Readiness of Application of Electronic Medical Records in Health Services (Literature Study)

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ABSTRACT

Background: Information and Communication Technology is advancing rapidly and has a major impact on all life, especially in the health sector, especially medical records. This is manifested in the Electronic Medical Record (EMR), which has now been further developed into an Electronic Health Record (EHR). This technology is used to replace or complement paper medical records. The purpose of this literature study is to determine the readiness to apply electronic medical records in health services.

Methods: This study uses a literature study obtained from searching scientific research articles from the 2010-2020 range. Keywords used in this study is readiness and DOQ-IT. The database used comes from Google Sholar, Garuda, Neliti, and One Search. The search found 130 articles, then a critical appraisal process was carried out to produce 10 suitable manuscripts.

Results: Various literatures found that the readiness to apply electronic medical records using the DOQ-IT method was influenced by 4 factors including the readiness of human resources, organizational culture, infrastructure, and leadership governance. It can be concluded that the readiness for the application of electronic medical records in health services with the very ready category is 30%, the moderately ready category is 50%, then the unready category is 20%.

Conclusions: From the discussion above, it can be concluded that EMR readiness in health services is categorized as quite ready (50%), very ready (30%), and not ready (20%).

Keywords: Readiness, DOQ-IT, Information Technology (IT), Governance Leadership.

INTRODUCTION

Along with the advancement of Information and Communication Technology (ICT) which brings a major impact toward all lines of life, notably to the health area especially in medical records, it is resulted an advanced technology called as Electronic Medical Records (EMR). EMR is part of Electronic Health Records (EHR) that has been widely used by several hospitals in various parts of the world to replace or complement the paper-based medical records (Triyanti E, 2018).

Electronic Medical Records (EMR) is not only used by the developed countries, but also by the developing countries which starting to adopt the electronic systems to gain effectiveness and efficiency in health services. Although those developing countries are still fully concerned with the handling of various infectious and contagious diseases, yet an effective and efficient health service documentation process is highly required (Wirajaya MKM, Dewi NMUK, 2020). In Indonesia, the development of EMR holds no specific regulation yet. However, the support in 2008’s Electronic Information and Transaction Law (UU ITE) and 2008’s Minister of Health Regulation (PERMENKES) Number 269 regarding the legitimacy of EMR as legal evidence provides a bright hope toward the development of EMR in Indonesia.

The development of EMR cannot be avoided and also has to be accepted by the whole medical record users consisting of medical recorders, doctors, nurses and other health workers. The advantages of using EMR are including more structurally stored data and much easier and faster process of data searching (Sabarguna BS, 2008). The advantages of electronic medical
records will provide many benefits toward more effective and efficient medical record management. In health services by hospital, every treatment performed to the patients from the first day hospitalized until their home return is written in a medical record book. According to the Indonesian Minister of Health Regulation Number 269 (PERMENKES RI No.269/MENKES/PER/III/2008), medical records are files containing records and documents regarding the patient identity, examination results, treatment, and other actions and services provided to the patient.

Electronic Medical Records (EMR) is the electronic version of paper medical records, which transfers records or forms previously written on paper into a computer. EMR has been widely used in hospitals around the world as a substitute or complement to paper-based medical records. In Indonesia, EMR is known as RME (Electronic Medical Record). Along with its development, EMR has become the heart of information in services of both Hospital Management Information System (SIMRS) and Public Health Center Management Information System (SIMPUS) (Triyanti E, 2018).

EMR is a life long patient medical record in electronic format about his/ her health information, written by one or more health workers in an integrated manner in every meeting between health workers and patients. EMR can be used by accessing computers from a network, with the main purpose of providing or improving an efficient and integrated health care and service (Perry & Potter, 2009). A computer-based medical record is an electronic repository of information about the health status and health services obtained by patients throughout their lives, stored in such way to serve various authorized medical record users (Triyanti E, 2018).

The data collected by the Ministry of Health through the Hospital Information System (SIRS) - a guideline for hospitals to fulfill their routine records and reports - until the end of November 2016, it is known that 1,257 hospitals from 2,588 hospitals in Indonesia already functioning SIMRS, indicating the percentage of active users around 48%. Furthermore, there are 128 hospitals (5%) not functioning SIMRS or already have one yet inactive, while hospitals with no SIMRS are around 425 hospitals (16%). Nevertheless, there are still 28% or 745 hospitals give no report regarding SIMRS, whether they already have SIMRS or not (Herlyani E, Koten B, Ningrum BS, 2020).

From a previous research, it is known that the Regional Public Hospital (RSUD) of Yogyakarta City is ready enough to develop the Electronic Medical Records/ EMR based on the EHR and Assessment by the Doctor's Office Quality Information Technology (DOQ-IT) DOQ-IT, 2009). Yet, there are still many aspects that must be fulfilled to support the successful implementation of EMR at the hospital (Pratama MH, Darnoto S, 2017). Meanwhile, at Wonotirto's Public Health Center, Blitar, the Public Health Center Management Information System (SIMPUS) is not yet applied. SIMPUS is also a program of health information system that provides information about all public health conditions at a local level (at Public Health Center or locally called as Puskesmas), starting from the patient personal data, medicine availability as well as the patient treatment data (Pratama MH, Darnoto S, 2017).

After being assessed with the DOQ-IT method regarding the implementation of SIMPUS, Wonotirto’s Public Health Center is at range II with score 53, which means that the Health Center is quite ready fulfilling some parameter of SIMPUS’s implementation readiness (Erawantini F, Deharja A, Yusfitasari Y, 2016). Although the development of EMR is not as easy as imagined, it will bring more benefits in the future. According to Richard (2012), one of the benefits of using EMR is the provision of good services, low financing and competitive advantages in the future.

In assessing the readiness of EMR implementation in health services, the research will use the DOQ-IT (Doctor’s Office Quality Information Technology) method, which using a score in its assessment. And the higher the score, the better the readiness of health services in implementing the EMR. The use of EMR requires careful preparation, and in the assessment of its implementation readiness, there are four parameters that must be prepared including human resources, infrastructure, work culture, and leadership governance. Hence, this research is intended to examine "The Readiness of Electronic Medical Records (EMR) Implementation in Health Services".
METHODS

The inclusion criteria here refer to the criteria of the selected articles in this research and serve as the research policy. The criteria used are the one published in the period of 10 years (2010-2020). The languages used are Indonesian and English. Subjects/Population include Doctors, Nurses, medical record officers, IT team and some people related to the use of medical records in hospitals. The type of article used is the original article, in the form of full text article publication. The theme of the article covers the scope of readiness, implementation, electronic medical records in health care centers (hospitals, health centers, and clinics), by applying DOQ-IT theory.

The keyword used by the authors in looking for the research articles is "Readiness, DOQ-IT". In this searching process, the authors use several portals, such as Google scholar, Garuda, Neliti, One Search, and university portals that provide RMIK (Medical Records and Health Information) education. From the process, it is found from Google Scholar: 113 results, Garuda: 32 results, Neliti: 1 result, One Search: 4 results. Then, the articles obtained are selected by looking at the entire text, resulting in 10 articles. The process of the selection can see in the Figure 1.

Figure 1 The process of the selection articles
RESULTS
The results of the literature study on the Readiness of EMR Implementation in Health Services by using 10 journals can be seen in the Table 1.

Table 1. Summary of research results

<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
<th>Population and Sample</th>
<th>Research Location</th>
<th>Research Design</th>
<th>Research summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>(13)</td>
<td>Readiness Analysis of Electronic Medical Record Implementation with DOQ-IT IT Approach</td>
<td>Doctors, medical records officers and patients</td>
<td>RS Haji Surabaya</td>
<td>Quantitative descriptive research with cross sectional approach</td>
<td><strong>Human Resource:</strong> Most of the staffs have shown their readiness in implementing EMR but there are still some of them stated that they are not ready, one of which is dominated by the statements of unwillingness to carry out EMR. <strong>Organizational Culture:</strong> Some staffs are ready but there are some of them who say they are not ready, one of which is dominated by the statement of the unavailability of instructions in carrying out EMR. <strong>Infrastructure:</strong> The availability of servers and computers is not sufficient <strong>Leadership Governance:</strong> There is no regulation in implementing EMR.</td>
</tr>
<tr>
<td>(14)</td>
<td>Strategy Analysis of Electronic Medical Record Development in the Outpatient Installation of Yogyakarta City Hospital</td>
<td>Subjects consiste d of 40 people consisting of: director, head of outpatient installation, head of service, head of nursing, head of outpatient section, deputy director of services, IT technician, outpatient medical record officer, 17</td>
<td>RSUD Yogyakarta</td>
<td>This study uses a concurrent mix method with a case study research design</td>
<td><strong>Human Resource:</strong> Already have six IT staffs. <strong>Organizational Culture:</strong> EMR Workflow is not arranged, EMR is seen as a technology that can be used for work efficiency. <strong>Infrastructure:</strong> The existence of EMR technology is seen as an investment, but the specific budget planning is still unidentified in detail for the EMR development process. <strong>Leadership Governance:</strong> The management supports the existence of EMR, however the detailed strategic planning regarding the development of EMR is not available yet.</td>
</tr>
</tbody>
</table>
nurses, 12 doctors.

(2) Analysis of Readiness of Dharma Kerti Hospital Tabanan Applying Electronic Medical Records

The population in this study were 82 health workers, consisting of hospital directors, heads of finance, heads of services, IT heads, medical records officers, doctors and nurses.

This type of research uses quantitative and qualitative methods and the design of this research is cross sectional.

Human Resource: Almost all respondents understand the importance of EMR and also the benefits of implementing it.

Organizational Culture: Already has a hospital information system that has been running well and also the scope of this hospital is not too complex thus the implementation of EMR can be faster.

Infrastructure: There are adequate facilities for IT and support from vendors, yet there is no specific financial budget for the administration of medical records.

Leadership Governance: Leaders have not formed a special team in order to accelerate the implementation of EMR.

(15) Readiness Analysis of Electronic Medical Record Application Using DOQ-IT in RSUD Dr. H. Abdul Moeloek Lampung

Consists of doctors, nurses, medical records officers, and technicians.

RSUD Dr. H. Abdul Moeloek Lampung

The type of qualitative research with a case study design and the subject of this research is determined by purposive sampling.

Human Resource: There is not a solid understanding of EMR and what its benefits are for hospitals.

Organizational Culture: There is an understanding of the organizational work culture changes that may occur when EMR is implemented.

Infrastructure: The capacity of information technology is quite strong, its SIMRS already uses servers with a temporary capacity of 8 terabytes.

Leadership Governance: The decision makers already have an understanding regarding the value of EMR.

(9) Analysis of Readiness of the Implementation of the Health Center Management Information System (Simpus) with the DOQ-IT method at the Wonotirto

Dentists, nurses, midwives, and administrative staff

Puskesmas Wonotirto Blitar

This type of research is quantitative descriptive, which describes the current state of the object based on the facts as they are then analyzed and interpreted.

Human Resource: The readiness of clinical and administrative staffs is still weak for the implementation of SIMPUS.

Organizational Culture: There is no compatible workflow to the SIMPUS as Wonotirto's Public Health Center still uses a manual service workflow.

Infrastructure: No hardware dedicated for SIMPUS implementation yet.

Leadership Governance: There is no IT management established for the implementation of the SIMPUS, and according to the staffing decree at Wonotirto's Public Health Center, there are no
(16) Readiness to Implement Health Center Management Information System (SIMPUS) in Bima City

10 officers, namely the head of the service, the secretary of the service, the head of the program and service reporting subdivision, 2 service staff, 5 heads of puskesmas, and 5 heads of TU puskesmas

Puskesmas Kota Bima

Type of qualitative descriptive research with case study design

Health Center staff originally comes from the field of IT.

(17) Analysis of Readiness for Implementation of Electronic Medical Records at Dinda Hospital Tangeran Using the Correlation Method

The entire population related to ESDM at Dinda Hospital Tangerang who met the inclusion and exclusion criteria was 145 people

RS Dinda Tangerang

This research is purpose sampling. The types of instruments used for data collection are interviews, questionnaires, and staffing data. In this study, the data collection tool used a questionnaire

Human Resource: Medical record staffs have skills in using computers, yet with a minimum of assistance

Organizational Culture: Standard operating procedures are still being prepared

Infrastructure: Most of the public health centers already have computers, but it is not optimally functioned.

Leadership Governance:

(18) Readiness of the Surabaya City Health Office in Facing the Electronic Health Office Surabaya

IT and SIK officers from the health office 1 person, medical records

Types of Quantitative Descriptive Research with cross-sectional design

Human Resource: Not explicitly implied about the availability of vendor for IT development

Organizational Culture: good enough in instilling the culture of IT importance and its use for community services

Infrastructure: Already

Leadership Governance:
Health Record (EHR) Era officers from the puskesmas 5 people and IT officers from the puskesmas 1 person have a good leadership, thus a good working atmosphere is created for IT development

(19) Readiness Assessment for the Application of Electronic Medical Records at the PKU Muhamadiyah Pakem Inpatient Clinic

- Director, 1
- Doctor, 1
- Nurse, 1
- Pharmacy, 1
- Medical Record, 1
- Financial administration person

Inpatient Clinic of PKU Muhamadiyah Pakem

Types of Descriptive Research with a qualitative approach

Human Resource: There is no IT expert to be chosen as the PIC (person in charge) of developing the EMR system

Organizational Culture: There are no policies for the development of EMR and there is no plan to implement the EMR system

Infrastructure: No hardware nor adequate software available

Leadership Governance: The budget is ready

(20) Planning for the Implementation of Electronic Medical Records in the Management of the Romana Primary Clinic Medical Record Units

- 5 officers
- Primary Clinic Romana Deli Serdang
- Qualitative Descriptive Research, data collection through observation and interviews

Human Resource: No medical record staffs yet

Organizational Culture: Already has operational standards in the management of medical records

Infrastructure: No computers and other supporting devices yet

Leadership Governance: No budget yet

From the 10 journals, it can be explained that the readiness in implementing EMR is influenced by several factors, including the following in Table 2.

Table 2 Criteria in the readiness of EMR implementation

<table>
<thead>
<tr>
<th>NO</th>
<th>Component</th>
<th>Authors</th>
<th>Scor</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human Resources</td>
<td>Staff ability in operating computers Officer Readiness There are IT staff Knowledge of RME</td>
<td>(13); (8); (15); (2); (16); (17)</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Organizational Culture</td>
<td>a. Readiness of workflow and SOP b. Have a good system</td>
<td>(8); (20); (18); (17)</td>
<td>4</td>
</tr>
</tbody>
</table>
The result of the readiness of health facilities in implementing EMR can be seen in the Table 3.

### Table 3. EMR readiness in health services

<table>
<thead>
<tr>
<th>No.</th>
<th>Place</th>
<th>Very Ready</th>
<th>Quite Ready</th>
<th>Not Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS Haji Surabaya</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RSUD Kota Yogyakarta</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>RS Dharma Kerti Tabanan</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>RSUD Dr. H. Abdul Maeloeok Lampung</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Puskesmas Wonotirto Blitar</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Puskesmas di Kota Bima</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RS Dinda Tanggerang</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Dinas Kesehatan Kota Surabaya</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Klinik Rawat Inap PKU Muhammadiyah</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Klinik Pratama Romana Deli Serdang</td>
<td>√</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION**

Information and communication technology has rapidly developed in various areas, including in the health area, one of which is the Electronic Medical Record (EMR). The completion of EMR management has begun to be implemented in several hospitals / health centers in Indonesia. As complex as the challenges for implementing EMR are, it is necessary to conduct an assessment regarding to the readiness before implementing EMR. This is the most prominent step to take before the implementation itself. The assessment of readiness will help in identifying the processes and the priority scales, and also assist the establishment of operational functions to support optimization of EMR implementation.

The process of analyzing the readiness of EMR implementation can be conducted to determine the "road map" and provide an overview of whether to continue with the electronic health record (Pratama A, Sutisna M, 2016). To determine the road map and the success of the electronic medical record development program, it is necessary to analyze the readiness of human resources, organizational culture, infrastructure and leadership governance. (DOQ-IT, 2009)

1. **Human Resources**

   The development of EMR will greatly depend on human resources (HR), both as users and as policy makers. According to the 2013 Minister of Health Regulation, information technology (IT)'s human resources for SIMRS consist of staff that at least qualified in the fields of system analysis, programmers, hardware, and network maintenance. And the staff's ability to operate computers is also an important component in supporting the development of EMR (Faida EW, Ali A, 2021).

   From Table 2, it can be seen that 60% of the readiness in implementing EMR is influenced by the readiness of of the staff in its implementation. This cannot be separated
from the staff's ability to operate computers (Faida EW, Ali A, 2021), and other researchers also said that most staffs could operate computers with a minimum of assistance (Pratama MH, Darnoto S, 2017); (Sudirahayu I, Harjoko A, 2016); (Hakim A, Saragih H, Suharto A, 2014).

Another component that affects the readiness in implementing EMR is influenced by the availability of IT staffs with a sufficient knowledge (Wirajaya MKM, Dewi NMUK, 2020); (Hakim A, Saragih H, Suharto A, 2014); (Kusriyanti D, Matuwi B, Supriyantoro, 2021). The readiness of human resources can be improved by frequent trainings to increase the their understanding related to the operating computers and the importance of using electronic medical records in the future.

2. Organizational Culture

From Table 2 it can be seen that as many as 40% that affecting the readiness in implementing EMR are the readiness of workflows and SOPs (Standart Operational Procedure); (Pratama MH, Darnoto S, 2017) (Silalahi RGH, Sinaga EJ, 2019); (Masyufah L, Uktutias SAM, 2021); (Kusriyanti D, Matuwi B, Supriyantoro, 2021). A good organizational work culture is that the leader is able to move and make policies in the form of SOPs and flows in every procedural activity that needs to be known and carried out by staffs, especially in running electronic medical records (Faida EW, Ali A, 2021).

However, some affecting factors on the failure of electronic medical records are influenced by the absence of policies in the development of EMR and there is no plan to implement the EMR system, therefore the implementation of EMR is not ready (Hidayat AR, Sari EW, 2017). And other researchers also said that the difficulty for staffs in implementing EMR is the unavailability of instructions in performing EMR (Faida EW, Ali A, 2021); (Erawantini F, Deharja A, Yusfitasari Y, 2016). It is necessary to make instructions regarding the implementation of EMR that can easily understood by the staffs in accordance with the workflow and SOPs.

3. Infrastructure

Components of information technology (IT) consist of hardware, software, procedures, databases, computer networks and data communications. And all these components are interconnected and cannot be separated. From table 2, it can be seen that as much as 50% of infrastructure readiness in implementing EMR is influenced by the availability of adequate facilities for IT consisting of computers, computer networks and support from vendors (Wirajaya MKM, Dewi NMUK, 2020); (Hidayat AR, Sari EW, 2017); all these needs cannot be separated from the financial budget, thus it must be planned and prepared (Sudirahayu I, Harjoko A, 2016); (Hakim W, Harjoko A, Lazuardi L, 2018); (Kusriyanti D, Matuwi B, Supriyantoro, 2021).

Other researchers said that the obstacle in implementing EMR is the inadequate availability of computers (Faida EW, Ali A, 2021); (Silalahi RGH, Sinaga EJ, 2019); (Hidayat AR, Sari EW, 2017); (Erawantini F, Deharja A, Yusfitasari Y, 2016), and the absence of a financial budget (Wirajaya MKM, Dewi NMUK, 2020). In this case, the leadership must complete the infrastructure required which is not yet available in health services and should be budgeted immediately.

4. Leadership Governance

Success in the EMR implementation process is influenced by a strong leadership support, participation from clinical staffs in design and implementation, staff training processes, and adequate budget planning processes (Pratama MH, Darnoto S, 2017). The role of leadership support and governance influences the development of EMR because leaders are at the highest level in decision making. Assessment areas and components of leadership governance consist of leader support, strategy, IT management support and accountability from SIMRS. The leadership area consists of two components, namely the leader's support for EMR development and an assessment of the existence of an executive team for EMR development (Pratama MH, Darnoto S, 2017).

The first critical element for the successful implementation of EMR is related to
leadership team. The leadership team is a committee that commands the development processes (Pratama MH, Darnoto S, 2017). From table 2, it can be seen that as much as 40% of the success of the readiness in implementing EMR from leadership governance factors is influenced by good leaders, good leadership whose employees will foster a working atmosphere for good IT development (Masyufah L, Uktutias SAM, 2021). With the leader's understanding of the benefits of implementing electronic medical records, it will facilitate a good decision making (Kusriyanti D, Matuwi B, Supriyantoro, 2021); (Sudirahayu I, Harjoko A, 2016). The successful implementation of medical records is also influenced by budget readiness, therefore leaders must prepare and plan finances to support the needs of electronic medical records (Hidayat AR, Sari EW, 2017).

Other researchers said that the unsuccessful implementation of EMR is influenced by several factors including the absence of a special team (Hidayat AR, Sari EW, 2017), the unavailability of regulations regarding the appeal to run EMR (Faida EW, Ali A, 2021), the absence of IT management for SIMPUS implementation and the unfitted personnel decree (9). In increasing the success of implementing electronic medical records, hospital leaders must give a socialization to the staffs about the importance of using EMR in the future.

5. EMR readiness in health services
In Indonesia, there are several hospitals that are ready to implement electronic medical records, as many as 30% with the very ready category, such as Haji Hospital Surabaya, Dinda Hospital Tanggerang, and the Health Office. Further, as many as 50% are at a fairly ready category, such as Yogyakarta City Hospital, Dharma Kerti Tabanan Hospital, Dr. H. Abdul Moeloek Lampung, Wonotirto Health Center Blitar, and Public Health Center in Bima City. For those in the unprepared category, as many as 20% are the PKU Muhammadiyah Pekam Inpatient Clinic and the Romana Deli Serdang Primary Clinic.

From the discussion above, it can be concluded that EMR readiness in health services is categorized as quite ready (50%), very ready (30%), and not ready (20%). The implementation of electronic medical records requires careful preparation. To analyze EMR readiness with the DOQ-IT method, there are 4 components that must be prepared, including:

1. Human resources
As many as 60% of HR readiness in implementing electronic medical records is influenced by the readiness of the staffs in implementing EMR. This cannot be separated from the staff's ability to operate computers. Around 30% of hospitals in Indonesia said that most of the staffs could operate computers with a minimum of assistance. Other components affecting the readiness in implementing EMR are also influenced by the availability of IT staffs and a sufficient knowledge.

2. Organizational Culture
As much as 50% of organizational culture readiness in the implementation of EMR is influenced by the workflow readiness factor or SOP. However, there are some hospitals that are not ready to implement the electronic medical record due to the unavailability of instructions to apply EMR, the absence of policies in the development of the EMR, and no plan to implement the EMR system, therefore the implementation of EMR is not ready yet.

3. Infrastructure
As much as 50% of infrastructure readiness in implementing EMR is influenced by the availability of adequate facilities for IT consisting of computers, computer networks and support from vendors. All these needs cannot be separated from the financial budget, thus it must be planned and prepared.

4. Leadership Governance
As much as 40% of the success of the readiness to implementing EMR is influenced by factors of good leadership governance, as well as the leader’s understanding of the benefits of implementing electronic medical records that will facilitate the decision making. And the success of the implementation of medical records is also influenced by the readiness of the
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Ethical approval: Nothing, just peer review.

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