Texila International Journal of Public Health
ISSN: 2520-3134
DOI: 10.21522/TIJPH.2013.11.03.Art020

Retrospective Analysis of the Epidemiological Profile of Measles in 2022 in Mali

Kouame Stanislas Kafflouman[1,2*], Fousseni Soulama[1]; Bindy Ouoba[1], Muhundo Kinda[1], Seydou Fomba[2], Sekou Amadou Kouata[2], René Diarra[3], Alou Macalou[4]

[1]*PhD, Texila American University, Guyana, Central University of Nicaragua, Nicaragua*
[2]*ICF/Infectious Diseases Detection and Surveillance project*
[3]*General Directorate of Public Health and Hygiene, Bamako, Mali*
[4]*National Council of the Order of Physicians of Mali, Bamako, Mali*

Abstract

Measles is a highly contagious viral disease caused by the morbillivirus of which humans are the only reservoir. Our descriptive study aims at analyzing retrospective measles surveillance data from 2022. Of the 2037 suspected measles case samples received at the laboratory, 784 (38%) were confirmed. The age group of 1-4 years is the most affected with an attack rate of 25.43 per 100,000 inhabitants. Children under 5 represent 47.71% of cases. The median age is 4 years and the average age 6.14 years (0 months-54 years). The male sex represents 51% of cases with a sex ratio of 1.06 and an attack rate of 9.72 per 100,000 inhabitants. Most confirmed measles cases (71.77%) were recorded during the dry season. The districts of Koutiala (140 cases: 17.85%), Sikasso (127 cases: 16.19%), Ségou (109 cases: 13.09%) and Bougouni (98 cases: 12.5%) record the most case. The average time for feedback from the laboratory was 3.95 days. Moreover, among the 1253 sample cases negative for measles, 8.22% were positive for rubella. The median age of patients was 6 years. Children under five are the most affected. Most of these cases are in unvaccinated people. The establishment of an enhanced vaccination program at country level considering the most affected groups could reduce the resurgence of measles epidemics.

Keywords: *Epidemic, Measles, Mali, Notifiable disease (MADO), Spatiotemporal.*

Introduction

Measles is a highly contagious viral disease caused by the morbillivirus and humans are the only reservoir [1].

Measles, viral infection often benign its main signs: fever, maculopapular skin eruptions often accompanied by cough coryza, conjunctivitis and enanthema on the oral mucosa. Most of these signs gradually subside within 3-5 days. But complications can arise [2].

Complications are diarrhea, acute otitis media, viral or bacterial pneumonia; post-measles encephalitis usually occurs one to two weeks after the rash appears. Subacute sclerosing panencephalitis is an extremely rare but always fatal chronic progressive encephalitis caused by measles virus infection acquired earlier in life. It is a major cause of infant morbidity and mortality worldwide, mainly in developing countries [3].

Measles is a rapidly growing disease in the world with 869,770 cases and 207,500 deaths recorded in 2019 [4, 5].

It remains an important public health problem in many countries despite the availability of effective vaccines. The re-emergence of measles epidemics around the world with anti-vaccination agents presents a major challenge

Received: 29.07.2023 ***Accepted: 17.08.2023*** ***Published on: 29.09.2023***

****Corresponding Author: kkafflouman @gmail.com***

for all countries and changes the epidemiological landscape of measles, especially in low-income countries with high morbidity also in the United States and in Europe with anti-vaccination agents presents a major challenge for these countries [6].

The measles virus is among the most contagious, it still attacks unvaccinated populations and vulnerable communities. In high-risk areas where populations are typically isolated, poor, or socially or culturally marginalized, such failures in immunization coverage carry the risk of a resurgence of virus transmission or outbreaks of measles in the due to the persistent endemic circulation of the virus or the importation of cases [7].

In 2005, 345,000 deaths were reported, 87% of them in the Africa and Asia regions of the World Health Organization. However, in recent years, strategies based primarily on vaccination programs have been put in place to reduce measles mortality in WHO regions [3].

In 2018, the WHO reported 9,769,600 measles cases worldwide and 142,200 deaths. Most deaths occur in children under 5 years old. In Africa, 1,759,000 measles cases have been reported, including 52,600 deaths. The countries with the highest incidence are Liberia, Madagascar, the Democratic Republic of Congo and Somalia. Mali experienced several measles outbreaks between 1998 and 2019. The first measles outbreak began in 1998, when more than 9,593 cases were reported across the country, including 23 deaths, the case fatality rate was 0.2 %. In 1999, 2,093 cases were notified followed by 11 deaths with a fatality rate of 0.5%. In 2001, Mali experienced its second largest measles outbreak with 4,464 cases due to many unimmunized populations susceptible to measles. Outbreaks reported in late 2008 continued in areas that were not fully vaccinated [8].

Despite a safe, highly effective, and inexpensive vaccine, measles worldwide affects, according to estimates by the World Health Organization, more than 30 million children and causes nearly 777,000 deaths each year, including more than half occur in Africa. Of all vaccine-preventable diseases, measles remains the leading cause of death among children [5].

Despite the enormous efforts made during mass vaccination campaigns and strengthening of the expanded routine vaccination program by the Ministry of Health and Social Development and its partners (WHO, UNICEF, GAVI, Bill & Melinda Gates Foundation), there was a recurrence of measles cases in 40% of health districts (30/75) across Mali in 2019 [6].

In 2020, Mali recorded 1217 suspected measles cases with 188 confirmed cases. However, in 2021, it recorded 2431 suspected cases of which 430 came back positive [9, 10].

In order to determine the root causes of the occurrence of these measles epidemics and contribute to the interruption of its transmission in Mali, we carried out this analysis, the results of which are described through this article.

Methodology

Study Area

The Republic of Mali is a continental country located in West Africa, bordered by Burkina Faso, Côte d'Ivoire, Niger, Algeria, Senegal, Mauritania, and Guinea [8], with an [area]of 1,241,238 km2. In 2022, the population of Mali was estimated at 21,697,000 inhabitants (hbts) [11]. In Mali, there are two types of seasons: the dry season which runs from October to May and the rainy season from June to September [6]. The country has 10 health regions (Kayes, Koulikoro, Sikasso, Ségou, Mopti, Timbuktu, Gao, Kidal, Taoudéni, Ménaka) in addition to the district of Bamako, with a total of 63 health districts and 1,627 functional Health Communication Centers (CSCom) in 2022 [12].

Study Sample Size

Our retrospective study consisted in analyzing data from the epidemiological surveillance of suspected measles cases collected and sent in 2022 to the reference

laboratory of the National Institute of Public Health (INSP) in Mali.

For our study, we carried out an exhaustive sampling of the 2037 cases from the national measles database for 2022 stored in the DHIS2 database [13].

All measles cases collected during the study period meeting the standard measles case definition and registered in the national measles database were included in the study.

All cases of measles notified but not having been the subject of a sample were excluded from this study and sent to the level of the national reference laboratory.

Data Collection Method

In accordance with national technical surveillance guidelines, measles data is collected at the level of the Community Health Centers (CSCom) and transmitted to the level of the Reference Health Center (CSRéf) through the form of notifiable diseases (MADO). The cases detected are investigated using the case investigation form, then sampled and sent to the CSRéf to be sent to the INSP laboratory for confirmation.

The data collected is entered into a national database at the level of the national reference laboratory. Thus, our analyzes focused on this database in Excel format that we requested and obtained from the General Directorate of Health.

Data Processing Method and Analysis

The analysis of this database focused on the notification period (date of notification, epidemiological week), residence of the cases (district, health facility, village), socio-demographic characteristics (age, sex, vaccination status), clinical data (symptoms, date of onset of illness), samples taken, results of laboratory tests and final classification.

The cleaning of the Excel database before the analysis consisted in checking the concordance of the variables entered. Measles cases were described in terms of time, place and people. IBM SPSS Statistics 25 and Excel software were used for data analysis.

Results and Discussions

Description of Cases According to Time

We note that cases were recorded over the entire period, to this end, we see two peaks, one of which at the 3rd week [and] the other at the 8th week, followed by a gradual decrease in cases up to the 52nd week.

Measles cases were recorded during all weeks of the year with a high concentration of cases between weeks 01 and 19. These results are almost like those found by Sy et al., who found that in 2021 in Mali most confirmed measles cases (81.37%) were recorded during the dry season [6].

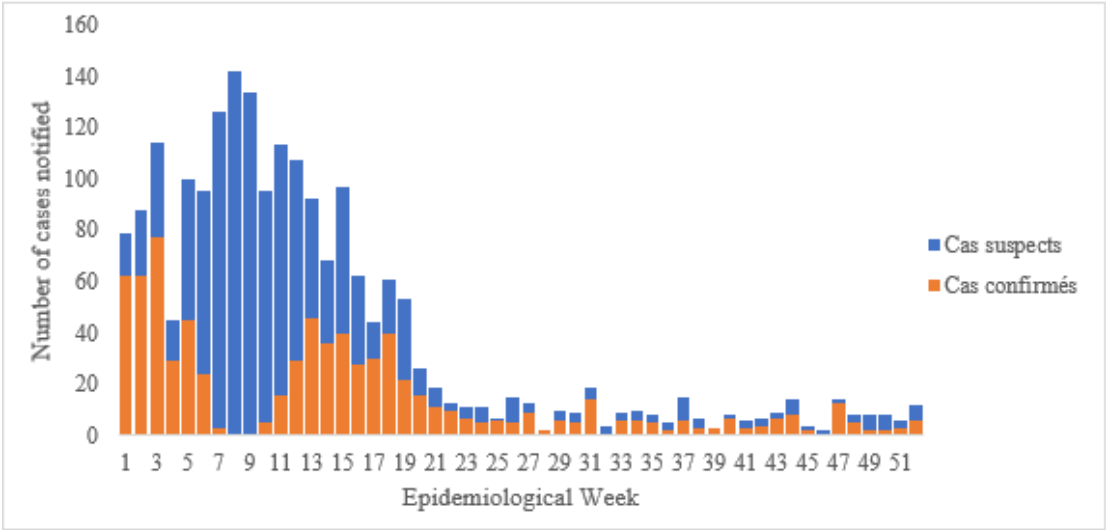

Figure 1. Histogram of the Weekly Evolution of Suspected and Confirmed Measles Cases in 2022 in Mali

Description of Measles Cases by District of Residence in 2022 in Mali

We note that out of the 75 districts in Mali, 61 (81.33%) reported at least one suspected case of measles over the study period. In view of the graph, the districts having notified the most cases were: Koutiala (140 cases or 17.85%), followed by Sikasso (127 cases or 16.19%), Ségou (109 cases or 13.90%) and of Bougouni (98 cases or 12.5%).

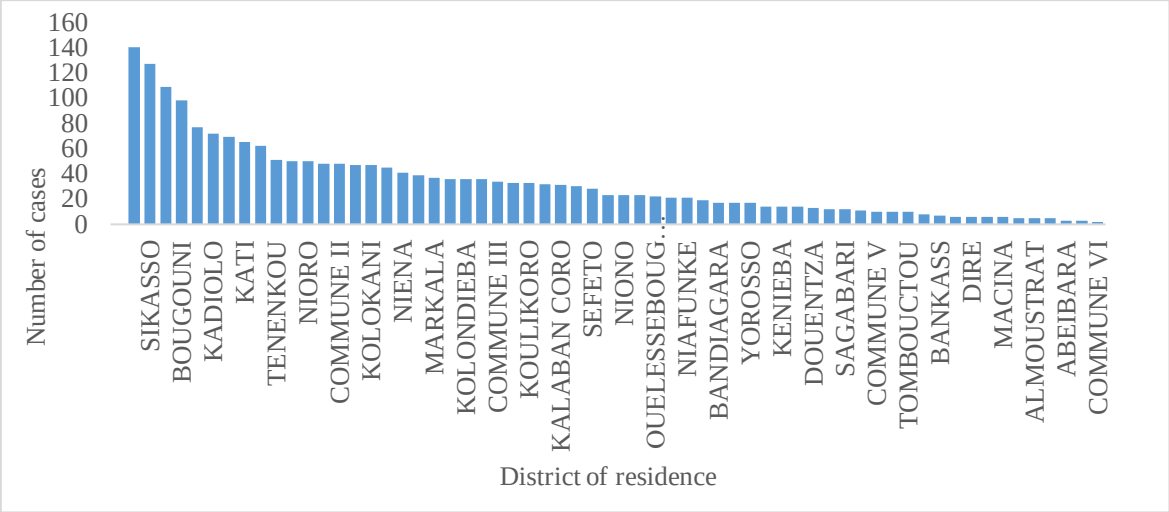

Figure 2. Distribution of 2037 Suspected Measles Cases by District of Residence in 2022 in Mali

Description of Cases by Measles Attack Rate by Age Group

For suspected cases, people aged 1 to 14 recorded the most measles cases (1522 cases). Then, among the 2037 cases sampled and received in the laboratory, the most affected age group in 2022 was the 1-4 year old group (attack rate = 25.43 cases per 100,000 inhabitants) followed by the 0-11 group month (attack rate = 21.91 cases per 100,000 inhabitants). Also out of 784 confirmed measles cases, the most affected age group in 2022 was the 1-4 year old group (11.80 cases per 100,000 inhabitants) followed by the 0-11 month group (11.18 cases per 100 000 inhabitants).

Children under 5 represent 47.71% of cases. These results are close to those found by Sy et al., (50.97%) found in 2021 in Mali [6], but different from those of Boushab who found in 2015 in Mauritania an age group of 20 years [14].

Table 1. Attack Rates of Suspected and Confirmed Measles Cases by Age Group in 2022 in Mali

Age group	Population by age group (DHIS2) (N= 20,415,244)	Status of suspected cases			Status of confirmed cases		
		Percentage by age group (%)	Suspected cases (N=2037)	Attack rate (100,000 inhabitants)	Percentage population by age group (%)	Confirmed cases (N=784)	Attack rate (100,000 inhabitants)
0-11 months	876 191	9.42	192	21.91	4.46	98	11.18
1-4 years	3,066,668	38.29	780	25.43	15.62	362	11.8
5-14 years old	6,242,859	36.42	742	11.88	31.8	219	3.5
15-44 years old	8,564,764	6.72	137	1.59	43.63	52	0.6
45-59 years old	1,664,762	0.44	9	0.54	8.48	2	0.12
Missing	N/A	8.68	177	N/A	N/A	51	N/A

Description of Cases According to Attack Rate by Sex

The male sex has the highest attack rate, for this purpose the most affected sex with a sex ratio of 1.06. We note a positivity rate of 38.81%.

Many cases were male (52%) and are like Sy et al. in 2021 (53.26%) but Diarra found different results in 2017 (50.3%) among females in Mali [6, 8].

Table 2. Attack Rate by Gender in 2022 in Mali

Sex	Population by gender (N=21,697,000)	Suspicious cases (N=2037)	Positive cases by gender (N=784)	Positivity rate by gender	Attack rate (100,000 inhabitants)
F	10,937,119	983	374	38.05	8.98
H	10,759,881	1046	406	38.81	9.72
missing	N / A	8	4	50	N / A

(Source: National Population Directorate October 2022: Mali = 21,697,000 inhabitants: Women = 10,937,119 / Men = 10,759,881)

Confirmation of Measles Cases

In 2022, 38% of suspected measles cases tested positive for measles.

Our results of 38% positive cases are almost like those of Sy et al., who recorded in 2021 (39.48%) and higher than those of Keita in 2014 who found (32.84%) in Mali [6, 15].

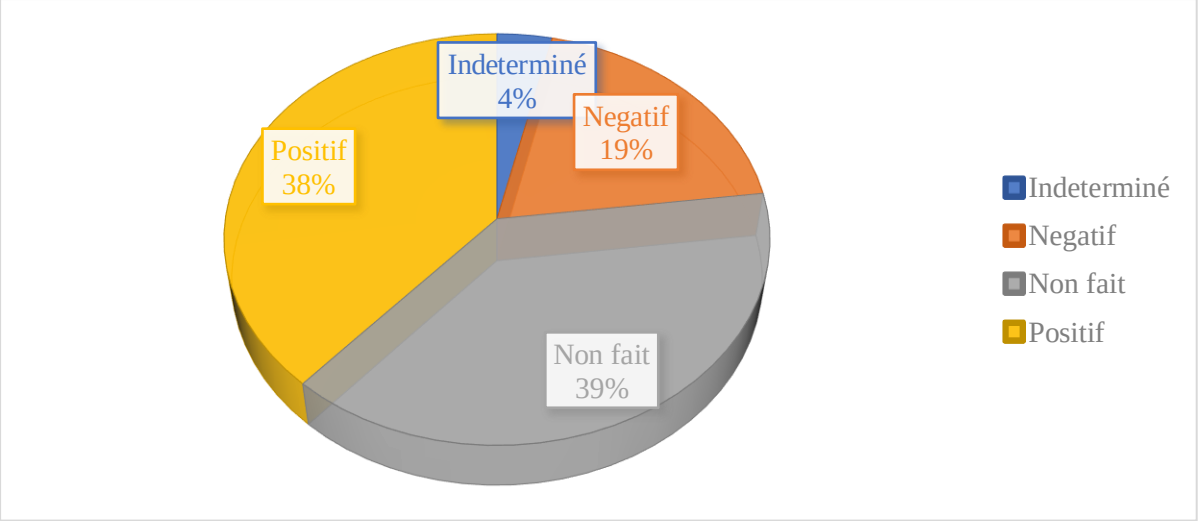

Figure 3. Distribution of Cases According to Laboratory Results in 2022 in Mali

Description of Measles Cases by Age

In 2022, the average age of the samples taken and received at the laboratory was 6.14 years and the median was 4 years. On the other hand, the average age of positive measles cases is 5.22 years and 03 years for the median age.

Table 3. Description of the Age in Years of Suspected and Positive Measles Cases in 2022 in Mali

Population (N=2037)	Status	Suspected cases received at the laboratory (N=2037)	Confirmed cases (N= 784)
Age	Valid	1860	769
	Missing	177	15
	Average	6.14	5.22
	Median	4	3

Quality of Samples Taken in 2022 in Mali

Adequate samples received at the reference laboratory represent 96%, there is a good mastery of the conditions of sampling, storage, and transport of samples by health workers samples received at the reference laboratory.

Our results of 96% of adequate samples show good control of the conditions of sampling, conservation, and delivery of the samples to the laboratory. These results are close to the (99.45%) found in Mali in 2021 by [6].

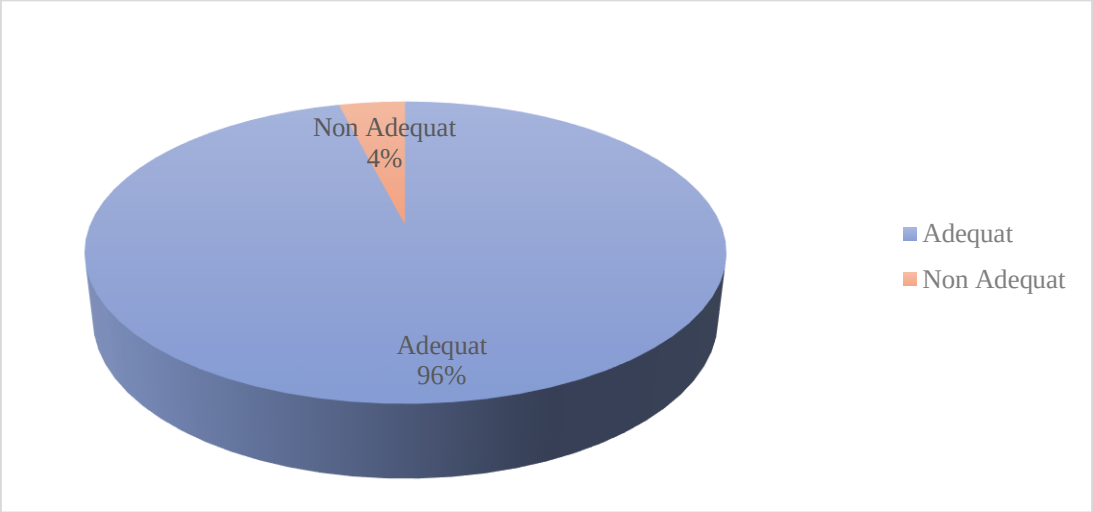

Figure 4. Situation of the State of the 2037 Cases of Samples in 2022 in Mali

Description of Suspected Measles Cases According to Vaccination Status in 2022 in Mali

Among suspected measles cases only 5% are vaccinated. Most cases have unknown vaccination status. This poses the problem of the quality of the investigation by the service providers and the availability of vaccination documents among the people who receive the vaccination.

The results of our study show that among the cases, 95% have an unknown vaccination status. These results are higher than those obtained by Keita H. in Mali 2005-2014 (88.5%) and Seck I in Senegal (88.5%) in 2012 [15, 16].

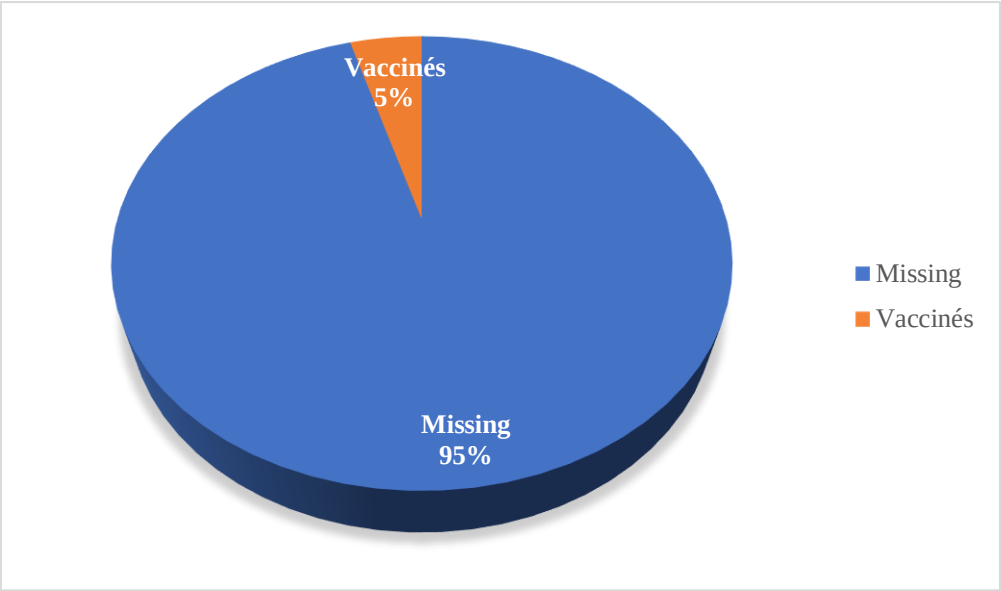

Figure 5. Situation on the Vaccination Status of Suspected Cases Sampled from Week 1 to 52 in 2022 in Mali

Description of Average and Median Sample Analysis Times in the Laboratory in 2022 in Mali

In 2022, the average time between the onset of the disease and the sampling is 04 days; it is 12.37 days between the taking of the sample and its reception at the laboratory, this may be linked to the distance between the sampling sites and the reference laboratory, but also due to the absence of a formal circuit for the transportation of samples. However, it took 3.95 days between receipt of the sample and the rendering of the results, and 21.99 days between the onset of the disease and the rendering of the results, with a median of 17 days.

The median time for receipt of samples by the reference laboratory would be nine (09) days and would fall within the interval (0-28), which is equal to the indicator of nine (09) days). Our results are superior to those of Alkassoum I in Niger in 2015 which found a delay of 04 days [17]. This median delay of nine (09) days could probably be explained by logistical difficulties (the availability of financial resources at the health district level for the delivery of samples to the national reference laboratory and the absence of a formal delivery circuit).

Table 4. Average Time between the Onset of the Disease, Sampling, Transport, Reception at the Laboratory and Reporting of Results from Week 1 to 52 in Mali in 2022

Population (N=2037)	Time between disease onset and collection	Time between collection and receipt	Time between receipt and results	Time between disease onset and results
Valid	2033	2022	1253	1304
Missing	4	15	784	733
Average	4	12.37	3.95	21.99
Median	3	9	4	17

The delay of feedback on the results of serology by the laboratory at the district level was within 3.95 days with a median delay of 04 days (0-92). Our results differ from those of Alkassoum SI in Niger in 2015 which found 07 days after the date of sampling, therefore within the recommended standards [17]. This delay in feedback could be explained by the fact that all

the samples are analyzed at the reference laboratory which is far from most regions of the country. These delays, considered too long, do not allow rapid decisions to be taken, especially in terms of preventive measures to control the epidemic.

Also, we can say that the prevalence of measles seems to be largely overestimated by the surveillance system in Mali based on the clinical definition of cases [18].

To track changes in measles epidemiology, better surveillance is essential and outbreak investigations will help define transmission patterns [19, 20].

Conclusion

Samples from suspected measles cases are taken within a reasonable time by health workers, the same goes for confirmation and results are returned by the reference laboratory upon receipt of the samples. We also note the good quality of the samples sent to the reference laboratory.

We also note the high proportion of unknown vaccination status (95%), hence the need to strengthen the skills of providers on the measles investigation guidelines. In addition, we deplore the insufficiency in filling out the data collection sheets and the long delay between the date of sampling and the date of delivery of the samples to the reference laboratory, but also between the onset of the disease and the return. results. We also note that of the 2037 suspected measles cases taken, 103 samples tested positive for rubella IgM. Finally, in order to make timely decisions, it will be wise to shorten these deadlines to properly complete the sample collection sheets and conduct a rigorous analysis of the surveillance data which are crucial to guide interventions in the fight against measles, a disease targeted for the disease. elimination.

Conflict of Interest

All authors and co-authors declare that they have no conflict of interest for the work submitted.

Acknowledgement

Doctor Seydou FOMBA; General Directorate of Health and Public Hygiene of Mali (DGSHP); Direction (DRS) of Koulikoro and Sikasso in Mali, the chief medical officers, and the community-based surveillance focal points of the districts of Kadiolo, Kati and Kangaba, the technical directors of the health centers and the district community health workers.

References

[1] Coulibaly H, Sangho O, Sogodogo S, Keyembé K, Dakouo H. Evaluation of measles epidemiological surveillance: Analysis of the Koulikoro health district database from 2012-2018. Mali Public Health. June 30, 2019;66 -9.

[2] Brenda LT. MSD Manual Professional Edition. 2021 [cited 2023 Jul 2]. Measles - Pediatrics. Available at: https://www.msdmanuals.com/fr/professional/p%C3%A9diatrie/diverses-viral-infections-in-the-infant-and-child/measles.

[3] Dia N, Fall A, Ka R, Fall A, Kiori DE, Goudiaby DG, et al. Epidemiology and Genetic Characterization of Measles Strains in Senegal, 2004-2013. PLOS ONE. 2015 May 22 ;10(5):e 0121704.

[4] Habibatou AI, Yanogo PK, Barry D, Togola OB, Adehossi E, Meda N. (PDF) Epidemiological profile of measles in Niger: analysis of measles case-based surveillance data from 2010 to 2019 [Internet]. 2019 [cité 25 avr 2023]. Disponible sur: https://www.researchgate.net/publication/363490495_Epidemiological_profile_of_measles_in_Niger_analysis_of_measles_case-based_surveillance_data_from_2010_to_2019.

[5] Koita M. Performance of the Laboratory System in the Management of the Measles Epidemic in 2020 in Mali. [Internet][Thesis]. USTTB; 2022 [cited 2023 Jul 2]. Available at: https://www.bibliosante.ml/handle/123456789/5993.

[6] Sy EHIA, Barry D, Traoré B, Boly A, Koné B, Dembélé A, et al. Epidemiological profile of measles

in Mali from 2009 to 2018. Journal of Interventional Epidemiology and Public Health [Internet]. 2021 Sep 24 [cited 2023 Apr 11];4(8). Available at: https://www.afenet-journal.net/content/series/4/3/8/full/.

[7] Regional Committee for the Western Pacific 063. Measles elimination [Internet]. WHO Regional Office for the Western Pacific; 2012 [cited 2023 Aug 8]. Available at: https://apps.who.int/iris/handle/10665/249122.

[8] Diarra MBO. Presented and defended publicly on 2017 In front of the Faculty of Medicine and Odonto-Stomatology. 2017.

[9] Mali MOH CMS. Annual national bulletin of epidemiological surveillance [Internet]. 2022 [cited 2023 May 6]. Available at: https://mali.iddsproject.org/.

[10] Mali MOH CMS. Search for annual newsletter | Mali MOH CMS [Internet]. 2021 [cited 2023 May 6]. Available at: https://mali.iddsproject.org/fr/search/node?keys=bulletin+annuel.

[11] National Population Directorate. Reports – National Population Directorate [Internet]. 2020 [cited 2023 Apr 17]. Available at: https://dnp-mali.ml/rapports/.

[12] SLIS. 2018 Statistical Yearbook of Mali's local health information system [Internet]. 2019 [cited 2023 Apr 12]. Available at: http://www.sante.gov.ml/index.php/nep-mali/item/3304-annonce-statistique-2018-du-systeme-local-d-information-sanitaire-du-mali.

[13] DHIS2. Mali Health Information System - SISM [Internet]. 2022 [cited 2023 May 6]. Available at: https://dhis2.snissmali.org/dhis/dhis-web-commons/security/login.action.

[14] Boushab BM, Mamoudou S, Sow M, Sounkalo D. Epidemiological, clinical and prognostic aspects of measles in the regional hospital center of Aïoun , Mauritania. *Tropical medicine and health.* 1 Jan 2015; 25:180 -3.

[15] Keita H. Trends in Measles Cases in Mali 2005-2014 FELTP Program, Ouagadougou, Burkina Faso. 2014. - Google Search [Internet]. 2014 [cited 2023 Apr 23]. Available at: https://www.google.com/search?client=ms-google-coop&q=Keita+H.+Tendances+%C3%A9volutives+des+cas+de+rougeole+au+Mali+2005-2014+Program+FELTP,+Ouagadougou,+Burkina+Faso.+2014.&cx=006207468133305365192:xikjgz0wzec.

[16] Seck I, Faye A, Mbacké Leye MM, Bathily A, Diagne-Camara M, Ndiaye P, et al. Measles epidemic and its response in 2009, in the Dakar region, Senegal. Public health. 2012;24(2):121 -32.

[17] Alkassoum SI, Brah S, Djibo H, Djibo I, Kouwawo M, Batoure O. Bing. 2015 [cited 2023 May 13]. Epidemiological surveillance of measles in Niger: Analysis of the database of notifiable diseases (MDO) from 2003 to 2015. *Int J Innov Sci Res.* 2016; 27(2):264-74. Available at: https://www.bing.com/search?q=Alkassoum+SI%2C+Brah+S%2C+Djibo+H%2C+Djibo+I%2C+Kouwawo+M%2C+Batoure+O.+Epidemiological+surveillance+of+measles+in+Niger%3A+Analysis+of+the+database+of+notifiable+diseases+(+MDO)+from+2003+to+2015.+Int+J+Innov+SCI+RES.+2016%3B+27(2)%3A264-74. & Cvid = C1EBC6AAEA994CB49F1BD4BBD8E860 & AQS = edge.0.69i59j69i11004.541J0J7 & FORM = ANNAB1.

[18] Cutts FT, Dabis F. Measles control in developing countries. Notebooks for French-speaking studies and research/Health. 1994 May 1;4(3):163 -71.

[19] Farhat BE, Salaaoui E, Tlili F, Tagorti R, El Berkri S, Turki R. yumpu.com. 2011 [cited 2023 May 13]. Surveillance of the target diseases of the national program of.

[20] Sounkalo D. EM-Consulte. 2008 [cited 2023 Aug 8]. B-08 Contribution of the laboratory in the epidemiological surveillance of measles in Mali. Available at: https://www.em-consulte.com/article/176864/b-08-apport-du-laboratoire-dans-la-surveillance-ep.

[21] DHIS2. Mali Health Information System - SISM [Internet]. 2022 [cited 2023 May 6]. Available at: https://dhis2.snissmali.org/dhis/dhis-web-commons/security/login.action.