Incidence of rubella IgM antibodies in individuals with febrile rash illness attending clinics in Akwa Ibom State, Nigeria, 2006-2009

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ABSTRACT

Background: Rubella is an infectious disease of public health importance because infection acquired during early pregnancy often results in foetal abnormalities that are classified as congenital rubella syndrome (CRS). The burden of rubella infection in most developing countries is however not well documented because of limited epidemiological data. Methods: Between 2006 and 2009, 781 individuals with febrile rash illness seen in clinics in Akwa Ibom State were screened for rubella specific IgM antibodies using the ELISA technique. Statistical analysis was done using Graph prime version 5.3 statistical package at 95% confidence interval. The level of significance was established at P = 0.05 using Fisher's exact two-tailed values. Results: Of 781 individuals screened for rubella specific IgM antibodies, 94 (12%) were found to be positive. Incidence of 8.7% recorded in 2006 gradually rose to 9.3% in 2007, 11.6% in 2008 and 14.3% in 2009. Those in the reproductive age group (> 16 years) were most affected (51.7%). However, this was not statistically significant (P = 0.228). Females (17.4%) were more susceptible than males (6.2%) (P < 0.0001) an rural dwellers (12.8%) more susceptible than urban dwellers (10.5%) (P = 0.416). Conclusion: The study shows that the incidence of rubella in Akwa Ibom State, Nigeria is high. The lowest incidence was however found among individuals below the reproductive age. Thus, the findings of this study can be used by policy makers to model the introduction of routine rubella vaccination into the country' Expanded Program on Immunization Schedule (EPI).

Keywords: Rubella-IgM Antibodies; Febrile Rash Illness; Akwa Ibom State

1. INTRODUCTION

Rubella virus infection usually causes a mild disease in humans, but infection during early pregnancy often leads to severe congenital abnormalities [1]. Although the incidence of such abnormalities has declined considerably as a consequence of rubella immunization, the immunization rates are not optimal and infections during pregnancy still occur. According to the world health organization (WHO) report [2], only 105 (49%) of 214 countries had introduced rubella vaccine in their national immunization programme [2].

Although rare, complications such as thrombocytopaenia, encephalitis, Guillain-Barré syndrome, myocarditis and pericarditis may appear in adults [3]. The most serious consequences of the infection occur in newborns, particularly if the mother acquired the infection during the first trimester of gestation. This manifests in the form of congenital rubella syndrome (CRS) which may include miscarriage, severe alterations in the growth and development of the foetus, and intra-uterine death [3].

In surviving infants, the usual clinical manifestations of CRS are deafness, cardiac disease, mental retardation, eye defects and insulin dependent diabetes mellitus, hepatitis, haemolytic anaemia [4] Congenital Rubella Syndrome is a disastrous systemic disease which can be prevented by vaccination during infancy and adolescence. WHO estimates that worldwide more than 100,000 children are born with CRS each year, most of them in developing countries [5]. Findings from a recent study in Nigeria reported the detection of anti-IgM rubella antibodies as a marker for recent rubella (as recommended by WHO) in 3.9% of pregnant women in the

first trimester in Makurdi, Nigeria [6].

Rubella immunization is not included in Nigeria EPI schedule and thus infections during pregnancy may still occur. This study was undertaken to determine in a cross-sectional surveillance survey, the incidence of rubella virus in the Akwa Ibom State and to make an empirical evaluation of the need for the introduction of rubella vaccine in Nigeria.

2. MATERIALS AND METHODS

2.1. Study Population

This study was conducted between January 2006 and December 2009 among individuals presenting with febrile rash illness in 324 health care facilities spread across Akwa Ibom State. These health facilities were 296 primary and 28 secondary health care facilities that serve the inhabitants of the state. A total of 781 consented patients were recruited for the study. The Blood specimens were obtained between the first and 7 days of rash onset. The mean age of subjects was 11.5 years ± 5.91 SD; males were 372 and females, 409.

2.2. Sample Collection and Laboratory Testing

Five [5] ml of blood was collected from each subject into plain sterile bottle following an informed consent. Blood samples were centrifuged and sera was separated and stored at –20°C until used. Samples were analyzed in batches for rubella specific IgM using commercial Rubella ELISA kit no. BQ 026G (Bio-Quant Diagnostics, San Diego, CA) in accordance with the manufacturer's instructions. Tests were read on a pre-programmed spectrophotometer Quantum II, dual wavelength 600 - 650 nm (Abbott, USA). The inability to include acute and convalescence IgG antibody testing in this study to augment IgM test result was a limitation.

2.3. Statistical Analysis

Results were presented on frequency tables by year. The comparison of characteristics of subjects by age, sex and setting was carried out using Graph Pad Prime version 5.3 statistical package with relative risk (RR) at 95% Confidence Interval (CI). The level of statistical significance was established at $p \leq 0.05$ using Fisher's exact 2-tailed values.

2.4. Ethical Issues

Appropriate informed consent and ethical approval were obtained from the subjects and authorities of the health institutions respectively.

3. RESULTS

Of the 781 individuals screened for rubella specific IgM antibodies, 94 (12%) were found to be positive (**Table 1**). The incidence of 8.7% recorded in 2006 gradually rose to 9.3% in 2007, 11.6% in 2008 and 14.3% in 2009 (**Figure 1**).

Table 2 illustrates the demographic characteristics of individuals screened. The infection was observed to increase with age. Those aged 21 years and above were mostly infected with rubella (28.6%), while those aged 16 - 20 and 6 - 10 years recorded 23.1% and 15.9% respectively. The lowest prevalence was seen in those aged 0-5 years. No statistical significant difference was established between the age groups considered ($p = 0.228$). However, the relative risk of acquiring rubella is high, 1.073 (95% CI 0.820 - 1.079). Females (17.4%) were most susceptible to rubella than males (6.2%), and the relationship was highly significant ($p < 0.0001$) with a high relative risk of 1.94 (95% CI 1.35 - 2.98). Examining infection by location revealed that rural dwellers (12.8%) were more susceptible to rubella than urban dwellers (10.5%) and the relative risk was slightly low, 0.941 (95% CI 0.820 - 1.079). The variation of seroposi-

Table 1. Distribution of rubella IgM antibodies in individuals with febrile rash illness by year, 2006 - 2009.

Year	Number screened	Number positive	Percentage Positive
2006	150	13	8.7%
2007	108	10	9.3%
2008	146	17	11.6%
2009	377	54	14.3%
Total	**781**	**94**	**12%**
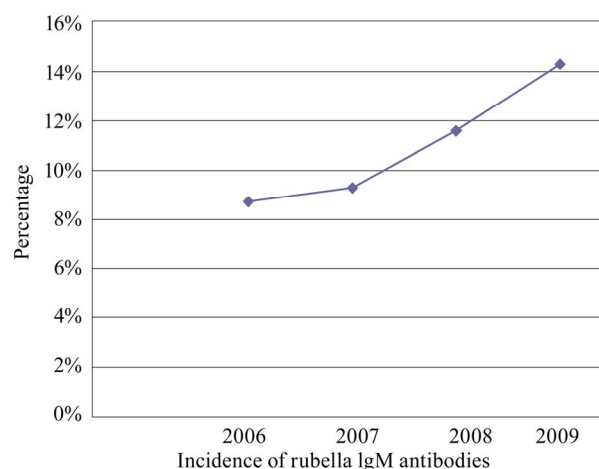
Figure 1. Incidence trend of rubella IgM antibodies in individuals with febrile rash illness, 2006 - 2009.

tivity among rural-urban dwellers did not establish any significance (p = 0.416).

4. DISCUSSION

In developing countries, the extent of maternal rubella infection is largely unknown. There are very few clinical records of rubella infection and or congenital rubella syndrome (CRS). Clearly, the first step in determining an appropriate immunization policy for a given population is to carry out a serologic survey, in order to determine the seroprevalence of rubella antibodies [7]. In Nigeria, rubella vaccine is not a component of the routine immunization policy despite its being safe, effective and could be readily added to national immunization programme at minimal extra cost.

Rubella outbreaks may continue to occur unnoticed in highly unimmunized populations due to efficient transmission of the virus among susceptible individuals [8]. This study shows that the incidence of rubella virus among patients with febrile rash illness in Akwa Ibom State, Nigeria is high and that the incidence varied considerably between age groups, sex and community settings (urban and rural). The incidence of 12% found in this study is slightly lower than 17.5% reported in Adane province Turkey [9], but higher than 8.6% reported in another study in Sana'a, Yemen [10] and 3.4% reported in Eastern Turkey [11]. The reason for the observed differences may be attributed to geographical variations and different levels of rubella immunization coverage.

The yearly rise observed in the incidence of rubella IgM antibodies from 8.7% in 2006 to 14.3% in 2009 may be due to the introduction of rubella case-based surveillance with laboratory support in 2006, which had provided a better platform for data collection, collation and analysis, and invariably to the none introduction of rubella vaccination into the national routine immunization schedule in Nigeria [6].

The susceptibility of the female population to rubella in comparison to their male counterpart seen in this study is different from a previous report [10], but in consonance with the report by Suay *et al*. [12] which documented that rubella antibody is marginally higher in females than males. The higher percentage of rubella IgM antibody positivity among those living in rural areas than in urban settings observed in this study was inconsistent with a previous study that reported high rubella IgM positivity among urban dwellers [13] and also with the findings of Gomwalk and Ezeronye [14] who found no difference between urban and rural mothers in Nigeria. The variation in serologic profiles between urban and rural settings as found in this study might be due to malnutrition, overcrowding and inadequate or lack of supportive health care in rural communities [15].

This study shows that the highest incidence of rubella IgM antibodies occurred among women of the reproductive age group having a high relative risk of infection. Immunizing this population will however require a multifaceted approach [16]. These include the creation of awareness among the general populace and healthcare providers of the deleterious effects of CRS, vaccination of pre-school age female children which should be included in the national immunization programme and active vaccination of unimmunized women of reproductive age group as part of routine medical and gynaecological care.

Table 2. Demographic characteristics of rubella antibodies in individuals with febrile rash illness (n = 781), 2006 - 2009.

Risk factors	No. Screened	No. Positive	% Positive	P-value RR(95%CI)
Age (years)				
Under 5	572	54	9.4%	
6-10	124	22	17.7%	
11-15	44	7	15.9%	*P = 0.2276* *1.073 (0.99 - 1.16)**
16-20	13	3	23.1%	
21+	28	8	28.6%	
Sex				
Male	372	23	6.2%	*P < 0.0001*
Female	409	71	17.4%	*1.946 (1.35 - 2.98)*
Setting				
Rural	524	67	12.8%	*P = 0.4164*
Urban	257	27	10.5%	*0.941 (0.82 - 1.08)*

P-value (Fisher exact) 2-tailed, RR = Relative Risk at 95% Confidence interval. *Compared Age bracket < 15 and > 15 years.

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