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Understanding and Perception of Electronic Medical Record Systems among Health Science Cluster Students: A Systematic Literature Review

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ABSTRACT

Introduction: As technology has developed, many countries have mandated the implementation of electronic medical records. The introduction and understanding of electronic medical records should begin at the lecture stage, especially in the health science studies (health science cluster). This study aims to assess the understanding and perception of students in the health science cluster regarding electronic medical records.
Methods: This study uses a systematic literature review protocol based on the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). A literature search in three databases, PubMed, Sage Journal, and Science Direct, yielded 75 article findings. After the review process, 8 eligible articles were selected based on the inclusion and exclusion criteria.
Results: From the 8 selected research articles, it was found that students' understanding, perceptions, and experiences related to electronic medical records were very positive. The analysis revealed that electronic medical records can significantly enhance collaboration between medical personnel and healthcare workers, improve professional career development, and raise the quality of health services.
Conclusion: The acceptance and perception of students in the health science cluster are positive regarding electronic medical record learning materials. They feel very helped by the existence of electronic medical records because it makes their work easier and efficient, and also adds skills in the application of information technology in the health sector. In the future, electronic medical record learning can be developed across all disciplines in the health science cluster, such as in the health information technology module. In addition, the subject matter in learning related to the ethics of managing electronic medical records can be further developed.

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INTRODUCTION

Medical records are files containing notes and documents about a patient's identity, examinations, treatments, actions, and other services provided to the patient. These records are factual documents related to the patient's condition, medical history, and past treatments, typically completed by designated healthcare workers (usually medical personnel) who provide services to the patient. Medical records provide essential health information to all healthcare workers involved in the institution that delivers services to a patient (1-3).

Medical records currently are required to transition to an electronic format. For example, in Indonesia, this is in line with the policy stated in the Minister of Health Regulation number 24 of 2022 concerning Medical Records. Based on this regulation, healthcare facilities must implement an electronic patient medical history recording system. The transition process from a conventional (paper-based) to an electronic system will be carried out no later than December 31, 2023 (3).

According to the Indonesian Hospital Association (PERSI), a survey conducted in March 2022, showed that out of 3,000 hospitals in Indonesia, only 50% had implemented an electronic medical record (EMR) system. From this percentage, then studied further, it turns out that only 16% of hospitals have organized electronic medical records properly and correctly (3). In primary care services such as Community Health Centers (Puskesmas in Indonesia), the adoption of electronic medical records also faces numerous challenges. According to the results of a survey by the Center for Indonesia's Strategic Development Initiatives (CISDI) in 2022, of the 9,831 Community Health Centers in Indonesia, there are still 48.9% or around 4,807 Community Health Centers that have not used an electronic medical records system (4).

On the other hand, the Indonesian Ministry of Health continues to strive for digital transformation of health services. One of them is through the SATUSEHAT platform. SATUSEHAT is a connectivity platform that integrates data, analysis, and services to facilitate coordination between applications and healthcare facilities. With the connection and integration of SATUSEHAT, patients no longer need to repeatedly fill out new forms when transferring health facilities. Through SATUSEHAT, patients can get information about their health conditions more transparently because electronic medical records will also be integrated with this platform. As of September 2023, there have been 792 hospitals and health centers that have joined the SATUSEHAT platform (4,5).

If we compare it with other countries, in the United States the use of electronic medical records has reached 88% by doctors (6). In the United Kingdom, the use of electronic medical records is also highly emphasized in the National Health Service (NHS) system, and it is expected that by March 2025, all health services in the UK will have implemented electronic medical records (7). Another example, in Australia, they have an integrated electronic medical records system that is the same as in Indonesia, called "My Health Record". This is to facilitate the coordination of health services and the public can easily access any health services that have been received along with their diagnoses (8).

By looking at the utilization of information technology in recording health information and the integration of electronic medical records in an integrated manner on the SATUSEHAT or My Health Record platform and others electronic medical records system, the introduction and understanding of medical records also needs to be done since the lecture stage, especially in study programs in the health science cluster (health science studies). Usually, medical records will be the main topic for those studying in the Medicine, Dentistry, Nursing, or Medical Records and Health Information programs. However, all students in the health science cluster must be able to recognize, understand, and know the basic use of electronic medical records. This is because one of the benefits of electronic medical records is to facilitate coordination between units in health facilities.

This study of understanding and perception has been expressed in the theoretical framework of Shidiq & Faikhamta, which states that attitudes, perceptions, and understanding of a STEM field material (here, electronic medical records are included in the Technology field in STEM) are interrelated. These results will produce students who are better able to understand learning in the STEM field, including electronic medical records (9). Therefore, we must be able to know the understanding of students studying in the health science cluster about electronic medical records. To what extent do they understand, perceive, and experience the use of electronic medical records? This can be seen using the systematic review method. Also, this can help to develop the materials and curricula related to electronic medical records for various study programs related to the health science cluster. In addition, this is also

useful for improving students' adaptability when doing internships at health facilities or working full-time at health facilities.

METHOD

This research is review research with a systematic literature review method. This systematic review used a protocol based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (10). The research questions are formulated more clearly using the PICO (Population, Intervention, Comparison, and Outcome) approach method.

Table 1. Research Questions with the PICO Approach

A)	PICO Approach	B)	Explanation
C)	P: Population	D)	Students studying in the health sciences cluster major
E)	I: Intervention	F)	Health science cluster students who receive learning about electronic medical records
G)	C: Comparison	H)	Health science cluster students who do not receive learning about electronic medical records or students who are not in the health science cluster
I)	O: Outcome	J)	Understanding and perception of modules and learning about electronic medical records.

This systematic review takes from three reputable sources of research databases, namely PubMed, Sage Journal, and Science Direct. The search process uses the keywords "electronic medical record" AND "understanding" AND "perception" AND "health student" in all three databases. The authors also use the filter feature in their search to find journal articles that are full access or open access, original research article, use English, and published in the last 5 years. The process of searching and analysing articles was carried out in November-December 2024. These inclusion criteria are used to make it easier for the authors to find, sort, and analysed all findings from 3 reputable databases, and also get the latest and relevant findings.

The systematic review in this study focused on the understanding and perception of health studies students related to the implementation of electronic medical record systems. Therefore, if the search results found were not health studies students or did not discuss electronic medical records, they would be excluded. The exclusion criteria used by the authors has reasons. First, electronic medical records are commonly used by medical personnel and health workers in health care facilities. So, the authors focus on students studying in the health sciences cluster. Second, because the authors want to focus on students' perceptions of electronic medical records, so the authors focus on the electronic medical record system that has begun to be implemented in various regions due to the influence of digitalization in the health sector and the rapid development of information technology, including in the health sector. And to get clear results, the authors need to find a journal that can be fully accessed.

From the literature search on the three databases, 75 articles were found. In the screening and selection process with PRISMA, no articles were excluded due to duplication. After that, 43 articles were excluded due to the screening process of titles and abstracts that did not meet the inclusion criteria, leaving 32 articles. Then the articles were selected again by removing 24 articles because the content of the article did not meet the inclusion criteria. After the feasibility test process, 8 articles were obtained that were considered worthy of qualitative analysis and discussion. The findings of the article will be analysed thematically, namely focusing on how students in the health science cluster understand, perceive, and experience learning modules on electronic medical records with various information technology approaches (such as conventional or using AI).

To help obtain valid and reliable results, the authors used two independent (external) reviewers. The authors used the PRISMA Checklist for use by independent reviewers, and used the Cohen's Kappa score method. After the external review process, the Cohen's Kappa value was 0.68 (from a score of 0 [minimum] to 1 [maximum]). Using indicators from Landis & Koch, this score of 0.68 has been labeled “substantial” and is worthy of proceeding to the analysis stage (11).

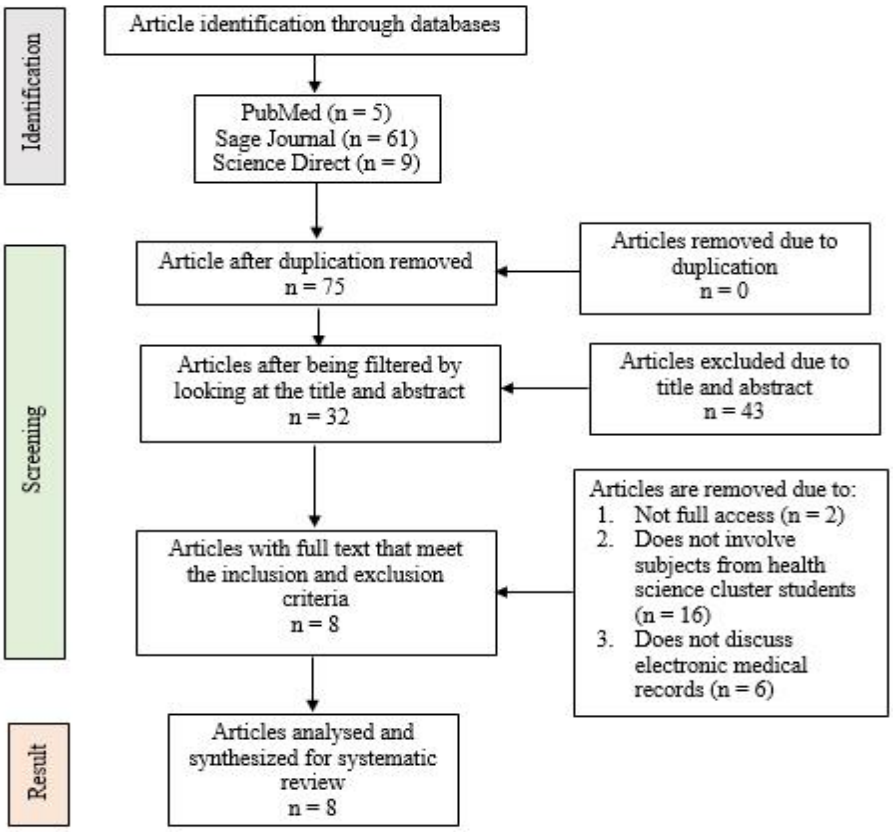


Figure 1. Flow Diagram of Article Selection using PRISMA Protocol

RESULTS

From the 8 articles reviewed, the analysis results showed that the understanding of health students regarding electronic medical records was quite good. In addition, their perceptions of electronic medical records also tended to be positive.

Table 2. Summary of the Articles Analysed

A) Author(s)	B) Study Design and Research Period	C) Subject	D) Measurement Method or Tool	E) Research Result
F) Gerstenberger et al. (2023) (12)	G) Experimental design with pre- and post-test using telesimulation method (period not stated, but lasted for 4 weeks)	H) 4th year Medical student from Spencer Fox Eccles School of Medicine at the University of Utah	I) Using three telesimulations related to Internal Medicine courses (one of which discussed electronic medical records). Data were collected at the end of the course with AY20-21 and with the help of Qualtirics.	J) Students feel that the aspect of communication and cooperation between health and/or medical personnel is very important. Communicatio

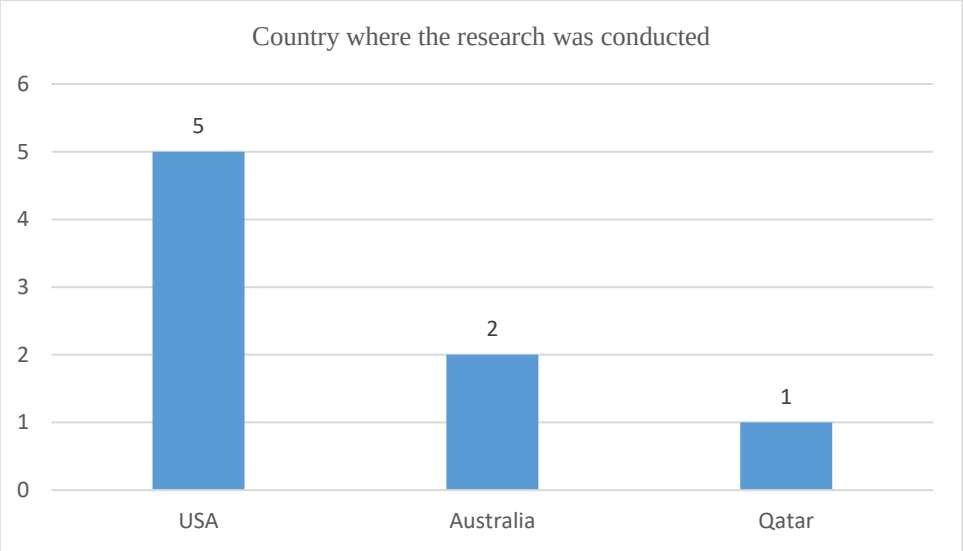
A) Author(s)	B) Study Design and Research Period	C) Subject	D) Measurement Method or Tool	E) Research Result
				n and cooperation related to the patient's condition, one of which, is by using electronic medical records.
K) Kallail et al. (2020) (13)	L) Experimental design with interview method as assessment using enrichment block method (period not stated, but runs for 8-9 weeks).	M) Medical Student at The University of Kansas School of Medicine.	N) Using an enrichment block system and using interviews as a tool to see enrichment results.	O) Students felt that this enrichment block was important for their future professional careers and one of them was about electronic medical record systems.
P) Ahmad et al. (2023) (14)	Q) Cross sectional design in November 2021 for 3 weeks.	R) Health cluster students at Qatar University	S) Using questionnaires from Oh, et al. and Abdullah & Fakieh's research. The instrument was written on kobotoolbox.org and distributed via Qatar University email.	T) Virtual Artificial Intelligence (AI), such as electronic medical records, is very useful. As many as 62% of respondents stated that they strongly agree that the use of AI in medical records is very helpful in the implementation of health care facilities.
U) Kovaric & Gingell (2024) (15)	V) Experimental design with qualitative studies in Fall 2021	W) Resident physicians from an institution in the Southern USA, with a total of 30 subjects.	X) Conducted using a 3-hour workshop method to discuss quality improvement in health services.	Y) Subjects or respondents felt that the improvement in quality of immunization services would be better if electronic

A) Author(s)	B) Study Design and Research Period	C) Subject	D) Measurement Method or Tool	E) Research Result
				medical records were developed with a reminder feature about immunization times.
Z) Maness et al. (2020) (16)	AA)Experimental design with pre and posttest (quantitative and qualitative) using the course instruction method and bioinformatics learning approach (lasting 15 weeks).	BB) Medical Student at University of Florida	CC) Conducted with the method of course instruction and learning with a bioinformatics approach. There are 3 courses, where one course lasts for 5 weeks (total lasts for 15 weeks).	DD)It was found that with information technology, electronic medical records can be useful in anatomical pathology and clinical pathology studies if combined with "omics" data from bioinformatics studies.
EE) Raghunathan et al. (2023) (17)	FF) Descriptive study, with an exploratory cross-sectional approach. An online self-assessment survey was conducted with a sample (n = 142) (data collection period September 2021 to April 2022).	GG)Undergraduate nursing students in Australia.	HH)Online survey developed with REDCap software.	II) Of the 142 respondents obtained, 52.11% of nursing student respondents had never known electronic medical records and used them. In addition, respondents perceived themselves as having the most computer usage skills at the intermediate level, as many as 57.75%.

A) Author(s)	B) Study Design and Research Period	C) Subject	D) Measurement Method or Tool	E) Research Result
JJ) Fish et al. (2022) (18)	KK)Experimental with the study used a retrospective analysis, by conducting an intervention in implementing a health design thinking learning method workshop in 2019.	LL) First-year medical students at the end of the clinical experience (CE) program year at Sidney Kimmel Medical College from both the pre-term (2018-2019) and post-term (2019-2020) periods.	MM) Conducting interventions in implementing health design thinking learning method workshops.	NN)The application of health design thinking was welcomed by respondents because it can improve the quality of performance, such as student training, health screening, and the use of information technology in health, one of which is electronic medical records.
OO)Hammoud et al. (2020) (19)	PP) Cross-sectional survey using The Phase 2 Clinical Knowledge Examination Final Survey on electronic health record use was administered to medical students after they completed the Phase 2 Clinical Knowledge component of the United States Medical Licensing Examination, specifically the Obstetrics and Gynecology section.	QQ)16,366 medical students graduated from Liaison Committee on Medical Education-accredited schools from 2012-2016 in the United States.	RR) The survey asked students about their experiences in medical school and the Phase 2 Clinical Knowledge Exam. The survey forms contained both general and unique questions and were randomly assigned to students. One form of the survey included questions asking students about their experiences accessing and entering information into the electronic medical record for the inpatient and outpatient components of the obstetrics and gynaecology clerkship.	SS) Electronic medical record use by students completing an obstetrics and gynaecology clerkship increased over the 5-year study period. In the final year, 94% of students accessed an electronic medical record, and 69% were able to enter medical data into the electronic medical record. However, >30% of students did not record and did not have the

A) Author(s)	B) Study Design and Research Period	C) Subject	D) Measurement Method or Tool	E) Research Result
				opportunity in the obstetrics and gynaecology clerkship to learn and practice the use of electronic medical records. Medical graduates who are able to use electronic medical records who intend to enter an obstetrics and gynaecology residency are more likely to be competent in documenting outcomes or electronic medical records in the future.

Table 2 explains that based on the 8 articles obtained, there is a central role of EMR implementation for all healthcare workers, both professionally and in the academic fields. Data recording and reporting of medical records based on technology can enhance the efficiency and effectiveness of performance and organizational management. If summarized in graphic visualization, the findings are as follows:



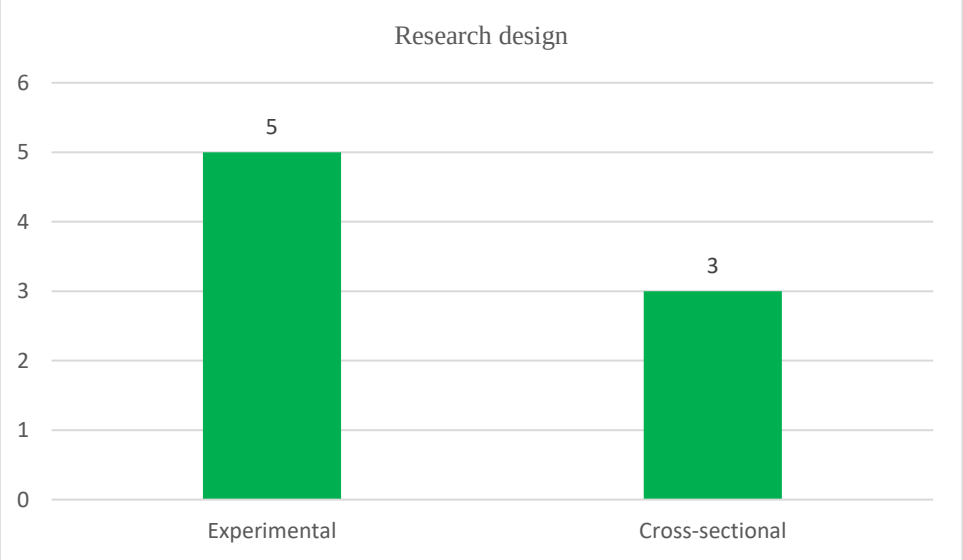


Figure 2. Summary Graph of Article Findings

DISCUSSION

Based on Table 2 in Results, it was found that health science cluster students have a positive response and understanding of the electronic medical record system. They feel very helped by the existence of electronic medical records because it makes work easier and efficient, and also adds skills in the application of information technology in the health sector. With the advancement of the times, technological developments will also develop. This technological development is also not missed in the health service system. One of the developments in this technology using medical records with an electronic system. With electronic medical records, fast, accurate, and efficient information will be the main positive effect, which decision-makers can use to make decisions accurately and quickly (1,2). In line with previous research, the effectiveness of utilizing electronic medical records is 0.87 times greater compared to healthcare services that do not use electronic medical records in improving services. (20). Electronic medical records in the current era are important to be implement and develop because they have many benefits and advantages compared to traditional systems. Some of the functions of electronic medical records include increasing

professionalism, increasing cost efficiency, speed of administrative completion, accuracy, ease of reporting, easier coordination between units, and changes in work culture that are more adaptive to technology (21-23).

Understanding and experience of using electronic medical records must be delivered from the lecture stage (high education) or when becoming a student. Students who will become prospective physicians and dentists (both general and specialist), nurses, and other health workers must at least understand the use of electronic medical records. The findings of research articles conducted in the United States, Australia, and Qatar show a very positive perception and better understanding of students regarding the health or disease conditions of patients or clients with electronic medical records (12,14,17). The study by Ragunathan et al. also revealed that year level of study, experience using computers, and experience using electronic medical records had a significant impact on students' perceptions of competency related to informatics skills (17). The results of a study by Harle et al. also explain that the use of electronic medical records can increase self-efficacy and adaptation to technology based on students' perceptions (23).

The importance of helping students in the health science cluster to understand electronic medical records is also in line with the results of research by Mannevaara et al., which states that understanding electronic medical records is not only for practitioners working in health services (doctors, nurses, managers, etc.) but also students. These students are at various levels such as undergraduates (3-years associate and bachelor) or postgraduate (masters and doctoral). (24,25). In the same study, it was found that important competencies applied in the application of health information technology are aspects of documentation and communication. One of the important topics to be given to students is the digitalization of documentation from a person's health examination results or electronic medical records. In addition, it is important to provide learning materials related understanding clinical and non-clinical data and how to store, collect, and access (data management) health information. It is also important for the development of health information systems (one of which is electronic medical records) regarding the security and confidentiality of patient data that has been collected (24,25).

This is because, based on research by Arie et al., the completeness of electronic medical records in one of the Community Health Centers (Puskesmas) in Surabaya, Indonesia, has not reached 100%. The incompleteness or low numbers are found in the validation and reporting indicators. The reasons for this incompleteness include limited resources and a lack of awareness and understanding among health service providers (26,27). Learning to understand the understanding and perceptions about electronic medical record in each country is important considering that the culture of each country and each higher education environment is different. Different cultures will create different understandings and perceptions. This will affect the quality of the use of electronic medical records in healthcare facilities. The results of a study by Lakhmudien et al. in Indonesia found that professional medical record personnel still have a lack of understanding of electronic medical record regulations that are interrelated with each other. In addition, an understanding of information system design and ICT literacy skills are also still lacking. It was also found that medical record personnel are still trapped in a negative perception that assumes that electronic medical records will be able to eliminate their profession in the future (28).

Understanding and perception related to medical records can be improved in professionals if given further socialization and training. According to the results of research from Suryanto, intensive socialization can improve the understanding and perception of health laboratory officers related to electronic medical records (29). However, if further understanding is given at the professional level (for people who have worked), this condition is said to be a little too late. This is because, with the spread of information technology in various lines of activity, if college graduates (especially in the health sciences cluster) are not balanced with knowledge of information and communication technology (one of which is electronic medical records) then the quality of college graduates will lag compared to colleges that have provided electronic medical records in lectures.

The success of the electronic medical records implementation is influenced by several determinant factors, including the ability and capability of human resources in supporting compliance with proper data recording, as well as the existence of structure planning and implementation. Additionally, the effectiveness of management plays a vital role in the operation of electronic medical records, especially in the realm of professional healthcare services (30). The development of training related to electronic medical records can enhance interest among healthcare workers and students. Tailoring the training to meet the needs, system requirements, objectives, and organizational environment in developing knowledge can improve the success of electronic medical records implementation (31).

The use of electronic medical records is also related to patient satisfaction with the health services received. Based on a literature study from Liu et al., it was found that the use of professional electronic medical records can increase patient satisfaction related to health services (32). The results of research by Antonio et al. who conducted an intervention study on the use of telehealth, found that the use of information technology in health services (telehealth) can help patients increase their knowledge and awareness of their health, including the existence of electronic medical records (33).

The limitation of this study is the small number of research findings in 3 reputable databases. This is what makes the initial findings very small in number. That is why the authors took this topic so that more researchers are interested in studying the understanding and perception of health cluster students regarding electronic medical records. In addition, the findings of this study are also limited to 3 countries, namely the United States, Australia, and Qatar. So, the findings of this study may be different if applied in other countries, especially developing countries, such as Indonesia. However, it is hoped that this study can spark other researchers in health behavior, medical and health education, and health informatics to collaborate on similar research topics.

CONCLUSION

This study tried to assess health science studies (health science cluster) students' understanding, perceptions, and experiences related to electronic medical records. The findings demonstrated that students' understanding, perceptions, and experiences related to electronic medical records were very positive. Very positive here means that students can accept very well the development of technology, especially in the field of medical records. They feel very helped by the existence of electronic medical records because it makes work easier and efficient, and also adds skills in the application of information technology in the health sector.

These results suggest, theoretically, to development of materials and curricula related to electronic medical records for various study programs related to the health science cluster. This is done, practically, by embedding learning modules such as health information technology or digital health or electronic medical records itself, which discuss the implementation of electronic medical records in each country, in the curriculum of all study programs in the health cluster.

While this study provides valuable insights into medical records, health information management, and medical and health science education, certain limitations should be noted, such as the lack of findings from articles conducted in Asian countries. Future research could focus on countries that have not published their electronic medical record systems in reputable papers, who have concerns in the field of medical records and health information management, with health science cluster majors developing research on this topic, and potentially enhancing topic about introducing an electronic medical records system in the country the ethics of managing electronic medical records.

AUTHOR'S CONTRIBUTION STATEMENT

Danang Wahansa Sugiarto (DWS) was responsible for the study conception, design, analysis, and drafting, writing, and revising manuscript. Ayudhia Rachmawati (AR) was responsible for the reviewing, writing, and revising manuscript.

CONFLICTS OF INTEREST

The authors declare no potential conflicts of interests with respect to the study, authorship, and/or publication of this article.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that this research does not use AI for substantial writing of all parts of the research or does not generate AI results in substantial writing. The authors use AI only to assist in checking grammar.

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