

Vaccination Hesitancy and Refusal Among Parents of Under-Fives Attending Health Facilities in Sokoto Metropolis, Nigeria Using the WHO Vaccine Hesitancy Tool

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ABSTRACT

Introduction and Objectives: Vaccination is evidently very effective having prevented an excess of 6 million deaths annually and the world's population projection in the next 2 decades is largely due to effective vaccines that prevent diseases globally. However, these gains are threatened by the increasing trend of vaccine hesitancy, a deliberate refusal to vaccinate despite available vaccines. This study aimed to assess vaccine hesitancy using the WHO SAGE working tool among parents of under-fives children in Sokoto, Nigeria.

Materials and Methods: A cross-sectional study conducted in the health facilities in Sokoto Metropolis over a 6-week period among 406 parents of under five children receiving care recruited with multi-stage sampling. Responses on their socio-demographic characteristics, vaccination hesitancy and perceptions on vaccination were entered into a study proforma. Data was analysed using IBM SPSS version 25.

Results: Of the 406 parents/child pairs interviewed, there were 219 (53.9%) males and 187 (46.1%) female children. Of the 406 respondents, 153 (37.7%) admitted to ever refusing, hesitating or being reluctant to accept a particular vaccine for their child. The proportion of those who refused vaccines increased along the immunization schedule. The commonest reason proffered was that they felt vaccination was not necessary to protect from diseases followed by family refusal of vaccination and concerns of safety from negative information gotten which included perceived handicap from the vaccine and infertility. Predictors of vaccine hesitancy were tertiary educated fathers and young mothers ($p < 0.05$).

Conclusion: Vaccine hesitancy is high among the population of care givers attending health facilities in Sokoto and increased with the latter vaccines in the immunization schedule. Poor knowledge, lack of trusted information, family/fathers refusal of vaccination were reasons given. Tertiary educated fathers and younger mothers had more vaccine hesitancy.

KEYWORDS: Vaccine; Hesitancy; Parents; Under-fives; Perceptions; Sokoto

INTRODUCTION

Vaccination, sanitation and safe drinking water are major public health interventions responsible for improved health outcomes globally [1]. Among these, vaccine development remains a major breakthrough in human history and till date is one of the major achievements that has revolutionized the health care industry [2].

The impact of vaccination on mortality and population growth worldwide cannot be over-emphasized. For instance, in 2003, vaccines had prevented an excess of 6 million deaths annually and the world's population projection in the next 2 decades is largely due to effective vaccines that prevent diseases globally [3].

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Increased rate of vaccination was evident in the report by WHO where it was quoted that by 2018, 86% of the worlds' under 5 children had received DPT 3 vaccine which was an increase from the 72% in 1980 [4]. However, this figure is still a far cry from the targeted 95% global coverage while about 13 million of 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.4 Aside from reasons of poor health systems which limit access to life saving vaccines, vaccine hesitancy and refusal⁵ by parents of under 5 children is also contributing to large numbers being denied vaccines leading to a high risk of reversal of gains gotten in two centuries since Edward Jenner discovered small pox vaccine [5,6].

Vaccine hesitancy is a continuum between vaccine acceptance and refusal. It is defined as an intentional delay or refusal to vaccinate children despite vaccine availability [7]. In many countries of the world, including developed countries [8] vaccine hesitancy is increasing even among educated populations, and this is receiving more attention with even deployment of new tools to assess the causes [9,10]. In Nigeria, there is already documented low uptake of vaccination for children with a secondary survey of the 2013 NDHS data revealing that about 76.3% of children had incomplete vaccination with poor health seeking behaviour from underlying poverty and low maternal education being principal root factors [11]. Also in Northern Nigeria, sociocultural and religious reasons also contribute to low uptake of vaccines with states like Sokoto, Zamfara and Kebbi having the lowest rate of the RI indicator of DPT3 of 2.3 % [12].

Vaccine hesitancy cannot really be defined as a variable with 2 opposing views (dichotomous). This is because many factors come into play in the decision-making process [9]. The 3C model has been used to explain the vaccine behaviour. It ranges from confidence which involves trust in vaccines and healthcare professional's advice, complacency which involves low awareness of risks of vaccine preventable disease likewise importance of vaccines and the third is convenience which looks at accessibility to care and availability of the vaccines. Therefore, there are two extremes in between which vaccine hesitancy lies. On one end are persons who accepts all vaccines, and the other end is those who refuse all vaccines and many others in between the two [9].

There has been no study that applied the use of standardized vaccine hesitancy tool like that developed by the WHO SAGE working group or Parents' attitude to vaccinate scale in North-western Nigeria [9,10]. These are standardized scales that assess vaccine confidence and vaccine refusal, develop communication interventions to address vaccine confidence failures, thereby preventing their public health implications [13].

a) The objectives for this study were: To assess the prevalence of vaccine hesitancy and refusal amongst parents of children aged 6 to 60 months in Sokoto metropolis?

b) To identify the factors associated with vaccine hesitancy and refusal among respondents?

c) To determine the perceptions of study respondents regarding childhood vaccinations

MATERIALS AND METHODS

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 LGAs. The State shares borders with the Republic of Niger to the north, Kebbi state to the west and south, and Zamfara to the south and east [14]. Sokoto metropolis which is the capital of the State lies between latitude 10° and 14°N, and longitude 3°31' and 7°71' east of the Equator. Sokoto metropolis has a projected population of 628,179 in 2019 based on the figures from the 2006 census [15].

The metropolis consists of urban, peri-urban and rural settlements within the Local Government Areas (LGAs) that constitute the metropolis [16]. The LGAs that constitute the metropolis include Sokoto North, Sokoto South, parts of Wamakko, Dange-Shuni and Kware LGAs. The inhabitants of the area are predominantly of Hausa and Fulani ethnic groups and mainly Muslims. There are also settlers from many other parts of the Federation who are of other ethnic origins and religion. The main economic activities in the area are farming, business and cattle rearing. Civil servants also constitute significant proportion of the residents in the area.

Sokoto metropolis has all the types of health facilities which include public and private health facilities. There are three major tertiary facilities, 4 secondary facilities and 55 primary health care facilities giving a total of 62 which include 13 in Wamakko LGA, 12 in Sokoto North LGA, 12 in Sokoto South LGA, 11 in Dange Shuni LGA and 13 in Kware LGA. The primary health facilities consist of Health Posts, Dispensaries, Basic Health Clinics and Primary Health Care Centres. Vaccination services are available in the tertiary, secondary and primary health care centres.

Study Design

This was a cross-sectional study.

Study Population

The study population comprised parents of under five children receiving care in these health facilities in Sokoto metropolis.

Inclusion criteria

a) Parents of children aged 6 months to 60 months attending the health facilities

Exclusion criteria

a) Those whose parents have not been resident in the area for 1 year.

b) Those who do not know the vaccination history of the child.

Sample Size Determination

The minimum sample size was determined using the formula $n = z^2pq/d^2$ [17]: where n = minimum sample desired; z = standard normal deviate at 95% confidence interval = 1.96; p = percentage of vaccination refusal in the population. 50% prevalence was used since there is no similar study in the North-western region $18 = 50\% = 0.50$; q = complimentary probability of $p = 1-p = 0.50$; d = tolerable alpha error or level of precision = $5\% = 0.05$. Thus, $n = 1.96^2 \times 0.50 \times 0.50 / 0.05^2 = 385$. A response rate of 95% was anticipated. The final sample size (n) was calculated using the formula 17 ; $n = n/0.95 = 406$. Four hundred and six (406) participants were selected by multistage sampling technique and enrolled into the study.

Sampling Technique

Multistage sampling technique was used.

Stage 1: Selection of LGAs: Out of the five metropolitan LGAs (Wamakko, Dange Shuni, Sokoto North, Sokoto South and Kware), 3 LGAs were selected by simple random sampling through balloting. The balloting process was done as follows. The name of five LGAs were written on plain white pieces of paper, occluded and mixed. Random selection of 3 LGAs was done by picking 3 papers from the group of five. The sample size was divided equally among the 3 LGAs selected.

Stage 2: Selection of Health Facilities: From the 3 selected LGAs, all the facilities were line listed per LGA. They were

categorized into 2 groups with the PHCs in the 1st group, while the secondary and tertiary health facilities were together in another group. The facility names were written on pieces of paper, occluded and mixed. Balloting method was used to sample five PHCs from the 1st group comprising only PHCs and one facility was selected from the 2nd group that consisted of tertiary and secondary facilities. This was done separately for the three LGAs as shown in the flow chart below (Figure 1). Thus, one tertiary, two secondary and 15 PHCs making a total of 18 facilities were sampled thus. This represented about 30% of the number of health facilities in the metropolis.

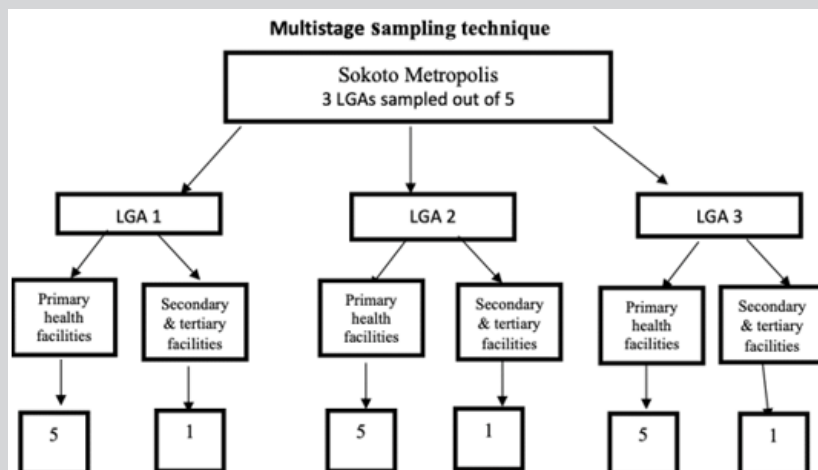


Figure 1: Showing the sampling technique.

Stage 3: Selection of Respondents: There was proportional allocation of the sample size based on the average number of children seen per week in each facility. This information was accessed from the records office of these facilities. In the tertiary facilities sampled, the data collection was done in the paediatric outpatient clinics and emergency paediatric unit, while in the PHCs, the data was collected in the clinics where children are being attended to. In each facility, the list of children registered every morning was accessed from the attending staff. Those under 5 years of age were further extracted and listed separately. Universal sampling was used to select from list of the under-fives daily if there were no exclusion criteria. This was done daily till the targeted sample size for each facility was met. The total sample size of 406 was divided proportionally among the 18 health facilities [18].

Instruments of Data Collection

The study instrument was a set of pre-tested, interviewer-administered, semi structured questionnaire which was formatted into an open data kit (ODK) software using an android mobile phone. The questions was adapted from WHO SAGE working group vaccine hesitancy tool [9]. The questionnaires had the following sections: Socio-demographic characteristics of the study subjects including age, gender; Socio-demographic characteristics of the parents including age, gender, educational attainment and occupation; Household characteristics, vaccination status; Parent's perception of vaccination and acceptance of vaccination. The instrument has been validated in previous studies by Ren [19]; Shapiro [20]; Wagner [21]; Masters [22].

Data Collection Methods

Administration of questionnaire by oral interview for the parents/child pairs (mother or father) in their clinic settings. The

questions were built into the ODK software for android phones. Four research assistants comprising medical and nursing students from UDUTH/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 ODK software, sample collection, analysis and research ethics. The research instruments were pretested in an LGA that is not amongst those sampled for the study. The pre-test was done immediately after the training of the research assistants.

Data Management

Data were exported from the ODK software into the IBM Statistical Package for the Social Sciences (SPSS) version 22.0 software. Data was presented using graphs and tables for frequencies and percentage of variables (age groups, gender, occupational, and educational status). The hesitancy and refusal of vaccines were assessed with dichotomous questions with "yes" or "no" answers. The questions on perception were scaled on a Likert scale of 1 (strongly disagree) to 5 (strongly agree). The median and interquartile range of the scores were computed with and presented in tables. Bivariate analysis (Pearson's Chi-square and Fisher's Exact tests) was used to assess the association between sociodemographic variables and vaccine hesitancy. Multivariate analysis (binary logistic regression analysis) was used to predict the socio-demographic variables which predicted vaccine hesitancy and refusal amongst those significant from the bivariate analysis. Those variables were classified dichotomously for instance the dominant tribe or educational status were coded as "0" against the others in their respective groups which were coded as "1" (eg Hausa tribe vs other tribes). The beta coefficients, odds ratio (OR) and 95% confidence intervals (95% CI) were determined. A p-value <0.05 was considered statistically significant.

ETHICAL CONSIDERATION

Approval for the study was obtained from [information redacted to maintain the integrity of the review process]. Informed consent was obtained from the respondents prior to recruitment. Strict confidentiality was maintained of respondents' identity.

RESULTS

All the 406 questionnaires were administered and analysed.

Socio-Demographic Characteristics of Respondents

Of the 406 parents/child pairs interviewed, there were 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. The mother's mean age was 27.7 ± 5.3 years, ranging from 18-55 years. The father's mean age was 40.1 ± 7.7 years, ranging from 21-62 years. Majority of the parents 286 (70.4%) were Hausa by tribe and Muslim 364 (89.7%). More of the mothers 208 (51.2%) had secondary education and 71 (17.5%) were unemployed while amongst the fathers, 263 (64.8%) had tertiary education and 277 (68.2%) were employed (Table 1).

Table 1: Sociodemographic characteristics.

Variable	Frequency	Percentage
Gender		
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
Yoruba	35	8.6
Igbo	21	5.2
Others	3	0.7
Religion		
Islam	364	89.7
Christianity	40	9.9
Traditional religion	2	0.5
Socio-Economic Status		
Low	359	88.4
Medium	44	10.8
High	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

Prevalence of Vaccine Hesitancy and Refusal

Of the 406 respondents, 153 (37.7%) admitted to ever refusing, hesitating or being reluctant to accept a particular vaccine for their children (Figure 2).

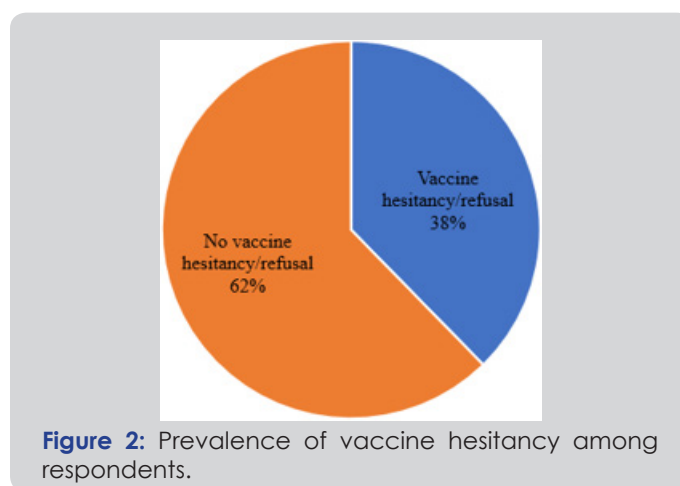


Figure 2: Prevalence of vaccine hesitancy among respondents.

Rates of Vaccine Hesitancy and Refusal for the Different Vaccines

Table 2: Rates of vaccine hesitancy and refusal for the different vaccines (n =406).

Vaccine	Hesitated	Refused
BCG	133 (32.8)	17 (4.2)
OPV0	138 (33.9)	17 (4.2)
HEP 0	124 (30.5)	27 (6.7)
PENTA1	126 (31.0)	26 (6.4)
OPV1	125 (30.8)	24 (5.9)
HEP 1	122 (30.0)	28 (6.9)
PENTA2	111 (27.3)	40 (9.9)
OPV2	104 (25.6)	45 (11.1)
HEP 2	97 (23.9)	52 (12.8)
PENTA3	89 (21.9)	60 (14.7)
OPV3	87 (21.4)	62 (15.3)
HEP 3	85 (20.9)	64 (15.8)
MEASLES	56 (13.7)	93 (22.9)
MENIN	36 (8.9)	111 (27.3)

The rate of vaccine hesitancy reduced progressively while those who refused vaccines is seen to increase progressively as shown in Table 2. A higher proportion refused the latter vaccines in the schedule compared to the earlier ones.

Reasons for Vaccine Hesitancy and Refusal

Of the 153 respondents who admitted hesitancy and refusal

of vaccination, the commonest reason proffered was that they felt vaccination was not necessary to protect from diseases. This was followed by family refusal of vaccination and concerns of safety from negative information gotten. Some felt they did not have adequate information and others felt they had previous bad experience with a vaccine in the past. Some did not proffer any reason (Table 3).

Table 3: Reasons for vaccine hesitancy and refusal among the respondents them (n =153).

Reason for Vaccine Hesitancy & Refusal	No of responses	%
Felt it is not necessary	23	15
Father/family refusal of vaccination	20	13.1
Heard negative information/have safety concerns	18	11.8
Do not have enough information	15	9.8
Previous bad experience with vaccine/ vaccinator	9	5.9
Distance from facility	4	2.6
Other reasons	27	17.6
No reason given	37	24.2

Relationship between Socio-Demographic Variables and Vaccine Hesitancy

The factors associated with vaccine hesitancy were examined. The factors associated with vaccine hesitancy were age of mother ($p=0.008$), age of father ($p=0.008$), religion ($p=0.018$) and tribe

($p=0.017$) of parents. It was seen that as educational status of the father increased to tertiary level, rate of vaccine hesitancy increased ($p=0.02$). There was no association between mother's education, socioeconomic status towards hesitancy/refusal of vaccines ($p=0.06$); (Table 4).

Table 4: Factors associated with vaccine hesitancy and refusal among respondents.

Variable	Ever Hesitated or Refused Vaccines		Test Statistic	p-value
	Yes	No		
Age of Mother				
18 – 29	110 (71.9)	144 (56.9)	FE = 9.319	P = 0.008
30 – 39	41 (26.8)	101 (39.9)		
40 – 49	2 (1.3)	8 (3.2)		
Age of Father				
18 – 29	14 (9.2)	13 (5.2)	FE = 11.63	P = 0.008
30 – 39	83 (54.2)	107 (42.6)		
40 – 49	45 (29.4)	93 (37.1)		
>50	11 (7.2)	38 (15.1)		
Religion of parents				
Islam	145 (94.8)	219 (86.6)	FE = 7.032	P = 0.018
Christianity	8 (5.2)	32 (12.6)		
Traditional	0 (0.0)	2 (0.8)		
Tribe				
Hausa/ Fulani	120 (90.8)	208 (82.2)	$\chi^2 = 5.725$	P = 0.017
Others	14 (9.2)	45 (17.8)		
Educational Status of Mother				
None	29 (19.0)	41 (16.2)	FE = 4.121	P = 0.25
Primary	13 (8.5)	29 (11.5)		
Secondary	85 (55.6)	123 (48.6)		
Tertiary	26 (17.0)	60 (23.7)		
Educational Status of Father				
None	15 (9.8)	13 (5.1)	FE = 8.830	P = 0.02
Primary	0 (0.0)	2 (0.8)		
Secondary	32 (20.9)	81 (32.0)		
Tertiary	106 (69.3)	157 (62.1)		

Marital Status of Mother				
Married	149 (97.4)	241 (95.3)	FE = 5.022	P = 0.066
Single	3 (2.0)	2 (0.8)		
Divorced	1 (0.7)	10 (4.0)		
Mother's Employment				
Unemployed	132 (86.3)	203 (80.2)	x ² = 2.408	P = 0.121
Employed	21 (13.7)	50 (19.8)		
Father's Employment				
Unemployed	54 (35.3)	75 (29.6)	x ² = 1.404	P = 0.236
Employed	99 (64.7)	178 (70.4)		
Socio-Economic Status				
Low	131 (85.6)	228 (90.1)	FE = 5.186	P = 0.055
Medium	19 (12.4)	25 (9.9)		
High	3 (2.0)	0		
Average Monthly Income (₦)				
1000 – 50 000	53 (34.6)	76 (30.0)	FE = 1.089	P = 0.847
51 000 – 100 000	77 (50.3)	135 (53.4)		
101 000 – 200 000	22 (14.4)	40 (15.8)		
≥ 200 000	1 (0.7)	2 (0.8)		

FE = Fisher's Exact test

Logistic Regression Analysis on Sociodemographic Variables Affecting Vaccine Hesitancy and Refusal

Those factors that were significant on bivariate analysis (age of mother, father, religion, tribe of parents and educational level of father) were further analysed by logistic regression analysis to assess the significant predictors of vaccine hesitancy and refusal. Table 5 shows that age of mother and educational status of father

remained significant predictors of vaccine hesitancy and refusal. For the mother's age, the adjusted Odds' ratio was 1.962 implying that younger mothers less than 30 years were more likely to be vaccine hesitant. For the father's educational status, the adjusted Odds' ratio was 1.975 implying that fathers with tertiary education were almost 2 times more likely to be vaccine hesitant and refuse vaccinations.

Table 5: Logistic regression analysis on sociodemographic variables affecting vaccine hesitancy and refusal.

Variable	Adjusted Odds ratio (aOR)	95% C.I		p-value
		Lower	Upper	
Religion of Parents				
(Islam vs others)	2.164	0.617	- 7.592	0.228
Tribe				
(Hausa/Fulani vs others)	1.101	0.522	- 2.324	0.801
Mother's Age				
(18-29 years vs others)	1.962	1.221	- 3.151	0.005
Father's Age				
(18-29 years vs others)	1.756	0.762	- 4.045	0.186
Father's Educational Status				
(Tertiary level vs others)	1.975	1.201	- 3.248	0.007

Perception of Respondents on Childhood Vaccination

Majority of the respondents felt their community leaders agreed with vaccination and almost a third, 119 (29.3%) had ever received negative information on vaccination before (Table 6). About 9.4% felt their health workers did not support vaccination while 12.1% and 14.0% felt their political and religious leaders do not support it. On the percentage agreement of the respondents

with the Likert scale questions overall, there was strong agreement to all the questions. The least mean score was to the question on risks of newer vaccines and about two-thirds of respondents (63%) felt that newer vaccines were riskier while 90 (22.2%) were unsure. The larger proportion of disagreement was to the question on children not needing vaccines for diseases that are no longer common (Table 7).

Table 6: Perspectives on vaccine hesitancy & refusal.

Perspectives on Vaccine Hesitancy & Refusal	Yes	No
Are there any other pressures in your life that prevented you from getting your child vaccinated on time?	86 (21.2)	320 (78.8)
Have you ever received negative information about vaccination?	119 (29.3)	287 (70.7)
Do leaders (political) in your community support vaccination?	357 (87.9)	49 (12.1)
Do leaders (religious) in your community support vaccination?	349 (86.0)	57 (14.0)
Do teachers in your community support vaccination?	332 (81.8)	74 (18.2)
Do health care workers in your community support vaccination?	368 (90.6)	38 (9.4)

Table 7: Perception of respondents on vaccines (Likert scale).

Variables	Frequency (%)	Median (IQR)
Childhood Vaccines are Important for my Child’s Health		
Strongly disagree	1 (0.2)	5 (5 – 5)
Disagree	5 (1.2)	
Unsure	5 (1.2)	
Agree	66 (16.3)	
Strongly agree	329 (81.0)	
Childhood Vaccines are Effective		
Strongly disagree	21 (5.2)	4 (4 – 5)
Disagree	23 (5.7)	
Unsure	22 (5.4)	
Agree	152 (37.4)	
Strongly agree	188 (46.3)	
Having my Child Vaccinated is important for the Health of Others in my Community		
Strongly disagree	1 (0.2)	5 (4 – 5)
Disagree	21 (5.2)	
Unsure	32 (7.9)	
Agree	102 (25.1)	
Strongly agree	250 (61.6)	
All Childhood Vaccines offered by the Government Program in my Community are Beneficial		
Strongly disagree	2 (0.5)	5 (4 – 5)
Disagree	22 (5.4)	
Unsure	35 (8.6)	
Agree	139 (34.2)	
Strongly agree	208 (51.2)	
New Vaccines carry More Risks than Older Vaccines		
Strongly disagree	17 (4.2)	4 (3 – 5)
Disagree	42 (10.3)	
Unsure	90 (22.2)	
Agree	128 (31.5)	
Strongly agree	129 (31.8)	
The Information I have received about the Vaccination Program is Reliable and Trustworthy		
Strongly disagree	21 (5.2)	5 (3 – 5)
Disagree	36 (8.9)	
Unsure	51 (12.6)	
Agree	56 (13.8)	
Strongly agree	242 (59.6)	

Getting Vaccines is a Reliable way to Protect my Child/Children from Disease		
Strongly disagree	2 (0.5)	5 (4 – 5)
Disagree	19 (4.7)	
Unsure	14 (3.4)	
Agree	114 (28.1)	
Strongly agree	257 (63.3)	
Generally, I do what my Health Care Provider Recommends about Vaccines for my Child		
Strongly disagree	3 (0.7)	5 (4 – 5)
Disagree	11 (2.7)	
Unsure	41 (10.1)	
Agree	121 (29.8)	
Strongly agree	230 (56.7)	
I am Concerned about Serious Side Effects of Vaccines		
Strongly disagree	3 (0.7)	4 (4 – 5)
Disagree	21 (5.2)	
Unsure	23 (5.7)	
Agree	184 (45.3)	
Strongly agree	175 (43.1)	
My Child/Children do not need Vaccines for Diseases that are no Longer Common		
Strongly disagree	31 (7.6)	5 (3 – 5)
Disagree	51 (12.6)	
Unsure	36 (8.9)	
Agree	46 (11.3)	
Strongly agree	242 (59.6)	

IQR = Inter Quartile Range

Reports of Side Effects and Other Concerns

About 239 (59.2%) said their children had experienced side effects of the vaccine. The commonest side effect was attributed to BCG and Pentavalent vaccine which were fever, excessive crying and scar formation from BCG vaccine. Prior negative information gotten about the vaccines include perceived handicap from the vaccine, perceived causing of infertility. Others also mentioned scar formation from BCG and high fever.

DISCUSSION

The vaccine hesitancy and refusal rate from this study was 37.7% which was much higher than reported rate of 17% in a similar study carried out in a community in India²¹ and that conducted in Egypt by Masters of 3.7%.²² The increasing trend of vaccine refusal as the immunization schedule progresses is concerning and may lead to reversal of gains of herd immunity against these child killer diseases. The reasons adduced for vaccine hesitancy and refusal among the respondents mainly had to do with lack of information, father/family refusal of vaccines and fear of side effects unlike in the Egypt study where it was mainly due to fear of needles with less concern for side effects [12]. Fathers education status was related to vaccine hesitancy and tertiary level of education was found to be a significant predictor. More educated fathers were more likely to be hesitant and this probably would have influence on the eventual decision of the mothers since fathers or extended family are the main decision makers especially in African setting as shown by Nyquist in her Ugandan study [23]. A study from Kebbi in North-

western Nigeria also showed a surprising finding of a high rate of vaccine hesitancy among medical doctors of which males accounted for 81% of that study population [24]. In a study in United States, affluence and high socio-economic status was also found to be a predictor of vaccine hesitancy [25]. Even though the context and settings of studies may differ given that there is a disproportionate burden of vaccine-preventable disease and where most childhood vaccinations are administered, it is important that studies on risk factors for vaccine hesitancy should be a priority in these areas as opined by Wagner [21].

Even though not significant in this study, the higher proportion of tertiary level educated mothers were not hesitant or refused vaccination in this study compared to less educated mothers. The Indian study also showed more educated mothers were less likely to be vaccine hesitant.²¹ However father or family decisions makes mothers to be more complacent so as not to go against the decision of the family.²³ In other studies by Shapiro and Ren, education level was significantly associated with vaccine hesitancy with Ren pointing out that lower education was associated with a greater degree of belief that new vaccines carry more risks.^{19, 20} This assertion also accounted for the highest proportion of unsure responses in the Likert scale questions in this study as 22.2% were unsure. Younger mothers in this study were also more likely to be vaccine hesitant and it was a significant predictor. This is not unexpected given that they are more likely to be less educated, less experienced and may be easily more influenced than their older counterparts by their husbands/family decisions. Studies

by Aldhakil and Elba Razi also showed that younger mothers were more vaccine hesitant due to their inexperience with childhood vaccinations as new mothers unlike those who had previous children [26,27].

More caregivers expressed agreement with the need for and importance of child vaccination (97.3%) similar to reports from other countries like India, China and Ethiopia were about 95% expressed overall positive attitude to vaccines [22,28,29] however 29.3% did not think the information they got from the vaccination program was reliable. This was higher than obtained from other studies where almost all respondents agreed that the vaccination program information was adequate [21,22]. Boulton [30] in a study in China had found that parents who had information from a medical practitioner were less likely to be vaccine hesitant. However, with previous findings from the Kebbi study of anti-vaccine sentiments even among medical doctors are worrisome and need to be addressed for appropriate information to get through to care givers [24]. Elba Razi in his study noted that health personnel do not receive adequate training to combat vaccine hesitancy and since they play an important role in influencing patients' decisions regarding undergoing vaccination, their confidence in addressing vaccine hesitancy must be improved [27]. This is really concerning given that almost 30% of caregivers in this study confessed to receiving negative information about vaccination even though their sources of information were not asked. A large proportion got information on "handicap" most probably referring to vaccine associated paralytic polio and also perceived infertility in the future. These reasons have been documented as anti-vaccine sentiments since more than a decade ago in Northern Nigeria by Jegede [31] and are still prevalent in the community possibly exposing an information gap.

This may now even be compounded by the current COVID-19 pandemic and the widespread anti-vaccine sentiments associated with the economic and political decisions being taken to curb the spread. The bulk of unsure response was the questions on risks of new vaccines and about two-thirds agreed that newer vaccines were riskier. There is a genuine fear that these sentiments in addition to the already existing lack of access will also greatly lower the rate of routine immunizations. Even though majority of the mothers in this study especially the educated ones affirmed acceptability of the vaccines if available, actually submitting themselves for the process may be hindered by other reasons predominant in the sociodemographic mile. Many still do not believe the infection is true while others admitted lack of understanding as the reasons for their lack of acceptance. Safety of vaccines was found to be the main reason for vaccine hesitancy in a survey carried out across 10 Low Middle-income countries (LMIC) in a study by Solis in 2021.

CONCLUSION

Vaccine hesitancy is high among the population of care givers attending health facilities in Sokoto and increased with the latter vaccines in the immunization schedule. Poor knowledge and information, family/fathers refusal of vaccination were reasons given. Tertiary educated fathers and younger mothers had more vaccine hesitancy. It is recommended that, more effort is required to educate and illustrate vaccines success stories across the globe, particularly highlighting the rarity of their perceived side effects. Trained vaccine educators in the facility and community may also help to bridge this gap if done consistently. Limitations of the study is being a facility-based study unlike a community based which

maybe more reflective as those who attend health facilities are more likely to accept interventions provided.

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