REVIEW OF MEASLES NOTIFICATION DATA WITHIN THE INTEGRATED DISEASE SURVEILLANCE AND RESPONSE (IDSR) IN NIGERIA (2012-2016)

Gloria Oiyahumen Anetor
Department of Human Kinetics and Health Education, Faculty of Education, National Open University of Nigeria, University Village, 91 Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja ***Correspondence:** yahunet@yahoo.com

ABSTRACT

Background: *Nigeria is among the 45 countries that account for 94% of the global deaths due to measles. This study examined measles data retrospectively for five years in other to ascertain measles trend and epidemiology, focusing on timeliness and completeness of data, attack rate (AR) and Case fatality rate (CFR) in order to proffer solutions to reduce measles cases in Nigeria.*

Methodology: *A retrospective survey design. Permission granted by Nigeria Centre for Disease Control, Abuja touse existing routine measles and outbreak notification data from 2012 – 2016.Using SPSS 20, the data was collated, analyzed and interpreted using percentages, graphs and Chi square at 0.05 significant level.*

Results: *A very low rate of laboratory confirmed cases was revealed. There is a significant difference in the number of cases of measles in the age groups ($p < 0.05$). Children in the age group of 1 – 5 years mostly affected. There is a significant difference in the cases of measles in terms of geopolitical zone distribution ($p < 0.05$); the northern zones were more affected. There is a significant difference in the number of deaths recorded for measles ($p < 0.05$); the case fatality rate (CFR) and attack rate (AR) show that deaths from measles were highest among children under 5 years. Timeliness and completeness of reporting data indicate poor quality in gathering measles data.*

Conclusion: *From data analyzed, IDSR appears to have an ineffective case management system and poor data reporting quality. There is the need for more proactive and efficient surveillance to combat measles.*

Keywords: *Measles, Surveillance, Notification, Nigeria, Infectious disease.*

INTRODUCTION

Measles is an acute, highly infectious disease caused by a virus that belongs to the group of *Morbilliviruses* of the family *Paramyxoviridae*[1,2,3].It has an incubation period of 10-12 days[3]. Measles is one of the leading causes of death among young children even though a safe and cost-effective vaccine is available[2]. The case fatality rate (CFR) of measles; which is a measure of the severity of the disease, in the developing countries is around 3-5%; with this being as high as 10% during epidemics[3].Measles is confirmed in the laboratory when a blood sample taken from a suspected case within 30 days of onset of rash shows measles IgM antibodies. There is a caveat when using the presence of IgM antibodies as diagnostic

index for the confirmation of measles; measles vaccination as well as measles infection both result in raised IgM antibodies. Therefore, the presence of measles IgM antibodies in persons vaccinated with the measles antigen 30 days before the sample is collected does not imply disease but, rather, vaccination against measles. In Nigeria, it is often advised to report suspected measles outbreak when 5 or more cases are suspected in one month[4].

It is important to control the spread of measles through accelerated measles schedule/control as recommended by World Health Organization (WHO)[5].The control involves highly visible activities that attract attention and support to immunization, especially during campaigns[5]. Accelerated measles control activities started in 2001 in the World Health Organization (WHO) African Region (WHO AFRO) countries, aiming to reduce measles deaths by half by 2005[6,7]. In 2012, Nigeria committed to WHO Africa Region's aim of eliminating measles by the year 2020. Nigeria is expected to record no more than 200 cases of measles per year with the elimination commitment, but in 2016 there was still a record of approximately 25,000 of both suspected and confirmed cases of measles despite immunization, indicating gross incapability of Nigeria coping with its target of maximum measles cases; representing the highest in WHO AFRO. [(1)] Surveillance for measles is important to monitor/adjust strategies and should evolve based on level of control. Those countries in which the objective is to completely interrupt measles transmission require very intensive case-based surveillance to detect, investigate, and confirm every suspect measles case in the community"[8]. Measles surveillance involves continuous monitoring, systematic collection, analysis and interpretation of measles-related data in order to clarify the epidemiology of measles and, to allow priorities to be set and to inform policy and strategies of control and management. Surveillance data are used to characterize persons, groups, or areas in which additional efforts are required to reduce risk of measles disease and outbreaks[8,9].

The types of surveillance for measles depend on the attributes and the objectives of the immunization programme. For example, when the objective of the programme is control of measles, and the number of cases is high; it is important to know where the cases are. When the number of measles cases is reduced and the objective of the programme changes to elimination, then, investigation of individual cases and transmission chains will become necessary[8,9,10].There are mainly two main types of surveillance which are National Active Surveillance and National Passive Surveillance. The active surveillance is usually used when a disease is targeted for eradication or elimination, when every possible case must be found and investigated. It is also used for outbreak investigations. Cases found are reported according to national policy[11]. On the other hand, the passive surveillance involves the regular collection and reporting of surveillance data and is the commonest method used to detect vaccine-preventable diseases. Such reports may be daily, weekly or monthly. However, completeness and timeliness of such data may not be guaranteed[11,12,13].However, Nigeria adopts both active and passive surveillance with more emphasis given to passive surveillance. It is important to give equal attention to active surveillance as is given to

passive surveillance because measles is endemic in the country. Giving proper attention to active surveillance will help to move the country from the control phase to the phase of eradicating or eliminating measles[14].

When measles is endemic, routine monthly reporting of aggregated data on clinical measles cases is recommended by district, age group and immunization status. Laboratory confirmation may be attempted by sampling approximately 10 cases per outbreak. Urine, nasopharyngeal or lymphocyte specimens (for virus detection and genetic characterization) should be collected from sporadic/outbreak cases (approximately 10 cases from each chain of transmission) to characterize viral circulation and importation patterns[15,16,17].An investigation of the measles trend in Nigeria has become very important especially as Nigeria has been reported to be among the 45 countries that account for 94% of the global deaths due to measles[3,12].This implies that the country is yet to fully control the upsurge of measles and needs to proactively embark on immunization strategies in order to reduce the infection. Therefore, prompt recognition, reporting, and investigation of measles is important to limit the spread of the disease. Enhancing early case identification, laboratory confirmation and public health response including vaccination are essential for controlling measles outbreaks[4]. These measures can be achieved through the Integrated Disease Surveillance and Response (IDSR). The Integrated Disease Surveillance and Response (IDSR) is a strategy and a tool to promote rational use of resources by integrating and streamlining common surveillance activities. Many intervention programmes still rely on their own disease surveillance systems[4]. The availability of accurate, up-to-date, reliable, and relevant health data and information is essential for strengthening and managing health systems. The World Health Organization (WHO) Regional Office for Africa (AFRO) proposes an Integrated Disease Surveillance and Response (IDSR) strategy for improving disease surveillance in Nigeria linking community, health facility, LGA, State and National levels[4].

In Nigeria, it appears that in various parts of the country, measles cases are still under-reported; health workers need to be trained in disease notification and surveillance.[9,10].In general, the number of reported cases reflects a small proportion of the true number of cases occurring in the country. Many cases do not seek health care or, if diagnosed, are not reported[18,19]. The long term goal of integrated disease surveillance is to ensure quality health for all Nigerians by contributing to the reduction of the burden of communicable diseases, conditions and events of public health significance. This study reviewed the trend of measles within the IDSR system (2012-2016) focusing on timeliness and completeness of reporting, as well as attack rate (AR) and Case fatality rate (CFR) in order to provide a greater understanding of measles trend and epidemiology in Nigeria within the period of study.

Report areas more affected by measles in terms of AR and CFR, so that more preventive (proactive IDSR) attention can be given to such areas to reduce the impact of the disease.

Identify lapses to be corrected in measles data reporting with regards to timeliness and completeness in order to reduce morbidity and mortality of measles cases in Nigeria.

METHODOLOGY

Ethical Consideration

A written permission was received from the Chief Executive Officer (CEO), Nigeria Centre for Disease Control (NCDC), to use the routine measles and outbreak notification data from 2012 – 2016 from the Surveillance Department of NCDC, Abuja. It is a de-identified data in which information was gathered and expressed in a summary form, for statistical analysis (aggregate data).

Study Design: A descriptive study using retrospective secondary data from NCDC to review measles records and trend.

Study Population: All reported measles cases (both suspected and confirmed) in the IDSR for the period of 2012 to 2016 were reviewed. IDSR weekly epidemiological data for the years under review was obtained from Surveillance Unit, Nigerian Center for Disease Control (NCDC). The document contains recorded measles cases from the 36 States (plus the FCT) of Nigeria.

Data Analysis: Using SPSS 20, the data was collated, analyzed and interpreted using percentages, simple proportions, table, graphs and Chi square. Discussion and recommendations were made in line with the findings.

RESULTS

Rate of Laboratory confirmed cases:

A total of 134,614 cases were reported from 2012 – 2016. The highest number of suspected cases occurred in 2013 (57,892). Only 703 (0.52%) out of 134,614 were confirmed in the laboratory. The highest percentage of laboratory confirmed cases (1.14%) occurred in 2012. No Laboratory confirmed case was recorded in 2014 (See Table 1).

Table 1: Rate of Laboratory Confirmed Cases, 2012 - 2016, Nigeria

	Cases	Lab Confirmed	Confirmed (%)
2012	11,061	126	1.14
2013	57,892	348	0.60
2014	15,989	0	0.00
2015	24,421	127	0.52
2016	25,251	102	0.40
Total	**134,614**	**703**	**0.52**

Age distribution of Measles cases in Nigeria (2012-2016):

The age group of 1 – 5 years was most affected by measles. The number of cases presented each year in this age group was as follows: 2012 - 8,046 cases, 2013 – 61,376 cases, 2014 – 12,348, 2015 – 12622, 2016 – 11430 cases (see figure 1). There is statistical significant difference in the number of cases of measles among all the age groups; the Chi square p - value is 0.045 which is less than the significant value of 0.05.

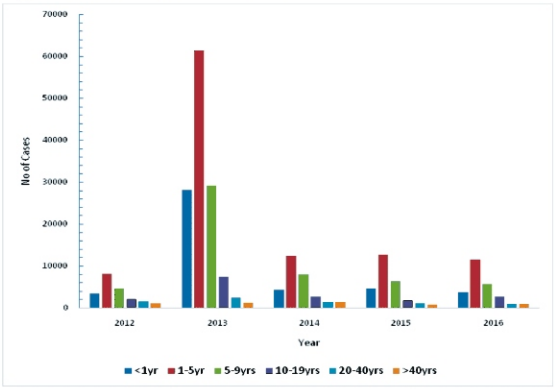

Figure 1: Distribution by age of measles cases in Nigeria (2012-2016)

Geopolitical distribution of suspected measles cases (2012 – 2016)

North West Zone had more number of measles cases in all the years except in 2014 as follows: 2012 - 10,000 cases, 2013 87,600 cases, 2014 – 10,399, 2015 – 11,421, 2016 – 11,113 cases. North- East Zone had 15,278 number of cases in 2014 (highest affected zone) see figure 2. The Chi-square p value is 0.035 and it is < than the significant value of 0.05.

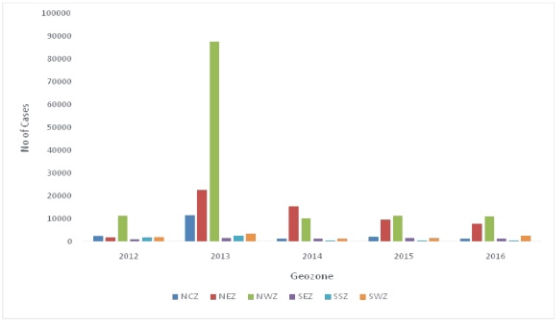

Figure 2: Suspected Measles Cases by Geographical zones, Nigeria, 2012 – 2016.

***Key:** Measles cases by geopolitical zones distribution; geopolitical zones represented as follows: NCZ= North-Central Zone; NEZ = North- East Zone; NWZ= North West Zone; SEZ- South-East Zone; SSZ= South-South Zone; SWZ= South -East zone.

Age Distribution of measles death in Nigeria (2012 – 2016):

Age group 1 – 5 was affected the most by measles death. The number of deaths presented by this age group was as follows: 2012- 79 deaths, 2013 – 435 deaths, 2014 – 82 deaths, 2015 – 67 deaths and in 2016 – 23 deaths. Children less than one year old also had a large death as follows: 2012 – 33 deaths, 2013 – 202, 2014 – 48, 2015 – 18 and in 2016 – 07 (see figure 3).

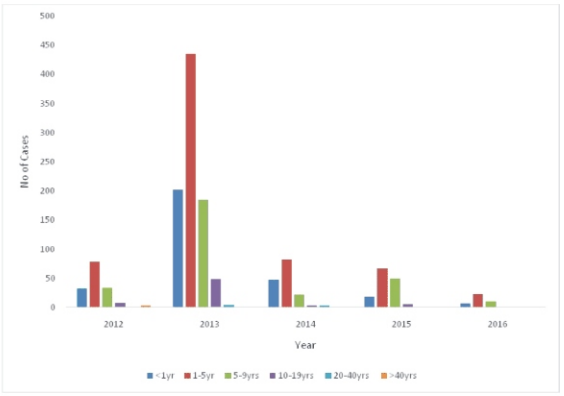

Figure 3: Measles deaths by age distribution in Nigeria (2012- 2016).

Annual proportions of cases, deaths and laboratory confirmation by geopolitical zone:

North West Zone (NWZ) contributed the highest number of cases, deaths and laboratory confirmation in all the years except in 2014 (cases range from 19.4% to 64.4%; deaths range from 11.8% to 73.5%; Laboratory confirmed cases range from 41.7% to 96.2%). North East Zone (NEZ) had the largest proportion of cases and deaths in 2014 (cases 54.5%, deaths 85.9%) but no laboratory confirmation. NWZ still had the highest laboratory confirmation in 2014 (96.2%). North-central zone (NCZ), had no laboratory confirmed cases for three years (2014, 2015 and 2016) (see figure 4).

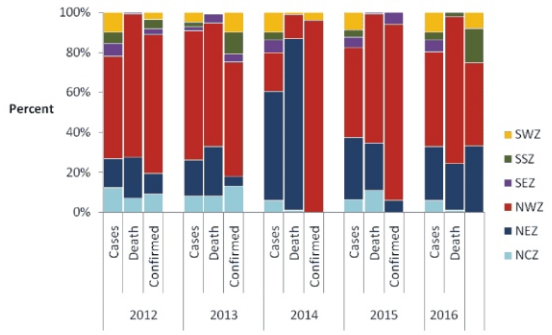

Figure 4: Annual proportions of cases, deaths and laboratory confirmation by geopolitical zone.

Attack rate (AR) and Case fatality rate (CFR) of children under 5 years old in Nigeria (2012 – 2016):

The AR are as follows: year 2012 – 30/100,000, year 2013 - 256/100,000, year 2014 – 46/100,000, year 2015 – 46.4/100,000, year 2016 – 39.5/100,000 (see figure 5). The CFR are as follows: year 2012 – 1.0%, year 2013 – 0.7%, year 2014 – 0.8%, year 2015 – 0.5%, year 2016 – 0.2% (see figure 5).

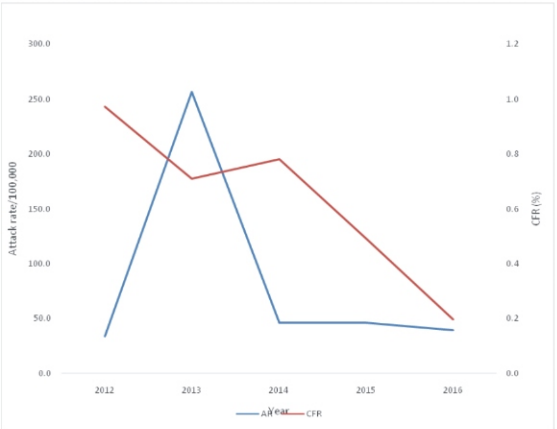

Figure 5: Measles under 5 years attack rate (AR) and case fatality rate (CFR) in Nigeria (2012-2016).

Measles attack rate by geopolitical zones for under five years children in Nigeria (2012 – 2016):

Three zones had high attack rate in 2013; NWZ- 693.8, NEZ – 349.3 and NCZ – 153.8. The attack rate in NEZ remained relatively high in 2014 (170.6) and 2015 (136.7) See figure 6.

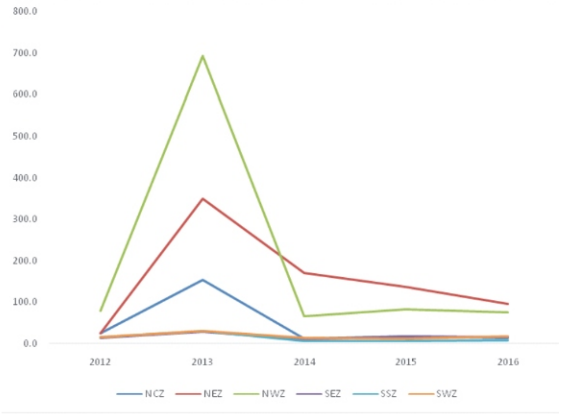

Figure 6: Under 5 years Measles attack rate by geopolitical zones in Nigeria (2012-2016)

Key: NCZ-North Central zone NEZ- North East zone North-West zone SEZ- South-East zone SSZ- South-South zone SWZ- South-West zone

Measles attack rate in states of North West geopolitical zone in Nigeria (2012 – 2016):

Jigawa, Sokoto, Katsina and Kano states contributed the highest number of cases to the attack rate respectively (1550.1, 795.4, 783.7 and 691.6) in North-West geopolitical zone in 2013. See figure 7.

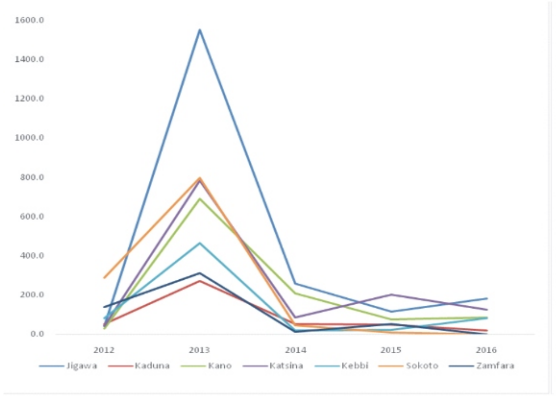

Figure 7: Attack rates by states in North West, Geopolitical Zone of Nigeria(2012 – 2016)

Weekly trends in measles incidence:
In 2013, highest number of cases occurred between March and May. In March - 26.0, April – 20.7, May – 17.5. In all the years, January – May within the first 20 weeks of the year had the highest occurrence of measles (see figure 8).

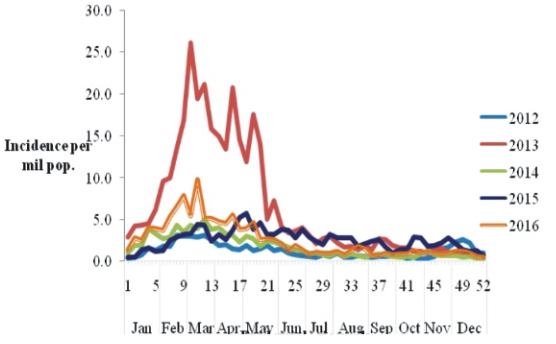

Figure 8: Seasonal weekly trends in measles incidence 2012-2016

Percentage of States Reporting Timeliness and Completeness of Measles data (2012 – 2013):

Timeliness reporting was as follows: 2012 - 74%, 2013 – 76%, 2014 – 84.5%, 2015 – 84.5%, and 2016 – 81.9% (see figures 9 and 10). Completeness reporting was as follows: 2012 –79%, 2013 – 99%, 2014 – 98.5%, 2015 – 99.3%, 2016 – 98.6% (see figures 9 and 10).

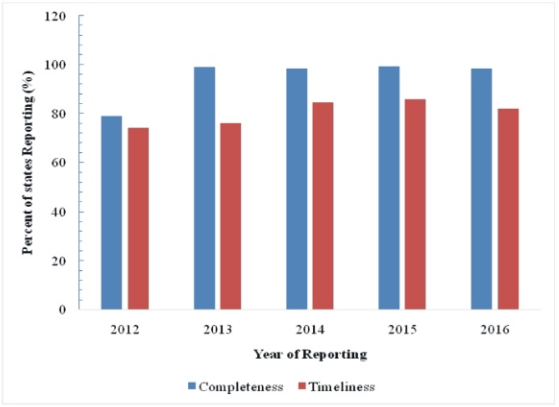

Figure 9: Timeliness and completeness data of Measles Reporting by States, Nigeria, 2012 - 2016

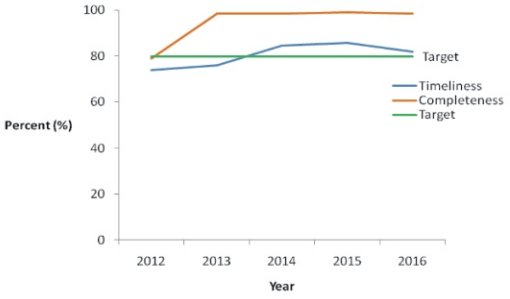

Figure 10: Annual trends in timeliness and completeness.

Timeliness dashboard showing states with poor report:
The timeliness dashboard shows the following: in 2012, Anambra and Ebonyi states had < 50%. In 2013, Anambra and

Borno had < 50%. In 2014, Abia and Ebonyi had < 50%. In 2015, Akwa Ibom had < 50% and in 2016, Kwara, Abia, Edo and Delta stateshad< 50% (see figure 11).

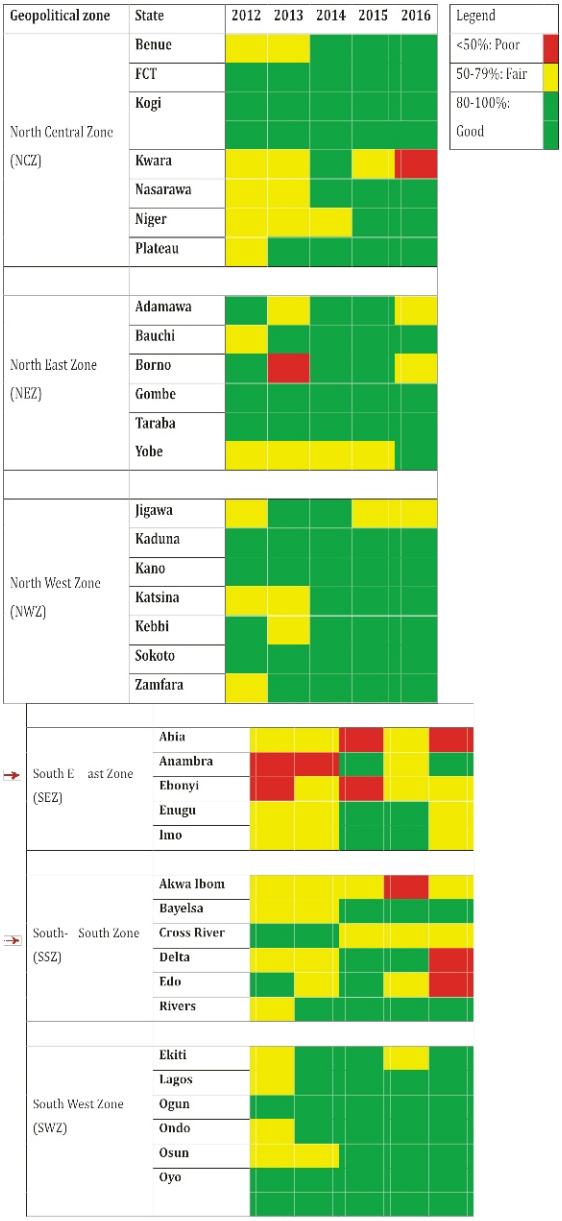

Figure 11: Annual timeliness dashboards by States in Nigeria, 2012-2016.

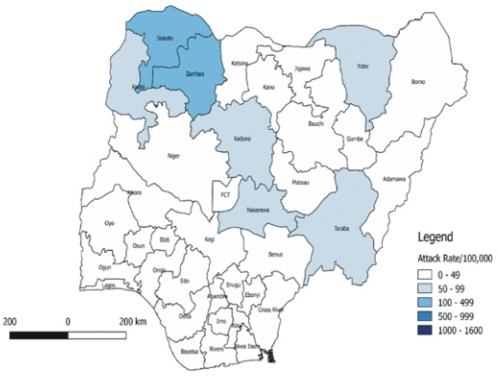

Figure 12 under five attack rate (AR) by state in 2012

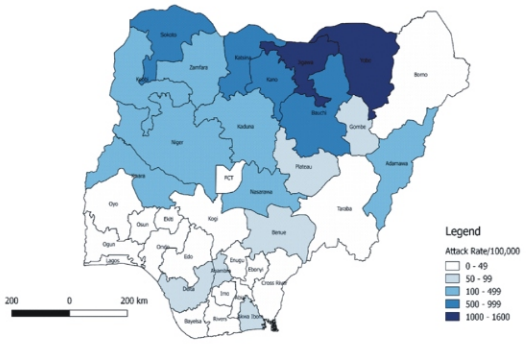

Figure 13 under five attack rate (AR) by state in 2013

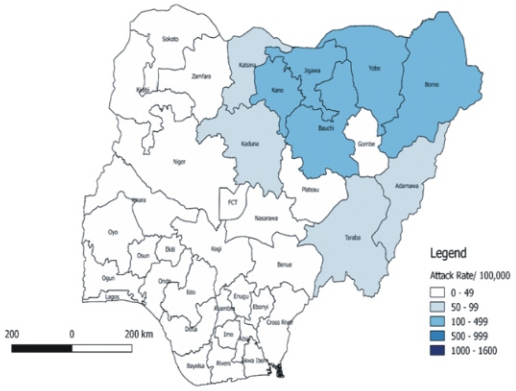

Figure 14 under five attack rate (AR) by state in 2014

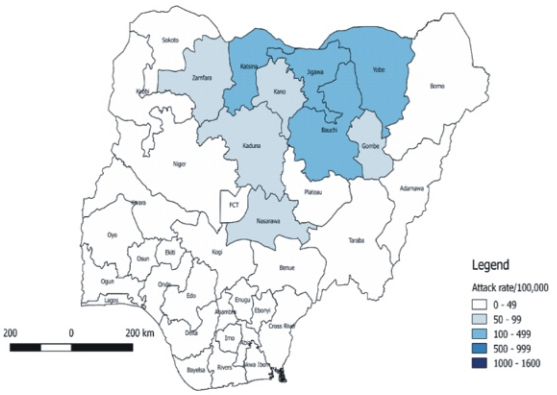

Figure 15 under five attack rate (AR) by state in 2015

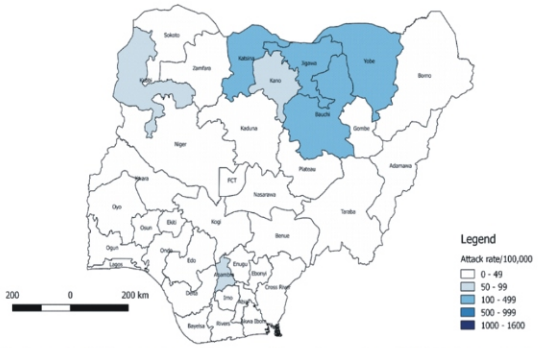

Figure 16 under five attack rate (AR) by state in 2016

DISCUSSION

This is a retrospective study of measles notification data from 2012-2016. This study revealed that cases of measles nationwide remain high and is still a cause of public health concern. Looking at the number of measles cases in the last two years of this study, it is obvious that Nigeria still needs to work very hard to put measles infection under control. Of significance is the very high figure of suspected measles cases in 2013 (57,892) which was over five times higher than the previous year (2012) and the laboratory confirmed cases was comparatively lower than the previous year. This leaves one wondering if it was not due to some errors in the analyses, reporting and presentation of cases; it may also be due to poor case management strategy. Notwithstanding, cases shown in other years still revealed that the occurrence of cases of measles remain relatively high in the country, so it is still a disease of public health significance. This finding is similar to the finding of Hassen *et al*[18] in Ethiopia where they reported that measles was on the increase in their country.

It is also observed that many cases of measles were not laboratory confirmed, less than 1% of measles cases in the five years studied were confirmed in the laboratory. To measure the success of a measles control programme, and prepare towards elimination, laboratory confirmation of suspected measles cases is essential[19,20]. The role of the laboratory is to confirm initial cases and to isolate and analyse wild-type virus strains from selected cases to characterize the genotype of circulating measles viruses (MVs)[15,21]. In a whole year (2014), there was no measles confirmed case, yet there were 15,989 suspected measles cases, this is also a very disturbing finding which points to lapses in the surveillance system. The implication of this is that adequate vaccination coverage is missed; adequate vaccination coverage is better carried out in areas with more confirmed cases of measles through confirmed laboratory investigations. Another possible reason for zero laboratory confirmation is the use of reagent that have expired or not potent; any of these will give negative result.

The importance of laboratory investigation cannot be overemphasized especially as other ailments that mimic measles are best

diagnosed and differentiated with a laboratory confirmation. Lack of laboratory confirmation is a serious lapse in case management and need to be seriously looked into if the country is to move successfully towards measles elimination. One major reason suspected to worsen the use of laboratory confirmation of measles is the lack of availability of reagent to test for measles virus most times in the laboratories Nationwide[14,15,21].This precarious situation must be looked into as a matter of urgency and given the necessary priority.

The age distribution of measles cases shows that a good number of children under one year (<1 year) of age are affected by measles. The Chi square analysis also reveals the significant difference among the age groups and measles infection. This is a pointer to investigate the immunization coverage of children under one. This study showing that children under one year are affected by measles infection confirms the finding of Olusola and Adeniji[22] in Ibadan where it was also revealed that children 7 – 11 months old presented with measles infection in 2014. Usually babies are presented at nine months for measles immunization. By nine months, the maternal antibodies received by the babies must have declined and so they become susceptible to infections; also, active breastfeeding is markedly reduced by many mothers after six months. Babies under one having measles is also suggestive of some mothers actually refusing to present their babies for immunization because of suspected reasons that include not wanting their babies to cry from pains inflicted on them from needle pricks, some religious reasons and safety concerns, thus undermining the importance of the immunization[21,23]. This type of attitude exhibited by some mothers show ignorance and lack of knowledge. One important factor that cannot be overlooked in our society is that there is still a relatively high level of maternal illiteracy[24,25].Therefore, concerted effort must be geared towards intensive health education (immunization education) as a response activity[26,27.28]. The under 5 years age group are most affected throughout the five years examined (2012-2016), this further buttresses the fact that most children probably missed their first measles vaccination at 9 months which should protect this age group. Another predisposing factor that comes to mind here is malnutrition, which is a major predisposing factor to the incidence of measles which also makes many other childhood diseases more marked among children at this age (under five years)[17,29].

Geopolitically, measles appears to affect the northern zones more than the southern and eastern zones of the country. This finding supports previous studies carried out by other researchers[3,12]. The North-Western zone had the highest cases in all the years examined except in 2014 when the North-East zone (NEZ) had the highest number of cases. It is perceived that people in these zones do not immunize their children for some cultural and environmental reasons. As earlier discussed, lack of education and awareness of the usefulness of immunization may have been contributory to the high cases of measles recorded in these zones; this has also been pointed out in previous studies[24,25].

An examination of the case fatality rate (CFR) and attack rate (AR) show that deaths from measles were highest among children under

the age of five all through the years in review but peaked in 2014 and the Northern zones had the highest death rates. This was earlier reported by other studies[3,12,31,32].When the case fatality is high, it is an indicator of poor prognosis or outcome of the disease[3,12,29,30]. In this study, although the CFR of under-five years started reducing after 2014 and as at 2016, it was 0.2%, but the target is to prevent deaths from measles thus bringing the CFR to 0%. This can only be achieved through proactive and effective immunization coverage of children in this age group (under 5 years old) and effective case management. The attack rate (AR) was also examined alongside the CFR and was also high among under-five years. Attack rate is an indicator that is used to plan vaccination strategy. Studies have documented that age-groups with high ARs are at high risk of disease and therefore there should be a target of vaccination to age-groups with highest rates[3,12]. According to the findings in this study, both CFR and AR were reduced by 2016; this finding is contrary to expectation, and further close investigation will be necessary to find out the true situation in the country especially as this finding is contrary to the finding of Oyefolu *et al*[33]where it was revealed that measles case fatality was not reduced in a ten year study carried out in 2016 in Lagos, Nigeria.

However, it is not certain if all the deaths from measles and all those affected by measles in Nigeria have been captured in the data used for this study. Although, both CFR and AR maintained significant decrease from 2015-2016; it is noteworthy to mention that the high AR observed before this date was from the 3 Northern zones in the country: North-east, North-west and North-central (NEZ, NWZ and NCZ). With this finding, the researcher further examined the states in the affected geopolitical zones in order to identify the states that contributed most significantly to the rise experienced in the attack rates. Three states (Sokoto, Katsina, and Kano) had the highest incidence of attack rates in that zone. This information is very vital to the National Primary Health Care Development Agency (NPHCDA) to plan their immunization strategy for the three northern zones, with particular attention the states with high attack rates. Usually, their campaign and immunization should commence from such zones and states because they are 'at risk[16,17]. Holistically, it is safer to increase efforts towards mass vaccination campaign, effective surveillance and case management to reduce CFR and AR among under-five. Appendix 1 shows the maps of the trend of the attack rates (ARs) for under-five in the country for 2012-2016.

Examining the seasonal weekly trends in measles incidence 2012-2016 revealed that a significant number of cases occurred between January and June with peak levels noticed between March and April. This finding corroborates the finding of Sawa[34], where it was revealed that in Zaria, measles infection is high in the month of March and April when the temperatures are also high. On international perspective, Yang *et al*[35] also reported in a study which they carried out in China; that the morbidity of measles shows a seasonal variation, indicating that in temperate climates, measles outbreaks typically occur in the late winter and early spring every year, whereas in the tropics, measles outbreaks have irregular associations with rainy seasons. This vital information should be utilized for strategic

immunization coverage plan so that 'at risk persons' get immunized before the specified months in Nigeria; preferably in December to February so that immunization counters the peak period specified.

Timeliness and completeness of reporting data was also assessed in the study. In Nigeria, to assess timeliness at national level, the number of states that submit their data report by 12 midnight on Wednesdays timely; while completeness is simply judged by detailing the submitted data[36,37]. To monitor whether surveillance reports are received on time and if all health facilities have reported is an essential first step in the routine analysis of the surveillance system. This assists the national (or other level) surveillance team in identifying silent areas (areas where health events may be occurring but which are not being reported) or health facilities that need assistance in transmitting their reports[4].Timeliness of reporting was below 80% (< 80%) in 2012 and 2013 which was not quite adequate but picked up in 2014 to 2016 to above 80% (> 80%). Completeness appears adequate (over 90%) in all the years except 2012. In this study, from 2014 -2016 there has been improvement in both timeliness and completeness to a minimum of 80% in four geopolitical zones. Findings show that South-east zone (SEZ) and South-south (SSZ) were the least improved with completeness and timeliness of reporting ranging from poor to good in the 5 year period. This calls for further monitoring and evaluation. This is therefore an indication for re-strategizing by surveillance to be able to find out the exact reasons why these two geopolitical zones are not improving in timeliness and completeness of reporting like the others. The researcher tried to find out if the surveillance unit staff of the NCDC that collect information on this data could proffer an answer to the cause of this problem but they perceived it as an attitudinal problem; people just do not care to do it right. This type of behaviour reflects lack of knowledge on part of the health workers on the importance of data they collect. Perhaps, there may be the need to start giving incentives to motivate the states that send in their reports promptly and fully complete every quarter. Another approach of ensuring an improvement in timeliness and completeness of reporting data could be to organize a training workshop on how to effectively and efficiently carry out this important assignment. In such workshops, the zones that are doing well will interact with the zones that are not improving so that they can learn from them (zones that are improving) how to improve in their deficiency. Taking actions to correct this is important because when the surveillance system is good, the rates for timeliness and completeness could approach 100%. The failure to report timely and completely may be from lack of good knowledge of case definitions having a negative effect on measles notification within the IDSR. In North-central zone; Kwara state has consistently deteriorated into "poor" state in keeping with timeliness. From excellent in 2014 to good in 2015 and poor in 2016. The North-east also shows Adamawa and Borno deteriorating in timeliness in 2016; both states had been excellent in 2014 and 2015. In the North-west zone, Jigawa appeared to be the only state not maintaining its consistency in timeliness. For South-east zone, all the states have issues with timeliness but the worst is Abia state. In south-south zone, there are also issues with timelines except for two states which appear to have been adequate with timelines- Rivers

and Bayelsa. The worst states in keeping with timeliness in this zone are Delta and Edo. In South-west zone, there appears to be a steady progress towards excellent timeliness except for Ekiti state which did not meet up with the excellence it had in 2013 and 2014. However, in 2016 all the States in the zone maintained excellence in timeliness.

RECOMMENDATIONS

Based on the findings in this study, the following recommendations are made:

- The laboratory investigation activities should be reported by Specialists in charge of carrying out tests weekly to the IDSR whether confirmed or not. This weekly feedback will keep the IDSR abreast of situations in the laboratory including having awareness of lack of reagent to carry out necessary test; so that IDSR will be prompt in taking necessary actions.
- There is the need for the IDSR to collaborate more with NPHCDA on re-strategizing to combat the large number of measles cases that is affecting the northern zones of the country.
- NCDC should key into the internet-based reporting system OSIRIS, by sending some of its workers to known establishment in Ireland to train on the use of OSIRIS which can help to trigger an appropriate public health response in order to prevent further increase in measles Infection[35].
- It is also recommended that there should be strengthening of RI and education of care-givers' on completing RI schedule.
- It is recommended that there should be the use of alternate reporting channels like high frequency radios and satellite phones in hard to reach areas with no mobile connectivity facilitated data transmission and improved completeness.

CONCLUSION

This study examined measles notification data within the integrated disease surveillance and response using the available measles data in Nigeria from 2012 to 2016 as recorded by NCDC. From the measles data analyzed, there are still a lot of measles cases every year. Responses to measles through vaccination appear still inadequate vis-à-vis the number of cases of measles presented, going by the attack rate (AR) and Case fatality rate (CFR) over the period examined. Laboratory confirmation of cases was still suboptimal. However, the quality of the data reported with regards to timeliness and completeness showed relative improvements in some geopolitical zones, but two geopolitical zones were not improving in timeliness and completeness. Thus, there is the need for more proactive and efficient surveillance and health education on the importance of disease notification within the IDSR in order to combat the disease.

Competing Interests: The Author declares that there is no competing interest.

Funding: There is no source of funding for this study.

Acknowledgments

The researcher sincerely appreciates the Chief Executive Officer of National Disease Control Centre (NCDC) and all the surveillance team members for the

opportunity given to carry out this study. The researcher is highly indebted to Drs. Sola Aruna and Yahya Disu for their immense contributions in terms of advice in carrying out this study.

REFERENCES

1. Nigeria Centre for Disease Control (NCDC). Contact tracing: A critical activity for enhanced surveillance. Available from http://www.ncdc.gov.ng/reports/weekly [Accessed January 10, 2018].
2. Measles. Available from http://www.who.int/mediacentre/factsheets/fs286/en/ [Accessed February 1, 2018].
3. Saleh JEA. Trends of measles in Nigeria: A systematic review. Sahel Med J. 2016; 19 (1):5-11. doi: 10.4103/1118-8561.181887.
4. Integrated Disease Surveillance and Response Technical Guidelines. Available from www.ncdc.gov.ng/themes/common/docs/protocols/4_1476085948.pdf [Accessed February 14, 2018].
5. WHO-recommended surveillance standard of measles. Available fromhttps://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measles_standards/en/ [Accessed January 10, 2019].
6. African Regional Guidelines for Measles and Rubella Surveillance. WHO Regional Office for Africa, Draft 2015. Available from African Regional guidelines for measles and rubella surveillance- Draft version April. 2015. [Accessed March 16, 2018].
7. AFRO/WHO. As Nigerian government Flags-off 2017/2018 Measles Vaccination Campaign, Kaduna state Governor's children get vaccinated against measles disease. Available from http://www.afro.who.int/news/nigerian-government-flags-20172018-measles-vaccination-campaign-kaduna-state-governors [Accessed January 20, 2018].
8. Biellik R, Madema S, Taole A, Kutsulukuta A, Allies E, Eggers R et al. First 5 years of measles elimination in southern Africa: 1996–2000. *Lancet.* 2002; **359**:1564-1568.
9. Public health surveillance. Available from https://www.who.int/topics/public_health_surveillance/en/ [Accessed February 5, 2018].
10. Phalkey RK, Shukla S,Shardul S, Ashtekar N, Valsa S, Awate P et al. Assessment of the core and support functions of the Integrated Disease Surveillance system in Maharashtra, India. *BMC Public Health.* 2013**;13**:575.
11. Types of Surveillance. Available from https://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/en/ [Accessed January 10, 2019].
12. Abubakar A, Idris SH, Sabitu KS, Shehu AH, Sambu MN. Emergency preparedness and the capability to identify outbreaks: a case study of Sabon Gari Local Government Area, Kaduna State. *Annals of Nigerian Medicine.* 2010; **4**: 21-7.
13. Centre for Disease Control and Prevention. Measles | Statistics and Surveillance. Available from https://www.cdc.gov/measles/stats-surv.html [Accessed January 10, 2018].
14. Measles. Available from http://www.who.int/immunization/diseases/measles/en/ [Accessed January

30, 2018].
15. Olusola BA, Adeniji JA. Molecular Detection of Measles Virus from Children during a Sporadic Outbreak in Two Semi-Urban Areas in Nigeria. *Afr. J. Infect. Dis.* 2014; **8**: 44 – 49.
16. Adedokun ST, Uthman OA, Adekanmbi VT, Wiysonge CS. Incomplete childhood immunization in Nigeria: a multilevel analysis of individual and contextual factors. *BMC Public Health.* 2017; **17**:236. doi 10.1186/s12889-017-4137-7.
17. Oleribe O, Kumar V, Awosika-Olumo O, Taylor-Robinson SD. Individual and socioeconomic factors associated with childhood immunization coverage in Nigeria. *The Pan African Medical Journal*. 2017; **26**:220. doi:10.11604/pamj.2017.26.220.11453.
18. Hassen MN, Woyessa AB, Getahun M, Beyene B, Buluanger L, Ademe A et al. Epidemiology of measles in the metropolitan setting, Addis Ababa, Ethiopia, 2005–2014: a retrospective descriptive surveillance data analysis. *BMC Infectious Diseases.* 2018; **18**: 400.
19. Moss WJ, Strebel P. Biological Feasibility of Measles Eradication. The Journal of Infectious Diseases. 2011; 204 (Suppl 1): S47 – S 53.
20. Hübschen JM, Bork SM, Brown KE, Mankertz A, Santibanez S, Ben Mamou M, Mulders MN, Muller CP. Challenges of measles and rubella laboratory diagnostic in the era of elimination. *Clinical Microbiology and Infection.* 2017; **23**: 511-515.
21. Hyde TB, Nandy R, Hickman CJ, Langidrik JR, Strebel PM, Papania MJ et al. Laboratory confirmation of measles in elimination settings: experience from the Republic of the Marshall Islands, 2003. *Bull World Health Organ.* 2009; **87**: 93–98. doi: 10.2471/BLT.07.045484.
22. Olusola BA, Adeniji JA. Molecular Detection of Measles Virus from Children During a Sporadic Outbreak in Two Semi-Urban Areas in Nigeria. *African Journal of Infectious Diseases.* 2014; **8**: 44–49.
23. W.H.O. Guidelines for Epidemic Preparedness and Response to Measles Outbreaks. From http://www.who.int/csr/resources/publications/measles/whocdscsrisr991.pdfAccessed February 25, 2018.
24. Lukwago L, Nanyunja M, Ndayimirije N, Wamala J, Malimbo M, Mbabazi W, et al. The implementation of Integrated Disease Surveillance and Response in Uganda: a review of progress and challenges between 2001 and 2007. *Health Policy and Planning.* 2013;**28**:30-40.
25. Ministry of Health (MoH) Nigeria. IDSR in West Africa—Bridging the Gaps. In: The National Science Academy (Ed). Lagos: West African Book Publishers Limited; 2010.
26. World Health Organization and Centers for Disease Control and Prevention. Technical Guidelines for Integrated Disease Surveillance and Response in the African Region, Brazzaville, Republic of Congo and Atlanta, USA; 2010:1-398.
27. WHO Recommended Surveillance Standards.WHO/CDS/CSR/ISR/99.2 Available from www.who.int/csr/resources/publications/surveillance/whocdscsrisr992.pdf [Accessed February 15,2018].
28. Balogun SA, Yusuff HA, YusufKQ,Al-Shenqiti AM, Balogun MT, Tettey P. Maternal education and child immunization: the mediating roles of

maternal literacy and socioeconomic status. *Pan Afr Med J.* 2017; **26**: 217. doi: 10.11604/pamj.2017.26.217.11856.
29. McKee C, Bohannon K. Exploring the Reasons Behind Parental Refusal of Vaccines. *J PediatrPharmacolTher.* 2016; **21**: 104–109. doi: 10.5863/1551-6776-21.2.104.
30. Clements CJ, Ratzan S. Misled and confused? Telling the Public about MMR Vaccine Safety. *Journal of Medical Ethics.* 2003; **29**:22-26.
31. Katona P, Katona-Apte J. The Interaction between Nutrition and Infection. *Clinical Infectious Diseases.* 2008; **46**: 1582–1588. https://doi.org/10.1086/587658.
32. Harrington RA. Case fatality rate. Available from https://www.britannica.com/science/case-fatality-rate [Accessed March 20, 2018].
33. Oyefolu AOB, Oyero OG, Anjorin AA, Salu OB, Akinyemi KO, OmilabuSA.Measles Morbidity and Mortality Trend in Nigeria: A 10-Year Hospital-Based Retrospective Study in Lagos State, Nigeria. *Journal of Microbiology and Infectious Diseases.* 2016; **6**: 12-18.
34. Pettygroove S. Attack rate. Available from https://www.britannica.com/science/attack-rate [Accessed March 20, 2018].
35. Sawa BA, Buhari B.Temperature Variability and Outbreak of Meningitis and Measles in Zaria, Northern Nigeria. *Research Journal of Applied Sciences, Engineering and Technology.* 2011; **3**: 399-402.
36. Yang Q, Fu C, Wang N, Dong Z, Hu W, Wang M. The effects of weather conditions on measles incidence in Guangzhou, Southern China. *Journal Human Vaccines & Immunotherapeutics.* 2014; **10**: 1104-1110.
37. Completeness and Timeliness - UiO Available from www.uio.no/studier/emner/matnat/ifi/INF5761/v14/timeplan/completeness.docx. [Accessed April 10, 2018].
38. Ward M, Brandsema P, VanStraten E, Bosman A. Electronic reporting improves timeliness and completeness of infectious disease notification, The Netherlands, 2003. *Euro Surveill.* 2005; **10**: 27-30.