

# Community-Based Electronic Recording and Reporting in Indonesia: Systematic Review

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## ABSTRACT

**Background:** Implementing electronic-based health information systems in Indonesia has shown a significant increase in the last decade. However, many problems still need to be solved that hinder the effectiveness of this system. Studies describing the implementation of electronic-based data collection, monitoring, and reporting show confusing results. **Aim:** This review aims to evaluate the implementation of community-based electronic data collection, monitoring and reporting. **Method:** PRISMA guidelines was used to conduct this review. Databases used to search relevant literature including PubMed, Sciondirect, Willey Online Library, and Proquest. Authors independently screening and extracted the data from the eligible studies. CASP for qualitative study was used to assess the quality of the study. **Result:** There are nine studies that matched with the inclusion criteria. Area of recording, monitoring, and reporting including maternal and child health, NCDs, and Tuberculosis. the challenges faced by Indonesia in implementing the ERMR including internet connections, access to electricity, absence of regulations, human resources, facilities, Fragmented application, Age, Pandemic, and lack of communication. Based on those barriers, infrastructure in supporting the implementation of ERMR is the most stated in the studies included. **Conclusion:** The implementation of ERMR is crucial for the Indonesian government to address immediately, given the significantly substantial benefits for the health status of the Indonesian people. The availability of adequate infrastructure, especially in remote areas, will support satisfactory public health services.

**Keywords:** Health, Recording, Monitoring, Reporting, Indonesia.

## INTRODUCTION

Health information system is a set of arrangements that include data, information, indicators, procedures, devices, technology, and human resources that are interrelated and managed in an integrated manner to provide guidance on taking necessary actions or decisions in supporting development in the health sector<sup>1</sup>. The assessment results of the six components of the Indonesian Health Information System based on the Health Metrics Network in 2016 were as follows: 58% for resources, 76% for indicators, 69% for data sources, 56% for data management, 72% for information products, and 84% for usage<sup>2</sup>.

In Indonesia, the health information system is integrated with the health system through the *Puskesmas* to find cases and provide health services<sup>3</sup>. However, in its implementation, there are still some problems. In a national study on the quality of the surveillance system in Indonesia, it was found that there is a gap in the distribution of Human Resources (HR) and infrastructure that is not evenly distributed. Based on the 2017-2019 national reports, there has been an increase in the completeness of reports nationally (55%, 64%, and 75%) and the speed of reporting (55%, 64%, and 75%), there will be a decrease in quality<sup>4</sup>. Whereas information about health must be relevant, accurate, timely and efficient as a basis for making decisions regarding the handling of infectious diseases to prevent the spread of disease, epidemics, death or disability due to the disease<sup>5,6</sup>.

The possibility of intentional and unintentional errors in recording and reporting causes the accuracy of information to decrease<sup>7</sup>. Errors in recording and reporting lead to uncertainty in reporting results<sup>8</sup>, resulting in disruption of systems for detecting outbreaks of common sources of disease (for example, in food-borne outbreaks), planning and evaluation of prevention and control programs (for example, for vaccine-preventable diseases)<sup>9</sup>. Therefore, an infectious disease reporting system is very important to help target prevention programs, identify certain subpopulations with the highest risk, and use resources efficiently<sup>10-11</sup>. In Indonesia, a health information system is integrated with the health system through the Public Health Center to find cases and health services<sup>12-14</sup>.

In accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 31 of 2019, the public health center's information system is an arrangement that provides information to assist the decision-making process in managing the public health center to achieve its target<sup>5</sup>. Recording refers to a series of activities to document the results of observations, measurements, or calculations at every step of health effort carried out by the public health center<sup>5</sup>. Public health center or *Puskesmas* is a health service facility that organizes public health efforts and first-level individual health efforts by prioritizing promotive and preventive efforts in its working areas<sup>15-16</sup>. The information presented by the public health center can be the basis for decision-making at various levels of the health system and various types of health management, improving the quality of service to the community.

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Evaluation of information systems is a process to explore and find out the extent to which an information system implementation activity, whether in the aspects of perceptions, users, organizations, or information and technology systems<sup>17</sup>. One of the models to evaluate information systems is the Human Organization Technology Fit (HOT Fit) Model by<sup>18</sup>. The important components in this evaluation model are humans, which include system use and user satisfaction; organization, which includes organizational structure and environment; and technology, which includes system, information, and service quality<sup>19</sup>. This study aims to evaluate the implementation of community-based electronic data collection, monitoring and reporting.

## METHOD

### Search Strategy

We followed PRISMA guidelines to conduct the systematic review<sup>20</sup>. (Page et al., 2021). We searched four electronic databases: PubMed, Scencedirect, Willey online library, and Proquest. The search terms included four categories: Indonesia, recording, monitoring, reporting, data management, and electronic tools. Search terms are listed in table 1 for all databases.

### Inclusion and Exclusion Criteria

We included studies if they described electronic data collection, management or analysis tools that were used in Indonesia either for survey, monitoring, and reporting. Studies published from 1st January 2010 to April 2023 in English, were included.

We excluded studies that described clinical trials in outbreaks, management and analysis of outbreak or outbreak-related humanitarian data. Study analyzed legal protection, hospital setting, and educations also were excluded.

### Identification of potentially eligible studies

We exported identified studies to Mendeley desktop software and removed any duplicates. Two authors independently assessed the

relevance of all titles and abstracts based on inclusion and exclusion criteria. In the case of differing views on the inclusion of an article, consensus was reached by discussion between the two researchers. Full-text articles were retrieved for all potentially relevant studies. Two authors independently assessed the full text articles using the inclusion and exclusion criteria.

### Data Extraction

The authors independently reviewed studies that met the inclusion criteria. Demographic data were collected from each eligible study. Year of publication, research objectives, study design, health reported, barriers, and research findings are documented.

### Study quality assessment

Kualitas studi dinilai menggunakan the Critical Appraisal Skills Program (CASP) for the qualitative study (CASP, 2018). This tool consists of 10 questions which are divided into four sections with the choices of Yes, No, and Can't Tell checklist columns. We categorize the quality of studies into High, Medium, and Low. High quality studies if you have answers YES 10 /10, medium quality if you have answers YES 8 – 9/10, and Low quality if answers YES ≤7/10.

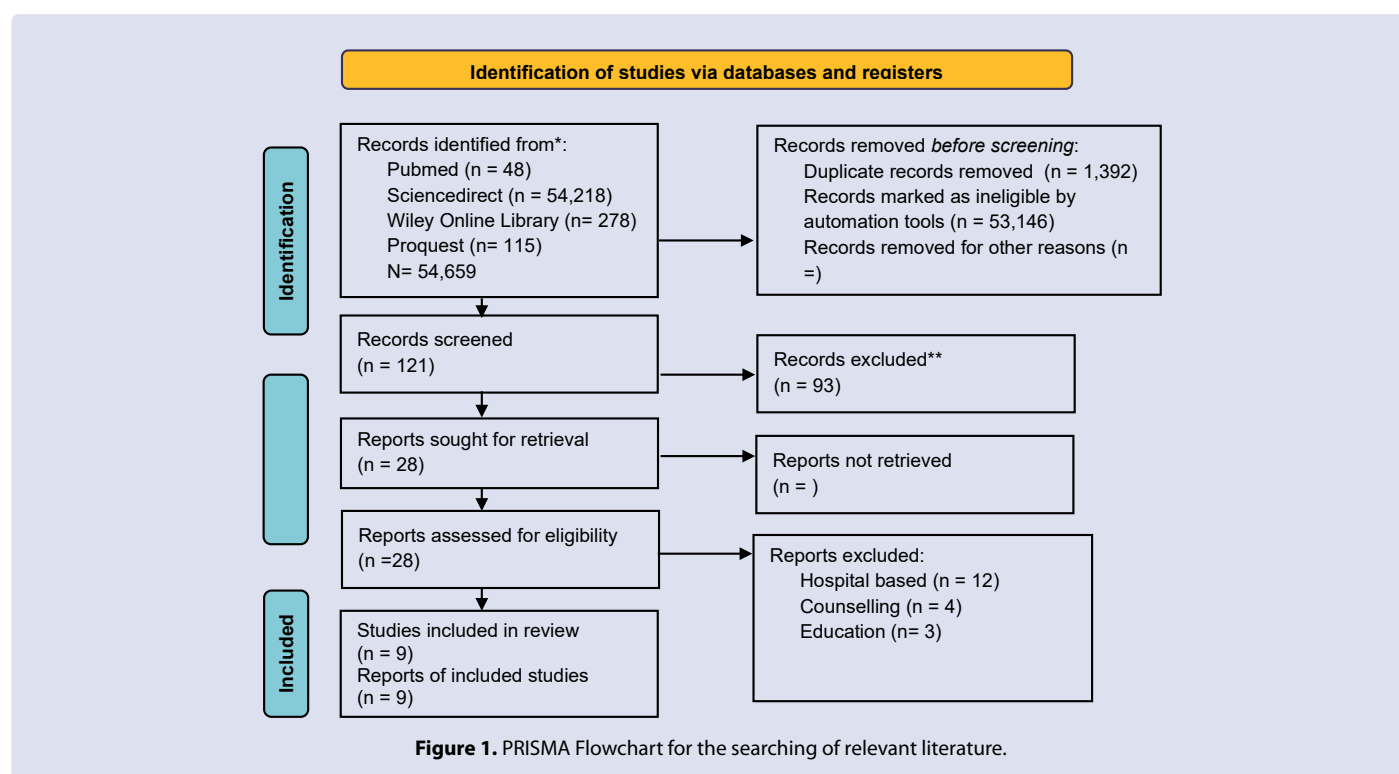
## RESULT

### Study Selection

A systematic electronic search identified that 54,659 publications were discovered through backward searching of relevant papers. The full-text screening was conducted on 121 articles. A total of 93 articles failed to meet eligibility criteria at the full-text screening stage, and only 9 articles were finally eligible for further analysis. The search results follow the PRISMA 2020 flow diagram (Figure 1).

### Characteristics of the eligible studies

Based on the year of publication, we found that the studies included in this study were published in the range of 2016 to 2023. The study design used was observational and qualitative or mixed methods.



**Table 1. Search string in databases.**

Databases	Search Terms
Pubmed	((("electronic health records" [MeSH Terms]) AND (((("records" [MeSH Terms]) OR ("monitoring" [Title/Abstract])) OR ("reporting" [Title/Abstract])) OR (surveillance [Title/Abstract]))) AND ("indonesia" [Title/Abstract]))
Scimedirect	electronic health records AND records OR monitoring OR reporting OR surveillance AND indonesia
Wiley online library	electronic health records AND records OR monitoring OR reporting OR surveillance AND indonesia
Proquest	electronic health records AND records OR monitoring OR reporting OR surveillance AND indonesia

**Table 2. The Basic characteristics of eligible studies.**

Author, Year	Purpose	Study Design	Health Reported	Barriers	Findings
Barnett et al., 2016	– the impact of the mobile phone application on data accuracy, timeliness, and real-time responsiveness	Mix-method	Nutrition in child	Connection to server, Access to electricity	– The mobile application increased the accuracy, improved the timeliness, increased responsiveness during growth monitoring
Faza et al., 2022	– Data quality: completeness, accuracy, consistency of the app	Mix-method	Mother and child health (MCH) and nutrition problems	Absence of regulations, human resources, pandemics, connection with the government’s applications, facilities, and infrastructure	The completeness, accuracy, and consistency of the data were in good quality.
Jusril et al., 2020	– Digital health real-time monitoring of immunization coverage	Prospective observational design	Immunization	Connectivity	– Associations between coverage and reporting frequency ( $R^2 = 0.28$ , $p < 0.0001$ ) – Strong relationships between reporting frequency and compliance (Risk Ratio [RR] 15.4)
Kurniawan et al., 2021	– Population’s health status according to the healthy family index through the CBHIS approach	Observational	Family health	Facilities, socialization	Health status of the community can be determined accurately through mHealth report
Lazuardi et al., 2021	– Maternal and child health information systems to support continuum of care services.	Qualitative	Maternal and child health	Fragmented application, connectivity	Useful report for continuum of care
Rinawan et al., 2022	– Demonstrate data quality analysis on its completeness, accuracy, and consistency – Map the data quality in Indonesia	Observational	Maternal and child health	Age, Pandemic	Good data quality in Completeness, accuracy, and Consistency
Wulandari et al., 2023	– Implementing portable health clinic to monitor NCDs	Qualitative	Non-Communicable Disease	Complexity of applications, Facility condition, connectivity	Improved monitoring NCD patients
Paskaria et al., 2022	– Digital health to solve the DPPM-TB problems	Qualitative	Tuberculosis	Lack of communication,	Digital health solution ensured the flow of information and communication between the public and the private health sector
Siregar et al., 2021	– m-Health for the early detection of CVD	Operational study	Cardiovascular Disease	Difficulties of the application, Connectivity	– Be able to reach the productive age population significantly (87.1%) – Simplifies CVD risk predictions

**Table 3. Quality assessment of the eligible studies using CASP for Qualitative study.**

Author	Section A					Section B				Section C
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Barnett et al., 2016	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Faza et al., 2022	Y	Y	Y	Y	Y	N	N	Y	Y	Y
Jusril et al., 2020	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Kurniawan et al., 2021	Y	Y	Y	Y	Y	N	Y	N	N	Y
Lazuardi et al., 2021	Y	Y	Y	CT	Y	N	N	Y	Y	Y
Rinawan et al., 2022	Y	Y	Y	CT	Y	N	N	Y	Y	Y
Wulandari et al., 2023	Y	Y	Y	Y	Y	N	Y	N	Y	Y
Paskaria et al., 2022	Y	Y	Y	Y	Y	N	Y	Y	N	Y
Siregar et al., 2021	Y	Y	Y	Y	Y	N	Y	N	Y	Y

\*Y: yes, N: no, CT: can't tell

## Study quality assessment

Assessment of study quality using CASP for qualitative studies. Based on the results of the assessment, four studies had 8 “yes” answers, three studies had 7 “yes” answers and two studies had 9 “yes” answers. These results indicate that the studies included in this review are in the Moderate quality category.

## Reported fields

Most of the included studies address the issue of electronic reporting and monitoring of maternal and child health issues<sup>21-25</sup>. More specifically, the areas discussed are nutrition in children in Barnett et al., and Faza et al. and immunization coverage<sup>26</sup>. In addition, other fields discussed are Family Health<sup>27</sup>, PTM<sup>28</sup>, Tuberculosis<sup>29</sup>, and CVD<sup>30</sup>.

## Challenges in implementation of electronic recording, monitoring, and reporting in Indonesia

Based on the results of qualitative interviews, the included studies explained that there are several obstacles to using digital or electronic applications, including internet connections<sup>21-25</sup>.

These barriers may be related to the geographic location of the research, where there are significant differences between urban and rural areas. For those studies that did not find any obstacles related to the internet connection, the interviewed participants are located in urban areas, and vice versa for people who live in rural areas.

## Benefit in the implementation of electronic recording, monitoring, and reporting

Domains that become parameters for assessing the benefits of implementing electronic or digital forms include completeness, accuracy, timeliness, and consistency. In general, studies report that based on this domain, electronic or digital-based recording, monitoring, and reporting improve the quality of reporting compared to conventional paper-based reporting. Qualitatively, the included studies state that using this electronic-based application increases the reporting frequency because health workers or cadres in the community find it easier to apply and do not need to carry more items, as is the case with paper-based reporting.

## DISCUSSION

The current review's main finding is that several community-based applications are available for various health conditions in Indonesia. The birth of electronic or digital-based application development is based on the ineffectiveness of paper-based reports and the large potential for data errors. However, the authors believe the widespread implementation of electronic-based data collection, monitoring, and reporting, especially in Indonesia, needs to be implemented properly due to limited infrastructure.

The ERMR revolution provides great promise for improving public health surveillance, but this promise is still unrealized. Use of ERMR for surveillance has many potential benefits. ERMR provide an opportunity to streamline and improve current surveillance practices. Their use could greatly improve the reporting of non-laboratory diagnosed diseases as well as the collection of treatment and risk factor data, so long as these data are entered in the application. The electronic report could be built with integrated, disease-specific surveillance modules with prompts for disease-specific questions—symptoms, treatment, exposures, and contacts—to assure that the necessary data are collected. ERMR could be used to greatly enhance surveillance for health status. They have the potential to expand the purview of routine surveillance to include maternal and child health status, NCDs, and communicable diseases at little marginal cost per condition. They can also provide rich data on health care utilization, treatment patterns,

and outcomes that are currently very difficult to assess with routine surveillance methods. Finally, ERMR provide multiple opportunities for greater integration of public health and clinical health by enhancing information sharing in both directions.

Using ERMR for public health surveillance has many challenges. As mentioned in the studies included in this review, the challenges faced by Indonesia include internet connections<sup>21-25</sup>. Indonesia's vast territory and budget constraints are the main reasons related to the availability of infrastructure for ERMR implementation. However, this can be a substantive input to achieve completeness and good reporting of public health status nationally.

In Indonesia, health workers are assisted by trained community members appointed by the Public Health Center to monitor and report on activities. They are called health cadres and get incentives for the activities carried out. However, most cadres still need proper training and have difficulty using ERMR. According to Rinawan and colleagues in his study, age was one of the inhibiting factors in reporting using ERMR. Most older ages have difficulty adapting to gadgets and tools in ERMR-based reporting. Younger cadres usually help provide a more detailed explanation for using ERMR<sup>25</sup>. In addition, other studies state that the number of applications used is a factor that makes cadres overwhelmed in making reports. Each area of health services has its application, for example, for toddler growth using e-KMS, for child nutrition using e-PPGBM, and so on<sup>24</sup>.

## CONCLUSION

This review provides information on electronic-based data collection, monitoring, and reporting of public health status. Regarding the benefits or advantages of ERMR, of course, it illustrates an urgent need for implementing ERMR nationally, but that must also be accompanied by the availability of infrastructure or facilities that support the sustainability of ERMR. This review provides information on electronic-based data collection, monitoring, and reporting of public health status. Regarding the benefits or advantages of ERMR, of course, it illustrates an urgent need for implementing ERMR in Indonesia, but that must also be accompanied by the availability of infrastructure or facilities that support the sustainability of ERMR.

In the development of community-based ERMR, in the future, it is necessary to consider the ease of application, the efficiency of the application to be less in terms of number but covering all areas or fields of health in the community, and regulations related to the implementation of ERMR.

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