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Evaluation of measles-rubella control and prevention program implementation: System and community review

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ABSTRACT

Introduction: The WHO targets Southeast Asia to eliminate measles and rubella by 2023. Measles-Contain Vaccination (MCV) coverage in Indonesia has dropped 6 %, and vaccine-preventable disease (VPD) reporting has fallen 30 % due to the pandemic. Bantul's MR positive rate rose 16 % in 2022. Measles outbreak with 71 cases in March 2023. We evaluated the system to identify program implementation gaps.

Methods: Following system surveillance evaluation guidelines 2006, we conducted a descriptive cross-sectional study. We evaluate the structure and attribute components. We chose eighteen public health facilities for sub-districts, with 52 health workers as representatives of all areas in the Bantul district. We interviewed with a semi-structured questionnaire. We calculated the frequencies and proportions of each component, categorized as good, fair, and weak.

Results: The average service time was almost ten years. No Public Health Center (PHC) used the system to make decisions. Since the private health facilities and community involvement was minimal, the surveillance system contains structural weaknesses in networks and partnerships. Timeliness completeness coupled with the weak evidence for variables of accessibility and flexibility is also vulnerable.

Conclusions: The Bantul measles-rubella disease surveillance system lacked networking, partnerships, and community involvement. The health office is expected to boost private health facility participation, monitoring and assessment, and vaccine coverage by at least 95 %, especially in vulnerable areas.

1. Introduction

Measles became the first child fatality reasons before the vaccination era. The WHO's five strategic plans for measles-rubella elimination include 95 % two-dose vaccination coverage and sensitive case-based surveillance.[1] Measles-contained vaccination (MCV) and vaccine-preventable disease (VPD) reporting in Indonesia dropped by more than 6 % and 30 %, respectively, in 2020.[2] A disrupted vaccination activity increased the measles resurgence during the COVID-19 pandemic[3] compared to pre-pandemic, which caused a high incidence risk in the community. Despite the COVID-19 pandemic, Bantul has stable immunization coverage with more than 95 % within 2020–2022. Yogyakarta has Indonesia's top two-dose MR Immunization in 2021–2022.[4]

Case-based Measles Surveillance (CBMS) activities also declined during the pandemic. CBMS is an infectious surveillance system that detects, reports, investigates, confirms, analyzes, and responds to measles cases, including dissemination to the stakeholders.[5] All fever and rash patients should be suspected and investigated to improve surveillance sensitivity.[1] Measles and rubella suspects in Indonesia are identified within one surveillance system based on the same clinical symptoms. The system collects individual data about demographics, vaccination status, and close contact, including blood/urine specimens. We use the system output to track and control the disease in the neighborhood.[6]

By the end of 2019, none of the WHO regions had achieved the measles elimination target and was noted to be weak.[6,7] Bantul -the second most populous district of Yogyakarta Province-reported that the blood sampling as part of CBMS activity in the sub-district only involved 55.6 % of sub-districts in 2021, the lowest performance since an

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electronic-based CBMS was applied. The low participation in CBMS will provide a biased case magnitude, thereby risking the possibility of an outbreak. Furthermore, the incident rate increased five times higher than in the last five years, with 7.2 per 100,000 population in 2022. A measles outbreak occurred in Wirokerton, Banguntapan, Bantul, with 71 positive cases in the first quarter of 2023. Despite the MCV coverage, we describe the evaluation of implementing a measles-rubella surveillance program in the Bantul district to determine the performance of measles-rubella control programs.

2. Methods

a. Describing the measles-rubella surveillance system under the Indonesia Ministry of Health (IMOH)

We conducted a descriptive cross-sectional study in the Bantul district using updated WHO generic questionnaires for surveillance system evaluation.[8] To describe Indonesia's Case-Based Measles Surveillance (CBMS), Indonesia's measles-rubella surveillance guidelines[2] and the measles-rubella elimination strategic plan from WHO were reviewed. We evaluate implementing a surveillance system in Bantul's public health center (PHC) as the center of the public health program. We Interview data managers, doctors, and analysts. We are using a semi-structured questionnaire based on WHO surveillance system evaluation guidelines[9] to collect data on CBMS from the health workers. We divided the questionnaire into four parts: demographics characteristics, networking, partnership of surveillance structure, and attributes such as timeliness, completeness, utility, simplicity, acceptability, and flexibility of data quality.

b. Evaluation of measles-rubella surveillance system

We evaluated the network and partnership implementation for the measles-rubella CDC program in the surveillance structure and attributes like timeliness, completeness, representativeness, utility, simplicity, acceptability, and flexibility as part of four components of the surveillance and response system.[9] We evaluated the system from 2021 to 2022 while the COVID-19 pandemic occurred. We analyze the data by scoring each variable within three evaluation categories: good (>80 %), fair (60–80 %), and weak (<60 %) system coverage. Eighteen (66.7 %) of the total 27 PHC and one DHO data manager interviewed represented all sub-districts in Bantul.

c. Operational Definitions

Network and partnership are defined as the availability of communication flow media information, including the network of health facilities willing and able to implement CBMS under the PHC, i.e., hospitals, clinics, or private health facilities.[10] This variable was part of the surveillance structure aspect.

Timeliness is defined as a weekly data report collected within the prescribed time. The notice is timely if a weekly report is submitted, at least on midday Thursday, including zero reporting data for the last six months.[11] Completeness refers to the proportion of health facilities that are full of data reporting from existence, i.e., digital government system (DGS), outbreak, weekly report, and early warning alert response system (EWARS) forms.[11]

Representativeness refers to the system's ability to accurately explain health events in terms of time, place, and person.[11] The utility is defined as the availability of disease reports, including detecting the alert continuously.

Simplicity refers to the operational ease of the surveillance system structure. We assessed clarity by whether the officer could explain the steps of CBMS for all suspect cases.[11] Acceptability is defined as the health facilities to implement the system. Flexibility is defined as the ability of the system to adopt a change within time.

d. Local setting

The study was conducted in Bantul, Yogyakarta's second most populous district. It was Indonesia's highest two-dose measles and rubella coverage vaccination achievement (78 %) in 2022. Based on the Indonesia Statistical Bureau, the Bantul population in 2021 and 2022 are 1.050.308 and 1.064.286, respectively. Bantul was divided into 17 sub-districts and has 27 PHC. We interviewed health workers in 18 (66.7 %) public health centers (PHC) representing each sub-district and district health office (DHO).

e. Data analysis

All proportions for structure and attribute surveillance were computed. All answers were scored with "1″ if the answer was yes and "0″ in contrast. Furthermore, we are dividing the sum of all respondent scores by the maximum score of indicator times by the number of respondents to find the overall score percent.[11] We interpret all the results into three categories: good (>80 %), fair (60–80 %) and weak (<60 %).

f. Human subject protection

This research has received approval from the Research Ethics Committee of Medicine and Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, number KE/FK/0033/EC/2023. We obtained permission from the DHO before the study. We are administering written informed consent in the local language from participants administering the questionnaire.

3. Result

a. Describing the measles-rubella surveillance system under the Indonesia Health Ministry (IHM)

Indonesia's Health Ministry (IHM) monitors measles and rubella as potential outbreak diseases. The CBMS would detect and respond to disease outbreaks early. Case-based surveillance reports were updated daily, whereas aggregate reports were updated weekly. The DHO officer examined district and PHC weekly data. Guidelines defined the standard, but each PHC reported cases differently. Each PHC sends suspect lists weekly to the central server via social media. Five private health clinics and 27 PHCs participated in this surveillance system. Fig. 1 depicts the IHM measles surveillance system, the evaluation scope, and the system gap in the red line.

Due to the pandemic, almost all health services' shortfalls affected the MR surveillance system. Thirteen (55.6 %) public health centers participated in case-based measles surveillance (CBMS) in 2021. The Meases-Rubella surveillance system implementation at the Bantul DHO is integrated into the VPD surveillance in the Disease Prevention and Control Department.

The measles data manager leads each PHC's Epidemiological Investigation (EI). Education and skills determine officers' investigative abilities. Table 1 shows that PHC officers are mostly nurses (89.5 %) and have a bachelor's in health (31.6 %). Most officers served for almost more than ten years (47.4 %). All program managers are health workers. However, only 11.1 % have epidemiological education, indicating a human resource shortage.

The measles program budgeting refers to the IHM policy number 1116/SK/Menkes/VIII/2003, derived from the regional budget. Due to the lack of standard budget allocation, the availability of the measles-rubella disease control budget differs in each PHC. During the pandemic, all disease control budgets focused on COVID-19.

The health workers' ability to detect suspects by each database also affects case detection. Fig. 2 compares all databases for detecting measles suspects in PHC. The detection is better in 2022 since the 2021 health facility will focus on COVID-19 control and prevention activities.

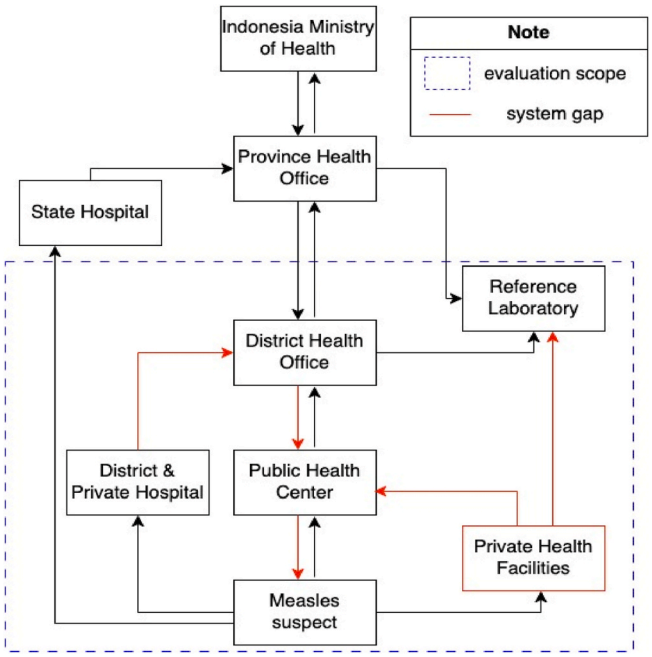

Fig. 1. Evaluation of measles-rubella surveillance system in Bantul, Indonesia. 2021–2022.

Table 1
Measles-rubella surveillance manager data.

Variable		Total (N = 19)	Percentage (%)
Gender	Male	7	36.8
	Female	12	63.2
Education	Diploma	11	57.9
	Bachelor in Health	6	31.6
	Bachelor in Epidemiology	2	33.3
Officer Status	Public Officer	18	94.7
	Non-Public Officer	1	5.3
Profession	Nurse	17	89.5
	Epidemiologist	2	10.5
Age	25–44 years old	12	63.2
	45–59 years old	7	36.8
Length of work	0–5 years	7	36.8
	6–10 years	3	15.8
	>10 years	9	47.4
Double job	Yes	18	94.7
	No	1	5.3

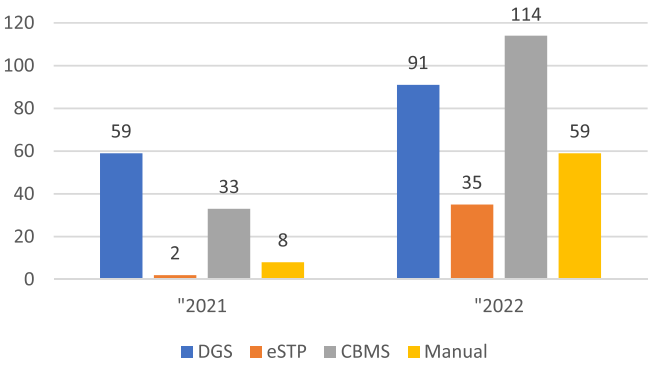

Fig. 2. Comparison of number of measles-rubella suspects from different types of reporting year 2021–2022.

b. Evaluation of measles-rubella surveillance system

We found the network and partnership was weak (58.3 %) (see Table 2). Meanwhile, the timeliness, completeness, acceptability, and flexibility remarks less than 50 %, as depicted in Table 2.

In 2021 and 2022, Bantul and Yogyakarta DHO conducted online networking and partnership socialization due to the potential disease outbreak, including measles and rubella. Only six (3.7 %) private healthcare care participate in the CBMS activities. Most private health institutions faced reporting cooperation difficulties (40.7 %).

Despite good MCV coverage, vaccination in private health care and independent midwives' clinics has never been supervised, which can contribute to cold-chain problems. Furthermore, laboratory feedback for specimens' results depends on the availability of IHM reagents. In the evaluation year, specimens from each second half year were delayed for the test due to reagent availability. Along with these difficulties, the system implementation was hindered.

We found that timeliness (50 %) and completeness (58.9 %) indicators were weak in the data quality indicator. Only six (33.3 %) PHCs consistently have accurate reporting in 2021 and 2022. In general, the accuracy of reporting in 2022 was better (91.9 %) than in 2021 (71.4 %). Only 16.7 % of health workers completed reporting of suspected Measles-Rubella cases with outbreak forms and weekly reports, even though 47.4 % of data managers already had national measles surveillance guidelines.

The main problems in acceptability indicators were due to the availability of evidence. We found that 100 % of PHCs have implemented the measles-rubella surveillance system. However, only 63.2 % of respondents could show evidence during 2021–2022. Furthermore, the ability of PHC to implement the update's case definition with only 11.1 % of health facilities in 2021 and 12 (66.7 %) in 2022 shows a weakness in the flexibility indicator.

4. Discussion

In disease control, especially for measles and rubella cases, preventive measures are needed at the individual level and regionally. An adequate surveillance system, including the availability of resources, monitoring, evaluation, and the sustainability of control disease programs, was essential to prevent cases in the community.[12] Furthermore, evaluation sustainability is needed to ensure the system finds its goal.[13]

a. Describing the measles-rubella surveillance system under the Indonesia Health Ministry (IHM)

The weakness of network and partnership will decrease the data quality, as we found. Ideally, a surveillance system can facilitate all health facilities since Yogyakarta's willingness to use the private health sector was high.[14] Meanwhile, PHC attendance dropped more than 40 % during the pandemic.[15] Community willingness during the pandemic decreased to 35.6 %.[16] This study found that the private sector has a significant role in prevention programs. Case detection as part of the

Table 2
Summary of the evaluation results of the Measles-Rubella surveillance system in Bantul District for 2021–2022.

Evaluation Variables	Measurement Sub variables	Percentage	Evaluation Results
Surveillance Structure	Networking and Cooperation	58.33	Weak
Data Quality	Timeliness	50.00	Weak
	Completeness	58.89	Weak
	Utility	100.00	Good
	Simplicity	83.33	Good
	Acceptability	55.56	Weak
	Flexibility	41.67	Weak

surveillance system functions requires community involvement, including the participation of private health care.

The community's measles-rubella CDC program is not included in PHC-trained health volunteers' training materials. It shows weak dissemination and coordination partnership functions.[17] Vulnerable coordination functions between programs and other health workers reduce the system's performance.[2,18] The finding shows that the private sector's role is vital in surveillance, especially for detection and reporting cases for adequate surveillance performance in the sub-district.

The IHM policy limited the examination of measles specimens in reference laboratories.[2] The officers forwarded the samples to a reference laboratory for analysis along with the report. The DHO officer will receive an email from the laboratory PIC with the results. While we conducted the research, Yogyakarta DHO was developing an electronic reporting system for measles and rubella lab results.

In. The resources issue, PHC officers should face at least ten basic service standards and 15 disease management programs, which forces more than 90 % of officers to perform two jobs. However, DHO knowledge-building activities in 2021 following the current measles-rubella surveillance guidelines supported training constraints.[19,2]

Funding at the district is only available for transportation activities. In contrast, at the PHC level, financing items vary from the availability of transportation costs for officers for investigation or specimen collection intended for VPD control in general. However, the specimen transportation budget was limited and decreased the officer performance.[20]

Furthermore, this study found low analysis data in health facilities. Along with the study in sub-Sahara Africa, the data analysis quality will affect the usefulness attribute in data quality[21] that needs analysis in each structure.[22]

PHC has a significant role in maintaining public health, individually and regionally. Since 2014, PHC has followed accreditation for quality control. The accreditation will evaluate the program's sustainability regarding resource availability, activity implementation, monitoring and evaluation implementation, preparation of follow-up plans for activities, dissemination, and implementation of follow-up plans.[2]

An adequate EI meets at least 80 % of investigations in less than 48 h of receiving notification.[1] It will result in delayed Epidemiological Investigation (EI) activity, ideally carried out less than 48 h after the suspect is found·[23,2] In addition, the completeness of patient data is also an issue that can hinder the tracing of cases, especially those from health facilities other than PHC and outside the Bantul Regency.

WHO targeted to reach a minimum of two per 100.000 population of measles discarded rate per year.[1] Despite the excellent performance of the discarded rate, Bantul did not send urine specimens during the evaluation year, while the guideline requires at least one urine sample per district per year.[1] According to the latest guidelines, the DHO officer admitted that the pandemic decreased awareness of adding specimen types.

b. Evaluation of measles-rubella surveillance system

PHC can only fulfill 16.7 % of adequate EI attributes. The timelines and completeness were weak even though 2022 was better than the previous year. The officer recognized the weak evaluation of SKDR 2021 as the impact of double workloads and the pandemic. This indicator performance increased after the repositioning of a change in the DHO data manager in 2022.

The DHO electronic surveillance system has provided alert notifications since mid-2022. No PHC has been able to show the reporting of measles-rubella cases, accompanied by the implementation of recommendations during the observation year. Despite the simplicity of the surveillance system, the officer's ability to implement the digital system depends on their skills.

The public health response relies on surveillance systems that provide reliable, timely, and complete support for activities.[13] From the study, the completeness and accuracy of the weekly report 2023 are far from the expected national standard and WHO targets.[24] The achievement of accuracy and completeness of reporting in 2022 is under national standards.[25] However, the system has not conducted data analysis that is the basis for follow-up or preparedness for outbreaks in the community. Budget availability is appropriate even though it is still joining other VPD activities. The data quality component shows that the accuracy and completeness of reporting weekly measles-rubella cases that utilize EWARS are not good. The average reporting accuracy at the PHC level has not reached the minimum standard of 85 % accuracy and 95 % completeness.[26]

A timely report will provide information to the region to assist in quickly handling cases or outbreaks, detecting outbreaks, and seeing disease trends. At the same time, the completeness of reporting will provide an accurate picture to measure the burden of disease in the community.[22]

Although the researcher did not evaluate the performance of an immunization program with significant roles in case prevention, this study was the first to evaluate a measles surveillance system during the COVID-19 pandemic phase in Yogyakarta. We focus on the case-based surveillance that is rarely concerned in other studies. In conclusion, the measles surveillance system's network, partnership, and data quality were not optimized in Bantul. An adequate surveillance system was needed not only as an activity but also in regional policy as a legal reference for regional action.

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Contribution of the authors

SG has contributed to conceiving the ideas of study, designing, data collection, analysis, and writing the first manuscript draft. BSW has contributed to developing research methods and systematic writing. MNS contributed to enhancing the study concept. SA has contributed to preparing field conditions for data collection.

Declaration of competing interest

None Declared.

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