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Analysis of the Measles Epidemiological Surveillance Database in the Yelimané Health District from 2015 to 2024

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ABSTRACT:

Introduction: Measles is a febrile eruptive disease caused by a virus of the Paramyxoviridae family, transmitted through the air. Given recurring epidemics and insufficient data analysis of measles surveillance in the district, we deemed it necessary to analyze the measles surveillance database for the Yelimané health district from 2015 to 2024.

Materials and methods: In September 2025, we conducted a cross-sectional study of suspected and confirmed measles cases recorded in the measles database. The analysis was performed using Epi Info 7.2.7.0 software. Tables and graphs were created using Excel 2013.

Results: Our study included 101 cases of measles, with a median age of 5 (range 0-39) and a male-to-female ratio of 1.15. The majority of cases tested negative in the laboratory (71.29%). The highest number of confirmed cases was recorded in 2022. The 5-14 age group was the most affected, representing 42.86% of cases, and the majority (71.43%) were unvaccinated.

Unvaccinated people have a 3.53 times greater risk of developing measles than vaccinated people with a 95% confidence interval (1.22-10.20).

Conclusion: The 5-14 year age group was the most affected, with a male predominance. We found a strong association between vaccination status and the occurrence of measles.

KEYWORDS: Analysis, baseline, measles, Yelimané

I. INTRODUCTION

Measles is a febrile rash disease caused by a virus of the Paramyxoviridae family (Morbillivirus) which is transmitted through the air, from person to person, by respiratory droplets suspended in the air [1]. The virus infects the respiratory system, then spreads throughout the body, and the disease manifests as a high fever, cough, conjunctivitis, runny nose, and a rash all over the body, for which there is no specific treatment [2]. Measles is one of the most contagious diseases in the world, transmitted through contact with infected nasal or throat secretions (coughing or sneezing) or by breathing air exhaled by a person with measles. The virus remains active and contagious in the air or on infected surfaces for two hours. It can affect anyone, but it is more common in children [2]. Measles can lead to serious complications such as lung infections (pneumonia), persistent diarrhea, ear infections (otitis), and rarer but serious neurological complications

such as encephalitis (inflammation of the brain) which can cause permanent brain damage, blindness or deafness and even death [3].

Young children (especially infants), immunocompromised individuals (e.g., those with HIV/AIDS), and unvaccinated adults are more vulnerable to serious complications [3]. Vaccination remains the most effective way to prevent measles and its complications [3].

Before the introduction and widespread use of vaccination in 1963, major epidemics occurred every two years, causing approximately 2.6 million deaths annually [4]. Thanks to accelerated vaccination activities by countries, the World Health Organization (WHO), the Measles & Rubella Partnership (formerly the Measles & Rubella Initiative), and other international partners, approximately 60 million deaths were averted between 2000 and 2023 [2]. It is estimated that, thanks to vaccination, the number of deaths due to measles has fallen from 800,062 in 2000 to 107,500 in 2022. These deaths have occurred mainly in children under five years of age [2]. Worldwide, according to the WHO and the US Centers for Disease Control and Prevention (CDC), the number of measles cases was estimated at 10.3 million in 2023, an increase of 20% compared to 2022 [5]. According to an analysis by WHO and the United Nations Children's Fund (UNICEF), 127,350 cases of measles were reported in the European Region in 2024, double the number of cases reported in 2023 and the highest number since 1997 [6]. According to the WHO count, there were 21 major measles outbreaks between April 2021 and March 2022, mostly in Africa and the Eastern Mediterranean region, with the countries experiencing the highest number of outbreaks being Somalia, Yemen, Nigeria, Afghanistan and Ethiopia [7]. In Africa, nearly 17,500 cases of measles were recorded in the first quarter of 2022, representing a 400% increase compared to the same period in 2021 [7]. According to the UN health agency, twenty African countries reported measles outbreaks in the first quarter of 2022, eight more than in the first three months of 2021 [7]. In the first quarter of 2024, a total of 30,201 measles cases (1,560 confirmed, 28,641 suspected) and 768 deaths (2.54%) were reported by 17 African Union member states, including: Burkina Faso (1,714 cases; 7 deaths), Burundi (2,432; 53), Cameroon (216; 57), Central African Republic (CAR) (708; 2), Congo (46; 0), Democratic Republic of Congo (DRC) (19,414; 638), Ethiopia (216; 0), Gabon (13; 0), Kenya (157; 2), Liberia (203; 0), Mali (103; 0), Mauritania (693; 1), Nigeria (915; 2), Senegal (82; 0), Somalia (2,490; 3), Uganda (329 ; 3), Zambia (470 ; 0) [8]. In Mali, between 2009 and 2018, 9,484 suspected cases of measles were reported and 6,461 (68.13%) confirmed cases, including 29 deaths, representing a case fatality rate of 0.45% [9]. During the first quarter of 2022, 459 cases of measles with zero deaths were recorded in the provinces of Sikasso, Kayes, Koulikoro, Ségou, Mopti and the District of Bamako [10]. In the Kayes region in 2024, 148 suspected cases of measles were recorded during three outbreaks, of which 53 were laboratory-confirmed (51.96%), with no deaths [11]. In 2024, the Yelimané health district reported seven suspected cases of measles, one of which was laboratory-confirmed [12]. Despite the existence of an effective measles vaccine, it remains one of the few contagious diseases that continues to cause regular outbreaks worldwide. These outbreaks are frequent in low-income countries where vaccination coverage is generally below 95%, including Mali. This coverage is considered to be less than 95% for the two doses of measles vaccine needed to immunize the population in most regions of Mali. Despite the efforts of the government and its partners within the framework of the Expanded Program on Immunization (EPI), as well as the ongoing training of health workers to improve surveillance of diseases with epidemic potential, Mali in general, and the Yelimané health district in particular, faces measles outbreaks every year.

Faced with these recurring epidemics and a lack of analysis of measles surveillance data in the district, we deemed it necessary to analyze the measles surveillance database in the Yelimané district in order to guide decision-makers for future public health actions.

II. MATERIALS AND METHODS:

2.1. Study Setting: Yelimané Health District

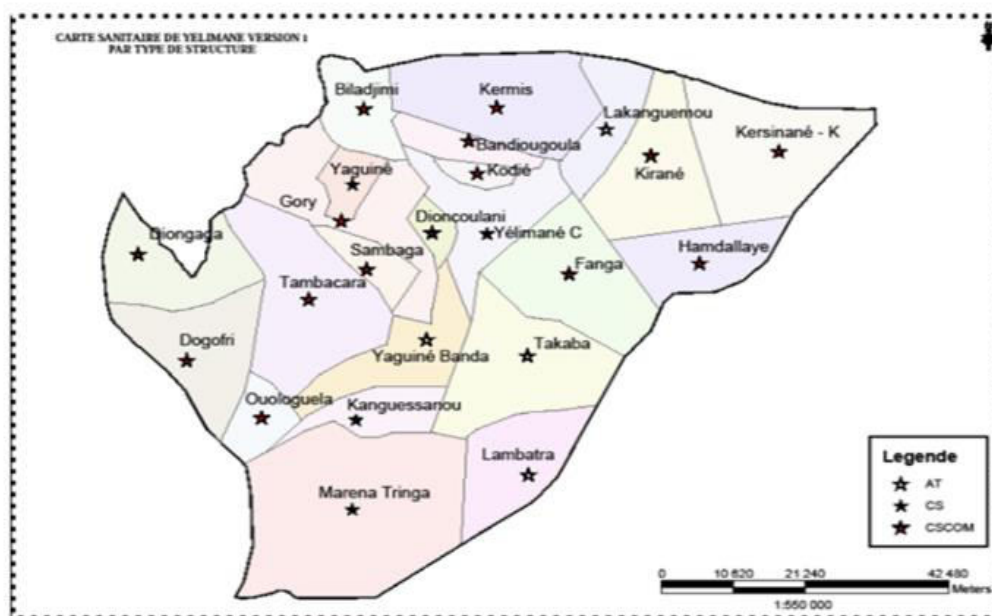


Figure 1: Health Map of the Yelimané District (Source: PDSC 2019)

Our study took place in the Yelimané health district, located in the northeast of the Kayes province between 14° and 16° North latitude and 10° and 12° West longitude. It is bordered to the northwest by the Islamic Republic of Mauritania, to the southwest by the Kayes health district, to the south by the Oussoubidiagna district, and to the east by the Nioro du Sahel district. It extends 110 km from north to south and 77.5 km from east to west, covering an area of 5700 km². The area has a Sahelian climate characterized by low rainfall, between 400 and 600 mm per year. Rainfall patterns vary considerably from year to year, both in quantity and distribution, during the short rainy season. Three seasons alternate: a cool season from December to March, a hot and dry season from April to June with temperatures reaching 45° to 48°C, and a rainy season from June to September. The prevailing wind is the harmattan, blowing from the northeast to the west, accompanied by dust clouds that reduce visibility. The Yelimané district has only one paved road, connecting the town of Yelimané to Kayes, a distance of 150 km. The other roads are unpaved and often impassable during the rainy season. The population is estimated at 285,750 inhabitants in 2025 (source: DNSI/RGPH 2009, updated). The district has 30 health areas, 17 functional community health centers, 13 medical practices, 6 pharmacies, and 4 drug depots.

All health areas conduct surveillance activities for notifiable diseases and other priority public health events. Health areas also provide fixed and outreach vaccination services in all villages of the district. The missions assigned to the reference health center (CSRéf) include, among others:

- Management of cases referred/evacuated by Community Health Centers (CSCOMs);
- Monitoring and evaluation of primary care facilities through supervision and monitoring;
- Coordination of health activities throughout the district;
- Advisory support to community and private facilities;
- Planning and coordination of all health activities, including national district programs and training of community health workers.

2.2. Study type: We conducted a cross-sectional study.

2.3. Study period: Our study took place from September to October 2025 and focused on measles epidemiological surveillance data from the Yelimané health district from 2015 to 2024.

2.4. Study population: Our study included suspected and confirmed cases of measles recorded in the Yelimané health district's measles surveillance database from 2015 to 2024.

2.4.1. Inclusion and exclusion criteria:

2.4.1.1. Inclusion criteria: Included in this study were: all suspected and confirmed cases of measles recorded in the measles surveillance database of the Yelimané health district from 2015 to 2024.

2.4.1.2. Exclusion criteria: The following were not included in this study: all suspected and confirmed cases of measles recorded in the database with more than 30% missing data.

2.4.2. Sampling type: We carried out an exhaustive sampling of measles surveillance data from the Yelimané health district from 2015 to 2024.

2.5. Operational definitions: The following definitions were used:

Suspected case: any person presenting with fever, a generalized maculopapular (non-vesicular) rash and cough, a cold or conjunctivitis (red eyes), or any person in whom a clinician suspects measles.

Confirmed case: presumed case confirmed in laboratory (positive search for IgM antibodies) or having an epidemiological link with confirmed cases or an epidemic.

2.6. Variables studied: We used the following variables: registration number, age, sex, vaccination status, laboratory result, outcome of the patient, residence, date of onset of the disease, date of notification, date of sampling.

2.7. Data collection technique and tools: The linear list of notifiable diseases in the Yelimané health district was retrieved in an Excel file from the staff responsible for data management and epidemiological surveillance.

2.8. Data Management and Analysis Plan

2.8.1. Data Entry and Management: The Excel file database was verified, and missing data was completed using the available notification forms, or deleted where necessary. Duplicates were removed. Inconsistent data was corrected or deleted.

2.8.2. Data Analysis and Processing: The data were analyzed by time, place, and person using Epi Info 7.2.7.0 and Excel 2013 software, and then presented in tables or graphs. Frequencies, proportions, and ratios were calculated, and ages were grouped into ranges. Qualitative variables were described as proportions, rates, and ratios. Quantitative variables were summarized and presented with their median and range.

Text processing was performed using Word 2013.

2.9. Ethical and Professional Considerations

An agreement was established with the chief medical officer of the Yelimané health district and the staff responsible for epidemiological surveillance. Throughout the study process, the confidentiality of information was guaranteed. The protocol was submitted to the intermediate-level field epidemiology training (FETP) mentors (cohort 6) for validation. Our data was stored on a password-protected computer.

III. RESULTS

After cleaning the database, our study focused on 101 cases of measles reported in the Yelimané health district between 2015 and 2024. The median age in this study was 5 years (range 0-39). Males were the most represented sex, accounting for 53% of cases, with a male-to-female ratio of 1.15.

Table I: Distribution of measles cases according to laboratory confirmation in the Yelimané health district from 2015 to 2024.

Specimen result	Frequency	Percent
Inadequate	2	1,98
Undetermined	1	0,99
Epidemiologic link	5	4,95
Negative	72	71,29
Positive	21	20,79
Total	101	100

The majority of cases tested negative in the laboratory, i.e. 71.29%.

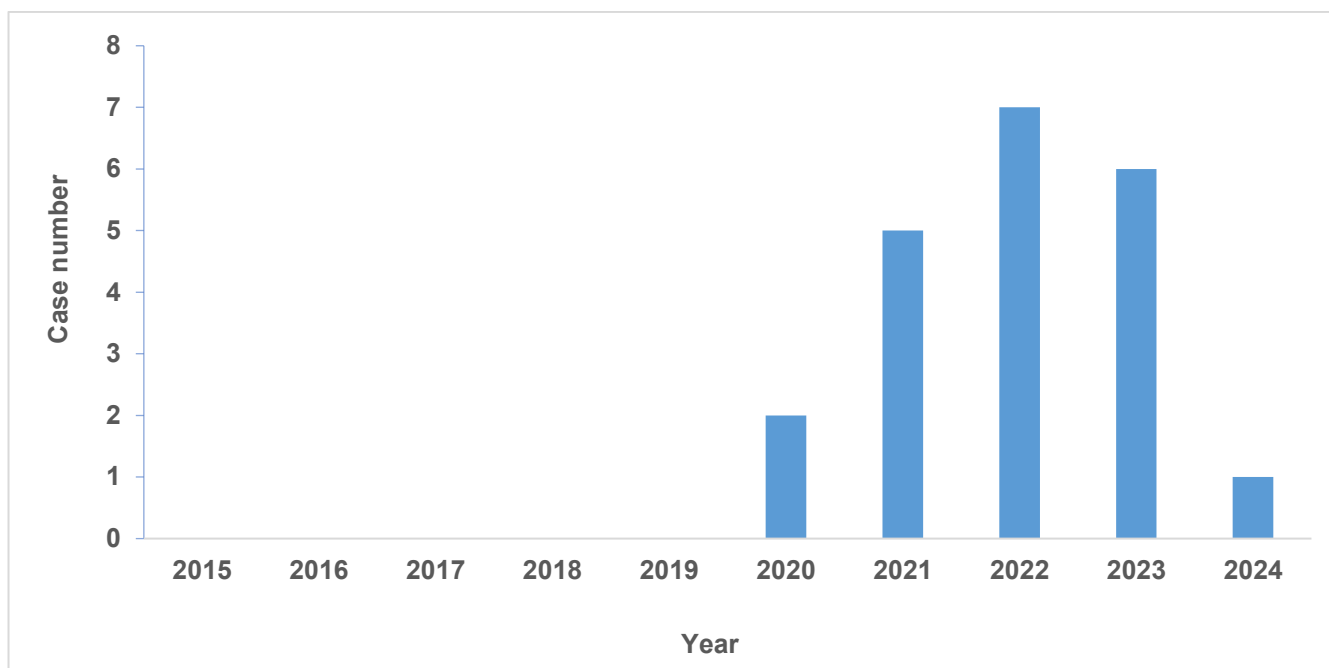


Figure 1: Distribution of confirmed measles cases per year in the Yelimané health district from 2015 to 2024.

The highest number of confirmed cases was recorded in 2022.

Table II: Distribution of confirmed measles cases according to vaccination status in the Yelimané health district from 2015 to 2024.

Vaccination status	Frequency	Percent
No vaccinated	15	71,43
Vaccine	6	28,57
Total	21	100

The majority of confirmed cases were unvaccinated, i.e. 71.43%.

Table III: Distribution of laboratory results according to age group, sex and vaccination status in the Yelimané health district, 2015 to 2024.

Variables	Number	OR	IC 95%
Age group			
<15 year	20	2,95	[0,35 ; 24,75]
≥15 year	1	-	-
Sex			
Male	12	1,33	[0,50 ; 3,56]
Female	9	-	-
Vaccination status			
No vaccinated	15	3,53	[1,23 ; 10,20]
Vaccine	6	-	-

Unvaccinated individuals have a 3.53 times greater risk of developing measles than vaccinated individuals, with a 95% confidence interval (1.22–10.20).

IV. DISCUSSION

During the period from 2015 to 2024 in the Yelimané health district, the majority of reported measles cases tested negative in the laboratory (71.29%). This could be explained by the sensitivity of the standardized definition in detecting the largest number of cases and the vigilance of health personnel in the context of active measles surveillance outside of epidemic periods. In our study, the highest number of confirmed measles cases was recorded in 2022, which could be explained by the decline in measles prevention measures during the COVID-19 period. This result is similar to those of Barry D. et al., who found more cases in 2022 in their study based on 2021-2023 data on measles cases in the Sikasso region of Mali [13].

In our study, the majority of confirmed cases were in the 5-14 year age group, representing 42.86% of cases. This result could be explained by low immunization rates in this age group. Our result differs from that of Togola OB. et al., who found that children under 5 were the most affected, accounting for 42.71% of cases, in their study of measles surveillance data from 2009 to 2018 in Tominian, Ségou province, Mali [14]. In our study, the male sex was the most affected at 57.14%, this result is comparable to those of Konaté MI. et al, who had found a male predominance of 51.45% during the study on the epidemiological, clinical and evolutionary profile of measles during the 2023-2024 epidemic in Burkina Faso [15]. In our study, the majority of confirmed cases were unvaccinated (71.43%), which could be explained by the disruption of vaccination activities following COVID-19 from 2020 to 2023. Our result is higher than that of Konaté MI et al., where 58.27% of cases were unvaccinated against measles in Burkina Faso in 2023-2024, and lower than that of Sy E H I et al., who found 95.71% in the study on the epidemiological profile of measles in Mali from 2009 to 2018 [9,15]. Unvaccinated individuals have a 3.53 times greater risk of developing measles than vaccinated individuals, with a 95% confidence interval (1.23–10.20). Lack of vaccination may be a contributing factor to exposure.

V. CONCLUSION

This study allowed us to correct the measles epidemiological surveillance database for the Yelimané health district from 2015 to 2024, resulting in a linear list of 101 cases. During the analysis of this database, the highest number of confirmed cases (7) was observed in 2022. Among the confirmed cases, males were predominant, and the 5-14 year age group was the most affected. We found a strong association between vaccination status and the occurrence of measles.

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