Assessment of Knowledge and Practice of Childhood Routine Immunization among Mothers/Caregivers attending Primary Health Care Centres in Benin City, Edo State, Nigeria

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ABSTRACT: The ultimate goal of immunization is to reduce the incidence of vaccine preventable diseases by attaining high levels of routine immunization coverage with potent vaccines administered at the appropriate ages and at the right intervals. This study assessed the knowledge and practice of childhood routine immunization among mothers/caregivers attending Primary Health Care Centers in Benin City, Edo State. A descriptive cross-sectional study involving 640 females whose wards were receiving immunization in 35 PHCs in Benin City was carried out. Mothers who met the inclusion criteria were recruited using a pre-tested interviewer administered structured questionnaires using a multistage sampling technique. Relationship between dependent and independent variables was determined using logistic regression analysis, at 95% confidence interval and p-values level less than 0.05 were considered significant. Results shows that all the caregivers were aware of immunization. 498(77.8%) had good knowledge while (38.6% and 12.6%), fair and poor knowledge of immunization respectively. BCG and OPV were the most known vaccines (89.1%), followed by HBV (77.8%), DPT and PENTA were known by 70.6% and 66.1% of respondents respectively. This study revealed good knowledge of immunization amongst the caregivers and good practice with regards to the actual purpose of immunization.

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Immunization is the process by which a person is made resistant to an infectious agent by the application of vaccines. Vaccine Preventable Diseases are a major cause of illness and deaths especially in developing countries and vaccines can significantly reduce childhood mortality and morbidity. (Salah et al., 2015) In Nigeria, immunization services (routine or supplemental) are provided through the primary health care system by the government to the populace. (Ekure et al., 2013) Routine immunizations are nationally scheduled regular administrations of vaccine dosages to infants at specified ages and require parents/caregivers taking the children to the health facility to receive age-appropriate doses of the antigens. This is done on specific days of the week to reduce vaccine wastage since most of the vaccines are supplied in multi-dose vials. (Zangeneh et al., 2011) Five visits are recommended by the National Programme on Immunization (NPI) to the health facility to enable the child receive one dose of Bacille Calmette Guerin (BCG) and Hepatitis B at birth, three doses of Oral Polio Vaccine (including one IPV), and three doses of Pentavalent vaccine, at six, ten and fourteen weeks and one dose of measles vaccine and yellow fever given at nine months of age. (Scott et al., 2014; FMOH, 2009) It is of importance that a child should receive all immunization at the appropriate ages and intervals in order to ensure maximal protection from vaccine preventable diseases. (Adedire et al., 2016; Sadoh and Eregie, 2009) The percentage of children who have receive the requisite number of vaccine doses irrespective of the age at receipt of the vaccine is used to calculate and determine vaccination coverage (Abdullraheem et al., 2011) and the third dose of pentavalent vaccine, is the key indicator to measure immunization programme coverage. (Mantua et al, 2016) At each visit the mother or caregivers is given appointment dates (written on the child’s registration card) for the next vaccination. (Hannan, 2014) Despite this approach, knowledge, level of education, and religion of mothers have been reported as major contributory factors to low immunization coverage Nigeria, Africa and Asia (Onsomu et al., 2015; Maina et al., 2013; Subani et al., 2015; Uzochukwu et al., 2004; Beaven et al., 2016; PAN, 2012) showed that mothers’ knowledge,
attitudes and practices on childhood immunization were at low levels. A research carried out in Nigeria reported that incomplete vaccination was due to maternal knowledge and attitudes, while partial immunization with multidose vaccines was more linked to problems with vaccination services. These factors have contributed to a fall in immunization coverage and upsurge of VPDs as well as failure to achieve the millennium development goal (MDG), and this has further worsened the country’s infant mortality rate of 69/1000 and under five mortality of 128/1000. (NDHS, 2013) This study assessed the knowledge and practice of childhood routine immunization among mothers/caregivers attending primary health care centers in Benin City, Nigeria. It was conducted among 640 mothers who met the inclusion criteria using a multistage sampling technique. Sample size were determined using the (Cochrane, 1977) formula for studying single proportion. \( n = \frac{(Z)\cdot p\cdot q}{(deff)^2} \) where \( p \) is prevalence of 51.0%, the proportion of mother’s knowledge of immunization from a study carried out in 2019 in Lagos, Nigeria. (Adefolalu et al., 2019) The respondents were selected using multistage sampling technique consisting of three stages from the 3 LGA (Oredo, Ikpoba Okha and Egor. Two wards were selected from each of the 3 LGAs (Oredo, Egor, and Ikpoba Okha) using simple random sampling technique, by balloting from the list of wards obtained from the PHC department in each LGA, making a total of 6 wards, then all the PHCs within the selected 6 wards were used for the study. Systematic sampling technique was used to select the mothers/caregivers, after determining the sampling internal and this was used to select the mothers until the sample size was achieved.

Survey questionnaire for mothers/caregivers: A pretested structured interviewer administered questionnaire was retrieved, screened for completeness, coded and entered into the IBM statistical package for social sciences (SPSS) statistics 21.0 software. The categorical variables were presented as frequencies and percentages while numerical variables that were normal in distribution was expressed as mean (standard deviation). The Chi-squared test of association was used to test statistical association between socio-demographic variables of the respondents and the knowledge of immunization, knowledge and practice of immunization. The Fisher’s exact test was used in instances where the total expected cell frequencies less than five is more than 20%. The binary logistic regression was modelled to explore and identify significant predictors of routine immunization services at the Primary Health Facilities in the LGAs. The level of significance was set at \( p<0.05 \). Socio-economic classes of the respondents were scored based on the mother’s/caregivers’ level of education and their husband’s occupation. Six questions in the maternal questionnaire were used to assess knowledge. Each correct response on knowledge was given a score 1 while incorrect response a score of 0, giving a maximum and minimum score of 0 and 6, respectively. It was converted to percentages and classified as: Poor knowledge: less than 50%, Fair knowledge: 50 - 74.9% and Good knowledge: 75 % and above. Ethical clearance to conduct this research was sought and obtained from the University of Benin Teaching Hospital Ethics and Research Committee. Permission was sought from the Permanent Secretary, Edo State Hospital Management Board and Chairpersons of the Local Government Areas. Institutional permission was sought and obtained from the Primary Health Care Coordinators, and Heads of the health facilities. Health education was given to the mothers after the data collection and those whose child were ill referred to the hospital.

RESULTS AND DISCUSSION
The socio-demographic characteristics of mother/caregivers is presented in table 1. Three hundred and thirty-two (51.9%) were 30 – 39 years old with mean age and (SD) of respondents was 32.1 (7.1). Six hundred and twenty-nine (98.3 %) were the mothers of the index child, 17 (2.6%) were single, with 409 (63.9%) having secondary level of education. All the caregivers (Table 2) were aware of immunization. Six hundred and seven (94.8%) reported healthcare practitioners as their source of information, with BCG and OPV the most known vaccine mentioned by 570 (89.1%) of the caregivers then DPT and PENTA as mentioned by 452 (70.6%) and 423 (66.1%) respectively.

Three hundred and fifteen (49.2%) were aware of seven or more vaccines while 610 (95.3%) stated that nine months was the age of completion of vaccination while some caregivers were of the opinion 21 (3.3%) that immunization makes children grow fast. In figure 1, we observed that three hundred and twelve (48.8%) of the caregivers had good knowledge scores while 247 (38.6%) had poor knowledge while 81 (12.6%) had fair knowledge.
All the caregivers reported vaccinating the index child. Six hundred and twenty-five (97.7%) presented with their vaccination cards while 15 (2.3%) had vaccination cards but presented without them. Six hundred and thirty (98.4%) of the index children had received BCG, all received the first doses of OPV, PENTA and PCV and smaller proportion received measles and yellow fever vaccines [118 (72.4%) and 119 (73.0%) respectively]. There was no statistically significant association between the age of the child and the caregivers’ knowledge of immunization (p = 0.853), neither was the association of More than half (52.1%) of the caregivers with female index children having good knowledge of immunization compared to 151 (45.6%) of those with male children. (p = 0.214). Two hundred and fifty-two (50.7%) of the caregivers who delivered in hospitals had good knowledge of immunization compared to 53 (44.2%) of those who delivered at home. This association was also not statistically significant (p = 0.230) and this was also the case among 10 (58.8%) of the single caregivers who had good knowledge of immunization compared to 299 (48.6%) of those who were married. (p = 0.655). One hundred and eighty-seven (52.4%) of caregivers with household sizes of 5 – 8 had good knowledge of immunization compared to 8 (42.1%) of those with household sizes of 9 or more. This association was statistically significant (p = 0.021). Twenty-two (81.5%) of the caregivers with tertiary level of education had good knowledge of immunization compared to 41 (48.2%) of those with no formal education. This association was also statistically significant (p = 0.042).

All mothers/caregivers had heard about routine childhood vaccines under the national immunization schedule. This finding is in tandem with the observation in a study done in Lagos, where also high maternal awareness of immunization was recorded. (OduSanya et al, 2009) However, the current finding is in contrast with that contained in a study done in Ambo, Ethiopia (Birhann et al., 2015) where the awareness of immunization was poor. This disparity

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between findings in this study and the Ethiopian study may be due to the differences in information, education and communication (IEC) programmes of the two countries or due to the location and accessibility of the mothers to health care services. Majority of the respondents in the Ethiopian study were in the rural areas while this study was made up of respondents from both urban and rural areas.

All mothers/caregivers knew about BCG and OPV vaccines. This level of awareness for these vaccines noted in this study is higher than the level of awareness of OPV reported from Niger (Kobayashi et al., 2003) but comparable to the high level of awareness of same vaccines in in Nairobi, Kenya (Kamau and Esamai, 2009) This finding can be attributable to the National Supplementary Immunization plus days which is aimed at improving coverage for OPV and eradicating the polio disease from the Integrated Diseases, Surveillance and Response (IDSR). The constant jingles being aired on television and radio to improve utilization of immunization and also proximity of the time of delivery to the vaccine scheduled early in the NPI schedule may also have contributed to the high level of awareness for OPV.

Awareness level for recently introduced vaccines, such as pentavalent vaccine, pneumococcal conjugate vaccine, and those given at the end of the immunization schedule (measles and yellow fever vaccines), were slightly lower compared to the other vaccines in the routine immunization schedule. This observation could be as a result of time lag between the two sets of vaccines which could cause mothers to forget the measles vaccine and dropout or not follow through with subsequent doses. Just as the vast majority of the people have been sensitized with regards to OPV, other vaccines should also be given similar have treatment. Such enlightenment requires health promotion in the form of health education where persuasive communications are utilized in passing the information on to the people. The message in such a manner that the content is comprehended and accepted by the people with the effect that mothers are urged to present their wards for immunization including those given late in the NPI schedule. This high level of caregiver’s awareness of immunization could have resulted from the aggressive health education carried out by health workers in health care centers, to peer group influence and general community participation in routine immunization. This is corroborated by the finding that healthcare practitioners were the commonest source of information followed by the mass media and friends.

The current finding is consistent with the study done in Addis Ababa where health workers were also the main source of information. (Birhan et al., 2015).

This trend may be attributed to the fact that vaccination information is usually given to mothers by healthcare professional just before giving vaccines to the children during each immunization sessions and postnatal visits. The finding is further substantiated by findings noted in studies done in Nigeria (Odusanya et al., 2009; Ibraheem et al., 2016) and Saudi Arabia. (Yousif et al., 2013) Friends and family members were also noted as important sources of information on immunization but their knowledge of immunization needs to be strengthened.

**Table 3: mothers’ practice of immunization**

| Variable                          | Frequency (n = 640) | Percent |
|-----------------------------------|---------------------|---------|
| Ever vaccinated child             |                     |         |
| Yes                               | 640                 | 100.0   |
| No                                | 0                   | 0.0     |
| Possession of vaccination card    |                     |         |
| Yes and seen                      | 625                 | 97.7    |
| Yes but not seen                  | 15                  | 2.3     |
| No                                | 0                   | 0.0     |
| Vaccination coverage based on age*|                     |         |
| BCG (n = 640)                     | 630                 | 98.4    |
| OPV1 (n = 640)                    | 640                 | 100.0   |
| OPV2 (n = 520)                    | 520                 | 100.0   |
| OPV3 (n = 399)                    | 398                 | 100.0   |
| PENTAT1 (n = 640)                 | 640                 | 100.0   |
| PENTAT2 (n = 520)                 | 520                 | 100.0   |
| PENTAT3 (n = 399)                 | 359                 | 90.0    |
| PCV1 (n = 640)                    | 640                 | 100.0   |
| PCV2 (n = 520)                    | 505                 | 97.1    |
| PCV3 (n = 399)                    | 338                 | 84.7    |
| Measles (n = 163)                 | 118                 | 72.4    |
| Yellow fever (n = 163)            | 119                 | 73.0    |

Dropout rate (BCG/Measles) = 26.0%; Dropout rate (PENTAT1/Measles) = 19.5%; Dropout rate (PENTAT1/PENTAT3) = 10.0%
The variation in these findings noted between the two studies may be due to the difference in methodology and the time of completing vaccination (at nine months or before the first birthday). The study revealed good knowledge of the age and time of completion of vaccination among the caregivers in the other study had at least primary school education. Despite the fact that caregivers had good knowledge of the age and time of completion of vaccination, fewer caregivers felt that routine immunization improves the growth and intelligence of children. A similar finding has been noted among mothers in rural Nigeria (Tagbo, et al., 2012) where majority of the respondents correctly stated the purpose of immunization but in contrast with findings from an Enugu based study (Tagbo, et al., 2012) where majority of the respondents mentioned the purpose of immunization correctly. The implication of this is that though some had incorrect knowledge of immunization they nevertheless regarded immunization to be beneficial.

Table 4: Knowledge of immunization and the socio-demographic characteristics of index child and their caregivers

| Variable                        | Poor (247) n (%) | Fair (81) n (%) | Good (312) n (%) | Test statistic | p value |
|---------------------------------|-----------------|----------------|-----------------|----------------|---------|
| Age (years)                     |                 |                |                 |                |         |
| < 20                            | 4 (57.1)        | 0 (0.0)        | 3 (42.9)        | **F = 19.194** | **0.038**|
| 20 – 29                         | 93 (40.1)       | 41 (17.7)      | 98 (42.2)       | **F = 6.006**  | 0.655   |
| 30 – 39                         | 131 (39.5)      | 29 (8.7)       | 172 (51.8)      |                |         |
| 40 – 49                         | 17 (28.8)       | 10 (16.9)      | 52 (44.2)       |                |         |
| 50 – 59                         | 0 (0.0)         | 0 (0.0)        | 3 (100.0)       |                |         |
| ≥ 60                            | 2 (28.6)        | 1 (14.3)       | 4 (57.1)        |                |         |
| Marital status                  |                 |                |                 |                |         |
| Single                          | 4 (23.5)        | 3 (17.6)       | 10 (58.8)       | **F = 6.006**  | 0.655   |
| Married                         | 238 (38.7)      | 78 (12.7)      | 299 (48.6)      |                |         |
| Cohabiting                      | 1 (100.0)       | 0 (0.0)        | 0 (0.0)         |                |         |
| Separated/divorced              | 3 (75.0)        | 0 (0.0)        | 1 (25.0)        |                |         |
| Widowed                         | 1 (33.3)        | 0 (0.0)        | 2 (66.7)        |                |         |
| Household size                  |                 |                |                 |                |         |
| ≤ 4                             | 108 (40.9)      | 39 (14.8)      | 117 (44.3)      | **χ² = 11.590**| **0.021**|
| 5 – 8                           | 134 (37.5)      | 36 (10.1)      | 187 (52.4)      |                |         |
| ≥ 9                             | 5 (26.3)        | 6 (31.6)       | 8 (42.1)        |                |         |
| Level of education              |                 |                |                 |                |         |
| No formal education             | 35 (41.2)       | 9 (10.6)       | 41 (48.2)       | **χ² = 13.085**| **0.042**|
| Primary                         | 142 (38.8)      | 48 (13.1)      | 176 (48.1)      |                |         |
| Secondary                       | 66 (40.7)       | 23 (14.2)      | 73 (45.1)       |                |         |
| Tertiary                        | 4 (14.8)        | 1 (3.7)        | 22 (81.5)       |                |         |
| Socioeconomic status            |                 |                |                 |                |         |
| Class I                         | 0 (0.0)         | 0 (0.0)        | 2 (100.0)       | **F = 9.782**  | 0.242   |
| Class II                        | 5 (22.7)        | 1 (4.5)        | 16 (72.7)       |                |         |
| Class III                       | 54 (41.5)       | 20 (15.4)      | 56 (43.1)       |                |         |
| Class IV                        | 132 (40.6)      | 40 (12.3)      | 153 (47.1)      |                |         |
| Class V                         | 56 (34.8)       | 20 (12.4)      | 85 (52.8)       |                |         |

More than three quarters of the caregivers received information on immunization from the media (television, radio, internet and newspapers). Television is an important source of health information because it is available in most homes and it is more convenient for caregivers to watch medical programmes than use the internet or obtain information by reading. The study revealed good knowledge of immunization among the caregivers with regards to true purpose of immunization and age of completion of vaccination. This value noted in this study are higher than those obtained in a study involving a rural Nigeria community and Ethiopia (Birhann et al., 2015) where only half of the mothers mentioned correctly the time of completing immunization (at nine months or before the first birthday). The variation in these findings noted between this study and others may be due to the difference in characteristics of the study participants particularly educational attainment since about 70% of mothers included in the study in rural Nigeria were illiterates, higher than the illiteracy rates in this study. Most of the caregivers in the other study had at least primary school education. Despite the fact that caregivers had good knowledge of the age and time of completion of vaccination, few caregivers felt that routine immunization improves the growth and intelligence of children. A similar finding has been noted among mothers involved in the rural Nigeria study8 where it was observed that less than a quarter of the respondents correctly stated the purpose of immunization but in contrast with findings from an Enugu based study (Tagbo, et al., 2012) where majority of the respondents mentioned the purpose of immunization correctly. The implication of this is that though some had incorrect knowledge of immunization they nevertheless regarded immunization to be beneficial.

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Table 5: Bivariate regression analysis of the predictors of caregivers’ knowledge of immunization

| Predictors                  | B (regression coefficient) | p-value | Odd Ratio | 95% C.I. for Odd ratio |
|-----------------------------|----------------------------|---------|-----------|-----------------------|
| Child age                   |                            |         |           |                       |
| ≤3 months*                  | 0.057                      | 0.744   | 1.059     | 0.752 – 1.490         |
| ≥4 months                   |                            |         |           |                       |
| Delivery place              |                            |         |           |                       |
| Hospitals                   | 0.357                      | 0.071   | 1.430     | 0.970 – 2.108         |
| Others*                     |                            |         |           |                       |
| Age (years)                 |                            |         |           |                       |
| < 40*                       | 0.514                      | 0.075   | 1.672     | 0.950 – 2.942         |
| ≥ 40                        |                            |         |           |                       |
| Marital status              |                            |         |           |                       |
| Ever married*               | 0.293                      | 0.567   | 1.341     | 0.490 – 3.668         |
| Never married               |                            |         |           |                       |
| Household size              |                            |         |           |                       |
| ≤ 4*                        | 0.099                      | 0.557   | 1.104     | 0.794 – 1.536         |
| > 4                         |                            |         |           |                       |
| Level of education          |                            |         |           |                       |
| Primary or less*            | 0.135                      | 0.620   | 1.145     | 0.671 – 1.954         |
| Secondary/tertiary          |                            |         |           |                       |
| Employment                  |                            |         |           |                       |
| Yes*                        | 0.126                      | 0.612   | 1.134     | 0.698 – 1.842         |
| No                          |                            |         |           |                       |
| Socioeconomic status        |                            |         |           |                       |
| Classes I – III             | 0.117                      | 0.681   | 1.125     | 0.642 – 1.969         |
| Classes IV and V*           |                            |         |           |                       |
| Constant                    | -0.187                     | 0.644   | 0.830     |                       |

*Reference category, Coefficient of determination (R²) = 1.4% – 1.9%; C.I = confidence interval; There were no statistically significant predictors of knowledge of immunization among the socio-demographic characteristics of the respondent. Which shows that for every increase in age of the child there was no increase in the caregiver’s knowledge of routine immunization with a p=0.744 with odds of 1.059 (0.752-1.490).

Health workers could leverage on the observed trend to educate the mothers on the true essence of immunization and its added benefits through the correct use of information, education, and communication materials available on immunization as a rationale for immunization rather than use only images of children known to have suffered from vaccine preventable diseases/ historic images relating to disease outbreaks. Over half of the mothers/caregivers were unaware of the full range of vaccines routinely administered to children in Nigeria. This observation is worrisome as it may suggest that immunization campaigns are suboptimal in spite of the WHO 2010 plan to improve massive cross regional vaccination campaigns. (FMOH, 2011) There could therefore be some knowledge gaps warranting the need for improved health education during antenatal and immunization activities, perhaps using improved community participation, mass mobilization, and retraining of community health workers.

All the caregivers reported vaccinating the index child and presented their vaccination cards. Most of the index children were completely immunized for age with an immunization coverage of eight five percent. Similar rates had been reported in India (Hamid et al., 2012) and Ethiopia (Lakew et al., 2015) where majority of the children were completely immunized for age. The current finding is however at variance with the lower immunization rates of less than twenty-five percent obtained from some Nigeria studies (FMOH, 2008; FMOH, 2011) and another carried out in Ethiopia (Etana and Derressa, 2012). The discrepancy in coverage rates may be due to social and cultural factors. Nonetheless the high coverage rate noted among the children in this study is in excess of the goals of the Global Immunization Vision and Strategy (GIVS) which set at least 80% vaccination coverage in every district. (FMOH, 2011) The coverage rate of 85% noted in this study is different from values.

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obtained in a study carried out in Edo State where immunization coverage according to the NDHS 2013, was 52% and other studies conducted in the Southern part of Nigeria that also fell short of the GIVS goal. The disparity in immunization coverage within the country may reflect the variation in effectiveness of immunization campaign in various localities outside other influences as vaccine supplies, level of literacy, employment and poverty.

**Conclusion:** knowledge and practice of immunization in this study was good although they were not as significant to what was expected due to the rigorous health education which occurs before immunization sessions daily and the yearly routine and supplementary immunization campaign by the federal and state government, also emphasis need to be given to educating and empowering the girl child and also raising awareness on family planning to enable improvement in the immunization coverage.

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