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Effectiveness of Measles Mass Vaccination in the Reduction of Childhood Morbidity and Mortality in Yobe State, Northeast Nigeria

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Abstract:- Measles is an issue of public health concern responsible for outbreaks and death of children especially in Sub-Saharan Africa. This study sought to determine the effectiveness of mass vaccination against measles in Yobe State, Northeast Nigeria. An ecological epidemiological study design involving the collection of secondary data from the same population was carried out over a period of two years. These data were collected from Epidemiology Unit of Yobe State Primary Healthcare Development Board from the Integrated Disease Surveillance Response database which collects records of notifiable diseases in Nigeria. All cases of measles within the period under review (2016-2017) were included and a comparison of the number of cases and deaths from measles reported in two different periods before supplementary immunization activity or mass vaccination against measles (2016) and after supplementary immunization activity against measles in the state (2017) was done. The mass vaccination intervention was conducted within first week of January 2017 as a measure to address outbreaks of measles in the state. Data were analyzed using the Statistical Package for Social Sciences (SPSS) windows version 22. A total of 4242 cases were reported during the study period. 3780(89.1%) in 2016 (before mass vaccination) and 462(10.9%) were reported in 2017 (after mass vaccination). A total of 556 deaths with case fatality rate of 13.1% was recorded during the study period. Majority of the deaths 525(94.4%) occurred in 2016 when there was no mass vaccination while few 31(5.6%) occurred in 2017 after the mass vaccination. Mass vaccination resulted in a 78.2% decline in number of cases and 88.8% decline in the number of deaths from measles. There was a statistical significant difference in the number of cases and mortality from measles pre and post mass vaccination against the disease in Yobe state. Paired sample t-test done revealed a monthly case distribution mean of 276.6 (95% CI 89.8 to 463.3) with alpha set at 0.05, P = 0.008 while monthly mortality mean was 41.1 (95% CI 15.5 to 66.7) with alpha set at 0.05, P = 0.005. Mass vaccination against measles therefore confers immunity and herd immunity to populations with a subsequent significant decline in morbidity and mortality associated with the measles infection. It is therefore recommended that this initiative be sustained for every two years or possibly yearly to ensure elimination of measles in the Sub-Saharan Africa region and the World at large.

Keywords:- *Effectiveness, Measles, Mass Vaccination, Morbidity, Mortality.*

I. INTRODUCTION

Measles is a highly contagious febrile viral disease with major epidemics that occur approximately every 2–3 years in endemic regions (Minta *et al*., 2023). Although measles vaccine was licensed in 1963, an estimated 30million measles cases with 777,000 deaths occur every year with most of these cases and deaths occurring in Sub-Saharan Africa and South East Asia (WHO, 2005).

In Nigeria, a 5years review across the country by Ibrahim *et al*. (2019) recorded a total of 131,732 cases with 817 deaths and case fatality rate of 0.62% over the study period. Majority of these cases and deaths occurred in the Northeastern region of the country where outbreaks occur periodically and immunization coverage has been poor in these states. These morbidity and mortality associated with measles infection occur despite availability of effective measles vaccine known to confer immunity against the virus in 85% of cases for the first dose and attainment of herd immunity with a high coverage of 90-95% against the virus (Plans-Rubio, 2020). Guerra *et al*. (2017) asserted that measles is a highly contagious disease with a basic reproduction number (Ro) of 8 – 12, which requires effective vaccination and a high immunization coverage to prevent and control outbreaks of the disease. The higher the Ro of any disease which is the number of persons that can contract the disease from an infected person, the higher the vaccination coverage required to achieve herd immunity for the prevention and control of the disease (Elbasha & Gumel, 2021). For measles a vaccination coverage rate of 95% in a population is required for herd immunity (Orenstein *et al*., 2000; Cho & Leo, 2016). Based on evidence and successes on efforts towards the elimination of the virus, the WHO in July 2010, called for a panel of experts who reviewed evidence and concluded that measles can and should be

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eradicated (Guerra *et al*., 2017). Despite the ambitious goal of eradicating measles, the US Center for Disease Control and Prevention (2023) asserted that "Today, every region in the world has a measles elimination goal, yet no region has achieved and sustained elimination". Although some regions in the world have optimized the use of existing effective vaccine while others have not, this has resulted to a scenario where regions across the globe have varying success in measles control and prevention, partly because measles is one of the most contagious infections (Guerra *et al*., 2017) in addition to systemic, individual and population level factors (Ophori, 2014; Majekodunmi et al., 2022) which has hindered the achievement of the WHO target of measles coverage of ≥95 using two doses of the vaccine (CDC, 2023). Several factors such as the health system, vaccine hesitancy, knowledge, attitude and perception of the disease and the socio-demographic characteristics of households have been identified as contributory factors associated with low vaccination coverage and outbreaks of measles and other vaccine preventable diseases in Nigeria (Ophori, 2014; Majekodunmi et al., 2022). A weak primary healthcare system or immunization system is one of the shortcomings responsible for the suboptimal coverage against measles and the consistent high burden of vaccine preventable disease in Nigeria. Routine and supplementary immunization services are enshrined in the primary healthcare system to carter for vaccine preventable diseases such as measles, meningitis, poliomyelitis, diphtheria, pertussis, tetanus, influenza and BCG. Health system failure has resulted to non-availability of vaccines, lack of effective cool chain to ensure vaccine viability and potency, lack of skilled and dependable health workers needed to implement immunization services and lack of good leadership and governance structure that is willing and capable of coordinating and directing the successful implementation of routine immunization services necessary to meet the health needs of the community (Magawa, 2012; Majekodunmi *et al*., 2022).

Vaccine hesitancy which is the delay in acceptance or refusal of vaccines despite availability in a facility by an individual or a group of persons (Pires, 2022) is another reason for poor immunization coverage with some children being zero dose in low and middle income countries like Nigeria (Mahachi *et al*., 2022). Addressing the various reasons for total refusal or missing vaccine uptake is critical towards improving vaccine coverage and herd immunity against vaccine preventable disease in any population (Haenssgen *et al*., 2021; Mahachi *et al*., 2022).

Knowledge deficits, poor attitude and a lack of perception of the severity of measles virus are common reasons identified for non-uptake of measles and other vaccines. Brieger *et al*. (2017) in their study noted that parental knowledge and opinion individuals or group of persons have influences their behavior and uptake of vaccines such as the measles and MMR vaccines. This was affirmed by report by GebreEyesus *et al*. (2019) who also observed that parental knowledge and favourable attitude towards immunization influences individual or group practices on immunization.

Socio-demographic characteristics of individuals and populations is another factor that has contributed to zero dose or incomplete vaccination status of children especially in Sub-Sahara Africa and other regions of the globe. Pandey *et al*. (2019) noted that mothers educational status and place of birth of the child significantly affect uptake of immunization with mothers with good education and in urban settlements where there are hospitals providing vaccination services more likely to have their children fully immunized while those with poor education and child given birth to in a hard to reach rural community either partially immunized or completely unimmunized. These problems are very prominent in Nigeria especially in the Northeast and Northwest region of the country where a myriad of factors including insurgency, poverty and presence of isolated hard to reach communities have made achievement of high immunization difficult through routine immunization alone (Ophori *et al*., 2014; Mahachi *et al*., 2022; Sato *et al*., 2022).

To address these gaps, mass vaccination campaigns which are state wide supplementary immunization activities (SIAs) are conducted periodically for eligible children within a geographical location (Olise, 2015). During routine immunization, the measles vaccine 1 (MCV 1) is administered to children at 9 months while to further boost the immunity of eligible children and improve vaccine coverage to 95% or above, a second dose of measles vaccine 2 (MCV 2) at 15 months has been recommended and often administered to children during supplementary immunization activities and this is currently implemented in some States of the Federation (Jean Baptiste *et al*., 2021).

Following the identification of a suspected measles case (an illness in a patient with fever and generalized maculopapular (non-vesicular) rash, or in a patient whom a health care worker suspects has measles), clinical measles case (any person in whom a clinician suspects measles infection; or any person with fever and maculopapular rash and: – cough, or – coryza or – conjunctivitis) and laboratory confirmed case of measles (a suspected case of measles that has been confirmed positive by testing in a proficient laboratory, and vaccine-associated illness has been ruled out) with an outbreak which is characterized as five or more measles cases (with dates of rash onset occurring 7–21 days apart) that are epidemiologically linked (suspected outbreak) or two or more laboratory-confirmed measles cases that are temporally related (with dates of rash onset occurring 7–21 days apart) and epidemiologically or virologically linked, or both (laboratory confirmed measles outbreak), various outbreak responses are planned and implemented (WHO, 2022). These include a reinforcement of the routine immunization activities, selective vaccination, non-selective mass vaccination (supplementary immunization activities), and surveillance of the affected population are put in place (WHO, 2022). Supplementary immunization activities and routine immunization against measles have proven to be effective in the control and prevention of the disease and there effects and impacts have been described in several studies across the globe (WHO, 2024; Minat *et al*., 2023; Wong *et al*., 2019; Bino *et al*., 2003).

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Minat *et al.* (2023) in their global progress towards measles elimination reported that measles vaccination resulted in an estimated 98.2% drop in measles deaths between 2000 and 2022 worldwide and the WHO (2024) noted that measles vaccination prevented an estimated 57 million deaths globally from 2000 to 2022 making vaccination one of the best buy in public health.

Bino *et al*. (2003) in their measles – rubella mass Immunization campaign in Albania in 2000 that was resolved to eliminate measles by 2007 based on a four step approach which involves conducting a "catch up" vaccination campaigns for all children aged 1-14 years, achieving and sustaining high coverage (≥95%) among children aged 1year with the first dose of measles-containing vaccine, by introducing a routine second dose of measles containing vaccine for children at age 5 years, and by improving measles surveillance were employed. The catch-up campaign took place in November 2000 and 867,000 doses of measles-rubella vaccine were administered with an estimated coverage of 99%. A total of 231 campaigns and by 2001, the incidence rate per 100,000 population was 0.5 (18 years).

Goodson *et al.* (2011) in their study on impact of measles outbreak response immunization campaign in Maroua, Cameroon carried out in nine days as outbreak response activity which was initiated 15 weeks after the start of the outbreak during high transmission season observed that there was a sharp decrease in cases from 555 before intervention to 162 cases after the outbreak response. These finding clearly demonstrated the potential benefit of immunization against measles in Africa.

Uddin *et al*. (2016) in their evaluation of impact of Measles-Rubella campaign in Bangladesh using both qualitative and quantitative evaluation reported that the coverage for measles –Rubella vaccine was very low (< 13%) before the campaign and it rose to 90% after the campaign. The pre-post campaign difference in Measles-Rubella coverage in each stratum was highly significant (P <0.001) and this was associated with a decline in the number of cases of measles in the country.

Wong *et al*. (2019) in their time series and multilevel regression analysis of the impact of measles immunization campaigns in India using a nationally representative sample of 27,000 child deaths from 1.3 million households surveyed from 2005 to 2013 reported that there was a difference in the decline in the number of cases and deaths from measles. The authors observed that the decline were stepper in girls than boys and were specific to measles death. The measles mortality risk was lower for children living in a campaign district (OR 0.6, 99% CI 04 – 0.80 or born in 2009 or later odd ratio (OR 0 0.8, 99% CI 0.7 -0.9). The campaigns averted an estimated 41,000 – 56,000 deaths during 2010 – 2013, or 39 -57% of the expected deaths nationally. They concluded that elimination of measles death in India is feasible through supplementary immunization activities.

Portnoy *et al.* (2017) in their review of the impact of measles supplementary immunization activities (SIA) on reaching children missed by routine programs reported that the average proportion of zero- dose children reached by SIAs was 66% and this was associated with a decline in the number of cases and deaths associated with measles after the SIA.

Biellik *et al.* (2002) in their survey of the first 5 years of measles elimination in southern Africa: 1996 – 2000 reported that nearly 24 million children aged 9 months to 14 years were vaccinated, with overall vaccination coverage of 91%. Reported clinical cases of measles declined from 60,000 in 1996 to 117 laboratory confirmed measles cases in 2000 while they reported measles deaths declined from 166 in 1996 to zero in 2000.

Despite these facts and benefits of mass vaccination, implementation of this activity has been sub-optimal in most low and middle income countries in Africa such as Nigeria and this could explain the continued poor child health indices in the State. In Yobe and several states in Nigeria, there is scarcity of information regarding the effectiveness of mass vaccination on child morbidity and mortality which is needed for advocacy and government commitment to drive such high impact intervention. This study therefore seeks to determine the effectiveness of mass vaccination against measles in Yobe State, Nigeria.

II. RESEARCH METHOD

An epidemiological ecological study design was employed for this study to determine the effectiveness of mass vaccination against measles in Yobe state. The incidence and mortality of children from measles were compared for two different years – a year that was not preceded by a mass campaign against measles (2016) and the other was a year that conducted mass immunization against measles in January (2017). Data obtained was analysed to determine the extent of decline in morbidity and mortality from measles in the state.

This research was conducted in Yobe State, Northeast Nigeria. It has 17 local government areas with 178 wards and headquarters in Damaturu. The people are predominantly Kanuris, Hausa/Fulani, Manga, Kare, Bolewa, Bade and other smaller tribes. Their occupation is mostly farming, fishing and livestock rearing which is done in the rural settlements where majority of them dwell. The state is rich in mineral deposits of gypsum, kaolin, and quartz. It has an area of 47,153km^2 with a population of 3,427,364 (National Population Commission, 2014). It is the second most affected state in the northeast by the activities of Boko haram which have lasted for more than a decade resulting in the displacement of populations and serious humanitarian crisis. This insurgency resulted to a deterioration of an already weak health system with resultant increased health burden in the state. The state has 517 health facilities of which 504 are primary, 12 secondary and 1 tertiary facility. 320 of these facilities are proving routine

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immunization services to control vaccine preventable diseases.

All cases of measles recorded in the Integrated Disease Surveillance and Response database within the study period (2016 and 2017) were included into this study. Monthly data from January to December of the two different periods were compared and analysed to estimate the effectiveness of mass vaccination in addressing morbidity and mortality from measles.

A purposive sampling technique was used for this study and this was because all the data during the study period are included in the study needed to make valid conclusion of the subject. Data were obtained from the Integrated Disease Surveillance and Response database where information about notifiable diseases are captured in the National Health Information Management Systems. A proforma (checklist) based on the Integrated Disease Surveillance and Response (IDSR) database was used to collect relevant information on the subject. Data collected includes socio-demographic information of patients (Local Government Area, Age and Sex), Immunization status of patients whether immunized or unimmunized and if immunized, how many dose was previously obtained. The other information obtained was outcome following disease and treatment which is classified as either alive or death to make comparison on the effectiveness of the vaccine before and after supplemental immunization activities.

Data collected was analyzed using the Statistical Package for Social Sciences (SPSS) Windows version 22. A summary statistics for incidence of measles was done and results obtained were expressed in frequency and percentages. A comparative analysis of the incidence of measles before and after mass vaccination was estimated. A paired sample t-test was used to test for significance with alpha set at set at 0.05 level of confidence.

III. RESULTS

This chapter presents the result obtained from the study with the tables and graph below.

Table 1:Epidemiology of Measles in Yobe State

Variable	Frequency (f)	Percent (%)
L.G.A		
Bade	176	4.1
Bursari	146	3.4
Damaturu	430	10.1
Fika	158	3.7
Fure	78	1.8
Geidam	297	7.0
Gujba	40	0.9
Gulani	159	3.7
Jakusko	973	22.9
Karasuwa	150	3.5
Machina	381	9.0
Naugere	23	0.5
Nguru	489	11.5
Potiskum	348	8.2
Tarmua	168	4.0
Yunusari	66	1.6
Yusufari	160	3.8
Gender		
Male	2261	53.3
Female	1981	46.7
Age Category		
Under 5	3858	90.9
5 – 18	352	8.3
19 and above	32	0.7

Table 1 shows the epidemiological distribution of measles in Yobe State. A total of 4242 cases were recorded during the study period. The LGA distribution are: Bade 176(4.1%), Bursari 146(3.4%), Damaturu 430(10.1%), Fika 158(3.7%), Fune78(1.8%), Geidam 297(7.0%), Gujba 40(0.9%), Gulani 159(3.7%), Jakusko 973(22.9%), Karasuwa 150(3.5%), Machina 381(9.0%), Nangere 23(0.5%), Nguru 489(11.5%), Potiskum 348(8.2%), Tarmua 168(4.0%), Yunusari 66(1.6%) and Yusufari 160(3.8%). Gender was males 2261(53.3%) and females 1981(46.7%). Age category was under 5years 3858(90.9%), 6 – 18years 352(8.3%) and 19 and above 32(0.7%).

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Table 2: Number of Cases of Measles during the Study Period

Year	Number of Cases	Percentage (%)	% Decline in Incidence
2016 (pre mass vaccination)	3780	89.1	78.2
2017 (post mass vaccination)	462	10.9	
Total	4242	100.0	

Table 2: shows the number of cases of measles during the study period. 2016 (pre mass vaccination) was 3780(89.1%) while 2017 (post mass vaccination) was 462(10.9%). Percentage decline of was78.2%.

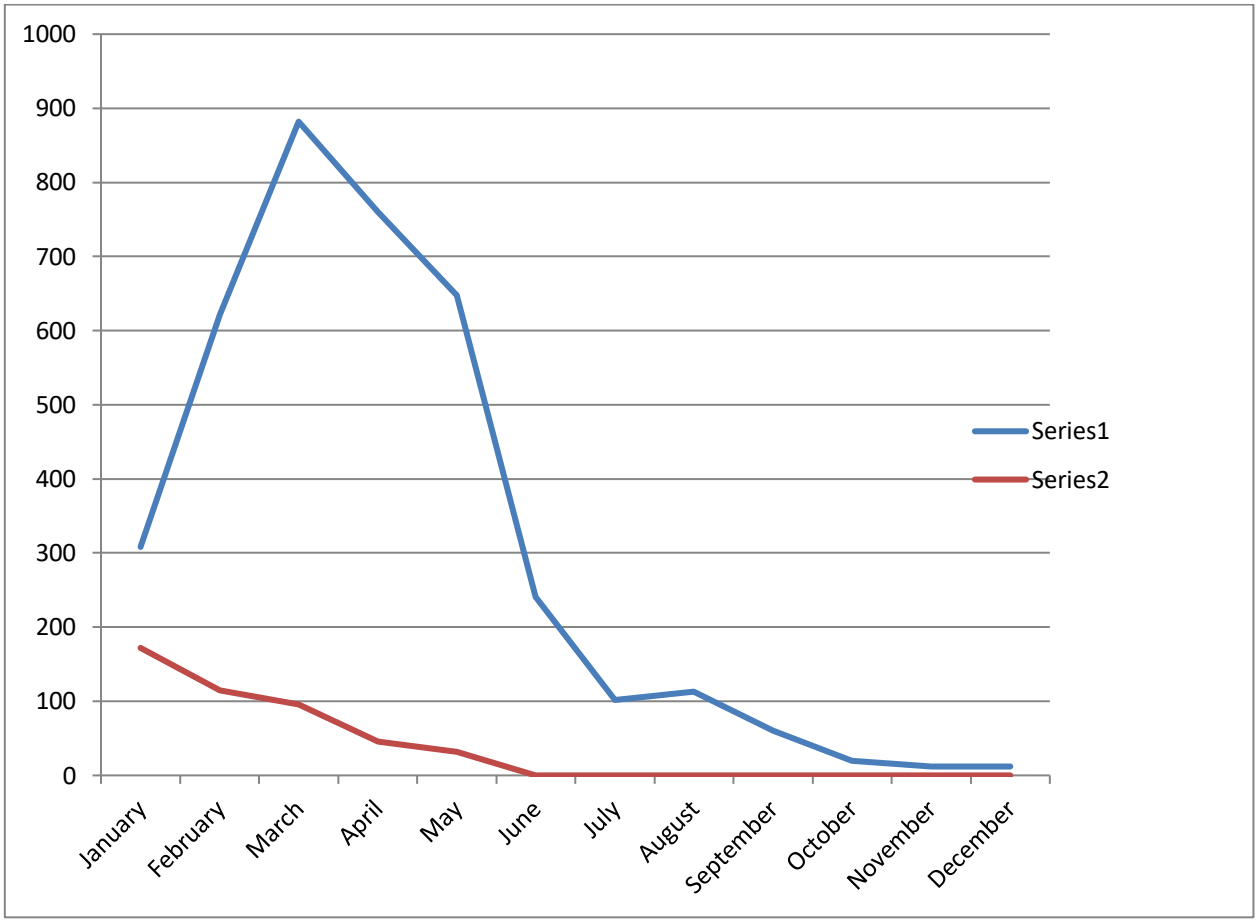

Fig 1: Monthly Variation of Number of Measles Cases

Figure 1 revealed that most of the cases occurred in within February and May with the highest incidence in the month of February.
N/B: Series 1 – 2016 Pre mass vaccination
Series 2: - 2017 Post mass vaccination.

Table 3: Incidence of Measles Based on Age Category and Estimated Population

Age Category	Estimated Population	Number of Cases	Incidence	Incidence/100,000
Under 5	616926	3858	0.00625	625
5-18years	322172	352	0.00109	109
19 and above	2488266	32	0.00001	1
Total	3427364	4242	0.00124	124

Table 3 shows the incidence of measles based on age per 100,000 population. They are 625, 109 and 1 for under 5years, 6-18 years and 19years and above respectively. Based on the general population including adults, the incidence is 124 per 100,000 population.

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Table 4: Mortality from Measles during the Study Period

Year	Number of Deaths	Percentage (%)	% Decline
2016 (pre mass vaccination)	525	94.4	88.8
2018 (post mass vaccination)	31	5.6	
Total	556	100	

Table 3 shows mortality distribution from measles during the study period; a total of 556 deaths occurred during the study period. Majority occurred in 2016 (pre mass vaccination) with 525(94.4%) deaths while the least occurred in 2017 (post mass vaccination) with 31(5.6%) deaths. Percentage decline in mortality was 88.8%.

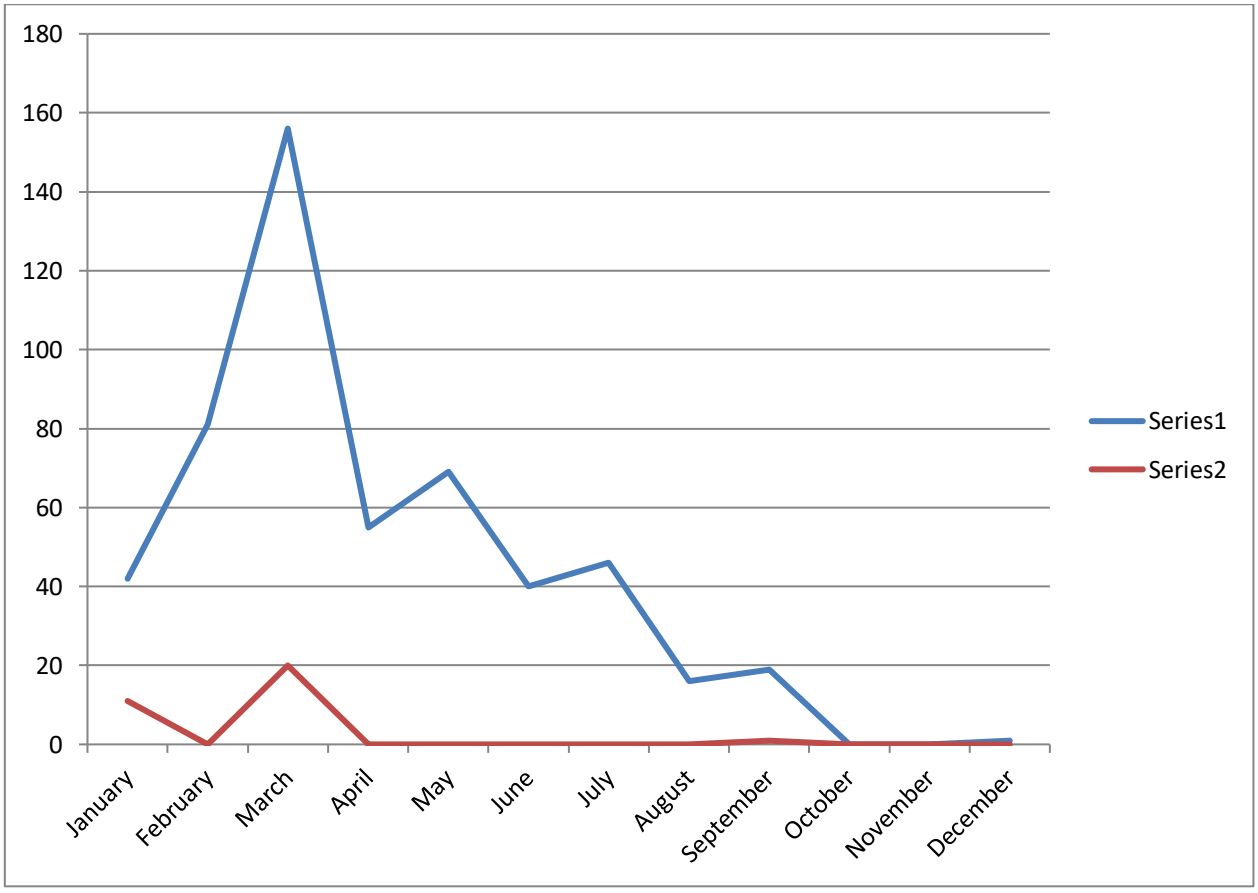

Fig 2: Monthly distribution of mortality from measles during the study period.

Figure 2 shows the monthly distribution of mortality from measles. Most causes occurred within the month of January to May. The highest mortality occurred in the month of March.

N/B:
Series 1: 2016 (Pre-Mass Vaccination)
Series 2: 2017 (Post Mass Vaccination).

Table 5: Relationship in the Morbidity and Mortality of Measles Pre and Post Mass Vaccination

	Morbidity		Test of Significance	Mortality		Test of Significance
Month	Pre mass vaccination	Post Mass Vaccination		Pre mass vaccination	Post Mass Vaccination	
January	308	172	Mean = 276.6 (95% CI 89.8 – 463.3) r = 0.576 P = 0.008	42	12	Mean = 41.1 (95% CI 15.5 – 66.7) r = 0.713 P = 0.005
February	622	115		81	0	
March	882	96		156	20	
April	760	46		55	0	
May	648	32		69	0	
June	241	0		40	0	
July	102	0		46	0	

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August	113	0		16	0	
September	60	0		19	0	
October	20	0		0	0	
November	12	0		0	0	
December	12	0		1	0	
Total	3780	462		525	32	

Table 5 showed the relationship in morbidity and mortality of measles pre and post mass vaccination. More cases (3780) are noted in 2016 which was the pre mass vaccination year while less cases (462) were recorded in 2017 which is the post mass vaccination year. There was a statistical significant relationship on the impact of mass vaccination on the incidence and mortality from measles ($P < 0.05$). Also, more deaths (525) occurred in 2016 than 2017 (32) were mass vaccination was done. A statistical significant relationship was observed pre and post mass vaccination ($P < 0.05$) as shown in table 5. Furthermore, the case fatality rate for the study period is 13.1%. The Pre mass vaccination (2016) case fatality was 13.9 while post mass vaccination (2017) was 2.6%. A decline of 11.3% was noted following mass vaccination.

IV. DISCUSSION

A. Incidence of Measles in Yobe State

A total of 4,242 cases of measles with 556 deaths and case fatality rate of 13.1% was recorded during the study period (2016-2017). The overall incidence among the total population was 124 per 100,000 population and among under 5 year, the incidence was higher which was 625 per 100,000 population. This was followed by those within 6-18years with an incidence of 109 per 100,000 population and the least was 32 per 100,000 population among those 19years and above. The finding from this is relatively higher than most studies including reports by Bino *et al.* (2003) in Albania who reported an incidence of 0.5 per 100,000 population among those 18years and below. It is also a pointer to the fact that measles is a tropical disease which is needs to be controlled to prevent associated morbidity and mortality in the Sub-Saharan Africa.

The study also revealed that the highest burden of measles was in Jarkusco with almost a quarter of the state burden (22.9%). This was followed by Nguru (11.5%), Damaturu (10.1%) and Potiskum (8.2%). Local Government Areas with least cases include: Nangere (0.5%), Gujba (0.9%), Yunusari (1.6%) and Fune (1.8%). This finding may be attributable to possible improved routine immunization activity that ensures administration of measles vaccines which confers immunity against the virus in most of the health facilities of local government areas with least burden of measles unlike in the once with high incidence and mortality from measles. A gap in the routine immunization and other factors including hard to reach children necessitated the need for supplementary immunization activities otherwise called mass campaign. However, immunization activities needs to be urgently strengthened in Local Government Areas like Jakusco and Nguru in order to ensure prevention of vaccine preventable diseases among susceptible children in these regions. These interventions are also needed to meet the WHO elimination target for measles vaccine across the globe. Improving immunization services is central to ensuring elimination of measles in the various local government areas of Yobe State. Regarding gender distribution, the result from this study showed a slight higher prevalence of measles among males (53.3%) than females (46.7%) possibly due to less interaction with people with the disease among the female folks unlike males who are very active and play and move in groups making disease transmission common among them. Furthermore, almost all the cases (90.9%) of measles affected children who are under five years (Table 1). This finding is similar to report by UNICEF (2019) who also observed that the highest burden of measles is seen among under 5 children in Sub-Saharan Africa. he implication is that immunization for measles should target this age group to ensure maximum outcome as they are more susceptible in developing the disease than adults.

B. Effectiveness of Mass Vaccination on Incidence of Measles

A total of 4242 cases of measles were recorded during the two years study period (2016-2017). (89.1% %) were recorded in 2016 when no mass vaccination was done while (10.9%) was recorded in 2017 when there was a mass vaccination against measles. Percentage decline in incidence was 78.2% (Table 2). This result revealed that mass vaccination against measles has the capacity of reducing the incidence of measles by 78.2% which is relatively high and commendable. A finding similar to report by Portnoy *et al.*(2018) in their systematic review across the globe who reported a 66% decline followed mass vaccination of children in and Mbabazi *et al.* (2009) who reported a 93% decline in measles cases following mass vaccination of children in South Sudan.

C. Mortality from Measles

Measles can be highly fatal especially when immediate and appropriate treatments are not commenced. The result from this study revealed that a total of 556 deaths and case fatality rate of 13.1% was recorded during the study period. Majority (99.4%) were in 2016 (pre-mass vaccination) while the least (5.6%) occurred in 2017 when there was a mass vaccination campaign. This provided a 88.8% decline in mortality following mass vaccination. A finding that is similar to report by Godson *et al.* (2011) in Maroua, Cameroon who also observed a marked decline in mortality of measles following reactive mass vaccination of eligible children against the infection. Similarly, Simons (2013) recorded a decline in mortality by 75% and more also reported that more than three quarters in in decline of cases occurred in the WHO Regions except South East Asia who did not reach this mark. Interestingly, Mbazizi *et al.* (2013) in South Sudan reported no deaths following mass

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campaign. This implies that mass campaigns should be encouraged in Sub Saharan Africa as a means of achieving sustainable development goal 3 on health which also focuses on reduction in child mortality. A monthly variation in the pattern of mortality was observed during the study period. More deaths occurred during the month of March with declines from August and no deaths from October to December mostly for the post vaccination year. Meaning mass vaccination should be conducted early in the year to avert morbidity and mortality due to measles.

D. Effectiveness of Mass Vaccination on Morbidity and Mortality

The result from this study showed that there was a statistical significant relationship on the impact of mass vaccination on the incidence and mortality from measles ($P < 0.05$) (Table 4). A strong correlation was also noticed with respect to mass vaccination and mortality from measles ($r = 0.731$). That for the number of cases was moderate ($r = 0.576$). This is similar to similar studies done Doumtsop *et al.* (2014) in Guinea who noted a strong association between clusters that had mass vaccination and those that did not. These findings further encourage the need for mass vaccination as a means for measles elimination across Sub-Saharan African and the globe at large.

V. CONCLUSION

The result from this study revealed that the incidence and mortality associated with measles in Yobe State is very high. Mass vaccination against the virus greatly reduced morbidity and mortality associated with the disease. Some Local Government Areas have the highest burden of the disease and Under 5years children had the highest incidence of the disease in the state. A seasonal variation with peaks in March and April was observed. Mass vaccination was noted to statistically reduce the morbidity and mortality associated with measles and this can be attributed to the individual and herd immunity provided by mass vaccination. These successes should be employed as a means of eliminating the disease in the Africa sub-continent and other parts of the globe. The need to strengthen mass vaccination to achieve higher coverage of the vaccine as a strategy for immunization becomes eminent.

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