MERIT RESEARCH JOURNALS
www.meritresearchjournals.org

Merit Research Journal of Medicine and Medical Sciences (ISSN: 2354-323X) Vol. 3(10) pp. xxx-xxx, October, 2015
Available online http://www.meritresearchjournals.org/mms/index.htm

Original Research Article

Determinants of Full Immunization Coverage and Reasons for its Failure for Children in Bida Emirate Area, Niger State, Nigeria

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Abstract

Recent survey conducted in Nigeria in 2013 reported that complete immunization coverage for Nigerian children is 25%. This is quite low despite the huge resources being committed and thus raises concerns to identify the factors that may be responsible. The study aim to determine the immunization status of children aged 12 – 24 months in Bida Emirate Area (BEA) of Niger state, the determining factors and reasons for immunization failure. Chi square was used to determine the relationship between selected mothers, fathers and children variables with full immunization status. Multiple logistic regression analysis was used to determine the likelihood effects of the selected factors on immunization status. Complete Immunization (CI) coverage for BEA was 29.86%, while, 48.42% were partially immunized (PI) and 21.72% had never been immunized at all, and 31.99% do not possess immunization card. 'Mother too busy' (19.83%), fear of side effect and not aware of the need for immunization were the most frequent reasons for failure to immunize children. The immunization status in BEA is very low compare with WHO expectation of 80% as at 2010. It is important to consider those socioeconomic and demographic variables that account for variations in immunization status if considerable improvement in immunization in BEA is to be achieved.

Keyword: Bida Emirate Area, Demographic, Full immunization, Immunization coverage, Immunization and Determinants, Socioeconomic, Vaccination

INTRODUCTION

In 1974, World Health Organization (WHO) launched the Expanded Program on Immunization aimed at reducing the incidence and mortality due to vaccine preventable diseases by promoting the expansion of immunization activities around the world (Barreto and Rodingues, 1992). It is known worldwide, that immunization of children remains one of the most important cost effective and public health intervention strategies to combat childhood morbidity and mortality arising from infectious diseases (Odusanya et al., 2008; WHO, 2014). This notwithstanding, over three million deaths are recorded annually worldwide from vaccine preventable diseases, while over two million deaths are delayed through immunization processes (Odusanya, et al., 2008; Centre for Global Development, 2005). That means, more childhood mortality resulting from vaccine preventable diseases is still being recorded than are being prevented by vaccines worldwide. Nigerian immunization Schedule (2015) stated that in Nigeria, vaccine preventable diseases account for approximately 22% of child death amounting to over 200,000 deaths per year.

Strengthening national immunization systems, especially in countries with the greatest number of under-vaccinated children, should be a global priority to reduce morbidity and mortality from vaccine-preventable diseases (Centre for Disease Control and Prevention, 2012). Recent schedule by World Health Organization (WHO), which was adopted for Nigeria and began in Niger State in February, 2013 stipulates that children take BCG, OPV0 and HEPB0 at birth, OPV1 and Pentavalent

1(a combination of five vaccines-in-one that prevents diphtheria, tetanus, whooping cough, hepatitis B and haemophilus influenza) at 6weeks, these are repeated at 10weeks and at 14weeks of baby age, and at 9months MCV (Measles Containing Vaccine) and Yellow Fever Vaccine (or at 12months) (Nigerian Immunization Schedule, 2015; Centre for Disease Control and Prevention, 2012).

According to Sanou et al. (2009), WHO projected that complete vaccination should reach at least 90% of children at the country level and 80% in sub-areas by the year 2010. One of the most current national surveys conducted in Nigeria in 2013 to assess the immunization coverage for children born within five years before the survey actually reported that the full immunization coverage for Nigerian children is 25% (National Population Commission and ICF Macro, 2013). This is quite low compared to the WHO expectation for 2010, despite the huge resources being committed. It therefore, provoked ones thought and thus raises concerns to identify the factors that may be responsible. The researchers are unaware of any research conducted to assess the implementation of the new immunization schedule in Nigeria or in Bida Emirate Area. The aims of this study are to determine the immunization status of children aged 12 – 24 months in BEA of Niger state, its determining factors and reasons for immunization failure.

MATERIALS AND METHODS

Survey design

The survey was conducted as a community-based cross sectional descriptive survey. Mothers of eligible children were interviewed using World Health Organization's (WHO) immunization coverage cluster survey design (WHO, 2014), and adjusted for our study to obtain mother level, father level characteristics and baby level characteristics. Eligible mothers were required to give consent, live in towns and villages comprising BEA and have children alive and were (12–24 months old) as at the time of the survey.

Sample Size Determination

We used the sample size computation as contained in the WHO immunization cluster survey manual (WHO, 2014). Our expected coverage for the area was 25% obtained in a national survey 2013 (National Population Commission and ICF Macro, 2013), a precision of ±4.7, a 5% level of significance and a design effect of 2 (WHO, 2014), resulting to a minimum sample size of 652. With 23 clusters and targeting 30 respondents per cluster, 682 respondents were actually captured and 19 (2.8%) who were not eligible were rejected, bringing to a total of 663 that were actually analysed.

Area of Coverage

Bida Emirate Area is a traditional state in Nigeria which is the successor of the old Nupe kingdom, with its headquarters in Bida and headed by Etsu Nupe (Bida Emirate, 2012). It comprises 6 Local Government Areas (Bida, Lavun, Edati, Gbako, Katcha and Mokwa). The emirate is situated on the coordinates of 9^0 05'N $6^0$01'E, an area of 12,410Km^2 and a total population of 1,052,998 as at 2006 census (Bida Emirate, 2012).

The local administration in the area is carried out on the basis of districts and villages. There are 43 districts headed by a district head (known as Akimi) and about 326 major villages headed by a village head (called Etsu-Nyakpa) (Unclassified document, Districts and Village heads in Bida Emirate Area, District Heads Office, Bida Local Government Area). Though immunization process is carried out on the basis of wards and settlements, however, for the purpose of this study, data were collected on the basis of districts and villages.

Sampling Techniques

The sample areas were selected using a systematic and stratified two-stage cluster sampling design on the basis of rural-urban strata. Bida Local Government is an urban area having 4 districts; Usman Zaki, Umaru Majigi, Malik and Masaba and thus was considered for this study as the urban area. Other districts in BEA (after excluding the district hosting the administrative headquarters) were considered as the rural area. A systematic random sampling was adopted to select representative sample cluster districts by selecting every second district from the sampling frame resulting into 19 districts. A simple ballot system was used to select the starting village in each of the 23 districts. All mothers eligible in the selected villages were interviewed and at the event we were unable to find the total needed for the cluster, the nearest village was considered and so on till the required 30 respondents were found (Etana and Deressa, 2012). This survey was conducted between 8th and 15th June, 2015.

Ethical Approval

Ethical approval for this project was given by the Research and Development Committee of Niger State Polytechnic, Zungeru. Informed consents from the Administrative Heads of the localities and from all respondents who participated in the survey were obtained before the interview was conducted. A Parting

gift of paracetamol syrup was given to each mother who consented to participate in the survey.

Variables of Interest

Outcome Variable

This describes the immunization status of the child and was obtained from the child's immunization card and where it was not available, the history was taken from the mother and categorised as: '1' if the child had been fully immunized of all the basic doses BCG, OPV0 and HEPB0 at birth, 3 doses each of OPV and Pentavalent, 1 dose each of MCV (Measles Containing Vaccine) and Yellow Fever Vaccine; categorised as: '0' if the child had missed any of these doses or had not been immunized at all.

Exposure Variables

These include the socioeconomic and demographic characteristics of the mothers, fathers and children. It also includes major reasons for immunization failure.

Methods of Data Analysis

To examine the relationship between selected mother/caregiver, children characteristics and other background variables with full immunization status we used chi-square test and 95% Confidence Interval. Factors that were found significant at 5% level from bi-variable analysis were further analysed for likelihood effect using a multiple logistic regression. Furthermore, Likelihood Ratio test (LHRT) was conducted to test for the goodness of fit of the models that resulted from our multiple logistic regression analysis. Variance Inflation Factor (VIF) was also used to check for multicollinearity (Kayode et al., 2012).

All validly completed forms were coded and two data entering clerks were engaged to enter data into a computer. Appropriate data cleaning was done by the Analyst to ensure accuracy and completeness and analysis of data was done using STATA version 14 for academic users (StataCorporation, 2014).

RESULTS

The average age of mothers and children used for this study were 29.07Years (±5.69years standard deviation) and 17.52month (±4.10months standard deviation) respectively.

Immunization Status

It was observed that the complete immunization (CI) coverage of children between 11 to 24 months in Bida emirate was 29.86%, while, 48.42% were partially immunized (PI), (i.e. had received at least one of the doses of immunization, but not all) and 21.72% had never been immunized at all, and 31.99% do not possess immunization card (see table 1).

It was found that 485 children representing 73.37% have had BCG, 65.13% received HepB 0 and 67.37% had received OPV0, while, only 52.82% were immunized with OPV3 bringing about a 14.55% dropout rate for children who had received OPV0 but could not complete the last dose of OPV. It was also observed that 66.46% of the children had been immunized with Pentavalent1, 60.41% with Pentavalent2 and 52.98% received Pentavalent3, leaving a dropout rate of 13.48%.

Reasons for Immunization Failure

The respondents (especially the PI or NI) were asked to state the most important reason why the child was not completely immunized (table 1). 20 different reasons were stated and these were grouped into 3 categories: lack of information, lack of motivation and obstacle related. Obstacle related were the most frequent reasons given (46.90%) followed by lack of information (41.53%) and lack of motivation (11.57%).

Of those who complained of obstacle related reasons, 'mother too busy' (19.83%) was the highest, followed by a reason in the lack of information group: 'fear of side effect (14.26%) and next was 'unaware of the need for immunization' (14.05%). In the lack of motivation category, 'no faith in immunization' (8.06%) was mostly reported. It was also discovered that in most places visited (in most rural areas), vaccines were not often available due to lack of storage facilities.

Relationships between Socioeconomic Background and Immunization Status

From table 2, the age of the respondents (*Chi sq=4.124, p=0.127*), the sex of the child (*chi sq=0.011, p=0.918*), the number of children ever born by the respondents (*chi sq=1.01, p=0.315*) and the place of residence (urban or rural) (*chi sq=3.75, p=0.053*) were not statistically significantly associated with the immunization status of their children. However, the religious status (*chi sq=24.11, p=0.000*), her educational status (*chi sq=42.42, p=0.000*), occupational status (*chi sq=34.78, p=0.000*) of the respondents were statistically significantly associated with the immunization status of children in BEA of Niger state. The study also showed that the indigenous status (*chi sq=12.34, p=0.000*), place of

Table 1. Percentage Frequency Distribution of Child's Immunization Status

Variables	N	(%)
Immunization Status		
Completely Immunized	198	29.86
Partially Immunized	321	48.42
Not Immunized	144	21.72
Child has immunization card		
No	214	31.99
Yes	455	68.01
Vaccines status		
BCG	485	73.37
Hep B 0	424	65.13
OPV0	444	67.37
OPV1	425	65.69
OPV2	396	61.59
OPV3	337	52.82
Pentas1	430	66.46
Pentas2	386	60.41
Pentas3	338	52.98
Yellow Fever	294	46.08
Measles	304	47.65
Drop-out		
OPV0 – OPV3	107	14.55
Pentas1 – Pentas3	92	13.48
Reasons for immunization Failure		
Lack of Information	201	41.53
Lack of Motivation	56	11.57
Obstacle related	227	46.90

Table 2. Relationships between the Respondents' Socioeconomic background and Immunization Status

Variables	CI	ICI	Chi Sq
Age of Respondents			4.124
15 – 24years	26	88	
25 – 34years	136	283	
35+ years	34	85	
Sex of the Child			0.011
Female	89	207	
Male	109	258	
Religious Status			24.11**
Christianity	71.4	28.4	
Islam	28	72	
Educational Status			42.42**
Higher	67.9	32.1	
Secondary	26	74	
Primary	24.1	75.9	
No Education	26.9	73.1	
Occupational Statu			35.95**
Civil Servants	68.2	31.8	
Farming/Trading	28.5	71.5	
Not Working	23.3	76.7	
Others	22.1	77.9	
Children Ever Born			1.01
Less than 5	131	326	
5 and Above	67	139	
Birth Order			9.22**
1st	30.6	69.4	
2nd	30.7	69.3	
3rd	17.7	82.3	

Table 2. Continue

4th or above	33.7	66.3	
Number of Wives of partner			8.58**
1	34.6	65.4	
2	25.7	74.3	
3	20.7	79.3	
4 & above	18.2	81.8	
Respondent's position as wife			6.26**
1	32.2	67.8	
2	24.7	75.3	
3 & above	11.1	88.9	
Indigene Status			12.35**
Yes	28.5	71.5	
No	58.1	41.9	
Place of Residence			3.75
Rural	136	353	
Urban	62	112	
Partner's Educational Status			10.00**
Higher	38	62	
Secondary	28.2	71.8	
Primary	31.9	68.1	
No Education	23.9	76.1	
Partner's Occupational Status			17.16**
Civil Servant	38.6	61.4	
Farming/Trading	28	72	
Not Working	31.3	68.8	
Others	18.4	81.6	
Place of Delivery			8.41**
Health Facility	34.5	65.5	
Home Delivery	24.2	75.8	
Attended ANC			12.57**
Yes	33.1	66.9	
No	17.5	82.5	
Total	**29.86**	**70.14**	

delivery (*chi sq=8.41, p=0.004*) and attendance to antenatal care were all statistically significantly associated with the immunization status of the child.

Also, the study revealed that the birth order of the child among other siblings (*chi sq=9.22, p=0.027*), the number of wives the partner has (*chi sq=8.58, p=0.035*) and the position which the respondent occupied among other wives (*chi sq=6.26, p=0.44*) were found to be statistically significantly associated with the immunization status of the child. The partners' educational (*chi sq=10.00, p=0.02*), and occupational status (*chi sq=13.94, p=0.003*) were also significantly associated with the immunization status.

Univariate Logistic Regression Analysis of the Variables and Immunization Status (unadjusted)

All the variables that were found to be significantly associated with the immunization status at the bivariate analysis were further subjected to logistic analysis. The mothers or care givers with higher education were 6 times significantly more likely to get her child immunized than a mother with no education (OR=5.75; CI=3.16-10.46; p=0.000), A Muslim mother is significantly more than 6 times less likely to take her child for immunization than a Christian mother. Children who are of 3rd order are significantly less likely to be immunized than children who are of 4th order or above among other children. A mother in a monogamous marriage was found to be 2.38 times more likely to take her child for immunization than a mother in a polygamous marriage (4 or above). An indigenous mother is 0.71 times less likely to take her child for immunization than a non-indigenous mother. Those who delivered in health facility (OR=1.65, CI= p=0.000) and those who attended ante natal care (OR=2.33, CI p=0.00) were respectively more likely to take their children for immunization than those who

Table 3. Unadjusted Logistic Regression Analysis of Likelihood of Complete Immunization of Children in Bida Emirate Area

Variables	OR (95% CI)
Educational Status of Respondents	
No Education	1.00
Primary Education	0.87 (0.51 – 1.48)
Secondary Education	0.96 (0.55 – 1.66)
Higher Education	5.75 (3.16 – 10.46)**
Religious Status	
Christianity	1.00
Islam	0.16 (0.07 – 0.36)**
Occupational Status	
Others	1.00
Civil Servant	7.57 (3.22 – 17.80)**
Farming/Trading	1.40 (0.77 – 2.58)
Not Working	1.07 (0.48 – 2.36)
Child's Birth Order	
Fourth & above	1.00
Third	0.42 (0.24 – 0.74)**
Second	0.87 (0.56 – 1.36)
First	0.87 (0.57 – 1.37)
Number of wives partner has	
Four & above	1.00
3	1.18 (0.22 – 6.25)
2	1.56 (0.33 – 7.40)
1	2.38 (0.51 – 11.18)
Position of Respondent among other wives	
Third & above	1.00
Second	2.62 (0.57 – 11.92)
First	3.79 (0.86 – 10.71)
Indigenous Status	
Non Indigene	1.00
Indigene	0.29 (0.14 – 0.60)
Partner's Educational Status	
No Education	1.00
Primary	1.50 (0.83 – 2.69)
Secondary	1.25 (0.80 – 1.96)
Higher	1.95 (1.27 – 3.00)**
Partner's Occupational Status	
Others	1.00
Not working	2.02 (0.62 – 6.54)
Farming/Trading	1.73 (0.99 – 3.03)
Civil Servant	2.79 (1.55 – 5.01)
Place of Delivery	
Home Delivery	1.00
Health facility	1.65 (1.17 – 2.33)**
Attended Ante Natal Care	
No	1.00
Yes	2.33 (1.44 – 3.75)**

delivered at home and those who did not attend ANC. (Table 3)

DISCUSSION

The findings of this study have revealed some issues concerning immunization uptake of children in BEA.

The Immunization Coverage of children in BEA

The study found out that only a little above a quarter of children in Bida Emirate Area (i.e. 30%) are fully immunized, this is just a little higher than national coverage of 25% achieved in 2013 (National Population Commission and ICF Macro, 2013). This low status is unfortunate in spite of the numerous campaign and

resources committed. BCG, HepB 0 and OPV0 are expected to be taken at birth; surprisingly there are variations in the number of children immunized with these vaccines (73.37%, 65.13% and 67.37% respectively). These show that these vaccines were not equally available at all times. The drop-out rate observed for OPV (14.6%) and pentavalent (13.5%) vaccines were seen to be at an increasing rate indicating that more children were not being immunized as they grow older. These rates were all higher than the acceptable benchmark of 10% (Adebayo et al., 2012) and possible explanation could be related to the reasons given by mothers for non-immunization of children in these communities.

Reasons for immunization failure in BEA

The three most important stated reasons for mothers' failure to take their children for immunization were that mothers were too busy; unaware of the need for immunization, and fear of side effects. These also explained why there were so many drops-outs in the process. These findings have clearly demonstrated the level of interest that these mothers have on immunization. It is not uncommon to see that in most developing countries, most people place more emphasis on curative care than preventive care.

The significant socioeconomic and demographic variables that are determinants of immunization status of children in BEA

It is important to state that this study showed that age of mothers, the sex of the child, the number of children the mother had and her place of residence were not significant determinants of immunization status of children in BEA. This is consistent with other findings (Barreto and Rodingues, 1992; Etana and Deressa, 2012; Odusanya et al. 2003).

However, the report shows that children whose mother had higher education had a higher percentage of children fully immunized than children who had incomplete immunization coverage. This association of education with immunization uptake is in agreement with other findings (Antai, 2011; Sanou, 2012). Higher level of education puts the mother in a position to know the importance of immunization and seeking healthcare services (Olusina, 2013).

Another important factor associated with immunization status is religion. In this study the proportion of children of Muslim mothers who immunized their children fully were significantly lower than their Christian counterparts. Though this study did not focus on what the Muslim community feels about immunization processes, however other studies (Sanou et al. 2012; Jegede, 2007; Renne, 2006) have earlier reported of the belief of some Islamic communities in Nigeria opposed to immunization seeing it as international conspiracies targeted at Muslim communities. The low immunization status is not limited to Muslim communities as earlier study (Sanou et al. 2012) reportedly found low immunization coverage rate among the orthodox Protestants in Netherland. Though religious complexity is noted in immunization coverage but, this study have clearly shown that in strengthening the immunization processes, religion cannot be neglected.

Mothers who are civil servants have greater proportion of their children being fully immunized than not completely immunized as compared to other categories of occupational status where the proportion of the children not fully immunized are greater than those fully immunized. This result agrees with some findings that there is difference in vaccination coverage related to economic consideration of the household. This study did not compute the income status of respondents, but in Nigeria and from our study composition many of the civil servants live in urban area, better educated, assess to steady income and are exposed to more information than those in the other categories of occupational status.

Another very interesting revelation from this study was that of the indigenous status of the respondents. The non-indigenes were found to have more of their children completely immunized compared to those who have incomplete immunization. This agreed with findings reported in earlier studies (Rangel et al., 2005) Those children born in health facility and those whose mothers attended ANC were found to be determinants of immunization coverage in BEA. This conclusion, however did not agree with the findings in a similar work in Lao PDR (Maekawa et al., 2007), but agrees with study conducted in Brazil (Barreto and Rodingues, 2008) and elsewhere (Etana and Deressa, 2012).

CONCLUSION AND POLICY RECOMMENDATIONS

This study concluded that the complete immunization coverage of children in BEA in 2015 was very low compare with the expectation of WHO of 80% full immunization coverage for sub-region as at 2010. This status is traceable to very high illiteracy level especially in the rural areas.

The findings from this study have very strong policy implications. So, any strategy that will improve the immunization uptake in this area must be such that will improve the well being of the people in this area especially in the rural communities. In view of the above, we recommend that:

- Maternal literacy level is built up through adult education outreaches, especially in the rural areas.
- More rural health facilities are required in rural communities especially the very hard to reach areas, equipped with solar powered refrigerators to help

preserve vaccines which must be kept at a particular temperature.

- Making more vaccines available at immunization centres especially for the routine immunization programmes.
- Increase in advocacies by health workers on the purpose and need for immunizing children against preventable deadly diseases.
- These advocacies could be propagated through the mass media, village meetings and religious centres.
- Rural health workers posted to rural health centres should be encouraged to live within the jurisdiction of their posting area.
- The use of SMS to remind mothers/care givers of immunization schedules especially those who delivered in the health facilities should be exploited.

Limitations

The interpretation of the results reached in this study is subject to some levels of limitations:

- In this study we did not take into consideration the validity of vaccines as at when they were taken
- Our data were collected on the premises of routine immunization, as such the study did not consider the immunization given during Supplementary Immunization Activities (SIA)
- The study design is cross-sectional, so causal effect could not be established.

ACKNOWLEDGEMENT

We would like to appreciate the local communities and all the people who participated in this study, Tertiary Education Trust Fund (TETFund), the Rector and staff of Niger State Polytechnic, Niger State Primary Health Care, Federal Medical Centre, Bida and the office of Bida Emirate Council. The fund for this project was granted by TetFund under the Institution Based Research Grant (IBR), reference: TETFUND/ DESS/POLY/ZUNGERU/ RP/VOL. II".

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