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ORIGINAL ARTICLE

ATTRIBUTE-BASED EVALUATION OF DENGUE SURVEILLANCE IN SUMENEP REGENCY: ASSESSING EFFECTIVENESS AND RECOMMENDATIONS FOR IMPROVEMENT

Evaluasi Surveilans Demam Berdarah Dengue Berbasis Atribut di Kabupaten Sumenep: Menilai Efektivitas dan Rekomendasi Perbaikan

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ABSTRACT

Background: Dengue Hemorrhagic Fever remains a significant public health concern in Sumenep Regency, with cases and fatalities reported annually. In 2023, both the incidence rate (27.74/100,000 population) and the case fatality rate (1.96%) exceeded the national targets (IR ≤10; CFR ≤0.6%). Therefore, evaluating the dengue surveillance system is essential to assess its performance and support effective control measures. **Purpose:** This study evaluates the dengue surveillance system in Sumenep Regency in 2023 based on surveillance system attributes to provide recommendations for improvement. **Methods:** The study was conducted at a public health center (puskesmas) and the Regency Health Office, involving 17 informants, including surveillance officers and DHF program managers. Data were collected through interviews, document reviews, and observations using questionnaires and sheets. Analysis was based on surveillance system attributes aligned with Indonesia's DHF prevention and control guidelines, with results presented in tables and narratives. **Results:** The surveillance system demonstrated good data stability and timeliness, but remains complex, inflexible, has low user acceptance, is not yet representative, and is not yet sensitive. **Conclusion:** The dengue surveillance system in Sumenep needs improvements in simplicity, user acceptance, representativeness, sensitivity, and data quality. Efforts should simplify processes, integrate active and passive surveillance, standardize procedures, and strengthen coordination to improve system effectiveness.

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ABSTRAK

Latar belakang: *Demam Berdarah Dengue masih menjadi masalah kesehatan di Kabupaten Sumenep, dengan kasus dan kematian yang dilaporkan tiap tahun. Incidence rate per 100.000 penduduk (27.74) dan case fatality rate (1.96%) belum mencai target yang telah ditetapkan nasional(CFR ≤0.6%, IR ≤10). Evaluasi sistem surveilans diperlukan untuk menilai kualitas dan kemampuan sistem dalam mencapai dan mendukung pengendalian DBD.* ***Tujuan:*** *Mengevaluasi kualitas sistem surveilans DBD di Kabupaten Sumenep tahun 2023 berdasarkan atribut sistem untuk memberikan rekomendasi yang tepat.* ***Metode:*** *Penelitian ini menggunakan studi evaluasi terhadap sistem surveilans DBD di puskesmas dan Dinas Kesehatan tahun 2023. Informan berjumlah 17 orang, terdiri dari petugas surveilans dan pengelola program DBD. Data dikumpulkan melalui wawancara dan studi dokumen menggunakan kuesioner serta lembar observasi, kemudian dianalisis berdasarkan atribut sistem surveilans. Penyajian data ditampilkan dalam bentuk tabel,dan narasi.* ***Hasil:*** *Sistem surveilans DBD memiliki dan stabilitas data baik, dan ketepatan waktu tinggi, tetapi masih belum sederhana, belum fleksibel, tingkat penerimaan masih rendah dari pengguna sistem, belum representative, dan belum sensitif.* ***Simpulan:*** *Sistem surveilans memiliki stabilitas data dan ketepatan waktu yang baik, tetapi masih kompleks, tidak fleksibel, penerimaan penggunanya rendah, belum representatif, dan belum sensitif. Upaya harus difokuskan pada penyederhanaan system, integrase surveilans aktif dan pasif, standardisasi prosedur, dan penguatan koordinasi untuk meningkatkan efektivitas sistem.*

INTRODUCTION

Dengue is an infectious disease caused by the dengue virus and transmitted by Aedes mosquitoes (1,2). Some infected individuals experience mild or no symptoms, while others develop severe symptoms, which may require hospitalization and can be fatal. In 2020, the WHO identified dengue as one of the top ten global health threats (2). WHO is commitment to dengue prevention and control is outlined in Global Strategy for Dengue Prevention and Control 2012–2020 and A Road Map for Neglected Tropical Diseases 2021–2030, with a goal of 0.00% case fatality rate by 2030.

Indonesia has prioritized dengue prevention and control, with aims for 90% of regencies to achieve a DHF incidence rate (IR) of ≤10 per 100,000 population, with a case fatality rate (CFR) target of ≤0.60% (3). However, the 2023 Indonesian Health Profile Report recorded a national IR of 41.36 per 100,000 population and a CFR of 0.78%. In East Java Province, one of the DHF endemic areas in Indonesia, the IR was 23.30 per 100,000 population, and the CFR was 1.10%. All regencies in this province reported DHF cases, with 26 (68.42%) recording deaths, and CFRs ranging from 0.42% to 2.96%. Sumenep is a regency in East Java that consistently reports DHF cases and fatalities yearly. In 2023, its IR was 26.88 per 100,000 population, and the CFR was 2.00%, exceeding the targets.

Indonesia's 2021 dengue control strategy focuses on strengthening surveillance and improving outbreak response (3). The national dengue surveillance has built a system by collecting various data to obtain information for effective and efficient decision making, through: 1) the Early Warning Alert and Response System (EWARS), 2) the Arbovirosis Information System (SIARVI), and 3) the Vector Control Information System (SILANTOR).

However, with its vast territory and large population, Indonesia features diverse geographical conditions, such as in Sumenep Regency. This area presents unique public health concerns, as one-third of its puskesmas are on the island. Initial assessments indicate that not all reporting units fully implemented the required surveillance activities, and recording and reporting remain

incomplete. Despite these challenges, research on the dengue surveillance system in this regency is limited and has not been previously conducted. To address these issues, evaluating the dengue surveillance system is essential. This evaluation will help improve the system's effectiveness. A strong surveillance system is critical for dengue control; routine evaluations ensure it meets program goals. The findings will provide recommendations to improve the effectiveness of dengue surveillance.

METHODS

This study employed an evaluation design conducted from July to August 2024. It assessed the implementation of dengue surveillance in Sumenep Regency for 2023, involving the Regency Health Office and eight selected public health centers (puskesmas), representing 26.67% of all puskesmas in this regency. Selection was based on specific criteria related to variations in incidence rate (IR) and case fatality rates (CFR), as follows: Puskesmas Saronggi (high IR, high CFR), Pamolokan (high IR, high CFR), Ganding (low IR, low CFR), Gapura (low IR, low CFR), Pandian (high IR, low CFR), Moncek (high IR, low CFR), Dasuk (low IR, high CFR), and Talango (low IR, high CFR). The inclusion of only eight puskesmas was due to limited time and resources, which is acknowledged as a limitation of the study. The study included 17 informants, comprising DHF program managers and surveillance officers. At Puskesmas Pandian, one officer was responsible for DHF program management and surveillance.

Data collection involved structured interviews using a questionnaire, document reviews with a checklist, and direct observations using an observation sheet. Descriptive analysis evaluated the dengue surveillance system based on simplicity, flexibility, acceptability, representativeness, sensitivity, timeliness, data quality, and stability. In this evaluation, positive predictive value could not be calculated due to the absence of detailed data on dengue suspects that underwent laboratory confirmation. The evaluation framework followed the CDC's Guidelines for Evaluating Public Health Surveillance Systems (2001) and aligned with Indonesia's national regulations and DHF control guidelines (1,4). Findings are presented in tables and narratives for better interpretation. This study adhered to ethical principles and received approval from the Faculty of Public Health Ethics Committee, Universitas Airlangga (Approval No. 165/EA/KEPK/2024).

RESULTS

The result of the evaluation of the dengue surveillance system was summarized in Table 1.

Simplicity

The dengue surveillance system is not yet considered simple. The system lacks simplicity in data collection due to variations in the types of dengue infections reported. Among the puskesmas, only 37.50% (3/8) reported all types of dengue infections, including Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF), and Dengue Shock Syndrome (DSS). The remaining puskesmas document only DHF and DSS cases. Additionally, reporting suspected cases through the EWARS website was inconsistent, with only 75.00% (6/8) puskesmas submitting reports.

Recording and reporting processes are complex at the puskesmas and regency health office levels due to multiple recording and reporting formats and a lack of system integration. Reporting units are required to complete more than five different formats, including: 1) DHF outbreak report (W1); 2) Weekly report via EWARS website (W2); 3) Routine monthly aggregate report (K-DBD); 4) Case investigation report via SIARVI format; 5) Individual DHF patients report (DP-DBD); 6) Hospital Report case report (KD-RS); 7) Vector control report via SILANTOR website. The lack of integration increases the workload, making data recording and reporting inefficient.

At the puskesmas level, data processing and analysis remain challenging due to the absence of automated data processing capabilities. Although the regency health office can process and visualize data, its analytical capacity is insufficient for comprehensive epidemiological assessments based on person, place, and time.

Flexibility

The dengue surveillance system has undergone modifications, particularly in the recording and reporting. Since late 2022, puskesmas have gradually transitioned from using individual recording formats to aligning their case investigation reporting with the SIARVI format. The collected data is submitted to the regency health office, which uploads it to the SIARVI website. Following this transition, the dengue surveillance system has shown flexibility regarding human resources and costs, as no additional personnel or expenses have been required. However, in terms of time efficiency, the system remains inflexible. The data entry process for case

investigations in SIARVI format requires additional time, with officers spending an average of five minutes per case to complete the input. This condition resulted in an increased workload.

Acceptability

This study assessed acceptability based on the participation of system users, specifically DHF program managers and surveillance officers, as well as non-users, including cross-program, community members, and organizations. Findings indicate that acceptability among system users remains low. Only 12.50% (1/8) had never recorded or reported dengue case investigations using the SIARVI format. Additionally, in puskesmas that conducted recording and reporting with the SIARV format, the data completeness level was only 35.00%, far below the minimum target of 90.00%. At the regency level, only 70.00% (21/30) of puskesmas recorded and reported case investigations using the SIARVI format, but data completeness remained low, with only 37.00% of the expected reports submitted. Furthermore, only 19.04% (4/21) achieved full recording and reporting of all case investigations.

In contrast, the acceptability among non-users is relatively high. Non-users participate in surveillance and control activities, strengthening collaboration and engagement, including: 1) Health promotion and environmental health teams support disease prevention and control; 2) Cadres and community organizations participate in awareness campaigns, education programs, and larval monitoring activities as larval monitoring cadres; 3) Mass media plays a crucial role in disseminating dengue prevention information to the public.

Representativeness

Representativeness refers to the extent to which DHF case reports accurately reflect the actual disease burden in the area, based on data submitted by reporting units. The findings indicate that the current system has low representativeness. About 25.00% (2/8) of puskesmas had never reported suspect cases on the EWARS. At the regency level, 26.67% (8/30) of puskesmas have not consistently recorded and reported suspect cases weekly through EWARS. This inconsistency reduces surveillance data's overall representativeness and completeness, potentially leading to underreporting and delays in response efforts.

Sensitivity

The sensitivity was evaluated based on reporting suspected cases on the EWARS website. The findings indicate that the system's sensitivity remains low, as not all puskesmas effectively detected, recorded, and reported suspected cases. Only 25.00% (2/8) of puskesmas reported several suspected cases equal to or greater than the number of confirmed DHF cases. At the regency level, 40.00% (12/30) puskesmas reported fewer suspected cases than confirmed DHF cases. This discrepancy suggests that many suspected cases remain unreported, potentially delaying public health interventions and increasing the risk of outbreaks.

The system's ability to detect potential case increases or outbreaks was assessed by verifying dengue alerts on the EWARS. The evaluation showed that outbreak detection sensitivity remains low. Among the sampled puskesmas, six alerts were triggered across three puskesmas, but only 16.67% were verified within 24 hours. At the regency level, the overall alert verification rate was 77.77%, with 66.67% verified within 24 hours, 11.11% verified after 24 hours, and 22.22% left unverified. These rates fall below the minimum target of 80.00%, indicating outbreak detection and response delays.

Timeliness

The timeliness was evaluated based on the weekly reporting of suspected cases on the EWARS. Reporting is considered timely if it meets the minimum target of 80.00%. Due to the low data completeness rate (37.00%) on the SIARVI, the timeliness of DHF case reporting through this platform could not be assessed. Overall, the timeliness of weekly suspect case reporting on EWARS was high. Among the sampled puskesmas, 87.50% (7/8) achieved the required timeliness in weekly reporting. At the regency level, the overall reporting timeliness reached the 80.00% target.

Data Quality

Data quality was evaluated by assessing the completeness and validity of dengue suspect reports on the EWARS and dengue case reports on the SIARVI. The evaluation revealed that the overall quality of dengue case data remains low. The completeness of dengue suspect reports on EWARS at the regency level reached 89.74%, falling slightly short of the national target of 90.00%. Of the sample puskesmas, 12.50% (1/8) puskesmas had a completeness rate below 90.00%. Meanwhile, the completeness of dengue case reporting on the SIARVI remains very low, at approximately 37.00%, due to many puskesmas failing to input all case data into the SIARVI format. The validity of dengue case data across different reporting formats also remains low. Not all puskesmas utilize the

same recording and reporting formats, and among the various formats used, only 13.33% (4/30) of puskesmas demonstrated consistent numbers across all reporting formats.

Data Stability

The stability was evaluated by assessing the operational reliability of SIARVI and EWARS. The findings indicate that the dengue surveillance system's data stability is good. SIARVI and EWARS are generally stable, with minimal technical disruptions, ensuring continuous accessibility for recording and reporting dengue cases without significant system interruptions.

Table 1
Evaluation Results of the Dengue Surveillance System in Sumenep Regency, 2023

Surveillance Attributes	Evaluation Results	
	8 Sampled of Puskesmas	Regency Health Office
Simplicity		
Data collection	Not yet simple; 62.50% (5/8)	Not yet simple
Data recording & reporting	Not yet simple; 100.00% (8/8)	Not yet simple
Data processing & analysis	Not yet simple; 100.00% (8/8)	Not yet simple
Flexibility		
Human resources	Flexible; 100.00% (8/8)	Flexible
Time	Not yet flexible; 100.00% (8/8)	Not yet flexible
Cost	Flexible; 100.00% (8/8)	Flexible
Acceptability		
System users	Low acceptance; 100.00% (8/8)	Low acceptance
Non-system users	High acceptance; 100.00% (8/8)	High acceptance
Representativeness	Not yet representative; 100.00% (8/8)	Not yet representative
Sensitivity		
Case detection sensitivity	Not yet sensitive; 75.00% (6/8)	-
Case increase/outbreak detection	Not yet sensitive; 16.67% (1/6 alert)	Not yet sensitive
Timeliness (EWARS)	Timely; 87.50% (7/8)	Timely
Data Quality	Low; 100.00% (8/8)	Low
Data Stability	Good; 100.00% (8/8)	Good

DISCUSSION

The dengue surveillance system is a systematic and continuous process of collecting and analyzing data on dengue and the factors influencing its transmission. Its primary goal is to generate timely, accurate information to support effective disease control and prevention measures (5). A well-implemented surveillance system facilitates risk assessment, monitoring of disease trends, and evaluation of control programs (6).

Simplicity

The dengue surveillance system is not yet considered simple, as it faces several challenges, including variability in the types of dengue infections reported on the SIARVI and inconsistent reporting of suspected cases on the EWARS. The variability in the types of dengue infection reported in Sumenep Regency can be attributed to the absence of standardized guidelines and a lack of uniformity in dengue data collection procedures established by the Regency Health Office. Additionally, insufficient coordination between DHF program managers and officers further complicates surveillance implementation. Similar challenges were reported in Bandung, West Java, where poor coordination between reporting units and the absence of clear data collection guidelines hindered the implementation of dengue surveillance (7). To enhance the simplicity in the data collection process, it is essential to strengthen coordination between health office personnel, establish standardized guidelines for data collection, and ensure uniformity in reporting formats across all health centers.

Routine recording and reporting are fundamental to an effective surveillance system (8). However, the dengue surveillance system remains complex. The lack of integration among various recording and reporting formats results in inefficient data management. The absence of a unified system complicates compiling comprehensive information, hindering timely

decision-making and response. Similar challenges have been identified in the South-East Asia Region (SEAR), where dengue surveillance data, including entomological and epidemiological information, remain fragmented. This lack of integration often leads to suboptimal preventive measures and delayed interventions (9). An effective surveillance system requires a combination of various types of integrated data to enhance its functionality (5). Another challenge is the continued reliance on paper-based reporting. This is inefficient as it increases the risk of redundant data entry and delays the data report, further emphasizing the need for a more streamlined and automated reporting system. To enhance the recording and reporting process, a fully integrated and standardized reporting system and transitioning from paper-based to a fully digital and real-time platform should be implemented to improve data accuracy and timeliness (6,10).

Epidemiologic surveillance involves reporting cases and analysing data to identify spread patterns and associated risk factors (11). The system is not yet simple in the data processing and analysis process. Currently, the system cannot automatically generate processed data and analytical results at the puskesmas level; thus, the program managers should perform the data analysis manually. In contrast, at the regency level, surveillance data processing is supported by EWARS, SIARVI, and SILANTOR. However, automated data processing capabilities remain insufficient, as they do not fully accommodate the essential epidemiological variables—person, place, and time. The reliance on manual data processing is also observed in other areas, such as Bandung, Indonesia, where the outcomes of dengue surveillance are primarily presented in tables, graphs, and narrative descriptions manually (12). Similarly, a study in Palopo, Indonesia, showed that in data processing and analysis, officers still perform these tasks inadequately; specifically, only 16.7% of them process their dengue data (13).

Developing a more advanced surveillance system capable of automatically processing and analyzing data is essential, as unprocessed data cannot generate meaningful information or facilitate early detection of case increases or potential outbreaks (14). An improved system can generate epidemiological insights efficiently at both the puskesmas and regency levels. This would reduce the officers' workload and enhance the system's timeliness and effectiveness.

Flexibility

Since the end of 2022, all puskesmas in Sumenep have been required to record and report the results of dengue case investigations using the SIARVI format. Following these changes, the system has demonstrated flexibility regarding human resources and financial requirements. Implementing the new recording and reporting standards did not necessitate additional personnel or funding, indicating that the system could adapt to the changes without significant modifications. However, in terms of time management, the system is inflexible. The new requirements have increased the workload for dengue program managers, as they now need to input case investigation data into the SIARVI format. The average time required for recording and reporting is approximately five minutes per case, accumulating over multiple cases and contributing to a greater administrative burden on health officers. While the introduction of standardized case reporting enhances the completeness and accuracy of dengue surveillance data, the increased time commitment for data entry may pose challenges in maintaining efficiency. Future improvements, such as automation or system integration, are needed to optimize the balance between comprehensive reporting and operational efficiency.

Acceptability

The acceptance level of the dengue surveillance system among users remains low. Some puskesmas have never used the SIARVI format for recording and reporting, while others still struggle with data completeness. As discussed under simplicity, difficulty obtaining certain data contributes to the reluctance to use the system. The factor affecting user acceptance is the lack of training on the technical aspects of data entry using the SIARVI system. A similar situation was also found in Bantul, Yogyakarta, Indonesia, where the DHF program manager had not received specific training on the reporting system (15). In Denpasar, Indonesia, issues including delayed reporting and insufficient training for surveillance personnel are undermining the effectiveness of case management (16). Effective health surveillance, including dengue surveillance, requires skilled epidemiologists to ensure data quality. The training of health workers in DHF control represents the key strategies and commitments undertaken by the WHO to support DHF control in Timor-Leste (17).

The availability of necessary infrastructure also influences user acceptance. While computers and other equipment are generally available at

puskesmas and the health office, 37.50% are outdated and malfunctioning, affecting data recording, reporting, and processing. Program managers use other programs' computers or personal devices as a temporary solution.

The level of acceptability of non-users of the system is good because external parties outside the DHF program manager participate in DHF prevention and control. The good involvement of external parties is due to the support of the head of puskesmas and the health office through officially signed decrees and circulars related to DHF prevention and control. In addition, at the local government level, there is also a circular letter related to dengue prevention and control officially issued by the head of the regency. Similar conditions also occur in Aceh, Indonesia, where cross-programs, cross-sectors, and the community are involved in implementing the DHF program (18).

Representativeness

At the puskesmas level in Sumenep, surveillance is conducted through case investigations, home visits, larval inspections, and case detection, similar to puskesmas in Semarang, Indonesia (19). The level of representation in the dengue surveillance system remains low at both the puskesmas and health office levels in Sumenep. However, some puskesmas have not reported suspected cases on the EWARS website, as not all reporting units have been involved in the surveillance system. Private clinics and practitioners are not included in the reporting network, resulting in suspected cases data on EWARS being limited to cases detected at puskesmas and by village midwives. A similar issue was observed in Puskesmas West Denpasar 1, Bali, Indonesia (20) and Bima, West Nusa Tenggara, Indonesia (21), where private practitioners did not actively report dengue cases.

Hospitals in Sumenep Regency also play a role in DHF surveillance, but 25% (1/4) never reported dengue cases. The low level of representation is also partly due to users' low level of acceptance. The lack of obligation among reporting units to report dengue cases further contributes (20). A similar situation occurred in Cimahi, West Java, Indonesia, where puskesmas primarily reported dengue cases, while private hospitals and clinics rarely submitted reports to the local health office (22). Data from the dengue surveillance system in Palopo City, Indonesia, was also unrepresentative, with dengue vector information collected in all puskesmas lacking thoroughness due to missing data on vector density and endemicity indicators for each region (13).

The underreporting of dengue cases is widespread, as seen in the SEAR Region (9). Not all cases are recorded and reported, leading to an inaccurate representation of the dengue burden. Research by Faridah et al. highlighted that underreporting in dengue surveillance systems is influenced by the lack of coordination among hospitals and health facilities with the public health center on data reporting (7). Research conducted in Dili, Timor-Leste, also suggests the possibility of underreporting, particularly in cases with mild symptoms that do not prompt individuals to seek treatment or undergo examination at healthcare facilities (23).

Accurate case recording and reporting are essential to understanding the true burden of dengue and must be prioritized (2). To improve the representativeness, active and passive surveillance must be integrated. This combination has been proven to enhance early case detection and improve system performance, as demonstrated by the dengue surveillance system in Bantul, Yogyakarta, Indonesia, and Klungkung, Bali, Indonesia, where data collection is conducted through both active and passive surveillance methods (15,24), in order for the data produced from the dengue surveillance system to be more complete.

Sensitivity

Early detection at the suspect stage is crucial to ensuring timely case management and reducing the potential for outbreaks (8). Suspected DHF cases should be promptly followed up with laboratory testing, recording, and reporting within 24 hours (1), as it is classified as a potential outbreak disease in Indonesia. Timor-Leste, where DHF is known to be endemic, has also implemented a 24-hour rapid verification policy (17). In Sumenep, the sensitivity of the surveillance system remains low, as not all health centers are consistently detecting, recording, and reporting dengue suspects.

The potential for a surge in dengue cases or outbreaks on the EWARS is indicated by alerts, which appear when the number of reported dengue suspects each week is at least twice the number reported in the previous week. Upon the appearance of an alert, surveillance officers at the regency health office must verify within 24 hours to determine whether it indicates a potential outbreak. However, in Sumenep, the system's sensitivity in detecting potential outbreaks through alert verification on the EWARS is still low. The percentage of verified alerts has not yet met the

national minimum target of 80%. Timely verification of alerts within 24 hours is critical to preventing the spread of cases. Delayed verification increases the risk of uncontrolled transmission and limits the ability to detect outbreaks early. Ideally, prompt verification of emerging DHF cases strengthens early detection and response efforts in affected areas (25).

Timeliness

The timeliness of DHF surveillance reporting is generally high at the regency level. However, some puskesmas are still struggling with timely reporting. Despite this, program managers report no significant obstacles. If inaccuracies occur, health office program managers promptly contact their counterparts at the puskesmas, who respond and confirm quickly. Poor timeliness in reporting can hinder effective decision-making based on accurate data. Therefore, evaluations must ensure reports remain timely and reliable (22). Enhancing the timeliness of dengue case reporting can be achieved through a straightforward yet adaptable electronic reporting system, similar to the development of a mobile-based surveillance information system in Yogyakarta, Indonesia, which accelerates reporting speed and boosts data accuracy, proving highly beneficial for making decisions during health emergencies (26).

Data Quality

The quality of data in the system remains low. Not all puskesmas use a standardized recording and reporting format; only 13.33% (4/30) have consistent data across different formats. Incomplete case recording and reporting contribute to poor data quality. Additionally, some puskesmas report only confirmed cases rather than suspects, despite suspect reporting being crucial for early response (1,6). This issue is also observed in the dengue surveillance system in Cimahi, West Java, Indonesia, where data quality remains poor due to discrepancies between recording and reporting at the puskesmas and the health office, primarily caused by a lack of coordination (22). To be effective, a good surveillance system should also accurately record and document cases soto initiate prompt control measures. Good data quality is crucial to prevent disease outbreaks (27).

Data Stability

The SIARVI and EWARS systems have good data stability. These platforms are easily accessible and rarely experience operational interruptions, ensuring stable usage. Similar conditions were reported in health centers in Aceh, Indonesia, where the dengue surveillance system also demonstrated reliable data stability (18).

CONCLUSION

The dengue surveillance system in Sumenep Regency requires improvement in several key areas, including simplicity, user acceptability, representativeness, sensitivity, and data quality. Strengthening the system necessitates developing a simplified and integrated surveillance model to support program managers, integrating active and passive surveillance, establishing standardized procedures for recording and reporting, and improving coordination and engagement of reporting units. These measures are essential to enhancing the effectiveness and reliability of dengue surveillance in the regency.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest in this research.

AUTHOR CONTRIBUTIONS

CY was responsible for data collection, analysis, drafting, and manuscript writing. ACH contributed to data curation, methodology, supervision, and conceptualization. FS oversaw the methodology and supervision. MAS was responsible for data collection and curation.

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REFERENCES

1. Ministry of Health Republic Indonesia. Guidelines for the Prevention and Control of Dengue Fever in Indonesia. Jakarta: Ministry of Health Republic Indonesia; 2017. 1–128 p.
2. World Health Organization. World Health Organization. 2024. p. 23 Dengue and severe dengue key facts.
3. Ministry of Health Republic Indonesia. National dengue control strategy 2021 -

2025. Jakarta: Ministry of Health Republic Indonesia; 2021. 1–92 p.
4. CDC. Updated guidelines for evaluating public health surveillance systems: recommendations from the Guidelines Working Group. MMWR Recomm reports Morb Mortal Wkly report Recomm reports. 2001;50(RR-13):1–35; quiz CE1-7.
5. Leandro A, Maciel-de-Freitas R. The development of an integrated surveillance system to improve preparedness to arbovirus outbreaks in a dengue endemic setting (Preprint). JMIR Public Heal Surveill. 2024;10:1–14.
6. Angelo M, Ramalho WM, Gurgel H, Belle N, Pilot E. Dengue surveillance system in Brazil: A qualitative study in the federal district. Int J Environ Res Public Health. 2020;17(6).
7. Faridah L, Rinawan FR, Fauziah N, Mayasari W, Dwiartama A, Watanabe K. Evaluation of health information system (HIS) in the surveillance of dengue in Indonesia: lessons from case in Bandung, West Java. Int J Environ Res Public Health. 2020;17(5):1–13.
8. Madewell ZJ, Hernandez-Romieu AC, Wong JM, Zambrano LD, Volkman HR, Perez-Padilla J, et al. Sentinel enhanced dengue surveillance system - Puerto Rico, 2012–2022. MMWR Surveill Summ. 2024;73(3):1–29.
9. Tsheten T, Gray DJ, Clements ACA, Wangdi K. Epidemiology and challenges of dengue surveillance in the WHO South-East Asia Region. Trans R Soc Trop Med Hyg. 2021;115(6):583–99.
10. Purnama S, Susanna D, Achmadi UF, Krianto T, Eryando T. Potential development of digital environmental surveillance system in dengue control: A qualitative study. Open Access Maced J Med Sci. 2021;9(E):1443–53.
11. Ikhtiyaruddin I, Alamsyah A, Muhamadiah M, Priwahyuni Y, Gloria Purba CV. SEpidemiological surveillance of Dengue Hemorrhagic Fever (DHF) at the Sungai Raya Community Health Center, Indragiri Hilir Regency. Al-Tamimi Kesmas J Ilmu Kesehat Masy (Journal Public Heal Sci. 2021;9(2):79–86.
12. Sutriyawan A, Suherdin. Mixed method study: epidemiological overview and analysis of the Dengue Hemorrhagic Fever (DHF) surveillance system in Bandung City. Indones J Infect Dis. 2022;8(2):15–29.
13. Patanduk Y, Ashlihah S, Nurjanah, Lande C, Syachrim M, Zulkifli A. Dengue vector surveillance in Palopo City: Post-outbreak program evaluation. Pros Semin Nas Kesehat Masy Univ Muhammadiyah Surakarta. 2024;57–73.
14. Tatura SNN, Denis D, Santoso MS, Hayati RF, Kepel BJ, Yohan B, et al. Outbreak of severe dengue associated with DENV-3 in the city of Manado, North Sulawesi, Indonesia. Int J Infect Dis. 2021;106:185–96.
15. Amanda Q, Astuti FD, Fadly A. Evaluation of implementation of dengue hemorrhagic fever surveillance. Dis Prev Public Heal J. 2023;17(1):13–31.
16. Karang NMR, Putra IWGAE, Dharmayuda AANG, Astiti CISD, Dharma S. Optimizing dengue hemorrhagic fever (DF) surveillance in Denpasar City: challenges, strategies and recommendations for sustainable control.. Prepotif J Kesehat Masy. 2025;9(April):1926–35.
17. Ministry of Health Democratic Republic of Timor-Leste. National strategic plan for integrated Vector-Borne Diseases, Timor-Leste 2021-2030. Dili: Ministry of Health Democratic Republic of Timor-Leste; 2022. 37 p.
18. Rimonda R, Saputra FF, Paradhiba M, Artika A. Overview of the implementation of dengue fever surveillance at the Meurebo Community Health Center based on a systems approach and surveillance attributes.. J Ilm Kesehat Rustida. 2024;11(2):162–74.
19. Sari DP. Evaluation of epidemiological surveillance of dengue hemorrhagic fever (dbd) in the Pudakpayung Semarang Health Center in 2018. J Ilmu Kesehat Masy Berk. 2020;2(1):23–31.
20. Rubianti I, Sawitri AAS, Gita IK, Azmin N, Olahairullah. Evaluation and implementation of the dengue hemorrhagic fever (DHF) surveillance system in the working area of West Denpasar 1 Community Health Center in 2019. Oryza J Pendidik Biol. 2020;9(1):1–7.
21. Rubianti I. Surveillance evaluation of dengue fever cases in Bima City. JUKEJ J Kesehat Jompa. 2023;2(1):138–42.
22. Sutriyawan A, Yusuff AA, Fardhoni F, Cakranegara PA. Analysis of the Dengue

Hemorrhagic Fever (DHF) Epidemiological Surveillance System: A Mixed Method Study. J Manaj Kesehat Yayasan RSDr Soetomo. 2022;8(1):137.

23. Machado FDN, Draper ADK, Bosco F, Tilman AJP, Soares E, Soares NG, et al. A brief description of the dengue in Dili, Timor-Leste, 2018-2022. Commun Dis Intell. 2024;48:1–9.
24. Sukmawathi NLA, Sawitri AAS, Megawati IA. Implementation of the Dengue Fever Surveillance System at the Klungkung District Health Office. J La Medihealtico. 2024;05(05):1134–44.
25. Zhang Y, Abudunaibi B, Zhao Y, Zhang D, Chu Y, Lei S, et al. Dynamics and efficacy: a comprehensive evaluation of the advanced dengue fever surveillance and early warning system in Ningbo City, 2023. Risk Manag Healthc Policy. 2024;17:1947–55.
26. Salim MF, Syairaji M, Wahyuli KT, Muslim NNA. Development of a mobile-based dengue fever surveillance information system as an early warning system for outbreaks in Yogyakarta City. J Kesehat Vokasional. 2021;6(2):99.
27. Baharom M, Ahmad N, Hod R, Manaf MRA. Dengue Early warning system as outbreak prediction tool: a systematic review. Risk Manag Healthc Policy. 2022;15(May):871–86.