dan *Authentication* Di Rsud Dr. Soediran Mangun Sumarso Wonogiri	-*Privacy* -*Integrity* -*Aunthentication*	*Privacy* only can be applied to an integrity application in the avaibility of medical records.filling in the completeness of patients data must be done. Authentication at least 10 digits of password
2	(Nugraheni & Nurhayati, 2018)	Prosiding Seminar Nasional Unimus	Aspek Hukum Rekam Medis Elektronik di RSUD Dr.Moewardi	-*Privacy* -*Integrity* -*Aunthentication* -*Availability* -*Access control* -*Non-Repudiation*	Integrity aspect and non repudiation aspect not already fulfill security system of electronic medical record in hopsital
3	(Bintoro et al., 2022)	MEDALI Journal	*Evaluation Of Electronic Medical Record Format And Security System In Dental Clinic Of The General Hospital In Batam City*	-*Privacy atau Confidentelity* -*Integrity* -*Aunthentication* -*Availability* -*Access control* -*Non-Repudiation*	Integrity aspect and non repudiation aspect not already fulfill security system of electronic medical record in hopsital
4.	(Tiorentap Diva Rizky Amanda & Hosizah, 2020)	Prosiding 4 SENWODIPA	Aspek Keamanan Informasi Dalam Penerapan Rekam Medis Elektronik Di Klinik Meddical Check-Up MP	-*Privacy* -*Integrity* -*Aunthentication* -*Availability* -*Access control* -*Non-Repudiation*	Privacy aspect reach 60%, Integrity 30%, Aunthenticantion 48%, Availability 25%, Access control 56%, Non-Repudiation 33%
5	(Reza Pahlevi et al., 2021)	MEDALI Journal	*Electronic Medical Record At Rsigm Sultan Agung Semarang Reviewed From The Completeness And The Safety Format System*	-*Privacy* -*Integrity* -*Aunthentication* -*Availability* -*Access control*	*Privacy* use cryptography. Integrity no electronic signature yet. Authentication, information from the doctor who check out. *Availability* information is easily to get when needed, *acces control* have a

No	Researcher (Year)	Journal Name	Title	Variabel	Output
				-*Non-Repudiation*	username and password. *non repudation* able to see.

According to tabel 3 about characteristic of literature data there are 6 aspect of electronic medical record in Indonesia, *Privacy, Integrity, Aunthenticantion, Availability, Access control,* dan *Non-Repudiation.*

Quality Assement Result

Table 4. Quality Assement Result

No	Writer	Year	QA1	QA2	QA3	Result
1	Irlaili, R.D., dan Rohmad	2017	Yes	Yes	Yes	Accepted
2	Nugraheini, S.W., dan Nurhayati	2018	Yes	Yes	Yes	Accepted
3	Bintoro, Wardana, dan Agustin	2022	Yes	Yes	Yes	Accepted
4	Tiorentap, D.R. R dan Hosizah	2020	Yes	Yes	Yes	Accepted
5	Pahlevi,A.R, Wardhana E.S, dan Agustin, E.D	2021	Yes	Yes	Yes	Accepted

Based on table 5, it can be seen that the research from Irlaili, R.D., and Rohmad; Nugraheini, S.W., and Nurhayati; Afif, M.R; and Tiorentap, D.R. R and Hosizah, and Pahlevi, A.R, Wardhana E.S, and Agustin, E.D are in accordance with the quality assement that has been determined, namely the journal is published in the 2017-2022 timeframe, the journal discusses the security of electronic medical records, and the journal is a National journal.

Study Analysis

Table 5. *study analysis*

No.	Journal Name	Title	Year	Security aspects of electronic medical records	Type of health facility	Results
1.	Jurnal Rekam Medis and Manajemen Informasi Kesehatan	Tinjauan Keamanan Sistem Informasi Manajemen Rumah Sakit Berdasarkan Aspek *Privacy, Integrity* dan *Authentication* Di Rsud Dr. Soediran Mangun Sumarso Wonogiri	2017	*Privacy, Integrity, and Authenticity*	Hospital	*Privacy is* only applied to one application, integrity in the availability of medical record documents, filling in the completeness of patient data must be done. Authenticantion at least 10 digit password.
2.	Prosiding Seminar Nasional Unimus	Aspek Hukum Rekam Medis Elektronik di RSUD Dr.Moewardi	2018	*Privacy, Integrity, Authenticity, Availability, Access control, Non-repudiation*	Hospital	The integrity aspect has not been facilitated, the availability aspect and the no-repudiation aspect have not been maximized.
3.	MEDALI Journal	*Evaluation Of Electronic Medical Record Format And Security System In*	2022	*Privacy or Confidentelity, Integrity, Authenticity,*	Hospital	*The integrity* aspect and the *non-repudiation* aspect have not fulfilled the electronic medical record

No.	Journal Name	Title	Year	Security aspects of electronic medical records	Type of health facility	Results
		Dental Clinic Of The General Hospital In Batam City		*Availability, Access controlNon-Repudiation*		security system in the hospital.
4.	Prosiding 4 SENWODIPA	Aspek Keamanan Informasi Dalam Penerapan Rekam Medis Elektronik Di Klinik Meddical Check-Up MP	2020	*Privacy, Integrity, Authenticity, Availability, Access control, Non-Repudiation*	Clinic	Aspects of Privacy reached 60%, Integrity 30%, Authenticity 48%, Availability 25%, Access control 56%, Non-Repudiation 33%.
5.	MEDALI Journal	*Electronic Medical Record At Rsigm Sultan Agung Semarang Reviewed From The Completeness And The Safety Format System*	2021	*Privacy, Integrity, Authenticity, Availability, Access control, Non-Repudiation*	Hospital	*Privacy* uses cryptography. *Intergrity* there is no electronic signature, *authentication of* information from the examining doctor, *availabelity of* information easily available when needed, *access control* has a *user id* and *password, non repudation* can be seen.

Based on table 5 of the results of the *study analysis, it* can be seen that the security aspects of electronic medical records in Indonesia that discuss aspects of privacy and integrity are 4 articles, while those that discuss *authentication, access control, availabelity,* and *non-repudation* are 5 articles.

Discussion

Electronic Medical Record *Privacy* in the Era of Society 5.0 in Indonesia.

Privacy aspects of electronic medical records in the era of *society 5.0* in Indonesia according to article 1 to maintain *privacy in* the SIMRS application, each unit in the hospital is given one access right according to their needs. In article 2 *privacy* or *confidentiality* on RME in hospitals must have a *user name* and *password* to maintain the confidentiality of patient data. In article 3 the *privacy* aspect of RME has a *user name* and *password* to keep patient data confidential to maintain security using *cryptographic* technology, *firewalls*, and document archives to protect against data leakage. In article 4, the *privacy* aspect of RME in the clinic has a percentage of 60%. To prevent *user* misuse, the clinic information system is made if within 5 minutes there is no activation by the user, the system will *log out* automatically. In article 5, the *privacy* aspect in hospitals uses *cryptography.*

Based on articles 1,2,3,4, and 5, it can be seen that the *privacy* aspect of electronic medical records must have a different *user name* and *password* for each unit, and if within 5 minutes there is no activation by the *user,* the system will *log out* automatically and use *cryptographic* security, *firewalls*, and document archives to protect against data leakage. In a book entitled computerized medical records, *privacy* leads to personal data such as those in patient medical records.(Sabarguna & Farian, 2008) *Privacy* serves to protect the system from someone who does not have access rights to the information.(Reza Pahlevi et al., 2021)

Integrity in Electronic Medical Records in the Era of Society 5.0 in Indonesia

Integrity aspects in electronic medical records in the era of *society 5.0* in Indonesia according to article 1 *Integrity* aspects in the application of SIMRS in hospitals require filling in all data in the available fields. If it is not filled in completely, it cannot be saved and there will be a warning to complete all the data. In article 2 *Integrity is* related to changes in information on electronic medical records. In article 3, to maintain *Integrity* in making changes to RME records, doctors have the obligation to provide an electronic signature or can use a PIN. In article 4, data changes can be made when the *user* has the right to change or reduce data in *real time*. To maintain data integrity, the data input process must be done correctly and the system must have the ability to record changes made by *users*, so that *users* who make data changes will be

recorded by the system. In article 5, the *intergrity* aspect is not good enough because there is no electronic doctor's signature.

Based on articles 1,2,3,4, and 5, it can be seen that the data in the RME must be filled in completely, if it is not filled in completely, there will be a warning to complete all the data. Data changes can only be made by doctors, and every change the doctor must give an electronic signature and the system must have the ability to record changes made by *users. Integrity* must guarantee the accuracy of the data that the data cannot be deleted, replaced, changed, copied, and added in accordance with the rules that have been applied.(Hamama et al., 2023)

Electronic Medical Record *Authentication* in the Era of Society 5.0 in Indonesia.

Aspects of *authentication* in electronic medical records in the era of *society 5.0* in Indonesia according to article 1 *Authentication* on RME in hospitals, namely to access RME must use a maximum password of 10 digits in *alphanumeric* format and the information system is equipped with *Automatic Log Off* (ALO). In article 2 *authentication of* access to RME is made only for officers who have access rights and have a *username* and *password*. In article 3, to maintain *authentication,* the RME record contains the name of the doctor or nurse, the date and time of data recording, and verification in the form of an electronic signature or PIN as proof that the data recording was carried out by the person concerned so that it can be accounted for its authenticity. In article 4, *authentication of* information systems can be done using a PIN to maintain the confidentiality of *user IDs* and *passwords*, where each officer may not share PINs to maintain data security. In article 5, the *authentication* aspect of medical information is only provided by the doctor or nurse treating the patient.

Based on articles 1,2,3,4, and 5, it can be seen that in the era of *society 5.0 the authentication* aspect of RME access can only be done by *users* who have a password, and the system is equipped with *automatic log off* (alo). RME is equipped with verification in the form of an electronic signature or pin that records as proof that the data recording is done by the person concerned. *Authentication* serves to ensure that the person accessing and providing information is someone who has access rights and can be responsible for their authenticity.(Sabarguna & Farian, 2008) For the *authentication* process, every doctor who enters electronic medical record data must have a PIN to access the electronic medical record system.(Kesuma, 2023)

***Access control of* Electronic Medical Records in the Era of Society 5.0 in Indonesia.**

Access control in electronic medical records in the era of *society 5.0* in Indonesia based on article 2 *access control of* RME in hospitals is facilitated by limiting access rights for users. In article 3 RME can be accessed if the officer has access and has a *username* and *password* to *log in.* In article 4 *Access control* in the MP clinic information system in the information system can only be done by *users* according to their rights or menus that can be accessed by *users* or according to work. Determination of access rights to the information system is done by submitting an *accsess account form* to the IT team. In article 5 of the *access control* aspect*, usernames* and *passwords for* electronic medical records must be well maintained.

Based on articles 2, 3, 4, and 5 *Access control* in Electronic Medical Records in the era of society 5.0 in Indonesia, namely *users* can access RME according to their work and can only be accessed if the officer has access and has a *username* and *password*.(Sabarguna & Farian, 2008) *Access control* has a function to view access rights between medical record officers and other medical records according to their sub units.(Reza Pahlevi et al., 2021)

***Availabilitity of* Electronic Medical Records in the Era of Society 5.0 in Indonesia.**

Availabilitity aspects in electronic medical records in the era of *society 5.0* in Indonesia based on the article In article 2, *availabilitity* aspects require *picture archieving and communication service* (PACS) imaging facilities. The parties related to the availability of RME are: registration, doctors, nurses, pharmacy, and finance. In article 3 the *availabilitity* aspect of RME in hospitals to be easily accessed the system must have a fast connection, have a guide for each unit, be able to upload scanned documents, and have *back-up* and *firewall servers* to protect document storage from viruses. In article 4, the *availabilitity* aspect supports MCU service activities as long as *users* have a *username* and *password, they* can access it anywhere and anytime. In article 5 of the *availabilitity* aspect*, the* information needed by electronic medical records can be easily available.

Based on articles 2,3,4, and 5, it can be seen that the *availabilitity* aspect of RME in the era of society 5.0 is related to the parties who need RME, namely: registration, doctors, nurses, pharmacy, and finance. Therefore, RME must be easily accessible, have a fast connection, have a guide for each pattern, be able to upload scanned documents, and have a *back-up* and *firewall server* to protect document storage from viruses. In addition, parties can access RME if they have a *username* and *password.* In the electronic medical

record system, the availability of patient data in the electronic medical record needed can be accessed quickly by health workers.(Rahmadiliyan et al., 2019)

Non-Repudiation of Electronic Medical Records in the Era of Society 5.0 in Indonesia.

Aspects of *Non-Repudiation* in Electronic Medical Records in the era of society 5.0 in Indonesia based on article 2 *Non-Repudiation* parties who make changes and fill in data on electronic medical records cannot be identified. Based on article 3, the track record of filling and changing patient data stored in the electronic medical record system cannot be recorded by the system. Based on article 4, the *Non-Repudiation* aspect is not good enough, but the system already has a function to prevent users from denying that they have made changes to patient data in the system. Activities carried out by users are automatically recorded by the system, and only the IT team can open it. Based on the article 5 aspects of electronic medical records have a digital track record so that someone who makes changes cannot deny it.

Based on articles 2, 3, 4, and 5, it can be seen that the *Non-Repudiation* aspect of RME in the era of society 5.0 relates to parties who make changes and fill in data on electronic medical records that can be recorded by the system. So that those who make changes to the data cannot deny it because the change activities have been recorded by the system and only the IT team can open it. *Non-Repudiation* contains a data change log that can record when, where, what, and who changed the data. (Rahmadiliyan et al., 2019)

Conclusions

The privacy aspect according to articles 1, 2, 3, 4, and 5 RME must have a different *user name* and *password* for each unit, and made within 5 minutes of no activation by the *user,* the system will *log out* automatically and use *cryptographic* security*, firewalls*, and document archives to protect against data leakage. The *integrity* aspect according to articles 1, 2, 3, 4, and 5 data on RME must be filled in completely, if it is not filled in completely then there is a warning to complete all the data. Data changes can only be made by doctors, and every change the doctor must give an electronic signature and the system must have the ability to record changes made by *users. The authentication* aspect according to articles 1, 2, 3, 4, and 5 RME can only be accessed by *users* who have a password, and the system is equipped with *automatic log off*. RME is equipped with verification in the form of an electronic signature or PIN that records as proof that the data recording is done by the person concerned. The access *control* aspect according to articles 2,3,4, and 5 is that *users* can access RME according to their work and can only be accessed if the officer has access and has a *username* and *password. The availabilitity* aspect according to articles 2,3,4, and 5 on RME is related to the parties who need RME, namely: registration, doctors, nurses, pharmacy, and finance. Therefore, RME must be easily accessible, have a fast connection, have a guide for each pattern, be able to upload scanned documents, and have a *back-up* and *firewall server* to protect document storage from viruses. In addition, parties can access RME if they have a *username* and *password. The non-repudiation* aspect according to articles 2,3,4, and 5 is the identification of the party filling and changing information where the track record of the user who will make changes will be visible. So that the *user* cannot deny the changes made because all activities carried out will be recorded automatically in the system.

Author Contributions

Conceptualization, Umi Sa'diyah and Ika Pantiawati; methodology, Umi Sa'diyah; validation, Umi Sa'diyah, Ika Pantiawati and Edi Jaya Kusuma; formal analysis, Umi Sa'diyah; investigation, Ika Pantiawati; resources, Umi Sa'diyah; data curation, Ika Pantiawati; writing-preparation of original draft, Umi Sa'diyah; writing-reviewing and editing, Umi Sa'diyah and Okti Saritha; visualization, Ika Pantiawati; supervision, Edi Jaya Kusuma; project administration, Okti Saritha. All authors have read and approved the published version of the manuscript.

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Conflicts of Interest:

The authors declare no conflict of interest

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