



Full Length Research Paper

A 5 year review of childhood measles at the Niger Delta University Teaching Hospital, Bayelsa state, Nigeria

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ABSTRACT

Measles control is yet to be achieved in Nigeria despite global efforts geared towards measles elimination. The aim of this study was to determine the prevalence and describe the pattern of childhood measles among children presenting to the Niger Delta University Teaching Hospital (NDUTH), Okolobri, Bayelsa State. Case notes of children with measles seen at the NDUTH over a five year period (1st September 2008 to 31st August 2013) were retrospectively reviewed. A hundred and seventeen (117) cases of measles were seen at the NDUTH. Measles constituted 2.0% of the total paediatric admissions and the peak age of presentation was in infancy (41.0%). Twenty-seven (23.1%) of the children were less than 9 months old. Majority (81.2%) had not received prior measles vaccine with a major reason given for failure to receive the vaccine being that the child was not up to the age for immunization. Complications occurred more in the malnourished and the unvaccinated children. Of the 76 children who were admitted, there was a case fatality rate of 3.9%. Mortality was associated with bronchopneumonia, lack of vaccination and age under 2 years. Measles remains a burden in our environment, affecting mostly infants and the unimmunized.

Keywords: Measles, children, infancy, vaccination, Bayelsa, Nigeria.

INTRODUCTION

Measles is an acute and highly contagious viral disease associated with high mortality mainly from complications like pneumonia, diarrhoea and malnutrition. It is a major cause of vaccine preventable deaths globally despite the availability of a safe and effective vaccine. More than 30 million people are affected by the disease each year, mostly in developing countries, particularly Africa and Asia (AFRO Measles Surveillance Guidelines, 2004). In the year 2000, measles caused an estimated 548,000 deaths mostly among children under the age of 5 years (Global measles and Rubella Strategic Plan 2012-2020). With case fatality rates of 3-5% in hospital settings and as high as 10% during epidemics in developing countries, measles is still a major cause of under 5 mortality (AFRO Measles Surveillance Guidelines, 2004).

In an effort to reduce the burden of measles, the Measles Initiative was launched in 2001 with the aim of

reducing the global measles prevalence as well as mortality. This public health partnership, which later became the Measles and Rubella Initiative in 2012 was led by the American Red cross, World Health Organization (WHO), United Nations Children's Emergency Fund (UNICEF), Centres for Disease Control and Prevention and United Nations Foundation (Measles and Rubella initiative, 2013). To achieve its objective, the WHO recommended that every child received 2 doses of the measles-containing vaccine (MCV) as increased vaccination coverage had been shown to reduce measles deaths (AFRO Measles Surveillance Guidelines, 2004; Global measles and Rubella Strategic Plan 2012-2020; Measles and Rubella initiative, 2013). Other strategies adopted were epidemiological surveillance with laboratory confirmation of cases and outbreaks and improved case management (AFRO Measles

Surveillance Guidelines, 2004; Global measles and Rubella Strategic Plan 2012-2020; Measles and Rubella initiative, 2013).

Over the next decade, global measles deaths dropped by 71%, from 548,000 cases in 2000 to 158,000 cases in 2011 following an increase in routine measles vaccination coverage to up to 84% (Global measles and Rubella Strategic Plan 2012-2020; Measles and Rubella initiative, 2013; Status report on progress towards measles and rubella elimination, 2012). In 2001, twenty-three mass vaccination campaigns were implemented with over 117 million children between the ages of 9 months and 15 years vaccinated against measles in countries with high disease burden (Status report on progress towards measles and rubella elimination, 2012).

Despite this global progress, measles control still remains a challenge in sub-Saharan Africa (Measles and Rubella Initiative, 2013). Though the measles vaccine is administered at 9 months under the Nigeria's Expanded Programme on Immunization (EPI) (PAN Advisory Committee on Immunization, 2012), Nigeria is still one of the 47 priority countries in the world where the burden of the disease is highest with outbreaks of measles still being reported in various states. By 2011, 1.7 million Nigerian children had not received the 1st dose of the MCV and there were 18,843 cases of measles reported (Status report on progress towards measles and rubella elimination, 2012). With another outbreak in 2013, where 29,000 cases of measles were reported in some states in northern Nigeria, a nationwide emergency mass vaccination campaign was conducted targeting children between the ages of 9 and 59 months (Measles and Rubella Initiative, 2013).

Presently, the global Measles and Rubella Strategic Plan 2012-2020 has been developed with a five pronged strategy to cut global measles deaths by at least 95% by 2015 compared with the 2000 levels and to achieve measles and rubella elimination in at least 5 of the 6 WHO regions by 2020 (Global measles and rubella Strategic plan 2012-2020; Measles and Rubella Initiative, 2013). Nigeria, though part of the WHO region of Africa is yet to incorporate the combined Measles and Rubella (MR) vaccine into its routine immunization schedule, though it has been endorsed by the Paediatric Association of Nigeria (PAN Advisory Committee of Immunization, 2012). Recognizing the important contribution of measles to childhood mortality, its elimination and eventual eradication would contribute to the attainment of the 4th Millennium Development Goal by 2015 (The Millennium Development Goals report, 2013)

Various hospital based studies on childhood measles (Osinusi and Oyedeji, 1986; Etuk et al., 2003; Asindi and Ani, 1984; Fetuga and Njokanma, 2007; Onyiruika, 2011; Ibadin and Omoigberale, 1998; Adetunji et al., 2007; Adeboye et al., 2011; Ahmed et al., 2010) have been carried out in Nigeria, but none at the Niger Delta University Teaching Hospital (NDUTH) Okolobri, Bayelsa

State. The present study was therefore carried out to determine the prevalence of measles among children presenting to the Paediatric department of the NDUTH and describe the pattern of the disease and its contributing factors in the area with the purpose of proffering possible solutions to achieving the elimination goals in this decade.

MATERIALS AND METHODS

Study area

The study was carried out at the Niger Delta University Teaching Hospital, Bayelsa, a tertiary hospital in Okolobri, a semi-urban town in Bayelsa State, Nigeria.

Data collection

Over a 5 year period (1st September 2008 to 31st August 2013) all the case notes of children with a clinical diagnosis of measles were retrieved from the Medical Records Department of the hospital and analysed. Information retrieved from the case notes and entered in a proforma included the age at diagnosis, sex, presenting complaints, measles vaccination history, month and year of presentation, duration of symptoms before presentation and duration of hospitalisation. The presence of complications (AFRO Measles Surveillance Guidelines, 2004), outcome and follow-up visit were also noted in the proforma. The weights' for age of each child was used to determine their nutritional status according to the modified Wellcome classification (Wellcome Trust International Working Party, 1970). A child was considered malnourished if he/she had a weight for age of less than 80% of expected with or without oedema and well-nourished if the patients' weight for age was over 80% of expected without oedema.

Criteria for clinical diagnosis of measles

The diagnosis of measles was made based on the WHO clinical criteria (AFRO Measles Surveillance Guidelines, 2004) with the following symptoms;

- High grade fever preceding the appearance of the rash by about 2-4 days
- A generalized erythematous maculopapular non-vesicular rash
- One or more of the following: Cough conjunctivitis or coryza.

A serologic diagnosis for confirmation was not made in any of the cases of measles due to lack of facilities.

Treatment protocol

The patients were seen either in the Paediatric Outpatient clinic or the Children's Emergency Ward and were

admitted into the Isolation rooms of the Paediatric ward. Treatment for the admitted cases consisted of broad spectrum intravenous antibiotics, chloramphenicol eye drops, calamine lotion, gentian violet lotion for oral sores and Vitamin A given on days 1, 2 and 14 with doses of between 50,000iu and 200,000iu based on the child's weight and age (Global measles and Rubella Strategic Plan 2012-2020). Nutritional rehabilitation for those who were malnourished was with high calorie, high protein diets and micronutrient supplementation. Other supportive care was administered accordingly. Those who were managed on an outpatient basis were given oral antibiotics, antipyretics and vitamin A and subsequently followed up.

Ethical considerations

Ethical clearance was obtained from the Research and Ethics Committee of the Niger Delta University Teaching Hospital, Bayelsa state.

Data analysis

This was a descriptive analytical study. Data was entered into a computer using SPSS 15.0 for windows (Inc Chicago, USA, 2001) with calculation of ratios, percentages and confidence intervals. Tests of significance was done using the Fishers Exact test with a p value of <0.05 considered statistically significant.

RESULTS

Over the 5 year period, a total of 117 cases of clinically diagnosed measles were seen at the NDUTH. Seventy-six; 76 (65.0%) of these children were admitted into the isolation rooms of the Paediatric ward which constituted 2.0% of the 3796 paediatric admissions in the hospital over the study period. The remaining 41 (35.0%) children were seen and managed on an out-patient basis.

Age and sex distribution

Of the 117 children with measles, 57 were male while 60 were female giving a male: female ratio of 0.9:1. (Table 1) The children's ages ranged from 5 to 108 months with a mean of 23.09 ± 20.75 months (95% CI 26.89- 19.29). Forty-eight; 48 (41.0%) of the children were between the ages of 0 and 12 months, out of which 27 (56.2%) were less than 9 months old. Children who were less than 9 months old constituted 23.1% of the 117 children.

Clinical features and complications

Of the 117 children with measles, all presented with fever and the typical skin rash (diagnostic criteria) followed by cough 100 (85.5%), coryza 71 (60.7%), poor appetite

58(49.6%) and conjunctivitis 55 (47.0%) (Table 2). Complications were noted in 79 (67.5%) of the children. The commonest complications were bronchopneumonia; 69 (59.0%), acute diarrhoeal disease with dehydration; 38 (32.5%) and Protein Energy Malnutrition; 32(27.30%) (Table 3). Of all the 117 children with measles, 85 (72.7%) were well- nourished while 32(27.3%) were malnourished. Of the 32 who were malnourished, 28 (87.5%) were underweight, 3 (9.4%) had marasmus while 1 (3.1%) had kwashiorkor. Complications were noted in 27 (84.4%) out of the 32 malnourished children as compared with 34 out of the 85(40.0%) well-nourished children. This difference was statistically significant ($p < 0.0001$, 95% CI 0.11 to 0.59).

Pattern of illness

Of the 117 children presenting with measles, the duration of illness before presentation ranged from 1 to 30 days with a mean of 6.78 ± 5.39 days (95% CI 7.76- 5.79). Majority of them; 98 (83.8%) had been ill for a week or less, 8 (6.8%) were ill for a period of 8-14 days, 7(6.0%) were ill for 15-21 days and 4(3.4%) were ill between 22 and 30 days before presentation at the hospital. The duration of hospitalisation for the 76 children who were admitted ranged from 1 to 30 days with a mean of 5.55 ± 4.31 days (95% CI 6.54-4.57). Majority; 66 (86.8%) of them were admitted for a week or less, 5(6.6%) for 8- 14 days, 4(5.3%) for 15- 21 days and 1(1.3%) for 22-30 days before discharge. History of contact with a person with measles was positive in 24 (20.5%) and negative in 93 (79.5%) patients. Of the 24 positive cases, 6 (25.0%) of the contacts were siblings while 18 (75.0%) were neighbours.

As shown in figure 1, more cases of measles; 64 (54.7%) occurred during the relatively longer rainy season (April to October) as compared with 53(45.3%) cases reported during the shorter dry season (November to March). Two peaks were noted between the months of March/April and July/August.

In figure 2, most cases of measles occurred in the years 2008/2009 and least between 2009 and 2011.

Measles vaccination status

Of the 117 children with measles, 22(18.8%) had received measles vaccine before the illness while 95(81.2%) had not. Among the unvaccinated children, 45(47.4%) were infants, out of which 27 (60.0%) were less than 9 months old. Out of the 22 children who had received the measles vaccine, 4 (18.2%) were aged less than 12 months, 17 (77.3%) were between the ages of 12 and 59 months while 1(4.5%) was over 59 months of age. The major reasons given for the failure to vaccinate the 95 children were (i) the children were less than 9 months and not yet up to the age for immunization; 19 (20.0%) and (ii) the lack of vaccines and/or the health worker at

Table 1. Age and sex distribution of the 117 children who presented with measles

Age (months)	Male	Female	Total	Percentage (%)
0-12	25	23	48	41.0
13- 24	19	17	36	30.8
25-36	5	12	17	14.5
37-48	4	6	10	8.6
49-60	1	0	1	0.8
>60	2	3	5	4.3
	56	61	117	100.0

Table 2. Presenting complaints of the 117 children who presented with measles

Presenting complaints	Total (of 117)	Percentage (%)
Fever	117	100.0
Skin rashes	117	100.0
Cough	100	85.5
Coryza	71	60.7
Poor appetite	58	49.6
Conjunctivitis	55	47.0
Vomiting ± diarrhoea	47	40.2
Oral sores	31	26.5
Weight loss	19	16.2
Fast breathing	19	16.2
Seizures ± loss of consciousness ± irritability	19	16.2
Others (heart failure, Kopliks spots, angular stomatitis, cancrum oris, oral thrush, pedal oedema, mucocutaneous candidiasis)	21	17.9

Table 3. Complications seen in the 117 children who presented with measles

Complications	Total(out of 117)	Percentage (%)
Bronchopneumonia	69	59.0
Acute diarrheal disease± dehydration	38	32.5
Protein Energy Malnutrition	32	27.3
Tonsillitis ± pharyngitis	21	17.9
Croup	4	3.40
Corneal keratitis	1	0.85
Otitis media	1	0.85

★ Some had more than one complication

the Health Care centres; 7 (7.4%) (Table 4).

Complications were noted in 11 (50.0%) out of the 22 children who had received the measles vaccine as compared to 68 (71.6%) of the 95 unvaccinated children. This difference was not statistically significant ($p=0.07$).

Outcome of the measles cases

Out of the 76 cases that were admitted, 66(86.8%) were

discharged, 7(9.2%) were discharged against medical advice and 3 died with a case fatality rate of 3.9%. The children who died were aged 9 months, 1 year and 2 years respectively with a male: female ratio of 2:1. None of them had received measles vaccine before the onset of the illness. All had complications which included bronchopneumonia; 3(100%), encephalitis; 2(66.7%), croup; 2(66.7%) and kwashiorkor; 1(33.3%). Of the 41 cases seen on Out-patient basis, 11 (26.8%) had

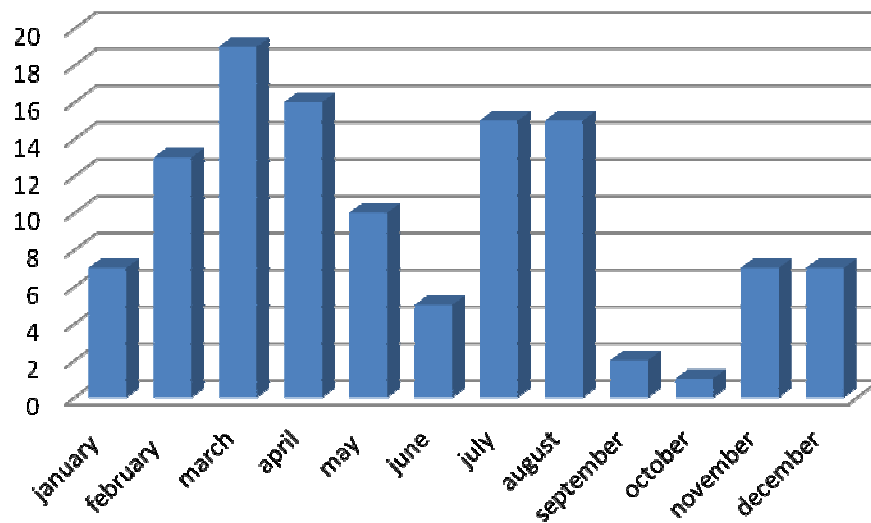


Figure 1. Months of measles presentation to the hospital over a 5 year period (2008-2013)

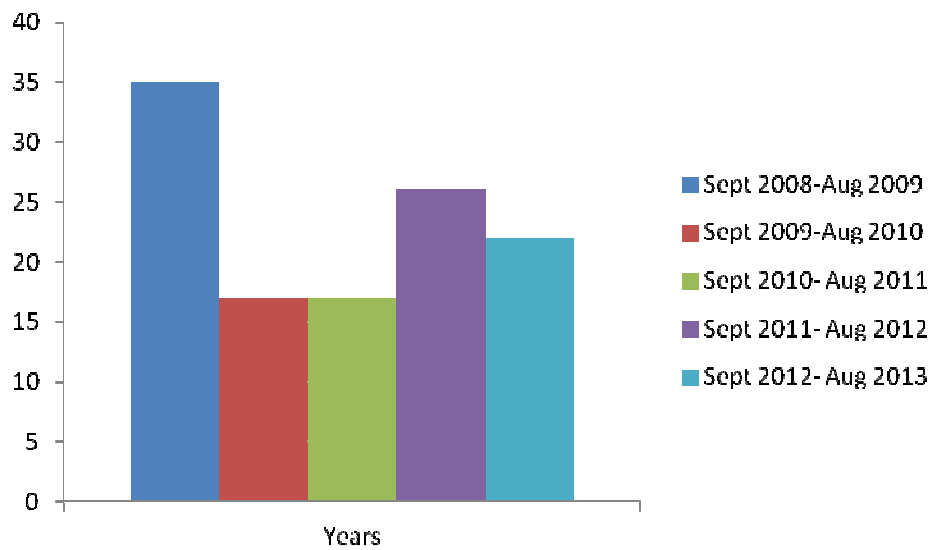


Figure 2. Yearly prevalence of measles cases over a 5 year period (September 2008 –August 2013)

Table 4. Reasons for lack of immunisation in the 95 children who did not receive measles vaccine

Reasons for non-immunisation	Total	Percentage (%)
Child not due for immunisation	19	20.0
No vaccine/ health worker at the Health care centre	7	7.4
Fever/ injection abscess during previous vaccinations	3	3.2
Mother forgot	2	2.1
Far distance from the Health Care centre	1	1.0
Reason not stated	63	66.3
	95	100.0

complications which included bronchopneumonia in 7 (63.6%); acute diarrhoeal disease with or without dehydration in 5(45.5%); protein energy malnutrition in 2 (18.2%) and tonsillitis in 2(18.2%). The parents of all the children with complications refused admission, mainly for financial reasons. Of the 41 cases seen as out-patients, after the initial clinic visit only 18 (43.9%) came for follow up while the remaining 23(56.1%) did not.

DISCUSSION

In this study, measles constituted 2.0% of the paediatric post-neonatal admissions. This is similar to 2.3% and 2.0% reported by Ibadin and Omoigberale, 1998 and Ahmed et al., 2010 respectively, but lower than figures reported in other Nigerian studies (Etuk et al., 2003; Fetuga and Njokanma, 2007; Onyiruika, 2011; Adebayo et al., 2011). Despite this low prevalence rate, the high contact history suggests an increased disease burden and low herd immunity in the environment. The lower prevalence of measles cases from mid-2009 to mid-2011 is at variance with the reported increase in prevalence in Nigeria and other parts of Africa due to outbreaks in 2009 and 2010 (Status report on progress towards measles and rubella elimination, 2012). This could be explained by the poor orthodox health seeking behaviour of some mothers, and their preference for alternative medical treatment thus leading to under reporting (Adika et al., 2013).

The peak age of presentation of measles was in infancy with over 50% of the affected children aged less than 9 months of age. Similar findings of increased incidence of measles in infants have been reported in Calabar, Sagamu and Ibadan (Osinusi and Oyedeji, 1986; Etuk et al., 2003; Asindi and Ani, 1984; Fetuga and Njokanma, 2007) but however differ from observations of other workers from other parts of the country where peak incidences occurred in the second year of life (Onyiruika, 2011; Ibadin and Omoigberale, 1998; Adetunji et al., 2007; Ahmed et al., 2010). The reason for this disparity is unclear but the finding of about 20% of all affected children aged less than 9 months appears to be common in most Nigerian studies (Etuk et al., 2003; Asindi and Ani, 1984; Fetuga and Njokanma, 2007; Onyiruika, 2011; Adetunji et al., 2007; Ahmed et al., 2010). This early presentation of measles has been attributed to a rapid decline in maternally acquired antibodies which some authors reported was due to the presence of infections (Fetuga and Njokanma, 2007) and malnutrition (Odoemele et al., 2008) in Nigerian children. With the introduction of the measles vaccine in 1963, children born to vaccinated mothers have been noted to have lower antibodies than those of mothers who had the natural infection (Danet and Fermon, 2013; Caceres et al., 2000). Other studies have documented a decreased placental transfer of maternal antibodies in relation to

prematurity, HIV and malaria (Caceres et al., 2000) which are all endemic problems in Nigeria. Oyedele et al., 2005 in their study found that 58% of Nigerian infants lose their maternal antibodies by 4 months and 97% between 6 and 9 months.

The policy of measles vaccination at 9 months was based on various studies on sero-conversion after measles vaccination at different ages (Expanded Programme on Immunization 1982; WHO Measles Vaccine, 2009; Aaby et al., 2012). Recent recommendations by WHO is that all children should receive 2 doses of measles containing vaccine(MCV); the first dose during the routine immunization programme and the second dose either through routine services or through Supplemental immunization activities(SIAs) (Danet and Fermon, 2013; WHO Measles Vaccine, 2009; Van et al., 2009). The age of administration of the first dose of the MCV varies with respect to the burden of measles in the geographical area (Global measles and Rubella Strategic Plan 2012-2020; Danet and Fermon, 2013; WHO Measles Vaccine, 2009). In areas of low transmission like the United States of America where measles has been largely eliminated but for few imported cases, MCV1 is given at 12 months and MCV2 at 15-18 months due to the fact that seroconversion to the MCV increases with increasing age (Global measles and Rubella Strategic Plan 2012-2020; Danet and Fermon, 2013; WHO Measles Vaccine, 2009).

Various studies on the advantages of an early 2 dose measles vaccine administration in African countries with high measles burden have been conducted (Carly et al., 1999; Aaby et al., 2010; Njie-Jobe et al., 2012). Carly and his co-workers (Carly et al., 1999) in Guinea-Bissau reported that the administration of the measles vaccine to children twice in infancy; at 6 and 9 months resulted in high vaccine coverage, high antibody levels and a better outcome compared to their cohorts on single dose of vaccine administration at 9 months. Other authors have also reported that the administration of 2 doses of the MCV in early infancy was beneficial to overall child survival (Aaby et al., 2012). Since the 1990s, the EPI has recommended an early 2 dose measles schedule for certain high risk groups in which measles morbidity and mortality were high such as infants in refugee camps, disaster areas, the HIV exposed, malnourished or in-patients with the first dose given at 6 months and the second at 9months with at least 4 weeks between the two doses (Danet and Fermon, 2013; WHO Measles Vaccine, 2009). With increasing occurrences of measles in early infancy and a corresponding decline in levels of trans placental antibodies, a two dose vaccine regimen to be given during routine immunization schedules at 6 and 9 months in Nigerian children is recommended. The 6 month MCV1 dose can be easily incorporated into the National Programme on Immunization schedule (PAN Advisory Committee on Immunization, 2012) to be administered alongside other vaccines to prevent an

increased rate of drop out from the vaccination programme. This early 2 dose schedule would protect the younger susceptible children with the second dose at 9 months to ensure sero-conversion in non-responders thus preventing vaccine failure.

In this study, measles infection was observed in 18.8% of the children who had been previously vaccinated against measles. This is similar to 17.4% and 22.1% reported by Adeboye et al., 2011 and Onyiruika, 2014 respectively though higher rates were reported from other Nigerian studies (Fetuga and Njokanma, 2007; Adetunji et al., 2007; Ahmed et al., 2010). Nnebe-Agumadu, 2005 in his study gave the reason for the occurrence of measles in previously vaccinated children to be due to the presence of ineffective vaccines, poor host immune status, wrong technique of vaccination and the different strains of the measles virus which meant that the same vaccine may not offer full protection. Seroconversion rates to the measles vaccine among Nigerian children have been reported to be between 30 and 70% as a result of suboptimal antibody response to routine measles vaccination due to low vaccine potency (Odoemele et al., 2008; Adu et al., 1992; Ladapo et al., 2013). This is lower than the 85% seroconversion rates expected following measles vaccination at 9 months (Danet and Fermon, 2013; WHO Measles Vaccine, 2009; Van et al., 2009). Though vaccine failures can be due to inactivation of the vaccines by improper storage and handling (Aaby et al., 2012; Adu et al., 1992; Ladapo et al., 2013) or due to neutralization by maternal antibodies (Caceres et al., 2000; Aaby et al., 2012) many epidemiological studies have shown that measles in previously vaccinated children runs a milder course (Aaby et al., 2012; Van et al., 2009; Aaby et al., 1986). Aaby et al., 1986 suggested that previously vaccinated children had partial immunity which though not enough to prevent the disease, was enough to modify its severity. In this study, complications were less in the previously vaccinated children which supports this finding and stresses the importance of strengthening routine measles immunization services in Nigeria.

In the present study, majority (81.2%) of the children had not received the measles vaccine before onset of illness with the lack of vaccine and/or health care worker at the health centres being a major reason for failure of vaccination. A similar reason was reported by Onyiruika, 2011 in Benin and Adetunji et al., 2007 in Osogbo. Etuk et al., 2003 in a comparative analysis of measles cases seen during the Expanded Programme on Immunization (EPI) eras and National Programme on Immunization (NPI) eras in Calabar, noted an upsurge in measles prevalence, morbidity and mortality during the NPI era which the authors postulated was due to politicizing the procurement of vaccines leading to vaccine scarcity and hence resulting in increased susceptibles and low herd immunity. Adeboye et al., 2011 in Bida however attributed the lack of vaccination in their study to be largely due to

negative parental disposition to vaccination and advocated for better health education at the community level. The lack of vaccination was a major contributor to mortality in this study and was associated with more complications, an observation also made by other authors (Adetunji et al., 2007). Government commitment towards increasing measles vaccination coverage by improving vaccine availability and potency would help to mitigate this problem.

The reason for missed vaccination was not documented in the majority (66.3%) of the cases in the present study. This shows lack of awareness of the relevance of this information among Physicians attending to children with measles which may lead to inadequate counselling of the mothers on the importance of vaccination for disease prevention. Adika et al., 2013 in a study on mothers' perception of childhood measles in Bayelsa reported a general poor knowledge by the mothers on the cause and prevention of measles. Only 32% of the respondents were aware that measles was a vaccine preventable disease and only 10% had been informed about the cause of measles by a health care worker. This highlights an urgent need for training and retraining of health care workers in the management and prevention of measles and other vaccine preventable diseases. Health education of mothers should also be ensured at the community level to improve their health seeking behaviour

Bronchopneumonia was the commonest complication and also an important cause of mortality as has been previously reported (Asindi and Ani, 1984; Ibadin and Omoigberale, 1998; Etuk et al., 2003; Adetunji et al., 2007; Fetuga et al., 2007; Ahmed et al., 2010; Onyiruika, 2011). In our study, more cases of measles were noted during the rainy season, (Bayelsa State-"The Glory of all Lands"- Nigeria, 2011) which is at variance with reports of seasonal prevalence of measles cases during the dry season from other parts of Nigeria (Osinusi and Oyedeji, 1986; Etuk et al., 2003; Asindi and Ani, 1984; Fetuga and Njokanma, 2007; Onyiruika, 2011; Adetunji et al., 2007; Adeboye et al., 2011). The first peak period of measles cases however, was noted to correspond to the end of the dry season while the second in July/August, could be attributed to the "August break"; a period of marked interruption in the rains heralding a very short dry season. Further studies are advocated, as this knowledge is important with regards to the timing of the SIAs which are usually conducted during periods of low transmission as determined by the local epidemiological data (Measles SIAs Field Guide, 2006).

A case fatality rate of 3.9% was reported in the present study with all the children who died being less than 2 years old. Other Nigerian studies have reported case fatality rates ranging from 2.8% (Asindi and Ani, 1984) to up to 34% (Osinusi and Oyedeji, 1986) in hospital settings. Reasons for the relatively low mortality from measles in this study could be due to the fact that

most of the admitted children were well nourished; so had higher immune status to fight the disease than those who were malnourished (Danet and Fermon, 2013). Similar findings were noted by Asindi and Ani, 1984 but this was contrary to reports from other Nigerian authors (Osinusi and Oyedeji, 1986; Fetuga and Njokanma, 2007; Ibadin and Omoigberale, 1998; Ahmed et al., 2010) who attributed the increased mortality from measles to a decline in the nutritional and socioeconomic status of Nigerian children.

CONCLUSIONS

The burden of measles in Nigeria remains high despite global efforts targeted at elimination, with infants and the unvaccinated being the most susceptible. A revision of the administration of the measles vaccine in the Nigerian EPI to an early 2 dose schedule in infancy is advocated. Governments' commitment to improving vaccine potency and availability should be made a priority to ensure increased vaccine coverage and prevent missed opportunities. Health education of mothers as well as training and retraining of the health workers on childhood measles should be emphasized at all levels.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the contributions of Dr I.A. Merenu, Dr Mukoro and Professor Felix Akinbami for their review of this paper.

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How to cite this article: Duru CO, Peterside O and Adeyemi OO (2014). A 5 year review of childhood measles at the Niger Delta University Teaching Hospital, Bayelsa state, Nigeria. *J. Med. Med. Sci.* 5(4):78-86