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Evaluation of the Measles Epidemiological Surveillance System in the Kangaba Health District in 2022

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Abstract

Introduction: The WHO's measles control strategy is based on epidemiological surveillance and vaccination. Little is currently known about the performance of the surveillance system, particularly in outlying areas. It is in this context that the present study was carried out to evaluate the measles epidemiological surveillance system in the Kangaba health district. **Method:** This was a descriptive cross-sectional study with retrospective data collection for the period from 1 January to 31 December 2022 in the Kangaba health district with 18 epidemiological surveillance officers. Data were collected using an observation grid and documentary analysis. **Results:** We found a simplicity of 97%, a representativeness of 95% and a reactivity of 53%. Not all notified cases were sampled (64%). Of the 17 CSCom, 8 were positive. A total of 34 confirmed cases of measles were recorded, with one death. **Conclusion:** Overall, the system is functional and well-established in the health centres, but it remains important to ensure that suspected cases are investigated and that the time between sampling and the availability of laboratory results is respected.

Keywords

Evaluation, Epidemiological Surveillance, Measles, Kangaba

1. Introduction

Measles is a serious, highly contagious viral disease. Before vaccination was introduced in 1963 and became widespread, major epidemics occurred every 2 out of 3 years, causing an estimated 2.6 million deaths a year. Measles remains one of the major causes of death in young children, despite the existence of a safe and cost-effective vaccine. An estimated 107,500 deaths due to measles in 2023 [1]. Worldwide, the number of measles-related deaths varies between 100,000 and 200,000 each year, mainly in children. They can vary considerably over a short period of time, depending on the vaccination status of the population [2].

In 2018, more than 140,000 people died from measles worldwide, according to new estimates from the World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC). These deaths have occurred at a time when the number of measles cases has exploded worldwide, with devastating epidemics in all regions. Most of the deaths occurred in children under the age of 5. In Africa, the countries most affected were Liberia, Madagascar, the Democratic Republic of Congo (DRC) and Somalia, as well as Ukraine in Europe. These five countries accounted for almost half of all measles cases worldwide [3].

Measles remain one of the major priorities of international public health programmes. The World Health Organization (WHO) has established a global measles strategic plan covering the period 2012-2020. The goal of the Global Measles Strategic Plan, for the period 2012-2020, was to eliminate measles (absence of a chain of transmission following the introduction of a case) in 5 WHO regions by 2020, but this goal has now been missed.

The WHO then developed the 2021-2023 Strategic Plan for Measles Outbreak Response. The primary objective of this plan is to enable countries to prevent, prepare for, respond to and recover from measles outbreaks, with support from the WHO and its partners [4].

Mali experienced several measles outbreaks between 1998 and 2019. The first measles outbreak dates back to 1998, when more than 9593 cases were reported across the country, including 23 deaths, giving a case-fatality rate of 0.2%. Despite the efforts made by the Ministry of Health and its partners (mass vaccination campaigns and reinforcement of the routine extended vaccination programme), measles cases recurred in 40% of health districts (30/75) across the country in 2019. Analysis of surveillance data is crucial for guiding interventions to combat measles, which is a disease with epidemic potential that needs to be eliminated [5]. It is in this context that the present study was carried out to evaluate the measles epidemiological surveillance system in the Kangaba health district.

2. Methodology

2.1. Study Setting

The study was conducted in the Kangaba Health District, in 17 CSCom and the CSRéf. The Kangaba Health District is one of ten districts in the Koulikoro region.

2.1.1. Geographical Data

The Kangaba health district completely follows the territorial limits of the

Kangaba cercle. It has a surface area of 5150 km^2. It is located approximately 95 km south-west of Bamako and 155 km from Koulikoro. It is bounded:

- ✓ In the North by the health district of Kati and Kita;
- ✓ To the south by the Yanfolila health district;
- ✓ In the East by the Ouelessebougou and Sélingué health districts;
- ✓ To the west by the prefecture of Siguiri Republic of Guinea.

The cercle of Kangaba has 62 villages spread across 9 communes (Minidian, Nouga, Kaniogo, Karan, Narena, Benkadi, Balan-Bakama, Maramandougou and Selefougou).

2.1.2. Socio-Demographic Data

The population is mainly made up of Malinké, Bambara, Somono, Peulh and Dogon. It is estimated to have 150,644 inhabitants in 2022, with a growth rate of 3.6% according to the RGPH 2009. During the dry season, there is a strong migration of the population to the gold panning sites: Kokoyo, Koflatie, Kobadani, Niaouleni, Samaya, Dabalé, Bakama etc.

2.1.3. Economic Data

The main economic activities in the Cercle are trade, transport, crafts, market gardening, agriculture, fishing, livestock farming and gold panning. There are small food industries such as bakeries.

2.1.4. Health Data

The Kangaba health district has one referral health centre, 22 CSCom, 2 rural dispensaries, 39 rural maternity units, 3 doctors' surgeries, 2 pharmacies, 4 drug sales depots, and 53 functional CHW sites.

2.2. Type and Duration of Study

We conducted a descriptive cross-sectional study with retrospective data collection for the period from 1 January to 31 December 2022.

2.3. Study Population

The statistical unit was the community health centre. The target population of the study corresponds to all health personnel responsible for epidemiological surveillance. The source population consisted of staff in charge (doctor, nurse) of epidemiological surveillance in the Kangaba health district.

- Inclusion criteria:

Were included in the study all consenting staff in charge of epidemiological surveillance, available at the time of the survey and in post for more than one year of service in the district.

- Non-inclusion criterion:

Not included in the study were all non-consenting epidemiological surveillance personnel, unavailable at the time of the survey and in post for less than one year of service in the Kangaba Health District.

2.4. Sampling

2.4.1. Sampling Method

A non-probability method was used.

2.4.2. Technique and Sample Size

The technique used was purposive selection. This involved the DTCs, who are the epidemiological surveillance officers of the 17 CSCom in the health district and the epidemiological surveillance officer of the Kangaba CSRéf. These people were chosen on the basis of the relevance of the information they were able to provide for the questions addressed to them, their profile in the health system and the seniority of their centres. So we didn't choose the 5 DTCs who had been in post for less than a year.

2.5. Data Collection Techniques and Tools

The following techniques were used:

- Observation using an observation grid.
- Document review using an extraction sheet.

The main variables selected for this study were:

- The availability of agents carrying out epidemiological surveillance;
- The use of case definitions for reporting suspected measles cases;
- Knowledge of the epidemiological threshold for suspected cases;
- Knowledge of the epidemiological threshold for confirmed cases;
- The availability of the epidemiological surveillance guide;
- The availability of technical guidelines on measles;
- The availability of notification forms;
- The standardised transmission of data;
- Completeness of reports;
- Timeliness of reports;
- The number of suspected measles cases;
- The Number of suspected cases sampled;
- The existence of rapid means of communication;
- The time between notification and investigation of cases;
- The time between sampling and availability of results;
- The number of samples tested positive.

2.6. Ethical and Deontological Aspects

- The INFSS management sent a letter to the health authority of the Kangaba health district;
- The protocol was approved by district officials;
- All data collected were kept confidential and used only for the purposes of the study;
- Documented verbal consent (witness) was obtained from health staff before the questionnaire was administered.

3. Results

Our study was conducted in the Kangaba Health District and involved seventeen (17) Community Health Centres and the surveillance unit of the CSRéf. We surveyed 18 health personnel involved in epidemiological surveillance. In the Kangaba district, the information follows the classic circuit of the country's epidemiological surveillance system (Figure 1).

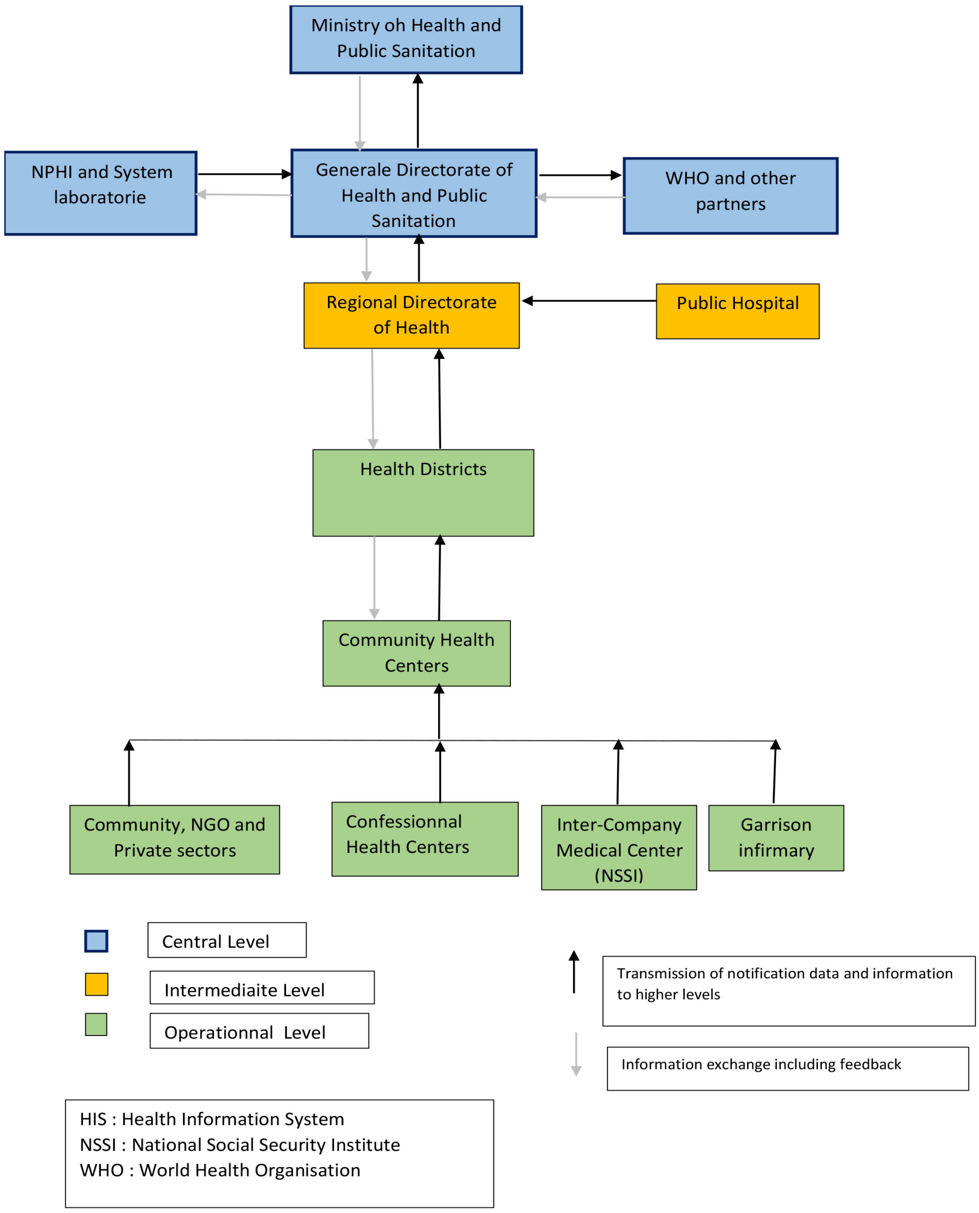

Figure 1. Information on disease and public health events surveillance and sample processing (IDSR 3rd Edition).

3.1. Description of the Operation of the Measles Epidemiological Surveillance System

All CSCom records suspected measles cases received during medical consultations in outpatient registers. They immediately inform the CSRéf by telephone or SMS. They take blood samples and send them to the CSRéf laboratory, together with a completed notification form. They take charge of patients.

The CSRéf in turn forwards the samples to the Institut National de Santé Publique (INSP) with the agreement of the Direction Régionale de la Santé (DRS) de Koulikoro for confirmation, given the district's geographical location. The Epidemiological Surveillance Officer (SE) is responsible for disease surveillance activities. He acts under the responsibility of the district's chief medical officer. They are responsible for collecting data. He provides the CSCom with sampling media and equipment. He or she is also responsible for collecting information on the epidemiological situation in the health district on a daily basis. The Local Health Information System (SLIS) officer and the Expanded Programme on Immunisation (EPI) officer are also key players in the epidemiological surveillance of measles. They are involved in supervision, staff training and upgrading, and data collection and analysis.

At CSCom level, each Centre Technical Director (CTD) is primarily responsible for epidemiological surveillance. They carry out this surveillance in collaboration with other staff, community health workers (CHWs) and community relays. This situation makes the CSCom the operational level par excellence for measles surveillance, as it is the first point of contact with the population. The district management team (DMT) supports the DTC in visiting villages/neighbourhoods to assess symptoms and classify the alert. It provides feedback to the DTCs and CHWs on the classification of the alert, mobilises resources and coordinates the organisation of the response.

The Regional Health Department team checks the data recorded in the weekly reports. It analyses the data and monitors trends to identify unusual events. It provides feedback to the districts and supports the CSRéf team in implementing surveillance activities and mobilising the necessary resources. The central level establishes policies, standards and procedures for integrated disease surveillance and response and mobilises the necessary resources (**Figure 1**).

3.2. Registration and Notification of Suspected Measles Cases

Documents for identifying suspected cases of measles (epidemiological surveillance guide, technical guidelines on measles, updated linear register, measles case notification forms, standardised definition for reporting cases of measles and probable outbreaks) were available at all facilities.

The registration and notification of suspected measles cases showed us the following points:

- Notification to the higher level is done through notification forms in all the centres visited, 100%. Actors use the standardised definition to report measles cases. Out of 54 suspected cases, 34 were confirmed.
- The confirmation of measles cases: out of 17 CSCom 8 recorded positive measles cases, among which 3 CSCom reached the epidemic threshold.

- The time between notification and investigation: in the district 61% of notified measles cases were investigated within two days.
- The time between sampling and the availability of results: all the results of the samples were only available after a delay of 7 days.
- Analysis and interpretation of measles data: most of the facilities surveyed, *i.e.* 94%, analyse data according to time, place and person.

3.3. Investigation and Response

During our study period, we recorded a total of thirty-four (34) confirmed cases of measles in the centres surveyed in the Kangaba health district. The epidemic threshold was exceeded in three health areas, which is why, in addition to the investigations carried out by the DTCs, a team from the CSRéf led by the epidemiological surveillance officer visited these different areas to investigate the cases further. Following confirmation of the suspected cases by the reference laboratory, the health district began organising a response by vaccinating children aged between 9 months and 5 years in the three health areas declared to be epidemic areas. During this response, the district vaccinated 4365 children aged 9 months to 5 years out of a target population of 6618, a rate of 65.96%. This low rate can be explained by the shortage of vaccines and the lack of funds to carry out the response.

3.4. Feedback

It was done systematically by e-mail at all levels of the health pyramid (national, regional, district and CSCom) and vice versa. It was done regularly by telephone between the CSRéf and the CSCom. Data was transmitted on a weekly basis to all the CSCom, *i.e.* 100%. There is a rapid means of communication (telephone) in all the CSCom.

3.5. Attribute Results

To ensure that the epidemiological surveillance system achieves its objective, its evaluation must include an assessment of the system's attributes, including simplicity, acceptability, representativeness, level of usefulness, flexibility, data quality, positive predictive value, speed and stability (**Table 1**).

4. Discussion

We made a reasoned choice concerning the 17 CSCom of the Kangaba health district in addition to the epidemiological surveillance unit of the CSRéf. The data were collated to establish the profile of measles in the Kangaba health district according to the various attributes. To carry out this work properly, we deemed it necessary to limit the study to staff involved in surveillance at the levels of the various structures and in post for at least one year.

Limitations and difficulties:

One of the main limitations of this study is the small sample size. The study was carried out in 17 of the 22 health areas and the CSRef epidemiological surveillance unit. It was not possible to determine the degree of involvement of community agents. We did not carry out analytical statistics such as comparisons between different centres and factors associated with delays. However, the 18 sites are geographically accessible throughout the year, but the main shortcoming is that the results of samples sent to the national reference laboratory are not available within less than 7 days. We have also not estimated the positive predictive value (proportion of cases captured by the surveillance system that are actually cases), given the retrospective nature of the data collection.

Table 1. Attribute-based representation of the measles epidemiological surveillance system in the Kangaba health district in 2022.

Attribute	Scores
Simplicity	**97%**
Availability of agents responsible for epidemiological surveillance	100
Use of case definitions for reporting suspected measles cases	100
Knowledge of epidemiological threshold for suspected cases	83
Knowledge of epidemiological threshold for confirmed cases	94
Availability of the epidemiological surveillance guide	100
Availability of technical guidelines on measles	100
Availability of notification forms	100
Standardised transmission of data	100
Acceptability	**94%**
Completeness rate of reports	100
Timeliness of reports	83
Sample collection rate	100
Representativity	**95%**
Case definition for data collection	100
Analysis of data by time	94
Analysis of data by location	94
Analysis of data by person	94
Use of graphs	94
Reactivity	**53%**
Existence of rapid means of communication	100
Time between notification and investigation of cases less than two days	61
Time between sampling and availability of results less than seven days	00
Sensitivity	**64%**
Number of suspected measles cases	134
Number of suspected measles cases sampled	86

Factors that may have influenced the completeness of the data include the quality of the internet connection in the health areas, the malfunctioning of the DHIS2 platform and the absence of data from private facilities.

Identification of the agents surveyed: we surveyed 18 facilities and questioned 18 health agents with different qualifications. The participation rate was 100%.

Confirmation of suspected measles cases: samples for confirmation of suspected cases were generally taken by the DTC or the laboratory technician and sent to the Institut National de Santé Publique (INSP) via the CSRéf. We found a sampling rate of 64% of suspected cases in the facilities surveyed, whereas Mara F et Coll found a rate of 86% in their evaluation of the measles surveillance system, Kérouané health district, Guinea August 2020 [6]. The death rate was 2.94% in the Kangaba health district. This rate is different from that of Diarra B O, who found a rate of 00% in commune IV [7]**.** Falaho Sani Kalil & al found that a widespread outbreak of measles which affected 1043 people, with five deaths in Ginnir district of Bale zone in 2019, and the outbreak lasted for 5 months [8].

Functioning of the surveillance system: In our study, the availability of the epidemiological surveillance guide was 100% in Kangaba. We observed 100% completeness of reports and 83% promptness. Our promptness is higher than the norm ≥ 80%. Our results are better than those of Falaho Sani Kalil & al who found 95% completeness [8]. As for the analysis of data by place, person and time, we found that 94% used graphs to show the evolution of cases, so well integrated into the public health system. It's the same as for M. Grey-Johnson, who found in his study in Ghana that the system had clear simple case definition which made it easy to capture suspected cases. It is integrated into the general surveillance system [9].

Attributes:

In our study, we found a simplicity of 97%. This result is very similar to Falaho Sani Kalil & al, who confirmed that all the key informants stated that the measles case definitions for identifying suspected cases are clear and easy to understand. The standard measles case definition was mainly used at the health centre level [8]. This trend is above that observed by Mara, F et Coll who found a simplicity of 86% [6]. However, efforts need to be made in the health district to improve staff knowledge of measles epidemiological thresholds. In our study, the acceptability (94%), this result is better than for Mara F et Coll who found 86% for acceptability [6]. Completeness and promptness of reports were within the norms. In this study we obtained a reactivity of 53%, our results are lower than those of Diarra B.O. who found 83% [7] and Wasu Chrispus Nchandon (77.6%) [10]. The WHO recommends a standard of 80% or more. Efforts must be made at all levels of the epidemiological surveillance system to comply with the standards between sampling time and availability of results, which was zero (availability time greater than 7 days) in our study. In contrast, in the study by Yanogo PK et al in Burkina Faso, more than 99% of patients had their blood samples taken for laboratory analysis in less than three days. However, only 9% had their samples sent to the laboratory in less than 72 hours [11].

5. Conclusions

At the end of our evaluation, we found that the Kangaba health district has an operational epidemiological surveillance system with some shortcomings in relation to measles surveillance, particularly in terms of responsiveness. Our study showed that the measles epidemiological surveillance system set up in the Kangaba health district fulfils the functions expected of an operational surveillance system. This study could be used as a basis for other studies, such as the evaluation of the epidemiological surveillance system in general.

At the end of our work, we recommend that the chief medical officers of the Kangaba health district train and upgrade the newly recruited technical directors in measles epidemiological surveillance and that the national reference laboratory makes laboratory results available within an acceptable timeframe of less than 7 days, as indicated by the WHO.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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