

VACCINATION STATUS AND SOCIO-DEMOGRAPHIC DETERMINANTS AMONGST UNDER FIVES ATTENDING HEALTH FACILITIES IN SOKOTO METROPOLIS, NIGERIA

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Abstract

Immunization is one of the most successful, cost-effective and sustainable public health interventions against diseases globally. Routine vaccination coverage has been poor in many African countries inspite of the documented benefits. Sokoto State has consistently recorded the lowest immunization coverage in different surveys conducted in Nigeria over the last decade hence this study on socio-demographic variables associated with vaccination status of children. This was a cross-sectional study conducted in the health facilities in Sokoto Metropolis among 406 care-givers of 6 months to 5 years children over a 4-month period between October 2021 to January 2022. Their socio-demographic characteristics and vaccination status were collected with a proforma and data was analysed using IBM SPSS version 25. There were 406 parents/child pairs recruited comprising 219 (53.9%) males and 187 (46.1%) female children 245 (60.3%) were fully vaccinated for age while 88 (21.7%) were partially vaccinated and 73 (18.0%) were unvaccinated. Higher proportion of those who were partially or unvaccinated had unemployed parents ($p=0.00$). Ownership of phones for both parents and availability of radio in the household were significantly related to the vaccination status ($p=0.007$; 0.03 ; 0.00). Those who had ever exhibited vaccine hesitancy were less likely to have fully vaccinated their children (39.2% vs 73.1%; $p = 0.00$). Two-thirds of children attending health facilities in Sokoto metropolis were fully vaccinated. The proportion of those vaccinated were more among employed and educated parents, possible vaccine apathy from information gaps was associated with lack of full vaccination.

Keywords: Vaccination, Status, Sokoto, Children, Health Facilities

Introduction

Immunization is one of the most successful, cost-effective and sustainable public health interventions against diseases globally. According to World Health Organization (WHO), routine immunization is estimated to prevent 3 million deaths globally every year and this has significantly reduced childhood morbidity and mortality due to vaccine preventable diseases (*World Health Organization & UNICEF, 2014*). For instance, an 84.0% decline in mortality due to measles vaccination globally was recorded (*World Health Organization, 2018*).

Routine vaccination coverage has been poor in many African countries inspite of the documented benefits. According to surveys, Nigeria had the lowest coverage of 31.0% compared to other countries like Ethiopia, Uganda and Ghana with 43.0%, 55.0% and 57.0% coverage respectively (Galadima, Zulkefli, Said, & Ahmad, 2021). Many under 5 children who predominate in low- and middle-income countries (LMICs) have never received any vaccine putting their communities at risk of disease and death (WHO, 2020). Aside from reasons of poor health systems which limit access to life saving vaccines, further disruption of health systems and programs by COVID-19 is also contributing to large numbers not having access to vaccines (Shet et al., 2022). Sokoto state has been reported as one of the states with low vaccination rates according to third dose of Diphtheria, Pertussis, & Tetanus vaccine (DPT3) in Nigeria according to the Nigerian Demographic Health Survey (NDHS). Sokoto state has consistently recorded the lowest immunization coverage in different surveys conducted in Nigeria over the last decade (National Population Commission & ICF, 2019). It is important to examine the socio-demographic variables influencing parents to vaccinate their children fully so as to harness such into planning and implementation programmes.

This study set out to answer the following research questions.

- i. What is the vaccination status of children aged 6 months to 60 months attending health facilities in Sokoto metropolis?
- ii. What are the socio-demographic variables associated with their vaccination status?

Materials and Methods

Background information on the study area

The study was conducted in Sokoto Metropolis located in Sokoto State, Nigeria. It is one of the six states of the north-western zone of the country. It has a total of 23 Local Government Areas (LGAs). It shares borders with the Republic of Niger to the north, Kebbi state to the west and south, and Zamfara to the south and east (The Editors of Encyclopaedia Britannica, 2012).

The metropolis consists of urban, peri-urban and rural settlements within the Local Government Areas (LGAs) that constitute the metropolis (Linard, Tatem, & Gilbert, 2013). The LGAs that constitute the metropolis include Sokoto North, Sokoto South, parts of Wamakko, Dange-Shuni and Kware.

Sokoto metropolis has all the types of health facilities which include public and private health facilities. These include 3 tertiary, 4 secondary and 55 primary health care facilities. There are 13 PHCs in Wamakko LGA, 12 in Sokoto North LGA, 12 in Sokoto South LGA, 11 in Dange Shuni LGA and 13 in Kware LGA. Vaccination services are available in the tertiary, secondary and primary health care centres.

Study design

This was a cross-sectional study. The data collection was done once per study participant.

Study population

The study population comprised parents of children aged 6 months to 5 years receiving care in these health facilities in Sokoto metropolis.

Study period

The study was conducted over a 4-month period between October 2021 to January 2022.

Inclusion criteria

1. Parents of children aged 6 to 60 months attending the health facilities

Exclusion criteria

1. Those whose parents have not been resident in the area for 1 year.
2. Those who do not know the vaccination history of the child
3. Those who do not have their vaccination cards
3. Those who are health workers in the sampled health facilities.

Sample size determination

The data was collected as part of a study on vaccine hesitancy where the sample size was determined using a prevalence of 50.0% (Araoye, 2004) since such study has not been conducted in the study area before. After adjustment for response rate of 95.0%, the final sample size was 406. Four hundred and six (406) participants were selected by multistage sampling technique and enrolled into the study.

Sampling technique

The first stage involved selection of three out of the five metropolitan LGAs (Wamakko, Dange Shuni, Sokoto North, Sokoto South and Kware) by simple random sampling through balloting. The sample size was divided equally among the 3 LGAs. From the 3 selected LGAs, all the health facilities were categorised into primary, secondary and tertiary and line-listed as such. Thus, one secondary or tertiary facility per LGA were selected by balloting. When there was only one of such facility in an LGA, it was selected. The PHCs were line listed and 5 PHCs in each LGA were selected by balloting. A total of 18 facilities were sampled. Proportional allocation of the sample size based on the average number of children seen per week in each facility. The total sample size of 406 was thus divided proportionally among the all the health facilities. Those sampled were first enquired about their vaccination cards. If they did not have the card for review, they were replaced by the next available parent-child pair. A total of 580 parents/child pairs were interviewed and 70.0% (406) had their vaccination cards for verification so were included in the study after satisfying the other inclusion criteria.

Study instruments

The study instrument was a set of interviewer-administered, semi structured questionnaire which had been built into an Open Data Kit (ODK) software using an android mobile phone.

Data collection tools

The instrument of data collection was a questionnaire. The questionnaire contained open and close-ended questions.

Data collection methods

Administration of questionnaire by oral interview for the parents/child pairs (mother or father) in their clinic settings and examination of their immunization cards for vaccination status of the children. The National Programme on routine immunization schedule was followed. The immunization schedule is as follows;

At Birth: Bacillus Calmette-Guerin (BCG), Hepatitis B Virus Vaccine, 1st dose (HBV-1), Oral Polio Vaccine, starter dose (OPV-0)

At 6, 10 & 14 weeks of age: Pentavalent vaccine (Diphtheria, Pertussis, Tetanus Vaccine, Haemophilus type b, Hepatitis B Virus Vaccine) and Injectable Polio Vaccine (IPV)

At 9 months of age: Yellow Fever Vaccine & Measles Vaccine

Any child that had received all the vaccinations due to his age was marked as fully vaccinated for age. Any missed vaccination was termed partially vaccinated. The children also had their left upper limbs examined to confirm their receipt of BCG vaccine. Those who had not received any vaccination at all were termed unvaccinated. Their socio-economic status was assessed according to the Oyediji classification. Scores were assigned to both mother and fathers' education and occupational status which are stratified into 5 classes according to Oyediji. The mean of their 4 scores was the social class assigned to each respondent (Oyediji, 1985). The classes were upper class, upper middle class, middle class, lower middle class and lower class numbered as class I to V respectively. To get the 3-category classification, class I & II were grouped as Upper class, III as Middle class, and IV & V as Lower class.

Personnel

Four research assistants comprising medical and allied health students from Usmanu Danfodiyo University (UDUS) were recruited to assist in data collection. They were trained on general principles, objectives and conduct of research, use of research instruments including the use of the ODK software, sample collection, analysis and research ethics.

Data management

Data was exported from the ODK software into the IBM Statistical Package for the Social Sciences (SPSS) version 25 software. Data was presented using tables for frequencies and percentage of variables (age groups, gender, occupational, and educational status).

The questions on vaccination status were assessed with dichotomous "yes" or "no" answers.

Bivariate analysis (χ^2) was used to assess association between sociodemographic variables (education, employment status) and vaccine status. While those that were significant on bivariate analysis were subjected to logistic regression analysis. P-value of less than 0.05 was considered significant.

Ethical consideration

Approval for the study was obtained from the ethical committee of Ministry of Health in Sokoto State and permission from the State Primary Health Care Development Agency (SPHCDA). Informed consent was obtained from the respondents and strict confidentiality was maintained of respondents' identity.

Results

Four hundred and six (406) were recruited and all had information that was adequate for analysis.

Socio-demographic parameters

There were 406 parents/child pairs recruited comprising 219 (53.9%) males and 187 (46.1%) female children. Their mean age was 15.2 ± 12.3 months with a range of 6 – 60 months. Hausa tribe accounted for the majority 353 (70.4%). Majority of the mothers 353 (86.9%) could read and write but were unemployed 335 (82.5%) while more of the fathers could also read and write 385 (94.8%) and were employed 277 (68.2%). Most of the mothers, 392 (96.6%) owned a phone. Majority were of low socio-economic status 359 (88.4%). Majority of fathers had tertiary education. 263 (64.8%) while the mothers mainly had secondary level of education 208 (61.2%) as shown in Table 1.

Table 1: Socio-demographic characteristics

Variable	Frequency	Percentage
Male	219	53.9
Female	187	46.1
Age category		
6.0 - 12.0 month	225	55.4
12.1 - 24.0 month	110	27.1
24.1 - 36.0 month	45	11.1
36.1 – 48.0 month	21	5.2
48.1 – 60.0 month	5	1.2
Tribe		
Hausa	286	70.4
Fulani	61	15.0
Yoruba	35	8.6
Igbo	21	5.2
Others	3	0.7
Mothers' ability to read and write		
Yes	353	86.9
No	53	13.1
Fathers' ability to read and write		
Yes	385	94.8
No	21	5.2
Mother owns a phone		
Yes	392	96.6
No	14	3.4
Socio-economic status		
Low	359	88.4
Middle	44	10.8
Upper	3	0.7
Mother's education		
None	70	17.2
Primary	42	10.3
Secondary	208	51.2
Tertiary	86	21.2
Mother's employment		
Unemployed	335	82.5
Employed	71	17.5

Father's employment

Unemployed	129	31.8
Employed	277	68.2

Father's education

None	28	6.9
Primary	2	0.5
Secondary	113	27.8
Tertiary	263	64.8

Vaccination status

Of the 406 respondents, 245 (60.3%) had received all the vaccinations due to them by age (fully vaccinated for age) while 88 (21.7%) were partially vaccinated and 73 (18%) were unvaccinated as shown in Figure 1.

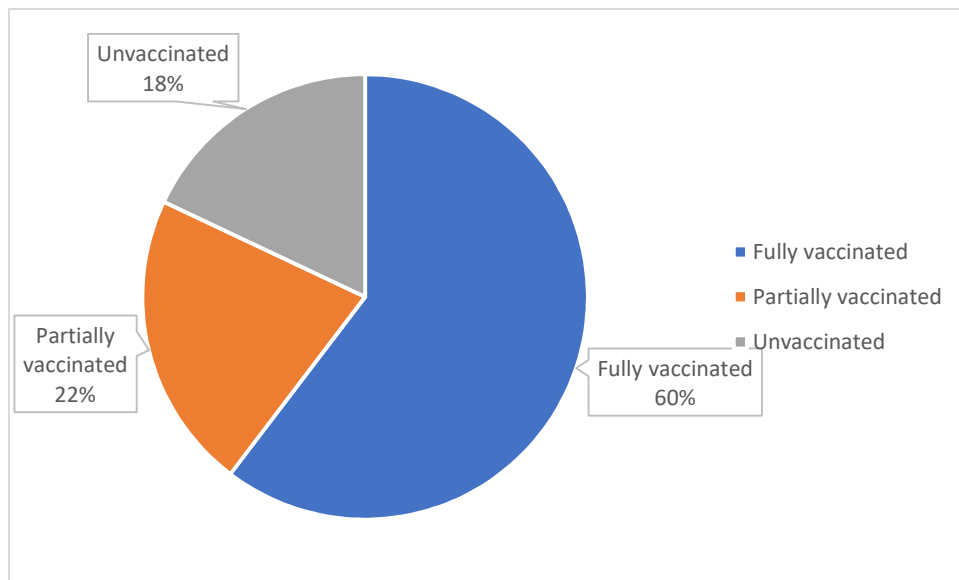


Figure 1: Vaccination status of the study population

Relationship between vaccination status and socio-demographic profile

Vaccination status was not related to the gender though higher proportion of females were unvaccinated. It was significantly related to age as increasing proportion of older children were unvaccinated. Vaccination status was not related to educational status of parents but to their employment status as higher proportion of employed parents had fully vaccinated their children (76% vs 57% for mothers & 66% vs 48% for fathers). Also, higher proportion of those who were partially or unvaccinated had unemployed parents ($p=0.00$). Ownership of phones for both parents and availability of radio in the household were significantly related to the vaccination status ($p=0.007$; 0.03 ; 0.00). Higher proportion of those who did not have these items had unvaccinated or partially vaccinated children. Parents of high socio-economic status were few but were either unvaccinated or partly vaccinated compared to others ($p=0.13$). In Table 2, the vaccination status according to age and other socio-demographics is demonstrated.

Table 2: Vaccination status according to age and other socio-demographics (n =406)

Variable	Full	Partial	Unvaccinated	Statistic	p-value
Gender					
Male	133 (60.7)	51 (33.3)	35 (16.0)	1.63	0.44
Female	112 (59.9)	37 (19.8)	38 (20.3)		
Age category					
6.0 - 12.0 month	127 (56.4)	74(32.9)	24 (10.7)	75.9	0.00
12.1 - 24.0 month	85 (77.3)	7 (6.4)	18 (16.4)		
24.1- 36.0 month	21 (46.7)	6 (13.3)	18 (40.0)		
36.1 – 48.0 month	11 (52.4)	1 (4.8)	9 (42.9)		
48.1 – 60.0 month	1 (20.0)	0 (0.0)	4 (80.0)		
Mother's education					
None	37 (52.9)	16 (22.9)	17 (24.3)	7.5	0.27
Primary	31 (73.8)	8 (19.0)	3 (7.1)		
Secondary	125 (60.1)	48 (23.1)	35 (16.8)		
Tertiary	52 (60.5)	16 (18.6)	18 (20.9)		
Father's education					
None	13 (46.4)	10 (35.7)	5 (17.9)	10.6	0.1
Primary	2 (100)	0 (0.0)	0 (0.0)		
Secondary	79 (69.9)	16 (14.2)	18 (15.9)		
Tertiary	151 (57.4)	62 (23.6)	50 (19.0)		
Mother's employment					
Unemployed	191 (57.0)	79 (23.6)	65 (19.4)	8.9	0.01
Employed	54 (76.1)	9 (12.7)	8 (11.3)		
Father's employment					
Unemployed	62 (48.1)	37 (28.7)	30 (23.3)	11.9	0.03
Employed	183 (66.1)	51 (18.4)	43 (15.5)		
Mother owns a phone					
Yes	242 (61.7)	83 (21.2)	67 (17.1)	9.9	0.007
No	3 (21.4)	5 (35.7)	6 (42.9)		
Father owns a phone					
Yes	245 (60.6)	86 (21.3)	73 (18.1)	7.3	0.03
No	0 (0.0)	2 (100.0)	0 (0.0)		

Radio in the household					
Yes	187 (69.8)	40 (14.9)	41 (15.3)	31.3	0.00
No	58 (42.0)	48 (34.8)	32 (23.2)		
TV in the household					
Yes	213 (61.7)	71 (20.6)	61 (17.7)	2.1	0.35
No	32 (52.5)	17 (27.9)	12 (19.7)		
Socio-economic status					
Low	214 (59.6)	78 (21.7)	67 (18.7)	7.3	0.13
Medium	31 (70.5)	8 (18.2)	5 (11.4)		
High	0 (0.0)	2 (66.7)	1 (33.3)		

Relationship between vaccination status and other preventive practices

Those who had ever exhibited vaccine hesitancy were less likely to have fully vaccinated their children (39.2% vs 73.1%; $p = 0.00$). Likewise, those who exclusively breastfed were more likely to vaccinate their children fully (74.2% vs 47.7%; $p = 0.00$). Also, those who had COVID vaccine hesitancy were less likely to vaccinate their children fully. In Table 2, the vaccination status according to age and other preventive practices is demonstrated. The highest proportion of the unvaccinated were seen in the tertiary health facilities and partially vaccinated in the secondary facilities.

Table 2: Vaccination status according to age and other preventive practices (n =406)

Variable	Full	Partial	Unvaccinated	Statistic	p-value
Ever hesitated to/ refused vaccines					
Yes	60 (39.2)	73 (47.7)	20 (13.1)	98.2	0.00
No	185 (73.1)	15 (5.9)	53 (20.9)		
Exclusively breastfed					
Yes	138 (74.2)	15 (8.1)	33 (17.7)	43.4	0.00
No	102 (47.7)	72 (33.6)	40 (18.7)		
Don't know	5 (83.3)	1 (16.7)	0 (0.0)		
Would you receive COVID vaccine?					
Yes	217 (66.8)	56 (17.2)	52 (16.0)	29.5	0.00
No	28 (34.6)	32 (39.5)	21 (25.9)		
Health facility					
Primary	146 (64.0)	45 (19.0)	37 (16.2)	21.7	0.00
Secondary	54 (50.5)	37 (34.6)	16 (15.0)		
Tertiary	45 (63.4)	6 (8.5)	20 (28.2)		

Logistic regression of factors predicting vaccination status

After logistic regression to ascertain the predictors of vaccination status, some parameters remained significant predictors of vaccination status of the respondents' children. These were age of child, fathers' employment status, vaccine hesitancy and ownership of a radio at the household level. The details are shown in Table 4 below.

	AOR	p-value-	95% C.I. for EXP(B)	
			Lower	Upper
Age	1.481	0.007	1.115	1.968
Mothers' employment status	1.717	0.111	0.884	3.336
Fathers' employment status	1.685	0.048	1.005	2.825
Mother owns a phone	3.508	0.087	0.833	14.774
Father owns a phone	109.17	0.999	0.000	
Radio in the household	2.267	0.003	1.332	3.858
Have you ever been reluctant, hesitated or refused to get any vaccination for your child?	0.243	0.000	0.138	0.430
If COVID vaccine is available would you take it?	1.965	0.023	1.097	3.519
Was the child exclusively breastfed?	1.349	0.264	0.797	2.284
Type of health facility	0.598	0.080	0.336	1.063

Discussion

Most of the respondents seen in the health facilities were of low socio-economic status which was consistent with findings from other studies done in health facilities in the state (*Isezuo et al., 2020 & Oladigbolu et al., 2017*) and this reflects the generally low socio-economic situation in the State (*Kware, 2019*). Majority of the mothers had completed secondary education while the fathers had mainly tertiary education. This is in conformity with other study's finding on the utilization of health services by women in Sokoto State where most of those who had ante-natal care had formal education likewise their husbands (*Ango et al., 2018*).

About 70.0% of the respondents had their vaccination cards with them which is not surprising being a hospital-based study, however this was higher than reported from previous community surveys by the NDHS in Sokoto which showed only 39.3% of households possessed vaccination cards for their wards which was abysmally low compared to other parts of the country where up to 95% was recorded (*National Population Commission & ICF, 2019*). In this study, just over half of the children attending the facilities were fully vaccinated (60.3%) which was similar to a community survey in Reno, Ogun State which revealed an immunization coverage of 59.6% (*Akwataghibe et al., 2019*). However, higher figures of 84.0% was reported in a study by Duru in Owerri, South-eastern Nigeria which was also a community-based study (*Duru et al., 2016*). This is in conformity with the previous findings on vaccination uptake as typified in the NDHS 2018 where the rates are lower in the North than the Southern part of the country. It was reported by

National Population Commission & ICF (2019) that vaccination coverage among children age 12-23 months was highest in Anambra (76.0%) and lowest in Sokoto (5.0%). This implies that a lot has to be done to encourage families to vaccinate their children in the communities specifically.

More of the older children were unvaccinated as the proportion increased with age. This could be possibly due to the random sampling of the children who were brought to the health facilities, it is more likely that they were ill for them to be there probably reflective of their non-vaccinated status thereby predisposing them to infections. More of the unvaccinated were also seen in the tertiary facilities, however since their condition for presentation in the hospital was not assessed in this study, it may not be clear whether they were due to vaccine preventable diseases.

In this study, higher proportion of mothers who had primary education had fully vaccinated their children unlike the study by Holipah (2018) from Indonesia where only mothers who had completed a higher level of education were more likely to immunize their children than mothers who had a primary-school education or less. The study from Owerri by Duru (2016) also showed that mothers with primary and tertiary education had highest rates of full vaccination similar to this study. The relationship between mothers' employment status and their children's immunization status was statistically significant also unlike in the Indonesian study (Holipah et al., 2018). Consistent with this report, a retrospective analysis from 2018 NDHS Sokoto State data reported in a dissertation by Madubu (2021) showed a significant relationship between parents' educational level, occupation, family wealth index and vaccination status.

On logistic regression, the age of the child, vaccine hesitancy including to COVID vaccine and presence of radio in the household remained significant predictors of vaccination status. This may imply that type of information received may influence vaccine status of a child and that probably more media input may be necessary to combat vaccine hesitancy in the populace. Even though, there have been reports of use of social media which is highly unregulated to foster vaccine apathy and resistance (Zhou, Ampon-Wireko, Xu, Quansah, & Larnyo, 2022), the use of conventional media (radio and television) has been found to be more controlled and used in a positive way to engender behavioral change.

Conclusion

This study showed that only about two-thirds of children attending health facilities in Sokoto metropolis were fully vaccinated. Though the proportion of those vaccinated were more among employed and educated parents, possible vaccine apathy from information gaps was associated with lack of full vaccination. The study was limited by being a facility-based study, it may not exactly reflect the vaccine status of the community at large. It is therefore recommended that health education should be continuous, especially in the communities and health centres. Utilization of methods like reminder messages to phone since a large proportion had phones and other electronic mass media is also helpful.

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