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ORIGINAL ARTICLE

EVALUATION OF DIPHTHERIA SURVEILLANCE SYSTEM IN PROBOLINGGO DISTRICT: STUDY OF SYSTEM APPROACH AND ATTRIBUTES

Evaluasi Sistem Surveilans Difteri di Kabupaten Probolinggo: Studi Pendekatan Sistem dan Atribut

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ABSTRACT

Background: There is still an outbreak of diphtheria in the Probolinggo district in 2023. Diphtheria mainly affects children who are not immunized. Support through a surveillance system is needed to overcome the diphtheria problem. This study aims to describe the quality of diphtheria surveillance systems based on system approach and surveillance attributes. **Methods:** Descriptive research was carried out on 17 samples with an evaluation study on the diphtheria surveillance system in 2023 at health centers in the working area of the Probolinggo District Health Office. Data were collected by interview and document study using questionnaires and check list sheets. Data analysis was carried out by describing the system components and attributes of the surveillance system in 17 respondents, compared with the Diphtheria control guideline book 2023, Indonesian Minister of Health Regulation No. 45 of 2014, and surveillance attributes (Guidelines for Evaluation of Public Health Surveillance System) from CDC. The information obtained was presented in the form of tables and narratives. **Results:** The evaluation of diphtheria surveillance system components (input, process, output) in Probolinggo District was done using surveillance guidelines. Meanwhile, the diphtheria surveillance system assessment based on attributes showed simplicity, flexibility, acceptability, representativeness, stability, and

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good data quality. However, the system is not yet sensitive, and timeliness is still low. **Conclusion:** The implementation of the diphtheria surveillance system has mainly been carried out well, supported by the completeness of several surveillance attributes. Optimizing the use of the SKDR application is necessary to improve the current surveillance system.

ABSTRAK

Latar Belakang: *Wabah difteri masih terjadi di Kabupaten Probolinggo pada tahun 2023. Difteri terutama menyerang anak-anak yang tidak diimunisasi. Dukungan melalui sistem surveilans diperlukan untuk mengatasi masalah difteri. Penelitian ini bertujuan untuk mendeskripsikan kualitas sistem surveilans difteri berdasarkan pendekatan sistem dan atribut surveilans.* ***Metode:*** *Penelitian deskriptif dilakukan pada 17 sampel dengan studi evaluasi terhadap sistem surveilans difteri tahun 2023 di puskesmas wilayah kerja Dinas Kesehatan Kabupaten Probolinggo. Pengumpulan data dilakukan melalui wawancara dan studi dokumen menggunakan kuesioner dan lembar daftar periksa. Analisis data dilakukan dengan mendeskripsikan komponen sistem dan atribut sistem surveilans pada 17 responden, kemudian dibandingkan dengan Buku Pedoman Pengendalian Difteri 2023, Permenkes RI No. 45 Tahun 2014, serta atribut surveilans (Guidelines for Evaluation of Public Health Surveillance System) dari CDC. Informasi yang diperoleh disajikan dalam bentuk tabel dan narasi.* ***Hasil:*** *Evaluasi terhadap komponen sistem surveilans difteri (input, proses, output) di Kabupaten Probolinggo dilakukan dengan menggunakan pedoman surveilans. Sementara itu, penilaian sistem surveilans difteri berdasarkan atribut menunjukkan bahwa sistem ini memiliki kesederhanaan, fleksibilitas, keterterimaan, keterwakilan, stabilitas, dan kualitas data yang baik. Namun, sistem ini belum sensitif dan ketepatan waktunya masih rendah.* ***Simpulan:*** *Pelaksanaan sistem surveilans difteri pada umumnya telah berjalan dengan baik, didukung oleh kelengkapan beberapa atribut surveilans. Optimalisasi penggunaan aplikasi SKDR diperlukan untuk meningkatkan sistem surveilans yang ada saat ini.*

INTRODUCTION

Diphtheria is a vaccine-preventable disease (1). Corynebacterium diphtheriae causes the highest number of diphtheria cases worldwide in Indonesia (2). The disease is characterized by a greyish-white pseudomembrane firmly attached to the underlying mucosal tissue and bleeds very easily if manipulated (2,3).

It is a disease that once occurred but is now re-emerging. Diphtheria is transmitted through the air, droplets when talking, and through direct contact with diphtheria patients (4). The average mortality rate from diphtheria is 5-10% in children under 5 years old and 20% in adults over 40 years old (5). The disease can infect anyone but is more common in children who are not immunized (6).

In Indonesia, low coverage of routine immunization is one factor that triggers diphtheria outbreaks. The best way to reduce Immunization-Preventable Diseases (PD3I) cases in Indonesia, including diphtheria, is for people to undergo complete immunization (7). The mortality rate is about 50% if untreated and without immunity, but about 10% if treated (8). Diphtheria is a disease that occurs every year in East Java. The number of diphtheria cases in 2022 increased 1.46 times compared to 2021. The death rate is similar, increasing 0.21 times compared to 2022.

Probolinggo District is one of the regions in East Java Province that shows a relatively high incidence of diphtheria. Based on the results of the initial analysis of health problems in the area, it was found that the incidence of diphtheria showed an

increasing trend over the last three years 2021-2023. In 2022, the Case Fatality Rate (CFR) due to diphtheria in Probolinggo District was recorded at 60%, indicating a high severity of cases (9). In addition, in 2023, Probolinggo District was still categorized as an area experiencing an outbreak of diphtheria at the provincial level.

A sound surveillance system is needed to quickly detect, report, and respond to cases. For this reason, it is necessary to evaluate the surveillance system to assess the effectiveness of the surveillance program in supporting the achievement of program objectives, indicators, and targets so that it can be the basis for policy-making related to health programs. The public health surveillance system is assessed to identify aspects that require improvement and provide suggestions to increase the system's effectiveness. This study also aims to describe the implementation of diphtheria surveillance in the Probolinggo District based on a system approach and assessment of surveillance system attributes.

METHODS

This type of research is included in evaluative research, which evaluates and assesses an activity using a qualitative approach to obtain in-depth information from informants or data sources about the activities carried out to explain the actual situation in the field. This research was conducted at the Probolinggo District Health Office from May 2024 to August 2024. The results of the study will be compared with epidemiological surveillance theory.

The object of the study was the epidemiological surveillance activities carried out by the health centers in the working area of the Probolinggo District Health Office. The population of this study were all diphtheria surveillance managers at the Probolinggo District Health Office and health centers. The sample of 17 informants was determined by purposive sampling technique with the criteria of health centers with positive diphtheria cases accompanied by CFR and health centers that have not had diphtheria cases in the last three years 2021-2023.

The informants were managers of the diphtheria surveillance program at 17 health centers, namely Dringu, Kuripan, Bantaran, This research applied ethical principles, such as usefulness, confidentiality, and justice, and obtained a research ethics letter from Universitas Airlangga, Faculty of Dental Medicine Health Research Ethical Clearance with number 1036/HRECC.FODM/X/2024.

RESULTS

Respondent Characteristics

The results of the evaluation of the diphtheria surveillance system in Probolinggo District based on the system approach and surveillance attribute assessment can be seen in Table 1.

An Overview of The Diphtheria Surveillance System Based on a Systems Approach

Input

From the results of the evaluation of diphtheria surveillance program managers in Probolinggo District, it is known that they have met the quantity, where all health centers have their own diphtheria surveillance program managers. However, the quality has not met the qualifications of surveillance program managers because it still does not meet the qualifications set by the Ministry of Health, where it is known that out of 17 health centers, there are only 13 (76.47%) health center officers who have received surveillance training, and there are still four (23.53%) officers who have not received surveillance training. This is due to the change of four (23.53%) new diphtheria surveillance program managers, with a tenure of <1 year and have not received health surveillance training. As for the longest program managers >10 years, only three (17.65%) exist. This certainly requires more effort to educate new program managers to carry out their duties and responsibilities by the Minister of Health's regulation on surveillance implementation (10). In line with research by Rimonda et al (11), which states that there are dengue fever program managers who have not had epidemiological training.

The implementation of diphtheria surveillance is supported by the availability of funding sourced from the State Revenue and Expenditure Budget (APBN) and Regional Revenue and Expenditure Budget (APBD). Funding for surveillance activities is appropriate. Namely, 17 health centers (100%) already have funding for surveillance program activities. It's just that specific surveillance programs, such as diphtheria surveillance, are not explicitly allocated but become part of the budget for the surveillance of potential outbreak diseases in surveillance and immunization.

Diphtheria surveillance guidelines are available, but program managers still have not read them because some health centers have new

diphtheria surveillance officers. This is due to the change of old officers to new officers. Namely, there are four officers (23.53%) with a tenure of <1 year, so there are still those who have not read the guidelines. At the same time, only three people had the longest tenure of>10 years (17.65%). Another influential factor was that all 17 officers (100%) had more than one workload.

There are still facilities and infrastructure that cannot function properly. For example, three (17.64%) health centers still have an unstable internet network in their area, which has hampered the sending of reports with the Early Warning Alert and Response System (EWARS) application. Not all facilities and infrastructure are dedicated to the diphtheria surveillance program. Therefore, all 17 surveillance officers (100%) use personal laptops for reporting and data analysis activities.

External elements' involvement in diphtheria surveillance activities includes cross-program involvement, namely health promotion officers and environmental health officers, and cross-sectoral involvement, namely local government, Indonesian National Army, and Police, in the discovery and tracking of close contacts of cases or suspected diphtheria cases.

Table 1
Evaluation Results of Diphtheria Surveillance System in Probolinggo District Based on System Approach and Surveillance Attribute Assessment

Component	Evaluation result
	System Approach
1. Input	
1) Man	Not all surveillance officers received training
2) Money	Availability of funds from the State Revenue and Expenditure Budget (APBN) and Regional Revenue and Expenditure Budget (APBD), as well as adequate surveillance activities
3) Material	Available to support surveillance
4) Method	Available as a surveillance guideline
5) Market	Available external support
2. Process	
1) Data Collection	According to the guidelines of Minister of Health Regulation No. 45-Year 2014
2) Processing Analysis and Data Interpretation	Analysis and interpretation of the data processing results have not been carried out
3. Output	
1) Epidemiological information	Available
2) Dissemination	Information dissemination has been carried out
4. Attribute Surveillance	
1) Simplicity	Simple
2) Flexibility	Flexible
3) Sensitivity	Not sensitive
4) Acceptability	Acceptable
5) Representativeness	Representative
6) Timeliness	Timeliness is still low
7) Stability	High stability
8) Data Quality	High data quality
9) NPP	Low predictive positive value

Process

Based on the evaluation of the diphtheria surveillance system in the Probolinggo District, the flow of diphtheria surveillance data collection is appropriate. However, the implementation of active surveillance at health centers has not run optimally. It is also known that case mapping, further analysis, and interpretation of the diphtheria surveillance program in Probolinggo District have not been carried out by each health center officer. Regarding

the Minister of Health Regulation No. 45 of 2014, which states that the data analysis process must be carried out actively, 41.18% of respondents still have not done the surveillance analysis process.

Output

Based on the evaluation results, it is known that the person in charge of the diphtheria surveillance program at the health center of Probolinggo District has disseminated information on the results of the diphtheria surveillance program delivered during routine monthly reports (Mini Workshop). As for the data visualization results, 6 (35.29%) health centers still have not visualized routine surveillance data. In Probolinggo District, only 11 (64.71%) health center stated that routine data visualization has been carried out with the help of graphs from the Early Warning Alert and Response System (EWARS) application. So, in this case, it can be concluded that the output component of the diphtheria surveillance system in the Probolinggo District has not been fulfilled.

Overview of Diphtheria Surveillance System Based on System Approach

Simplicity

Based on the evaluation results, the surveillance system implemented in the Probolinggo District is simple. This is due to the effectiveness of the ongoing surveillance process, where reporting and data collection have been integrated between health center officers and officers in the village, in this case, the Sub- Health Center, and Village Health Pos. with the support of the Health Center Management Information System (SIMPUS) and Integrated Disease Surveillance (STP), so that the data collection process becomes more efficient. In addition, data compilation has also been integrated. It is running well with the help of the Early Warning Alert and Response System (EWARS) application, which can quickly provide information if a new diphtheria case is found so that the reporting system can be more straightforward.

Flexibility

From the evaluation results, it was found that the current surveillance system is flexible. This is because the implementation of the diphtheria surveillance system in the Probolinggo District has never changed, both in terms of system changes in routine report applications and case findings' reporting flow. This is because the diphtheria incident report system has been integrated by various parties, not only from the health center and Health Department officers but also involving government and private hospital officers and clinics in the Probolinggo District. By utilizing the WhatsApp Group (WAG) and Early Warning Alert and Response System (EWARS) notifications, it is easier to inform all surveillance officers to conduct epidemiological investigations more quickly. Technological interventions have helped make human life easier (12), The same thing is also done in Lesotho, South Africa which uses an information system called 'LeCellPHIA' (Lesotho Cell Phone Population- Based HIV Impact Assessment Survey) for a web-based surveillance system or application (13).

Sensitivity

Based on the evaluation results, by utilizing the WhatsApp Group (WAG), the current diphtheria surveillance system has been integrated from various parties so that when there are new cases, all parties connected to the WhatsApp Group membership can be immediately informed. However, the sensitivity of surveillance officers at health centers is still not optimal in detecting cases early on, even though the accuracy and speed in identifying diseases play a role in the success of treatment. Delays in diagnosis are still common in health centers due to the lack of sensitivity of medical personnel in recognizing early symptoms. As a result, some diphtheria-positive cases are only detected in hospitals, where medical personnel are more vigilant. Therefore, increasing the capacity of health workers in early detection should be a priority. With close monitoring and continuous training, the health surveillance system is expected to optimally protect the public from infectious diseases.

In addition, delays in sending routine reports through the Early Warning Alert and Response System (EWARS) are still an obstacle, with 52.94% of surveillance officers not sending reports on time. As a result, real-time reporting has not been realized, so the diphtheria data analysis process has experienced obstacles. It can be concluded that the current diphtheria surveillance system cannot detect diphtheria cases as early as possible.

This is different from the results of research conducted at the Depok City Health Centre, which has utilized a reporting system by implementing a web-based health center software application of Community Health Center so that the reporting is more accurate in accordance with the standard reporting format set by the Indonesian Ministry of Health (14).

Acceptability

The evaluation results show that the current diphtheria surveillance system is acceptable. This can be seen from officers' active participation in routine case data collection and reporting through the weekly Early Warning Alert and Response System (EWARS) report based on events and zero reporting. In addition, stakeholders' involvement in implementing diphtheria surveillance is also an important indicator. They play a role in tracking cases that require cross-sector collaboration, including assisting officers in finding close contacts for confirmed cases.

Representativeness

Representativeness in this evaluation was assessed based on the reporting units in the areas that reported diphtheria cases. The evaluation results show that the current diphtheria surveillance system has fulfilled the representativeness aspect. This is due to the integration of diphtheria suspect reports that come from health center and include reports from clinics and hospitals. A notification system supports this reporting process through a WhatsApp Group (WAG) managed by surveillance officers throughout the Probolinggo District. This system immediately lets all surveillance officers know every newly discovered diphtheria suspect case. In addition, some cases that the Health Office follows up on also come from hospital reports so that the data recorded are more accurate and can reflect the actual conditions in the field.

Timeliness

The evaluation results revealed that there were still delays in sending reports through the EWARS application. Nine (52.94%) health centers experienced delays in sending routine reports from week 1 to week 30 of 2024. This could hamper the data analysis process, affecting the evaluation so that policies can be based on invalid data. Putri (2022) also revealed the same thing in a literature review regarding assessing surveillance information systems in supporting health resilience in Indonesia, which stated that delays in providing reports are still an obstacle at this time (15). Therefore, assessment of the surveillance system has a vital role in ensuring its implementation by applicable regulations so that it can be used as a basis for planning and guidelines in decision-making to deal with disease events (16).

Data Stability

The stability of the diphtheria surveillance system is considered good if the EWARS application can be accessed smoothly without experiencing significant interruptions during its use. Based on the report of the health center surveillance officers, 17 officers (100%) stated that the EWARS application has never faced significant obstacles. Officers can operate this application efficiently in inputting and managing data for analysis. The existence of this application makes the current surveillance system easier.

Data Quality

The evaluation results show that data stability in the diphtheria surveillance system is of good quality. This is supported by applying a uniform recording and reporting format in all 17 health centers (100%) so that there are no differences in the preparation of reports. With the standards applied, all data in the diphtheria recording and reporting form are filled in entirely without missing parts. This consistency is maintained through a periodic validation process between the health center and the Probolinggo District Health Office every three months. Therefore, it can be concluded that the quality of data in diphtheria surveillance in the Probolinggo District has reached an excellent level. This is in contrast to the results of a study conducted by Masturoh et al (17), in which the completeness and accuracy of reports were still low, thus affecting the quality of the surveillance system.

DISCUSSION

System Approach

Based on the system's approach to the input component, the description of the diphtheria surveillance system consists of five aspects: man, money, material, method, and market.

Input

The input component of the evaluation consists of five aspects: man, money, material, method, and market. Based on the regulation on the implementation of health surveillance, it is stated that the diphtheria surveillance program manager must meet the qualifications of the program manager. The Regulation of the Indonesian Minister of Health No. 45 of 2014 concerning the Implementation of Health Surveillance must be supported by the availability of human resources competent in the field of epidemiology. By this regulation, there must be a diphtheria surveillance program manager who has competence in epidemiology as evidenced by a history of diphtheria surveillance training, educational background, ability to understand the disease, and

ability to carry out a series of diphtheria surveillance activities (analysis, data interpretation, and sensitivity in capturing new cases).

A critical aspect of developing a surveillance system is the availability of adequate diphtheria surveillance personnel with appropriate competencies. Therefore, the presence of professional diphtheria surveillance personnel is a top priority in improving the surveillance system at the district level (18). Funding is assessed based on the availability and adequacy of financing for implementing the diphtheria program. Minister of Health No. 45 of 2014, the Implementation of Health Surveillance, states that the implementation of health surveillance must be supported by adequate funding. Meanwhile, the method for implementing diphtheria surveillance was assessed based on the availability and implementation of guidelines for diphtheria surveillance activities.

Facilities and infrastructure are assessed based on the availability of facilities and infrastructure that help carry out diphtheria surveillance, such as computers/laptops, internet networks, laboratory examination logistics, communication tools, operational vehicles, and recording and reporting applications. The market is assessed by the involvement of external cross-program and cross-sector elements in implementing diphtheria surveillance.

Process

The flow and frequency of diphtheria surveillance data collection assesses data collection. The implementation frequency and the study results evaluate data management and analysis. The process of diphtheria surveillance is assessed from the aspects of data collection, management, and analysis. The data collection process consists of report completeness, timeliness of submission, data compilation, data analysis, and data interpretation. The ideal conditions should be data collection, data processing, data analysis, and dissemination as an inseparable unit to produce information that is objective, measurable, and comparable over time, between regions, and between community groups as material for decision-making (19).

Output

Output is assessed based on information obtained from the current surveillance system. Information types include the number of diphtheria cases and deaths based on variables (person, place, and time), IR rate, CFR, weekly diphtheria suspect reports in the EWARS application, monthly reports on diphtheria incidence, diphtheria outbreak reports, and reports on the results of epidemiological investigations.

Attribute Approach

Simplicity

Simplicity refers to the public health surveillance system's structure and ease of operation (20). The indicators used to assess simplicity are diagnosis establishment, ease of data collection flow, data recording, data compilation, data analysis and interpretation, and difficulty filling out diphtheria surveillance report forms.

Flexibility

The flexibility of a public health surveillance system is described as the ability to adjust to changes in information needs or operational conditions with little additional cost, effort, and time (21). Implementation of indicators assesses the application of flexibility if changes affect the increase in cost, effort, and time.

Sensitivity

The sensitivity of the surveillance system is measured based on the level of data collection and the proportion of cases or health problems that can be utilized to describe trends in case incidence. The sensitivity of the diphtheria surveillance system in Probolinggo District is assessed by the ability of the diphtheria surveillance system to describe the possibility or indication of an outbreak that could occur. Sensitivity assessment is evaluated by the ability of the surveillance system to detect diphtheria outbreak cases as early as possible and the diphtheria surveillance system's ability to handle diphtheria cases. The speed at which the surveillance system can identify potential outbreaks can be measured by alerts that can capture and detect changes so that the risk of an outbreak is detected as early as possible.

Acceptability

Acceptability reflects the willingness of individuals and organizations to participate in implementing the diphtheria program surveillance system in the Probolinggo District. As a subjective attribute, acceptability is essential in ensuring the availability of accurate, consistent, complete, and timely data (22). A high level of acceptability indicates the active involvement of various parties in supporting the implementation of diphtheria surveillance so that the diphtheria surveillance system can run optimally and effectively. The implementation of the health system in Indonesia

involves interconnected stakeholders who play a role in its implementation (23). Accessibility is viewed from acceptance of the diphtheria program management system and non-systems, such as across programs and sectors, communities, and organizations.

Representativeness

Representativeness is when case finding and reporting are correctly recorded (24). It is achieved when the reported diphtheria data reflect the conditions in the field, whether collected by health centers or hospitals based on individual aspects, location, and time. The level of representativeness is measured by comparing the characteristics of the reported cases with the entire incidence that occurred.

Timeliness

Timeliness in supporting supervision and maintaining data quality refers to the availability of sufficient and relevant diphtheria data in the Probolinggo District (25). Aspects assessed in timeliness include the ability of the diphtheria surveillance system to provide data quickly to support disease control and long-term diphtheria program planning. Timeliness describes how speedily or slowly diphtheria events are reported. Timeliness assessment was conducted based on weekly reporting of diphtheria-suspected cases through the EWARS application. Timeliness is optimal if it reaches a target of at least 80%.

Data Stability

Reliability and availability are crucial elements in the diphtheria surveillance system. Reliability describes the ability of the system to collect, process, and present data accurately and error-free so that the information generated can be used as a reliable basis. On the other hand, availability refers to the capacity of the system to continue functioning optimally when needed, ensuring timely accessibility of data and analysis to support efficient decision-making in disease control efforts (26). The stability of the diphtheria surveillance system is good if the EWARS application can be accessed quickly and does not experience significant interference when used.

Data Quality

Data quality relates to the level of data accuracy, which aims to minimize errors in interpretation (27). Data quality describes the completeness and validity of the data used in the surveillance system. Data stability refers to the reliability of the supporting facilities used in the program to operate correctly without failure or interruption. The assessment indicators of data completeness and accuracy assess the system's quality. The data are said to be complete because all activities are reported in the EWARS routine report and the tracking results report.

CONCLUSION

It can be concluded that the results of evaluating diphtheria surveillance system components (input, process, output) in Probolinggo District are based on surveillance guidelines. Meanwhile, assessing the diphtheria surveillance system based on attributes shows simplicity, flexibility, acceptability, representativeness, stability, and good data quality. However, the system is not yet sensitive, and timeliness is still low. We, therefore, recommend optimization in the use of the SKDR application to improve the current surveillance system.

Research Limitations

This study has several limitations. A significant portion of the data was obtained through interviews and document reviews, which may introduce subjective bias due to varying individual perceptions and interpretations of the surveillance system. Furthermore, the involvement of newly assigned surveillance officers who have not yet undergone comprehensive training could affect data validity, particularly in terms of understanding and implementing standard reporting procedures and diphtheria surveillance protocols.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

AUTHOR CONTRIBUTIONS

LNM: developed the main concept, analyzed data, and compiled articles. SSNS: guided during research and revision. S: provided direction. AT: gave advice and suggestions by reviewing. RA: final version of the manuscript.

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REFERENCES

1. Truelove SA, Keegan LT, Moss WJ, Chaisson LH, Macher E, Azman AS, et al. Clinical and epidemiological aspects of diphtheria: a systematic review and pooled analysis. Clin Infect Dis [Internet]. 2020 Jun 24;71(1):89–97.
2. Ministry of Health of the Republic of Indonesia. Guidelines for prevention and control of diphtheria. Jakarta; 2017.
3. WHO. Field guide for preparedness and response to diphtheria outbreaks in the Western Pacific Region [Internet]. Pacific WHORO for the W, editor. Manila; 2023.
4. Fardani SA, Wahyono TYM. Distribusi kasus difteri, riwayat imunisasi difteri, tingkat keparahan gejala dan risiko kematian pada penderita difteri di Indonesia tahun 2020 – 2022. J Epidemiol Kesehat Indones [Internet]. 2023 Dec 31;7(2):77.
5. Niken Istania Nuryanti, Hendrati LY. Prevalence of risk factors for diphtheria: CLTS and DPT-HB-HIB3 immunization coverage in East Java (periode 2018-2020). J Kesehat Lingkunganngkungan [Internet]. 2022 Jul 29;14(3):153–62.
6. Saunders R, Suarca IK. Diagnosis and management of diphtheria. Cermin Dunia Kedokt [Internet]. 2019;46(2):98–101.
7. Mpungi I, Zainuddin A, Jumakil J. Case study of diphtheria in toddlers in Henda village, Sampolawa sub-district, South Buton district. J Gizi dan Kesehat Indones. 2022 Jan 22;1(3):108–13.
8. Ministry of Health Republic of Indonesia. Indonesian Health Profile of 2021. Jakarta; 2022.
9. Probolinggo District Health Office. Probolinggo District Health Profile 2022. 2023.
10. Minister of Health of The Republic of Indonesia. Regulation of the minister of health of the Republic of Indonesia Number 62 of 2017 on product license of medical devices, in vitro diagnostic medical devices and household health products. Indonesia; 2017.
11. Rimonda R, Saputra FF, Paradhiba M, Artika A. Overview of the implementation of dengue fever (DBD) surveillance at the Meureubo Health Center based on a systems approach and surveillance attributes. J Ilm Kesehat Rustida [Internet]. 2024 Jul 1;11(2):162–74.
12. Saini DK, Bala S, Sharma AK, Zia K. Emerging technologies for pandemic and its impact. In: Hybrid Artificial Intelligence and IoT in Healthcare [Internet]. Springer, Singapore; 2021. p. 291–310.
13. Greenleaf AR, Francis S, Zou J, Farley SM, Lekhela T, Asiimwe F, et al. Influenza-like illness in Lesotho from July 2020 to July 2021: population-based participatory surveillance results. JMIR Public Heal Surveill [Internet]. 2024 Oct 8;10:e55208–e55208.
14. Delimayanti MK, Waluyanti FT, Riandini. Web-based application of community health center (puskesmas) for patient electronic medical records. In: Proceedings of the 11th International Conference on Information Integration and Web-based Applications & Services [Internet]. New York, NY, USA: ACM; 2009. p. 567–71.
15. Miftah ZPZ. ResearchGate. 2022. Evaluation of surveillance information systems in supporting health resilience: a literature review.
16. Ilahi V, Dt. Mangguang M. Evaluation and implementation of the Covid-19 epidemiological surveillance system at the Class II Padang Port Health Office in the Minangkabau International Airport working area.. Heal Med J. 2021 Dec 31;4(1):40–6.
17. Masturoh I, Sugiarti I, Riandi MU. Evaluation of dengue fever surveillance system in Tasikmalaya city. Balaba J Litbang Pengendali Penyakit Bersumber Binatang Banjarnegara [Internet]. 2021;17(1):57–72.
18. Purnawan IN. Evaluation of the implementation of the non-communicable disease (NCD) surveillance system in Gianyar district, Bali province: a qualitative approach using ISI analysis. IAKMI J Kesehat Masy Indones [Internet]. 2022;3(2):91–8.
19. Fitri RF, Helda H. Evaluation of the Covid-19 surveillance system in Bengkulu City, Bengkulu Province in 2021. J Nurs Public Heal [Internet]. 2022 Oct 19;10(2):210–8.
20. Chimsimbe M, Mucheto P, Govha E, Chadambuka A, Karakadzai M, Juru TP, et al. An Evaluation of the Notifiable Disease Surveillance System in Chegutu District,

Zimbabwe, 2020: a cross-sectional study. Pan Afr Med J. 2022;41(215):1–12.
21. Madamombe K, Karakadzai M, Masoja G, Dhliwayo T, Juru T, Chadambuka A, et al. Evaluation of the weekly disease surveillance system for epidemic-prone diseases in Makonde District, Zimbabwe 2020: a descriptive cross-sectional study. Pan Afr Med J. 2022;43(1).
22. Purwanto AD. Phlebitis surveillance system evaluation based on surveillance attribute at Rumah Sakit Umum Haji Surabaya. Dama Int J Res [Internet]. 2018;3(5):99–104.
23. Nugraheni DT, Sulistiadi W. Kebijakan academic health system dalam upaya pemenuhan tenaga kesehatan di Indonesia : systematic review. Innov J Soc Sci Res [Internet]. 2023;3(6):1827–44.
24. Setiawan DC, Wahyono TYM, Apriani W. Evaluasi sistem surveilans kematian bayi di provinsi Sulawesi Tengah tahun 2022. Med Alkhairaat J Penelit Kedokt dan Kesehat [Internet]. 2024;5(3):356–61.
25. Riyanto S, Marlina E, Subagyo H, Triasih H, Yaman A. Metode penilaian kualitas data sebagai rekomendasi sistem repositori ilmiah nasional. Baca J Dokumentasi dan Inf [Internet]. 2020 May 29;41(1):11.
26. Noor NS. Evaluation of hypertension surveillance system in Semarang city with attribute approach. Media Gizi Kesmas [Internet]. 2023 Nov 30;12(2):891–7.
27. Njuguna C, Vandi M, Mugagga M, Kanu J, Liyosi E, Chimbaru A, et al. Institutionalized data quality assessments: A critical pathway to improving the accuracy of integrated disease surveillance data in Sierra Leone. BMC Health Serv Res. 2020;20(1):1–9.