TELEMEDICINE AND ELECTRONIC HEALTH RECORD IMPLEMENTATION IN RURAL AREA: A LITERATURE REVIEW

* Arifah Alfiyyah, **Dumilah Ayuningtyas, ***Agus Rahmanto

* Faculty of Public Health, Universitas Indonesia
** Health Policy and Administration, Faculty of Public Health, Universitas Indonesia
*** Budi Kemuliaan Hospital, Gambir, DKI Jakarta

E-mail: arifahalfiyyah@gmail.com

Abstract. The Indonesian Minister of Health 2019 issued regulations regarding the implementation of telemedicine services between health service facilities. Telemedicine is aimed primarily at rural areas. This research aims to look at the quality of telemedicine-based services, which are documented in an electronic health record (EHR) with complete information. This research uses the narrative literature review method: Garuda journal channels, Google Scholar, IEEE Explorer, ProQuest, PubMed, Science Direct, and Scopus. With the input-output process approach, eight scientific articles were published on countries with telemedicine/telehealth policies in rural areas. The implementation of telemedicine has advantages and disadvantages depending on the things supported and the target users. It must have policies, infrastructure, financial resources, and human resources to use, maintain and develop telemedicine. Telemedicine will help the health service process by increasing the degree of public health in rural areas if it is used on a large scale. The completeness of the EHR seems to be lacking in terms of informed consent. Still, a quality EHR can make it easier for health workers to enforce the history, establish the diagnosis, and provide patient healthcare.

Keywords: Telemedicine, Electronic Health Records, Quality, Rural Area, Literature Review.

Abstrak. Menteri Kesehatan RI pada tahun 2019 mengeluarkan peraturan penyelenggaraan pelayanan telemedicine antar fasilitas pelayanan kesehatan. Telemedicine ditujukan terutama pada daerah pedesaan atau rural area. Tujuan dari penelitian ini melihat mutu pelayanan berbasis telemedicine yang didokumentasikan dalam rekam medis elektronik (RME) dengan informasi yang lengkap. Penelitian ini menggunakan metode narrative literature review dengan memanfaatkan kanal jurnal Garuda, Google Scholar, IEEE Explore, ProQuest, PubMed, Science Direct, dan Scopus. Dengan pendekatan input, proses dan output total 8 artikel ilmiah yang didapatkan dari negara yang telah memiliki kebijakan telemedicine/telehealth di rural area. Penyelenggaraan telemedicine memiliki kelebihan dan kekurangannya masing-masing bergantung kepada hal-hal pendukung dan sasaran penggunanya. Harus memiliki kebijakan, infrastruktur, sumber keuangan dan sumber daya manusia yang dapat menggunakan, memelihara dan mengembangkan telemedicine. Telemedicine membantu proses pelayanan kesehatan yakni meningkatkan derajat kesehatan masyarakat di rural area jika penggunaannya berskala besar. Kelengkapan RME terlihat kurang dalam hal informed consent, namun RME yang bermutu dapat mempermudah tenaga kesehatan dalam melakukan penegakkan anamnesa, penegakan diagnosis, dan asuhan keperawatan kepada pasien.

Kata kunci: Telemedicine, Rekam Medis Elektronik, Mutu, Rural Area, Literature Review.

INTRODUCTION

The field of information technology in the last two decades has experienced developments and impacted the health world. Health services with information technology facilities through cyberspace are called telemedicine or telemedicine. Terms such as mHealth and telehealth are often used in telemedicine usage. Use mHealth to collect patient health data and provide health care information to practitioners, researchers, and patients. Vital monitoring of patients in mHealth is carried out directly for telemedicine services.

Telemedicine has the potential to offer much-needed access to subspecialty services in rural areas (1). Using telehealth in rural areas to provide and assist in the delivery of health services can reduce or minimize the challenges and burdens by patients, such as transportation problems related to travel for special care. Telehealth can also improve monitoring, timeliness, and communication within the healthcare system (2).

Various countries with specific policies and strategies regarding telemedicine show the implementation of telemedicine use and the quality produced in rural areas. These countries have

implemented telemedicine between health workers in health facilities and between health workers and patients. Data from the World Health Organization (WHO) (3) in 2016 shows that 58% of member countries have an eHealth strategy, 55% have laws to protect electronic patient data, and 87% of member countries report having one or more national mHealth initiatives.

In 2019 the Ministry of Health of the Republic of Indonesia issued Regulation of the Minister of Health of the Republic of Indonesia No. 20 of 2019 concerning the Implementation of Telemedicine Services Between Health Service Facilities. The Ministry of Health program with Telemedicine Indonesia, also known as *TEMENIN*, can conduct remote consultations regarding radiology, electrocardiogram, and ultrasonography. Currently, in Indonesia, there are no special regulations or guidelines for the use of telemedicine between health workers and patients.

Health services in medical practice include physical examinations that cannot be replaced by intermediary media using telemedicine. Telemedicine will be of maximum benefit if it has detailed and complete patient medical records that can be easily accessible by health workers with Electronic Health Records (EHR). Search history of examinations, history of previous diagnoses, consultation of current complaints, treatment of current complaints, sending of medical data during hospitalization, and discussions between doctors and patients can be done remotely.

The general objective is to know the general description of telemedicine-based health services and electronic medical records to improve the quality of services in health facilities. The specific objectives are: (1) to find out the advantages and disadvantages of health services using telemedicine applied in rural areas, (2) to determine the use of telemedicine in assisting the health service process, especially in rural areas, and (3) to determine the

quality of electronic medical records produced by implementing telemedicine.

METHODS

The research was conducted using a narrative literature review (NLR) method with an input, process, and output system approach. This study aims to comprehensively understand the data regarding the quality of electronic health record documentation after telemedicine services (4).

Planning the NLR

The search strategy is defined by creating a search query for finding the following keywords. The first keyword was used to identify telemedicine. The second keyword was related to Electronic Health records (EHR) in English or Bahasa Indonesia with Rekam Medik Elektronik. The third keyword for quality, and the last keyword for location. These keywords were searched in the database for the title, abstract, and keywords.

The inclusion (IN) criteria were defined in the previous research. The first inclusion (IN1) filters only the studies published between 2016-2020. Next, captured only studies published with all types of methods that could answer the topic, using all methods, conducting research in countries with particular telemedicine/telehealth policies, using Indonesian or English (IN2). Next, he exclusion (EX), articles were analyzed for deleting double data because of articles published with more than one journal channel (EX1). Finally, the references discussing broader topics were excluded (EX2). Gray literature exclusion criteria include thesis or thesis and not full text (EX3). Search using online channel search on Garuda, Google Scholar, IEEE Explore, ProQuest, PubMed, Science Direct, and Scopus.

Table 1. Search Strategy on the Database Used

Search Strategy Steps	Search Terms
1 (telemedicine)	Telemedicine OR telecare OR telemonitoring OR telehomecare OR telehealth OR internet-based care/programs OR mHealth OR telemedis OR telemedik
2 (electronic health record)	Electronic health records OR electronic medical records OR EHR OR EMR OR rekam medis elektronik OR rekam medik elektronik OR elektronik rekam medis OR elektronik rekam medik OR RME
3 (quality)	Quality OR quality hospital OR healthcare quality OR clinical care quality OR standard OR safety goals OR patient safety OR completeness
4 (location)	Rural OR rural area OR rural population OR remote area
5 (Inclusion)	Implementation OR evaluation OR policy OR law OR legality
6 (Exclusion)	System OR system basis OR technology OR application OR software OR algorithm OR network

Data Quality Assessment

Each study obtained was assessed using a checklist. Study quality is assessed based on the Critical Appraisal Skills Program (CASP). CASP for randomized controlled trials and systematic reviews is a program designed to develop critical appraisal skills to understand scientific evidence better. The program is complemented by a validity, outcome, and relevance assessment checklist (5).

Implementation of NLR

The review process was conducted by executing query searches in the selected databases using the predefined keywords in the title, abstract, and keywords. Then, IN1 and IN2 were applied. In total, 6417 articles were retrieved. Then, EX1 was applied, resulting in 3836 articles. It appears that many articles were published with more than one journal channel. After investigating to perform, EX2 was applied, resulting in 52 articles. Only eight relevant articles were selected after conducting a manual investigation to perform EX3. The scope of this study focuses on the quality implementation of EHR with telemedicine in rural areas
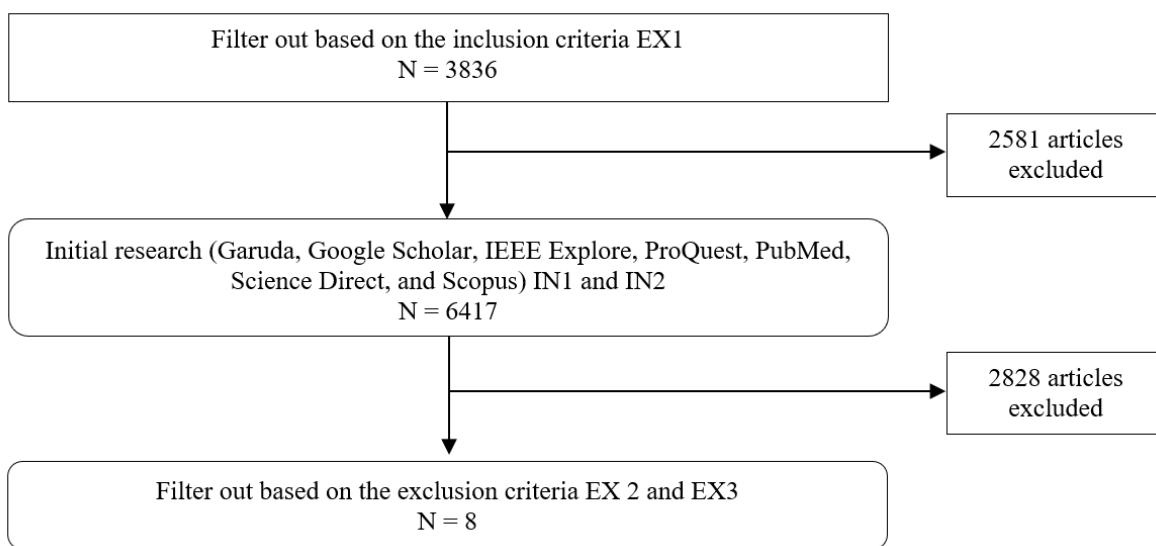

Figure.1 Literature Review Flow Diagram

RESULTS AND DISCUSSION

The results from NLR conducted one article from Brazil, China, Italy, Botswana, and Mali. From India, there are three journals. The research found from African states that Botswana, Brazil, and India have national telemedicine policies. China and Mali implement a national telemedicine policy and a national telehealth policy or strategy. Italy has a national telehealth policy or strategy. Eight studies showed the impact of using telemedicine in rural areas across the factors that make the quality of EHR.

Impact of using Telemedicine

The use of telemedicine has a positive and negative impact on both the health workforce and the patient side, as well as on the health services produced after teleconsultation.

Table 2. The Impact of Using Telemedicine in Rural Areas

Positive Impact	Negative Impact
The use of health services is increasing.	Very dependent on the quality of the network.
Increase patient satisfaction.	Patients feel confidentiality is not maintained.
Reduce indirect costs to healthcare facilities.	Significantly depends on purchasing power and access to the internet and user application.
Early screening is increasing.	

In South India, the increase in new telemedicine users reached 62%, with visits to health facilities reduced by 5.1%. Indirect costs in travel costs to health facilities decreased by 30% (6). With the Mobile Unit (MU) in Brazil visiting remote areas, sending screening images to a dermatologist in real-time shows user satisfaction results. The data showed that the team could perform 40 clinical dermatological examinations in one day, including cryotherapy and surgery (7). More specific health services are increasingly available in rural areas with telemedicine (8). Telemedicine improves patient satisfaction, especially in pediatric and rehabilitation services (9).

Research on the Skyhealth program in Bihar, India, showed no significant difference in terms of the negative impact of telemedicine. This program is carried out to increase public knowledge and appropriate treatment by doctors for diarrhea and pneumonia in children. Diarrhea medication administration increased from none to 16.7% of doctors prescribing treatment correctly after follow-up. Similarly, for pneumonia, from 11.1% to 22.9%, the correct administration of drugs for pneumonia by following the standard questions (10). The uptake of telemedicine in Uttarakhand, India, showed that most patients (67%) felt that their confidentiality was not maintained, who felt comfortable during teleconsultation only 51.3% of patients, and only 33% of patients who would visit a telemedicine center. However, it is not explained in detail what causes patients who feel uncomfortable to consult telemedicine (11). In Mali, Sub-Saharan Africa, users are not satisfied due to poor network (12). In Botswana, eHealth is not very successful because people's ability to buy smartphones is low (13).

Implementation Factors Telemedicine

Telemedicine requires professionalism and scientific discipline, so telemedicine requires professional human resources, supporting facilities and infrastructure, good management governance, supporting funding, and law and policy as a legal umbrella in its implementation.

a. Telemedicine Policies or Standards

Policies related to data security hold four basic principles that must be carried out: security, confidentiality, data integrity, and accessibility (14). From the scientific articles obtained, none indicated the existence of standard operating procedures (SOPs) regarding taking pictures or videos during teleconsultation. Policy regarding consultation SOPs are needed to ensure the consistency of the results. Especially the standard for diagnostics from taking pictures or videos that do not go through machine tools (15). There have

been complaints against teledermatology services in Brazil because there are no clear standards for taking pictures, so the results are consistent (7).

The absence of a policy regarding telemedicine financing standards is also a complaint. Private telemedicine network service companies, Non-Governmental Organizations (NGOs), and the government want a reasonable price to cover the costs of providing telemedicine (13). Health insurers need to estimate cost coverage for their clients by using telemedicine services (9). All research journals do not explain the standard of validity of informed consent in telemedicine that can be used as a reference in obtaining it (oral or e-form). The points required in informed consent have also not been discussed.

b. Human Resources (HR)

In Brazil, health workers in rural areas continuously convince health workers in urban areas to participate in providing services with telemedicine. Nurses must be trained to perform teledermatological procedures, and a trained physician is in charge of visually examining the lesions (7). In Uttarakhand, India, consulting services by health workers are only 30% in real-time (11). In telemedicine, health workers cannot perform physical and supporting examinations directly (10). In Botswana, health workers, must be able to speak the regional language (rural) in conducting consultations (13).

In India, two articles discuss telemedicine providers for Healthcare facilities, namely Skyhealth and Aravind (5, 10). Third-party providers provide IT personnel to develop and maintain telemedicine. All journals do not explain the use of telemedicine for non-health workers, such as administrative.

c. Telemedicine Infrastructures

Lack of infrastructure can be a barrier to the creation of telemedicine. The implementation of telemedicine requires basic applications that support it (19). Telemedicine requires computer equipment with web cameras, terminal adapters, laser printers, and high-quality video conferencing systems, supporting electrical power and an uninterrupted data internet connection (20).

Hardware such as computers or smartphones equipped with cameras that can take pictures or videos with the adequate resolution is indispensable in telemedicine. Hardware installed in rural areas includes an infrared thermometer, HD camera, digital phonoscope, 12-lead electrocardiograph pressure gauge, spirometer, Oximeter, and video communication system (8). People need

smartphones to be able to access telemedicine services (13).

The software includes a network, whether an internet network, a cellular network, or an application used for telemedicine. Mali is using Skype (12). In South India, there is the Aravind network for eye care. Aravind is the largest network, with 77 telemedicine centers (6). In Bihar, India, Skyhealth is a private network provider developing telemedicine for pneumonia and diarrhea in children (10). Telemedicine requires internet connectivity to conduct audio, visual, or audiovisual consultations between health workers and patients take place in real-time (21). In China, the government provides telemedicine facilities and has reached 68.39% at the regional level (9).

d. Financial Resources

Telemedicine requires no small amount of funding to be able to maintain and develop it. Funding can be sourced from government, private, and NGO funds. Financial sources are also obtained from payments for services by patients or health facilities that use them, either paid through insurance or privately. Financial resource support is used for employee payments and the purchase and maintenance of equipment to produce higher-quality telemedicine care system (17).

Currently, there is no standard average cost for one telemedicine service charged to patients, so it is difficult to identify the number of fees that will be given to telemedicine service providers (10). Existing financial resources are also allocated for incentives for employees or telemedicine service providers to motivate them in service (22). Research shows that the amount of remuneration obtained affects the duration of telemedicine services provided in rural areas. So, with satisfactory incentives, patient satisfaction with teleconsultation will also increase.

In India, a sizable service provider is Skyhealth. This service provider gets funds from potential investors who will do a franchise network. Telemedicine service provider SkyHealth offers to join its network by paying a US$ 500 franchise for the SkyHealth Center and an investment of US$ 1000 to set up the telemedicine center, including the cost of training health workers (10).

Advantages and Disadvantages of Telemedicine in Rural Areas

The advantage of telemedicine is achieving health services for areas away from health care facilities by reducing indirect patient costs in terms of travel costs and time efficiency. Telemedicine also improves the quality of service, especially for screening of mild and simple diseases. Patients without access to specialist doctors or primary care can benefit greatly from this practice. Telemedicine can be done through audiovisual means by sending medical images for remote evaluation by specialists in fields such as radiology, pathology, ophthalmology, cardiology, and dermatology. This matter will speed up access to referral centers or speed up triage in health facilities as first aid while waiting for comprehensive services from a doctor.

The disadvantages of telemedicine are the need for a sophisticated diagnosis infrastructure and significant funds for maintaining and developing telemedicine. Infrastructure and network quality are the main factors for sending data or conducting consultations in real-time. Requires a fee for staff training so that telemedicine is carried out continuously to improve the quality of health services. Intense promotion to the public and health workers so that telemedicine is carried out on a large scale needs to be done.

Use of Telemedicine in Health Care Processes in Rural Areas

Telemedicine can improve public health status, especially in rural areas. With this technology, health services such as promotive, preventive, curative, and rehabilitation can be done. Promotive health like Bihar, India, increases public knowledge about diarrhea and pneumonia in children (10). Preventive for provision of glasses and prevention regarding cataracts as in South India (6). Curative as the team in Brazil did, with the Mobile Unit coming to remote areas so that it can perform teledermatology services as many as 40 examinations clinical dermatology including cryotherapy and surgery per day (7). Rehabilitative as in China, telemedicine has proven to be an effective way of conducting outpatient visits walk safely with high patient satisfaction (9).

In Mali, Sub-Saharan Africa, there are no standards or guidelines for filling EHR, so the filling still follows the standard of completeness of conventional medical records. The government needs to develop special regulations for EHR in telemedicine. Policies governing telemedicine already exist in Mali. Because of harmful network effects, good telemedicine users, health workers, and patients are not entirely satisfied with telemedicine services. Research shows a positive correlation between the quality of service or quality of service (QoS) and the quality of experience or service experience (QoE) (12).

In Botswana, eHealth is already not very successful due to numbers community literacy and low education. Plus, internet access and the ability of people's purchasing for smartphones is one of the

factors causing eHealth to be unsuccessful. Botswana also has a shortage of health workers, so not all health services can be handled. This is because it is difficult to arrange the distribution schedule of health workers between direct practice in health facilities and telemedicine (13).

Quality of EHR Generated by Implementing Telemedicine

Review in EHR quality assessment to improve service quality health is carried out by taking into account the needs of scalability, flexibility/integration, security and privacy, authentication, access control, interoperability, and convenience use. EHR can show patient satisfaction reports, improve accuracy documentation, reduce clinical errors, and speed up access to patient data (23). EHR quality services can improve the quality of health services with telemedicine in various countries.

In Brazil, the number of screenings for skin cancer (7). EHR boosts accuracy in administering medication for diarrhea and pneumonia after follow-up when teleconsultation. The provision of diarrhea medication increased from none to 16.7% doctors prescribing treatment correctly and for pneumonia from 11.1% to 22.9% administering drugs appropriate for pneumonia by following standard questions (10). But for safety and privacy from the patient's side felt that their confidentiality was not maintained as much as 67%, who felt comfortable during teleconsultation only 51.3% of patients and only 33% of them visited a telemedicine center (11). EHR facilitates triage in health facilities as first aid while waiting for comprehensive service by a doctor (7, 9).

CONCLUSION

Telemedicine is possible to be used by people who live in rural areas. The implementation of telemedicine has its advantages and disadvantages. Each depends on supporting factors such as government policies, resources, finance, human resources, and infrastructure as well as the target users. Telemedicine services can improve public health status in rural areas if their use is large-scale. With this technology, health services such as promotive, preventive, curative, and rehabilitation can be done by adjusting the needs of individuals and numbers of pain in an area. Telemedicine can reduce indirect costs and time efficiency of the user.

EHR makes it easy to transfer and receive patient data when telemedicine is in rural areas. Quality EHR can make it easier for health workers to carry out diagnosis, history taking, and patient care. Policies The Indonesian government is currently aiming for electronic health services, then a quality EHR has become the primary requirement for organizing telemedicine.

RECOMMENDATIONS

The journals found almost entirely did not explain the quality indicator standards of EHR for telemedicine services, so research is needed that explains the standard indicators and quality results from electronic health records for telemedicine-based services. It is necessary to research the ethical context of health workers with telemedicine. The government needs to immediately issue a legal umbrella in establishing patient diagnoses with telemedicine to protect patients and doctors suspected of malpractice.

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