Early Warning Alert and Response System for Detecting Infectious Disease Outbreaks Based on Surveillance Attributes in Lumajang, Indonesia

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Abstract: Introduction, Early Warning Alerts and Response Systems (EWARS) is a surveillance tool to detect early warning signals/threats of potential outbreaks of infectious disease. EWARS data for Lumajang District in 2022 shows that the accuracy of the EWARS report is the lowest in East Java 42.64%, while the completeness 84.48%, ranking 35th out of 38 district in East Java Province. There were 20 public health centers (80%) that had report accuracy <80% and one of public health center (4%) had report completeness <90% of the 25 public health centers in Lumajang District. This research aimed to identify the implementation of EWARS in the Lumajang District based on the attribute approach. Methods, This research was descriptive quantitative research. The population was all 25 health center surveillance officers. Methods of data collection by filling questioner forms and documentation. Data analysis used descriptive analysis. EC: No. 2389/UN25. 8/KEPK/DL/2024. Results of this research The implementation of EWARS only fulfilled the attributes of simplicity (88%), flexible (64%), data quality(72%), acceptance (100%), completeness(96%), accuracy(88%) and not fulfilling the attributes of representativeness(36%), stability(12%), utility(44%). There were 92% who wanted regular meetings related to data evaluation, performance, and training to improve the quality and benefits of EWARS. Conclusion Assessment according to EWARS attributes shows the system does not meet representativeness, stability, and utility. Several recommendations can be made to address representativeness, stability, and utility. Regularly assess whether data sources and surveillance points represent the entire population or target area. Continuously training staff and ensuring there are sufficient human resources can also be done to increase target achievement according to surveillance attributes. Design the output of the system to provide actionable insights. This means not just collecting data, but analyzing it in ways that directly support public health decisions and actions.

1 INTRODUCTION

Indonesia has a varied topography and high internal and international mobility. This makes Indonesia very vulnerable to various diseases, especially infectious diseases. Infectious diseases can cause outbreaks and extraordinary events without monitoring and controlling(Nkengasong, Djoudalbaye, & Maiyegun,

2017). Without a good response at the national and international levels, these outbreaks and extraordinary events will become a threat. Through the 2005 International Health Regulation (IHR), WHO mandates that all member countries establish basic capabilities in the field of monitoring and response at all administrative levels to manage health data to be conveyed to the public, especially diseases

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that have the potential to cause health emergencies (Public Health Emergency International Concern)(Andriarsa et al., 2022). As a member of the WHO, Indonesia must implement the IHR regulations by establishing an Early Warning Alert and Response System (EWARS). This system is part of surveillance activities that aim to detect health events that can threaten public safety, namely diseases with the potential for outbreaks and epidemics(Cahyadin & Indriyanti, 2018). The types of diseases observed in EWARS are types of diseases that have the potential for outbreaks. According to the Ministry of Health, 17 types of diseases have the potential for outbreaks, but the Ministry of Health can determine other types of diseases in the future (Kemenkes, 2010)(Sutriyawan et al., 2020).

Extraordinary events and epidemics need attention. Late and inadequate detection can increase the number of cases, prolong the outbreak, increase the number of deaths and increase the possibility of the outbreak spreading to other areas nationally, regionally and even internationally(Suharmida, 2018). Outbreaks and epidemics can also increase morbidity and mortality rates, which, of course, also have an impact on various fields such as tourism, the economy and society. All related parties must pay attention to and handle this matter. Outbreaks and epidemics require early discovery and fast and appropriate action. This identification increased awareness and prepared the community to face potential outbreaks(Wikansari, Santoso, Pramono, & Widarsih, 2019). Therefore, it is necessary to have an Emergency Warning and Response System (EWARS) that is implemented and utilized correctly because, in implementing effective surveillance, there are two principles: early warning of disease incidents and early detection.

Indonesia's 2021 health profile data states that there were 235 cases of outbreaks in Indonesia for VPDs of diphtheria, 8 cases of measles, 12 cases of pertussis and 9 cases of neonatal tetanus. Apart from outbreaks of disease, outbreaks of food poisoning were also found, which had relatively high numbers. It was found that there were 25 outbreaks of food poisoning in 13 provinces in Indonesia in 2021(Kemenkes RI, 2022). In 2022, East Java Province recorded 54 Extraordinary Events in several cities/regencies, including Lumajang Regency(Dinkesprov Jatim, 2021). If outbreaks are still found, it is necessary to evaluate the implementation of EWARS. East Java Province in 2022 shows that the accuracy of EWARS in Lumajang Regency is the lowest in East Java at 42.64%, while its completeness is 84.48%, ranking it

35th out of 38 regencies.

Research on SKDR has been widely carried out both abroad and in Indonesia. Research from Tejeda et al. (2023) regarding EWARS in controlling dengue fever in Mexico found that EWARS is a tool that can coordinate efficient surveillance, prevention and control of dengue fever(Sanchez Tejeda et al., 2023). Another research, namely by Hassan (2023), using the literature review method, discusses One Health EWARS in efforts to handle zoonotic diseases with the result that the implementation of One Health EWARS requires good collaboration between stakeholders, including non-governmental organizations, international country offices, research agencies, the private sector. as well as local communities in the development of one health EWARS(Hassan, de Balogh, & Winkler, 2023). EWARS research in Indonesia was conducted by Cahyadin and Indriyanti (2018) regarding EWARS in Blora Regency, Central Java, with the result that the obstacle in implementing EWARS in Blora Regency is the difference in the source of reports for each health centre and the number of village health services or posts that collect reports. Weeks are sometimes different(Cahyadin & Indriyanti, 2018). Another research by Wardani (2018) regarding the process of collecting PD3I surveillance data in EWARS in the City of Surabaya resulted in the accuracy, representativeness of the data and stability of the EWARS in the City of Surabaya being good(Wardani, 2021).

This research aims to evaluate the implementation of the Early Warning Alert and Response System (EWARS) in Lumajang Regency, especially on the completeness and accuracy of reporting by community health centers. Accurate and comprehensive reporting is crucial for early detection and effective response to outbreaks such as PD3I, infectious diseases, and food poisoning. By assessing EWARS implementation, the study seeks to provide insights for improving and developing the system in Lumajang Regency to enhance outbreak prevention and control efforts.

2 METHODS

This study used a quantitative descriptive method with an attribute approach to evaluate the implementation of the early warning alert and response system (wars) in Lumajang Regency, East Java. The research was conducted from January to June 2022. The attribute approach refers to the theory of the Centres for Disease Control and Prevention

(Klaucke et al., 2001), which includes nine main attributes in evaluating a health surveillance system: simplicity, flexibility, data quality, acceptability, representativeness, completeness, accuracy, stability, and utility.

Data were collected through questionnaires given to 25 surveillance officers in all health centres in Lumajang Regency and obtained through total sampling.. The questionnaire was designed based on indicators that were appropriate for each attribute. In addition, secondary data was obtained from war reporting documents owned by health centres and the Lumajang health office to support the analysis. Each attribute was assessed using a series of questions with specific criteria, such as ease of understanding the system (simplicity), the system's ability to adapt to new threats (flexibility), the quality of the data produced (data quality), and other attributes based on the CDC's surveillance evaluation guidelines.

The use of secondary data had the potential for bias, such as incomplete or inaccurate data due to recording and reporting errors, and the possibility that the data needed to be representative of all worked areas. To overcome this limitation, the research carried out cross-validation between secondary data and primary data through interviews with surveillance officers. In addition, the analysis was carried out carefully by considering the context and possible gaps in reporting.

The collected data was analyzed descriptively using frequency distribution tables and narrative explanations to identify attributes that had been met and those that had not. The evaluation results were compared with national guidelines and recommendations from the CDC to measure the effectiveness of wars in detecting and responding to infectious disease outbreaks. This attribute approach allows the study to comprehensively evaluate the performance of the surveillance system in supporting public health decision-making. This study obtained ethical approval from the health research ethics committee of the University of Jember with protocol number ec: No.2389/UN25.8/KEPK/DL/2024. The following are operational definitions and question items for each variable:

Table 1: Question items and criteria based on each attribute variable.

No	Suveillance Attributes	Criteria
1	**Simplicity** a. Do officers understand what data should be collected? b. Do officers understand how recording should be done? c. Do officers have EWARS guidelines? d. Do officers make and save weekly reports using the Weekly Report (W2) format? e. Does the officer make and keep a line/case list for the weekly W2 reports sent? f. Do officers know how to analyze the data collected? g. Is there evidence of any EWARS data analysis by public health centre officers? h. Is the method of sending reports via WhatsApp easy to do? i. Do you understand the Operational Definition (DO) of the 23 potential outbreak diseases you reported? j. Do you also report the same disease with EWARS using another reporting system/format/form?	• Meet = Answer "Yes" ≥ 6 • Unmeet = Answer "Yes" < 6
2	**Flexibility** a. If there is a threat of a new disease not on the list of 23 diseases, can you identify/include it in the EWARS reporting? b. If additional information, such as laboratory data, exists, can you include it in the EWARS reporting? c. If the officer responsible for EWARS moves or is not there, can SKDR data collection, reporting, and analysis continue?	• Meet = Answer "Yes" ≥ 2 • Unmeet = Answer "Yes" < 2
3	**Data Quality** a. Do officers understand the Operational Definition (DO) of diseases on the EWARS list? b. Do officers understand the data source of the EWARS report? c. Has any feedback from the above levels ever regarding irregularities in the reported data and incompleteness? d. Has there ever been an ERROR or irregularity caused by the EWARS application system? e. What training have the Public Health Center surveillance officers received?	• Meet = Answer "Yes" ≥ 4 • Unmeet = Answer "Yes" < 4
4	**Acceptance** a. Do you think that implementing the EWARS system is a burden for you or your institution?	• Burdened = Answer "Yes" • Unburdened = Answer "No"

No	Suveillance Attributes	Criteria
5	**Representativeness** a. Does the weekly health centre EWARS report come from the recapitulation results received by all Puskesmas work areas (Service Units/Networks/ Networks)?	• Meet = Answer "Yes" • Unmeet = Answer "No" < 6
6	**Completeness** a. Do you know the completeness of the reports you submitted this year and the previous year? b. Do officials report the number of cases of all potential disease outbreaks (with zero (0) for no cases)?	• Meet = Answer "Yes" = 2 • Unmeet = Answer "Yes" < 2
7	**Accuracy** a. Do you know the accuracy of the reports you submitted this year and the previous year?	• Meet = Answer "Yes" • Unmeet = Answer "No"
8	**Stability** a. Are there any problems sending weekly EWARS reports using the WhatsApp application? b. If the officer in charge of the health centre EWARS does not come to work/is sick/absent), is there an officer who can replace him? c. Are there funds/costs to support EWARS from year to year? d. Are there communication facilities provided by the Puskesmas/Health Service?	• Meet = Answer "Yes" ≥ 3 • Unmeet = Answer "Yes" < 3
9	**Utility/Benefits** a. Do you feel any benefit from the EWARS data you collect and report to detect outbreak signals in your area? b. Have you ever encountered any KLB alerts/suspects from this system? c. Have any rumours of disease/disease outbreaks been reported from the Puskesmas/District? d. Have any bulletins or reports been submitted to relevant leaders/ programs/stakeholders? e. If so, is there any feedback from the leadership/program manager/relevant stakeholders?	• Meet = Answer "Yes" ≥ 4 • Unmeet = Answer "Yes" < 4

3 RESULTS

In this study, 25 EWARS coordinator surveillance officers participated. Table 2 shows the distribution of respondent characteristics, such as age, gender, education, and length of surveillance work. The age groups were early adulthood (20-40) and middle-aged (41-60). Gender was categorized as male and female. Education was divided into DIII/S1, and the surveillance work period was grouped into ≥ 2 years and < 2 years. According to Table 2, most respondents were in early adulthood, accounting for 16 people (64%). There were 13 females (52%), 14 respondents with DIII education (56%), and most respondents had worked as surveillance officers for more than two years, totalling 18 people (72%).

This research aims to identify the implementation of EWARS in Lumajang Regency using an attribute approach. The identification results using the attribute approach include simplicity, flexibility, data quality, acceptability, representativeness, completeness, accuracy, stability, and utility or benefits, as presented in Table 3. The attributes, simplicity, flexibility, data quality, representativeness, completeness, accuracy, stability, and Benefits are

Table 2: Distribution of Respondent Characteristics for Lumajang Regency EWARS Coordinator Surveillance Officers.

No	EWARS Coordinator Characteristics	n	%
1	**Age**		
	Early Adult (20 - 40 Years)	16	64
	Middle Age (41 – 60 Years)	9	36
2	**Gender**		
	Male	12	48
	Female	13	52
3	**Education**		
	DIII	14	56
	DIV/S1	11	44
4	**Surveillance Work Periods**		
	≥ 2 Years (Old)	18	72
	< 2 Years (New)	7	28

grouped into met and unmet. In contrast, acceptance surveillance attributes are grouped into burdened and unburdened.

Table 3 provides information on the distribution of answers from respondents to each question item according to the variable. Based on Table 3, it is found that the majority of respondents for the variables simplicity, flexibility, data quality, representativeness, accuracy, completeness,

Table 3: Distribution of Respondents' Answers to each question item.

No	Suveillance Attributes	Answer	
		Yes	No
1	**Simplicity**		
	a. Do officers understand what data should be collected?	24	1
	b. Do officers understand how recording should be done?	24	1
	c. Do officers have EWARS guidelines?	13	12
	d. Do officers make and save weekly reports using the Weekly Report (W2) format?	24	1
	e. Does the officer make and keep a line/case list for the weekly W2 reports sent?	20	5
	f. Do officers know how to analyze the data collected?	19	6
	g. Is there evidence of any EWARS data analysis by public health centre officers?	16	9
	h. Is the method of sending reports via WhatsApp easy to do?	25	0
	i. Do you understand the Operational Definition (DO) of the 23 potential outbreak diseases you reported?	25	0
	j. Do you also report the same disease with EWARS using another reporting system/format/form?	7	18
2	**Flexibility**		
	a. If there is a threat of a new disease not on the list of 23 diseases, can you identify/include it in the EWARS reporting?	9	16
	b. If additional information, such as laboratory data, exists, can you include it in the EWARS reporting?	14	11
	c. If the officer responsible for EWARS moves or is not there, can SKDR data collection, reporting, and analysis continue?	23	2
3	**Data Quality**		
	a. Do officers understand the Operational Definition (DO) of diseases on the EWARS list?	25	0
	b. Do officers understand the data source of the EWARS report?	25	0
	c. Has any feedback from the above levels ever regarding irregularities in the reported data and incompleteness?	21	4
	d. Has there ever been an ERROR or irregularity caused by the EWARS application system?	15	10
	e. What training have the Public Health Center surveillance officers received?	19	6
4	**Acceptance**		
	a. Do you think that implementing the EWARS system is a burden for you or your institution?	0	25
5	**Representativeness**		
	a. Does the weekly health centre EWARS report come from the recapitulation results received by all Puskesmas work areas (Service Units/Networks/Networks)?	22	3
6	**Completeness**		
	a. Do you know the completeness of the reports you submitted this year and the previous year?	21	4
	b. Do officials report the number of cases of all potential disease outbreaks (with zero (0) for no cases)?	16	9
7	**Accuracy**		
	a. Do you know the accuracy of the reports you submitted this year and the previous year?	22	3
8	**Stability**		
	a. Are there any problems sending weekly EWARS reports using the WhatsApp application?	9	16
	b. If the officer in charge of the health centre EWARS does not come to work/is sick/absent), is there an officer who can replace him?	12	13
	c. Are there funds/costs to support EWARS from year to year?	2	23
	d. Are there communication facilities provided by the Puskesmas/Health Service?	6	19
9	**Utility/Benefits**		
	a. Do you feel any benefit from the EWARS data you collect and report to detect outbreak signals in your area?	25	0
	b. Have you ever encountered any KLB alerts/suspects from this system?	11	14
	c. Have any rumours of disease/disease outbreaks been reported from the Puskesmas/District?	15	10
	d. Have any bulletins or reports been submitted to relevant leaders/programs/stakeholders?	13	12
	e. If so, is there any feedback from the leadership/program manager/relevant stakeholders?	10	15

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stability and utility answered "Yes". Acceptance variable showed 100% respondent answered "no" (unfavorable question), this indicates that they agree with EWARS and that this is not a burden for surveillance holders to implement.

Table 4: Evaluation Results of the Lumajang Regency early Awareness and Response System (SKDR).

No	Suveillance Attributes	n	%
1	**Simplicity**		
	Met	22	88
	Unmet	3	12
2	**Flexibility**		
	Met	16	64
	Unmet	9	36
3	**Data Quality**		
	Met	18	72
	Unmet	7	28
4	**Acceptance**		
	Burdened	0	0
	Unburdened	25	100
5	**Representativeness**		
	Met	9	36
	Unmet	16	64
6	**Completeness**		
	Met	15	60
	Unmet	10	40
7	**Accuracy**		
	Met	22	88
	Unmet	3	12
8	**Stability**		
	Met	3	12
	Unmet	22	88
9	**Utility/Benefits**		
	Met	11	44
	Unmet	14	56

Based on Table 4, it is found that the simplicity attribute is fulfilled chiefly, namely 88%; the most flexible is fulfilled, namely 64%; the data quality is fulfilled chiefly, namely 72%; the acceptance attribute is 100% fulfilled, the representativeness attribute is mostly not yet fulfilled, namely 64%, most of the completeness attributes have been fulfilled, 60%. Most of the accuracy attributes have met 88%, most stability attributes have not met 88%, and most utility attributes have not met 56%.

This research also discusses suggestions given by officers holding the EWARS program to improve the quality and program improvements of EWARS implementation in the future. This aims to produce information useful in developing programs or controlling infectious diseases. These suggestions consist of regular meetings, availability of guidebooks, computer facilities and applications, funds for communication, supervision visits (central, provincial or city), availability of reporting, availability of personnel, or the distribution of suggestions from surveillance officers, as presented in Table 5.

Table 5: Distribution of Input and Suggestions for improving EWARS Implementation in Lumajang Regency in 2022.

No	Feedback and Suggestions	n	%
1	Regular meetings for evaluastion of data, performance and Trainning	23	90
2	Availability of handbook and reporting form	15	15
3	Computer facilities and application for reporting and data analysis	18	18
4	Funds for communications	19	19
5	Supervision visits from center/Province/Regency	5	5
6	Availability of personer/HR	10	10
7	Other	0	0

Based on Table 5, which provides input and suggestions for improving EWARS in Lumajang Regency in 2022, the majority, 23 (92%) respondents, suggested holding regular meetings to evaluate data and performance and provide training.

4 DISCUSSION

The research results show that most students came from early adulthood, aged 20 to 40 years. Age is related to the performance of health workers. As age increases, work productivity will decrease due to decreased work motivation. Meanwhile, if you are still young, your motivation is still high, and your desire to apply knowledge is still relatively high(Handayani, Fannya, & Nazofah, 2018). The results also show that the majority of respondents are female. This aligns with the results of research conducted in Tanah Bumbu Regency and Banjar Regency, which found that most EWARS officers are female, 57%(Andiarsa & Hidayat, 2023). Gender has an indirect influence on the performance of health workers. According to him, there are differences in characteristics between women and men. Women also have freedom in developing their roles; however, marriage factors make women more focused on handling the household, while men tend to be more focused on their work(Julianti, Duarsa, & Yuliyatni, 2021).

Most of the highest education is DIII. The higher the level of education one has, the higher a person's performance will be. This is related to the higher awareness and responsibility that the person has for their tasks, resulting in better performance compared to officers who do not have higher education(Tua & Mardhiyah, 2022). Most of the respondents' work

period was more than two years. This shows that the officers are experienced enough in their field and have more insight regarding the EWARS program. Apart from that, working for more than two years shows they have had more work experience and a more mature mindset due to experience(Budiman, Makaginsar, & Putra, 2022).

The evaluation results indicating that most aspects meet the simplicity requirements suggest that the EWARS system in Lumajang Regency is user-friendly and easy to implement. This simplicity likely facilitates better adoption and usage by community health centers, minimizing technical or procedural barriers. However, it is essential to ensure that simplicity does not compromise the system's accuracy or comprehensiveness, and continuous monitoring is needed to maintain this balance while addressing other areas requiring improvement. This aligns with research conducted in Yemen, which shows that EWARS officers can collect and process data without significant disruption, and the reporting system is simple and easy to use. Where officers obtain data using cell phones and enter it using computers, and all officers in health services receive training to collect and input data(Dureab et al., 2020).

The results showing compliance with the flexibility attribute indicate that the EWARS system in Lumajang Regency can adapt to the varying needs and capacities of public health centers. This flexibility likely enhances the system's effectiveness in accommodating diverse local conditions and challenges. However, continuous evaluation is necessary to ensure that this adaptability remains aligned with the core objectives of accurate and timely outbreak detection and response. This aligns with research conducted in Yamen, which shows that the EWARS system meets flexibility requirements. It is stated that the EWARS system is easy to maintain and flexible enough if it is to be widely used in new health facilities. It is also easy to adjust, for example, by adding new priority diseases(Dureab et al., 2020).

Data quality attributes based on the results show that most public health centres in the Jember Regency have complied. This is in line with research conducted in West Papua, which stated that almost all public health centres in West Papua met data quality guidelines. Officers understand the definition of a case that is classified as an outbreak or outbreak. Apart from that, the data quality is adequate, indicating that the level of knowledge possessed by the officer in charge is quite good. This needs to be maintained and improved, one of which is by providing regular feedback to the public health centre and monthly reports back to the public health centre

or posts(Manurung, Reo, Pardosi, & Muscatello, 2020).

The findings on the acceptance attribute indicate that the EWARS program is well-received, with no significant burden felt by the users. This positive perception likely contributes to better engagement and adherence to the program, ensuring consistent reporting and monitoring. However, it is essential to maintain this level of acceptance by addressing any emerging challenges promptly and ensuring that the system continues to meet the needs of its users effectively. This aligns with research conducted in West Papua, which stated that officers accepted the EWARS program. This could be because all respondents knew that the EWARS system was handy and essential in detecting infectious disease outbreaks(Manurung et al., 2020).

The results showed that the EWARS representation attributes of public health centres in Lumajang Regency could have been more fulfilled. This is in line with research, which states that the EWARS report needs to meet the requirements for representation. This could be because several private health services and general and specialist practice clinics do not provide reports to the health centre, so the data received by EWARS officers does not represent data in the work area of the health centre. The report completeness of 60% in most Public Health Centers in Lumajang Regency, while a positive achievement, falls significantly short of the national EWARS target of 90%. This gap highlights a need for stronger efforts to improve data collection, reporting systems, and resource allocation. Addressing barriers such as limited staff capacity, training gaps, or technical challenges is critical to achieving the national standard and ensuring the effectiveness of EWARS in detecting and responding to outbreaks. These results are in line with research from Paramita (2017), which shows that the majority of public health centres studied have fulfilled the completeness of the report, namely 87.9%, which also does not meet the national minimum requirements. Of course, efforts need to be made to increase the completeness of reports. This is because the completeness of the report will also determine the quality of the data produced in EWARS.

The reporting accuracy of 88% in some Public Health Centers in Lumajang Regency exceeds the national minimum requirement of 80%, indicating that the data reported through EWARS is generally reliable and precise. This achievement reflects effective training and implementation in these centers. However, efforts should continue to maintain or improve accuracy, especially in centers that may

fall below this threshold, ensuring consistent and high-quality reporting across all facilities (Marullyta & Rohananingsih, 2022). This result is in line with research conducted in Bangladesh, which showed a result of 82%. Where it was recorded that there were no significant delays except during Ramadan. Only 29% of service facilities need to be on time in reporting(Wijekoon et al., 2020). The stability attribute shows that most of the results could be more satisfactory. These results align with research conducted in South Sudan, which stated that the level of stability of EWARS was shallow(Rumunu et al., 2022). This could be because most EWARS officers need training in good data analysis and processing, so the reports produced are unstable. Therefore, efforts are needed to increase its stability, one of which is by holding training for EWARS officers and providing facilities and infrastructure to support the implementation of the EWARS system(Polak, Sumampouw, & Pinontoan, 2020).

The utility or benefit attributes of EWARS in most Public Health Centers in Lumajang Regency still falling short suggests that the system's practical impact on outbreak prevention and response may be limited. This gap could stem from issues such as inadequate training, lack of integration with other health initiatives, or insufficient feedback mechanisms. Addressing these challenges is essential to enhance the perceived and actual benefits of EWARS, ensuring it effectively supports public health efforts at the local level. This is in line with research stating that EWARS needs to be appropriately utilized in formulating policies and creating treatment solutions. According to research conducted in the United States, EWARS can be maximized in making decisions and providing information regarding current conditions related to the spread of infectious diseases(Ricks et al., 2022).

The results of research regarding suggestions and input from surveillance officers in improving the implementation of EWARS in Lumajang Regency in 2022 mainly chose to hold regular meetings to evaluate data, performance and training. Critical data is evaluated periodically to assess the objectives and targeted benefits and check the accuracy and completeness of the data(Rahajeng & Wahidin, 2020). Apart from that, it is also essential to assess the performance of surveillance officers to determine whether the implementation of surveillance is effective. If it is not practical, through performance evaluation, we can find out what obstacles are causing the implementation of surveillance activities to run poorly. Providing training for EWARS officers has had a positive impact. This is in line with research

conducted, which states that training for surveillance officers provides increased understanding of potential epidemic diseases, identification of risk factors, data management and participation in epidemiological studies with simple presentations. In addition, training provides capacity strengthening and increased motivation for officers to carry out their duties, which improves the quality of EWARS reports (Syafruddin et al., 2022).

The study results indicate that the representativeness, stability, and utility attributes of EWARS in Lumajang Regency still need to meet the standards, which impacts the effectiveness of early detection and response to outbreaks. Data unrepresentativeness hinders data-based decision-making, increasing the risk of late detection and spread of outbreaks. Due to a lack of training and infrastructure, low system stability increases the risk of unpreparedness for health emergencies. In addition, the limited utility shows that EWARS data could be more optimal in supporting strategic decisions, so opportunities for outbreak prevention are not maximized. Therefore, routine training, strengthening infrastructure, and increasing collaboration with the private sector are needed to ensure more representative and stable reporting. These steps are essential to mitigate the risk of health emergencies and increase the effectiveness of EWARS in supporting a rapid and appropriate public health response (Cardenas, Hussain-Alkhateeb, Benitez-Valladares, Sánchez-Tejeda, & Kroeger, 2022).

This study has limitations, such as potential inaccuracies in secondary data, a limited research scope to one district, and a short research time. Cross-validation with primary data is carried out to reduce data bias, while broader and longitudinal research is recommended for more comprehensive results. However, this research provides important insights for strengthening EWARS through regular training, strengthening infrastructure, and better coordination to support early detection and effective response to infectious disease outbreaks.

5 CONCLUSIONS

The implementation of EWARS in Lumajang Regency in 2022 requires improvement, particularly in representativeness, stability, and utility, which impact the effectiveness of outbreak detection and response. Efforts to address these issues include routine training, enhanced data collection, regular evaluations, infrastructure strengthening, improved

supervision, and adequate human resources. Health centres are advised to conduct routine training, increase the scope of data collection, and conduct regular report evaluations. The District Health Office needs to provide infrastructure support, improve supervision, and ensure the availability of human resources. These steps aim to optimize EWARS functionality, support public health decision-making, and strengthen community health resilience. Further research is needed to explore additional variables and approaches for improving EWARS implementation.

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