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## RESEARCH ARTICLE

# CHILDHOOD MEASLES IN A SOUTH EASTERN STATE UNIVERSITY TEACHING HOSPITAL

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**ABSTRACT**

**Background:** The disease burden from measles, a vaccine preventable disease remains high despite decades of interventions by World Health Organization, Nigeria and other agencies.
**Objective:** To assess the prevalence and pattern of childhood measles among children presenting at Imo State University Teaching Hospital, Orlu, Imo State.
**Design:** Retrospective descriptive.
**Methods:** A retrospective descriptive study of children who had measles infection in Imo state university teaching hospital within the given time frame (June 2009 - June 2014). Data was abstracted from the hospital records using a proforma, and analysed with SPSS at a statistical significance level of 0.05.
**Results:** Within the study period, 12,216 patients attended the paediatrics clinic. Of these, 115(0.9%) were diagnosed with measles infection. The peak age was in infancy 30 (26.1%). Of the total infants 15(50%) were less than 9 months of age. The age group 37-42 months had the lowest frequency 9(7 7%). Males, 80(69.6%) were statistically significantly more than females 35(30.4%) giving a female : male ratio of 1:2.3 with a P value is < 0.0001,Chi-square statistic (with Yates correction) = 33.670, Odds ratio= 5.224, 95% Confidence Interval: 2.979 to 9.164. most of the patients 112(97.4%) were Ibos. Rural dwellers 108(94%)were statistically significantly more affected than urban dwellers7(6%). Most of the parents of these children 50(43.5%) were farmers; 28(24.5%) were housewives. 60(52.1%) of these parents had only primary school education while 15(13.3%) had junior secondary and 15(13%) had no formal education. 109(94.8%) were Christians. All the 115 patients presented with both skin rash and fever; 100(87%) presented with cough; 52 (45.2%) presented with poor appetite and 30(26%) presented with weight loss. Complications from the measles infection were bronchopneumonia 40(34,8%), otitis media 32(28%), protein-energy malnutrition 25(21.7%), tonsillitis 15(13%) and blindness 3(2.6%). Majority 77(67.0%) had not received measles vaccine while 38(33%) had received the vaccine. The major reason given for failure to receive the vaccine was that the mother forgot 28(36.4%), child not due for immunization 21(27.3%), no vaccine at the health centre 14(18.2%) while 14(18.2%) had no excuses. The children who died were aged 5months, 7months, 8months, 14 months and 24months respectively with a female to male ratio of 1:2.5. None of the dead children had received the measles vaccines before the onset of the illness. All of them had complications which included bronchopneumonia 5(100%), otitis media 5(100%) and encephalitis 4 (80%). Complications occurred more in the malnourished and the unvaccinated. Of the 80 children who were admitted, there was a case fatality rate of 6.3%. Mortality was associated with bronchopneumonia, otitis media, encephalitis and age under 2years.
**Conclusion:** Measles remains a burden in our environment affecting mostly infants, the unvaccinated, rural dwellers, and children whose parents were of low educational and socio – economic status.

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## INTRODUCTION

Measles virus is a single-stranded lipid enveloped RNA virus in the family Paramyxoviridae and genus Morbillivirus. (World health organization, 2014) Humans are the only host of measles virus so, like small pox. It can be eradicated with vaccination. It is the most common acute exanthematous illness and is the major cause of morbidity and mortality in children in developing countries. It is one of the most infectious and severe diseases of childhood. Virtually all unvaccinated will be infected and most of them would develop clinical disease. (World health organization, 2014; Azubuike and Nkagineme, 2007) Only one serotype is known and its structure is similar to that of the mumps and parainfluenza viruses. At least during the prodromal period and for a short time after the rash appears the virus is present in nasopharyngeal secretions, blood and urine. The incubation period is 8-10 days (Wikipedia, 2014; Christopher, 2007). Maximum dissemination of virus occurs via droplet infection from the respiratory tract. Transmission to

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susceptible contacts takes place much before the index case is diagnosed and such infected persons become infective to others 9-10 days after exposure. The disease most commonly affects preschool children in the ages of 1-3 years though it does occur up to 5 years of age and also below 12 months. (http://en.m. wikipedia.org/wiki/measles-vaccine; Christopher, 2007; William Schaffner *et al*., 1966) Measles can be serious in all age groups. However, children younger than 5 years of age and adults older than 20 years of age are more likely to suffer from measles complications. (William Schaffner *et al*., 1966; http;//www.cdc.gov/media/releases/2014; Richaed *et al*., 2004; Pharmascope, 2010) Common measles complications include ear infections and diarrhoea. Ear infections occur in about one out of every 10 children with measles and can result in permanent hearing loss. Diarrhoea is reported in less than one out of 10 people with measles (Wikipedia 2014 Richaed, 2004). Some people may suffer from severe complications, such as pneumonia (infection of the lungs) and encephalitis (swelling of the brain). (Afro Measles Surveillance guidelines, 2004; Ahmed *et al*., 2010; Chika O.Duru *et al*., 2014; Ibadiri and Omoigbere, 1998) They may need to be hospitalized and could die. As many as one out of every 20 children with measles gets pneumonia, the most common cause of death from measles in young children. About one child out of every 1,000 who get measles will develop encephalitis (swelling of the brain) that can lead to convulsions and can leave the child deaf or with intellectual disability. For every 1,000 children who get measles, one or two will die from it. Measles may cause pregnant woman to give birth prematurely, or have a low-birth-weight baby. (Afro Measles Surveillance guidelines, 2004; Ahmed *et al*., 2010; Chika O.Duru *et al*., 2014; Ibadiri and Omoigbere, 1998)

Long-term complications: Subacute sclerosing panencephalitis (SSPE) is a very rare, but fatal disease of the central nervous system that results from a measles virus infection acquired earlier in life. SSPE generally develops 7 to 10 years after a person has had measles, even though the person seems to have fully recovered from the illness. The virus is highly contagious and can spread rapidly in areas where people are not vaccinated. Worldwide, an estimated 20 million people get measles and 146,000 people die from the disease each year—that equals about 400 deaths every day or about 17 deaths every hour. (Afro Measles Surveillance guidelines, 2004; Ahmed *et al*., 2010; Chika O.Duru *et al*., 2014; Ibadiri and Omoigbere, 1998) The measles vaccine has changed the epidemiology of measles dramatically. Once worldwide in distribution, endemic transmission of measles has been interrupted in many countries where there is widespread vaccine coverage (Ibadiri and Omoigbere, 1998). Measles prevention is by immunization, by the use of live attenuated vaccine given at the age of nine months under the Expanded Program on Immunization (EPI). (Christopher, 2007) Efficacy of Measles vaccine is 90-95%. The British medical research trial gave the protection rate as 85% and those who develop the disease despite vaccination, develop only a mild form. (Christopher, 2007) The portal of entry for Measles virus is through the respiratory tract or conjunctiva following contact with large or small droplets aerosol in which the virus is suspended, face to face contact is not necessary because viable virus may be suspended in the air up to one hour after a source case leaves a room. Secondary cases have been reported in physician's offices and hospitals by spread of aerosolized virus. Approximately 90% of the exposed susceptible individuals develop Measles. (Richaed *et al*., 2004)

Measles infection consists of four phases: incubation period, prodromal illness, exanthematous phase and recovery. Incubation period from exposure to onset of symptoms ranges from 10-14days. The prodromal illness is characterised by non specific symptoms: Fever (usually high grade, $40^0$c or $104^0$ F) (Pharmascope, 2010) Anorexia, Conjunctivitis associated with lacrimation, photophobia, malaise, and cough. It may be associated with croup. Croup signifies the occurrence of laryngotracheobronchitis. (Azubuike and Nkagineme, 2007) Enanthem: koplik spots (ie bluish-grey specks or grains of sand on a red base) appear on the buccal mucosa opposite the second lower molar on the 3rd or 4th day of the prodromal period, just prior to the onset of the rash. Their presence is pathognomonic for measles. This enanthem begins to slough as the rashes appear. The rash which is erythematous and maculopapular in nature begins first behind the ears and at the hair line on the forehead and spreads sequentially to the whole face, neck, trunk, upper extremities, buttocks, lower extremities, completing the whole body by the 3rd day and lasts for about 5 days. Patients appear most ill during the 1st or 2nd day of the rash. By the 3rd and 4th day, the rash begins to clear, following the same sequence of its appearance. (Azubuike and Nkagineme, 2007)

Under-5 Children are more susceptible to Measles infection with the greatest incidence in those under 2years of age. Other risk factors include children with immunodeficiency due to HIV/AIDS, leukaemia, alkylating agents or corticosteroid therapy regardless of immunization status, travel to areas where Measles is endemic or contact with travellers from endemic areas, and infants who loose passive antibodies prior the age of routine immunization. The disease is severe and causes more complications and mortality in malnourished than well nourished children. Common infectious complications include: Otitis Media, bronchopneumonia, croup, diarrhoea, conjunctivtis, convulsions, meningism, and encephalitis. Rare complications include: hepatitis, encephalitis and sub-acute sclerosingpanencephalitis (SSPE) – a rare chronic degenerative disease that occurs several years after Measles infection. Mean incubation period for SSPE is 10.8years. Measles related mortalities are most often due to respiratory and neurological complications. Worldwide, Measles causes approximately 880,000 deaths each year. An estimated 85% of these deaths occur in Africa and south Asia. Case fatality rates are higher among children younger than 5years. Highest fatality rates are among infants aged 4-12months and in the immune-compromised.

Confirmation of Measles virus infection can be by Antibody Assay of IgM in the blood. This is the quickest method to confirm Measles infection (Azubuike and Nkagineme, 2007). The blood is obtained on the 3rd day of the rash, because IgM may not be detectable prior to this time. Other methods include: demonstrating more than 4fold rise in IgG antibodies between acute and convalescent sera. IgG antibodies may be detectable from 4 days after a rash or about a week after the onset of the rash. (Azubuike and Nkagineme, 2007) Patients

with SSPE have unusually high titres of Measles antibody in their serum and CSF. Measles virus can be isolated from nasopharyngeal swabs. In immune-compromised patients, identification of Measles antigen by immunoflorescence may be the only method to confirm diagnosis because they may have poor antibody response that preclude serological confirmation of Measles. Diagnosis of Measles based on WHO clinical criteria include: high grade fever preceding the appearance of the rash by 2-4 days, a generalized erythematous maculopapular non-vesicular rash with one or more of the following: cough, conjunctivitis or coryza. (http://www.afro. WHO.int/index.php) Treatment of Measles infection is mainly supportive. Antibiotics may be administered if there is Otitis Media or bacterial pneumonia. Vitamin A supplementation for children aged 6-24months (100,000IU daily for 2days and on the day 14. 100,000IU is given to children weighing less than 8kg or less than 1 year of age. The use of Ribavirin is still in the experimental stages. (Azubuike and Nkagineme, 2007)

## MATERIALS AND METHODS

**Study area:** The study was conducted in Imo State University Teaching Hospital, in Orlu Local Government Area of Imo State in South Eastern Nigeria. It is a tertiary institution.

**Study population, sample size and sampling:** Sample frame was all children 0-18years who attended paediatrics clinic within the time frame. Out of this, all children who were diagnosed with measles within the reference period were enrolled (June 2009 to June 2014).

**Study design:** A retrospective cross sectional descriptive study

**Data collection:** Data was collected from the clinic records of all affected children within the specified time frame using a pro forma.

**Data analysis:** Data was analysed using computer software, SPSS 15.0 for windows (Inc., Chicago, USA, 2001). At a statistical significance level of 0.05.

**Ethical consideration:** Approval was obtained from the ethical committee of Imo State University Teaching Hospital, Orlu.

**Competing interests:** Authors have declared that there are no competing interests.

**Authors' contributions:** Merenu IA, Uwakwe K. and Diwe K designed the study. Merenu IA wrote the manuscript and all the authors read and approved the final version of the manuscript.

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## RESULTS

Within the study period, 12,216 patients attended the paediatrics clinic. Of these, 115(0.9%) were diagnosed with measles infection. Table 1 (socio –demographic parameters) showed that the peak age for measles infection was in infancy30 (26.1%), 15(50%) of the total infants were less than 9 months old, the age group 37-42 had the lowest frequency 9(7 7%). Males made up 80(69.6%) while females made up 35(30.5%) giving a female: male ratio of 1:2.3 and a P value < 0.0001,Chi-square statistic (with Yates correction) = 33.670, Odds ratio= 5.224, 95% Confidence Interval: 2.979 to 9.164. Most of the patients 112(97.4%) were Igbos; 108(94%) were rural dwellers while 7(6%) were urban dwellers Fisher's Exact Test showed, P value is < 0.0001, Odds ratio= 238.04, 95% Confidence Interval: 80.730 to 701.89(using the approximation of Woolf.) the difference between rural and urban dwellers was statistically significantly different.

Most of the parents of these children 50(43.5%) were farmers; 28(24.5%) were housewives. 60(52.1%) of these parents had only primary school education while 15(13.3%) had junior secondary and 15(13%) had no formal education. 109(94.8%) were Christians.

### Socio - demographic data

**Table 1. Age distribution of the patients (n= 115)**

| Variable Age (months) | Frequency | Percentage (%) |
|---|---|---|
| 0-12 | 30 | 26.1 |
| 13-24 | 26 | 22.6 |
| 25-36 | 25 | 22.0 |
| 37-48 | 9 | 7.7 |
| 49-60 | 15 | 13.0 |
| >60 | 10 | 8.6 |
| Total | 115 | 100 |

Sex female:male =1: 2.3

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Male | 80 | 69.6 |
| Female | 35 | 30.4 |
| Total | 115 | 100 |

**Tribe**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Igbo | 112 | 97.4 |
| Hausa | 2 | 1.7 |
| Yoruba | 1 | 0.9 |
| Total | 115 | 100 |

**Area of Residence urban to rural 1:15.4**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Rural | 108 | 94.0 |
| Urban | 7 | 6.0 |
| Total | 115 | 100 |

**Occupational Status of Their Parents**

| Variables | Frequency | Percentage (%) |
|---|---|---|
| Civil servants | 20 | 17.3 |
| House wives | 28 | 24.5 |
| Farmer | 50 | 43.5 |
| Others | 17 | 14.7 |
| Total | 115 | 100 |

**Level of education of their parents**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| No education | 15 | 13.0 |
| Primary | 60 | 52.1 |
| Junior secondary | 20 | 17.3 |
| WASSCE/SSCE | 15 | 13.3 |
| Above secondary | 5 | 4.3 |
| Total | 115 | 100 |

**Religion of the patients**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Christianity | 109 | 94.8 |
| Islam | 1 | 0.9 |
| Traditional | 5 | 4.3 |
| Total | 115 | 100 |

Table 2 (clinical details) showed that all the 115 patients presented with both skin rash and fever; 100(87%) presented with cough; 52 (45.2%) presented with poor appetite and 30(26%) presented with weight loss.

## Clinical details

**Table 2. Presenting complaints of the patients (n=115)**

| Variable | Frequency | Percentage % |
|---|---|---|
| Skin rash | 115 | 100.0 |
| Fever | 115 | 100.0 |
| Cough | 100 | 87.0 |
| Poor appetite | 52 | 41.4 |
| Conjunctivitis | 48 | 45.2 |
| Weight loss | 30 | 26.1 |

Table 3 showed that complications from the measles infection were bronchopneumonia 40(34,8%), Otitis media 32(28%), Protein-energy malnutrition 25(21.7%), Tonsillitis 15(13%) and blindness 3(2.6%).

**Table 3. Complications from the measles infection (n=115)**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Bronchopneumonia | 40 | 34.8 |
| Otitis media | 32 | 28.0 |
| Protein-energy | 25 | 21.7 |
| Tonsillitis | 15 | 13.0 |
| Blindness | 3 | 2.6 |

Table 4 shows that the majority of the children 77(67.0%) had not received measles vaccine while 38(33%) had received the vaccine.

**Prevalence of measles infection in vaccinated and unvaccinated children**

**Table 4. Measles vaccinations status of the patients (N=115)**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Vaccinated | 38 | 33.0 |
| Un-vaccinated | 77 | 67.0 |
| Total | 115 | 100 |

Table 5 showed that the major reason given for failure to receive the vaccine was that the mother forgot 28(36.4%), child not due for immunization 21(27.3%), no vaccine at the health centre 14(18.2%) while 14(18.2%) had no excuses.

**Table 5. Reasons for lack of vaccination**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Mother forgot | 28 | 36.4 |
| Child not due for immunization | 21 | 27.3 |
| No vaccine at the health center | 14 | 18.2 |
| No reason at all | 14 | 18.1 |
| Total | 77 | 100 |

Table 6 showed that the children who died were aged 5months, 7months, 8months, 14 months and 24months respectively with a female to male:ratio of 1:2.5. None of the dead children had received the measles vaccines before the onset of the illness. All of them had complications which included bronchopneumonia 5(100%), otitis media 5(100%) and encephalitis 4 (80%) children.

## Outcome of the measles cases

**Table 6. Admission Status and outcome**

| | Frequency | Percentage (%) |
|---|---|---|
| Admitted patients | 80 | 69.6 |
| Out-patients | 35 | 30.4 |
| Discharged | 55 | 68.8 |
| Discharged Against medical advice | 20 | 25.0 |
| Dead | 5 | 6.3 |

Table 7 shows that of the 80 children who were admitted, 5 died with a case fatality of 6.3% The children who died were aged 5months, 7months, 8months, 14 months of 24months respectively with a female to male : ratio of 1:2.5. None of the dead children had received the measles vaccines before the onset of the illness.

**Table 7. Case fatality of measles infection**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Dead** | 5 | 6.3 |

Mortality was associated with bronchopneumonia, Otitis media, encephalitis and age under 2years.

# DISCUSSION

Of all the patients who presented at the paediatrics clinic of Imo State University Teaching Hospital Orlu, within the specified 60 month period, 0.9% had measles. A similar study conducted in Bayelsa state, (Chika O.Duru *et al*., 2014) Benin city, (Ibadiri and Omoigbere, 1998) and national hospital Abuja (Ahmed et al., 2010) showed that measles infection constituted 2.0%, 2.3% and 2.0% of clinic attendance respectively; this is much higher than the 0.9% in this study. This lower prevalence of measles in this study may be due to the higher cost of services at the Teaching Hospital, also as the hospital serves as a referral centre, most cases would be seen at health centres. The poor orthodox health care seeking behaviour of some mothers, and their preference for alternative medical treatment thus leading to under reporting could also be a cause. (Status report on progress towards measles and rubella elimination, 2012) It may also be due to better uptake of measles vaccination in Orlu than in these other study areas. The age

range with the highest prevalence rate was 0-12 months (2.5 per 1000). The peak age of presentation was in infancy with over 50% of the affected infants aged less than 9 months. This agrees with the findings from a study conducted in Bayelsa. (Chika O.Duru *et al*., 2014) Calabar (Etuk *et al*., 2003) in Ibadan. (Fetuga *et al*., 2007) This early presentation of measles has been attributed to rapid decline in maternally acquired antibodies which some authors reported was due to the presence of infections and malnutrition in the mothers. (Fetuga *et al*., 2007) With the introduction of 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) Other studies have documented a decreased placental transfer of maternal antibodies in relation to prematurity, HIV and malaria which are all endemic problems in Nigeria (Caceres *et al*., 2000) A study showed that 58% of Nigerian infants lost their maternal antibodies by the 4th month and 97% between 6th and 9th month. (Oyedele *et al*., 2005)

In this study, 80 (69.6%) of the children were male and 35 (30.4%) were female which showed that the male children were more prone to measles infection than the females. This may stem from some fundamental vulnerabilities of boys, according to a new study by Reuters. (Reuters: Basic biology may explain higher death rates for boys, 2013) Majority of the patients, 108 (94.0%) were resident in the rural area, with only 7 (6.1%) in urban area. There has been no established reason for this but it could be that parents in the rural area have poor health seeking behaviour. In the present study, measles infection was observed in 38 (33.0%) of the children who had been previously vaccinated against measles. This is at variance with reports from other studies (Chika O.Duru *et al*., 2014; Ibadiri and Omoigbere, 1998) of 18.8% and 17.4% respectively. The occurrence of measles in vaccinated children may be due to ineffective vaccine, poor host immunity, wrong technique of vaccination or a different strain of measles virus which means the same vaccine may not offer full protection. (Nnebe – Agumadu, 2005) Vaccine failures can be due to inactivation of the vaccines by improper storage and handling or due to neutralization by maternal antibodies, studies have shown that measles in previously vaccinated children runs a milder course. (Caceres *et al*., 2000) This maybe because previously vaccinated children had partial immunity to measles infection 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 stress the importance of strengthening the routine measles immunization services in Nigeria. In this study, majority (67.0%) of the children had not received the measles vaccine before the onset of illness with the reason that the mother forgot being the major reason for failure of vaccination followed by the reason that the child was not due for immunization. In a study conducted in Bayelsa state (Chika O.Duru *et al*., 2014), the majority of the children had not received the vaccine before the onset of the illness with the lack of vaccine and/or no health care worker at the health centres being the major reason for failure of vaccination. This calls for the urgent need for training of health workers in the skills needed for vaccination and health education of parents at community level to reduce the risks of missed opportunity for vaccination. Bronchopneumonia (34.8%) was the commonest complication and was also an important cause of mortality in this study. This was followed by otitis media (28.0%), and blindness (2.6%) which was the least common complication. A similar pattern was observed by Duru *et al* in Bayelsa state. (Chika O.Duru *et al*., 2014)

A case fatality of 4.3% was reported in the present study with all the children who died being less than 2years old. This was contrary to the case fatality rates from other Nigerian based studies, (Asindi and Ani, 1984; Chika O.Duru *et al*., 2014; Osinusi and Oyedeji, 1986) ranging from 2.8%, 3.8% and up to 34% Reasons for the low mortality 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. This is in accord with reports from another Nigerian author who attributed the increased mortality from measles to a decline in nutritional and socioeconomic status of Nigerian children. (Fetuga *et al*., 2007; Danet and Fermon, 2013)

**Conclusion**

Case fatality of measles was associated with complications of bronchopneumonia, otitis media blindness and malnutrition and amongst children below 2years of age and those whose parents were of low socioeconomic status.

**Recommendation**

Immunization remains the most cost effective tool for reducing childhood morbidity occurring from vaccine preventable diseases. It is recommended that continuous surveillance be in place to identify and review reasons for disease burden despite presence of a safe and effective vaccine. Continuous health education of parents and guardians on the need for vaccination to reduce missed opportunities for immunisation and increase their health seeking behaviour. If possible, appointments should be given on market days to help the mothers remember. Training and retraining of health care workers on prevention and management of measles and other vaccine preventable diseases. They should also be educated on proper administration of vaccine to reduce the risk of vaccine failure and occurrence of the disease in "vaccinated" children. A revision of the administration of measles vaccine in Nigeria EPI to an early 3 dose schedule in infancy will be more effective. One dose at 6 months, 9 months and a booster dose later is advocated. The government should endeavour to maintain the cold chain for vaccine storage. This would ensure the effectiveness of the vaccines

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