Original Article

Low Immunization Completion among Under-Five Children: Are Underserved Nomadic and Farming Communities in a North Central State of Nigeria doing Better?

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Received: 26-Sep-2022;
Revision: 10-Jan-2023;
Accepted: 26-Jan-2023;
Published: 14-Jul-2023

Abstract

Background: The recent drop in immunization coverage in Nigeria has left more than 3.25 million children unimmunized and has risen concern over immunization completion among the under-five children. More so among underserved communities of pastoralist nomads and farmers that were isolated from immunization services because of operational and sociocultural factors. **Materials and Methods:** A cross-sectional analytical (comparative analysis) study was carried out among 550 eligible caregivers of under-five children in nomadic and farming communities in Niger State, Nigeria. The mothers and caregivers paired with under-five children were recruited into the study using a multistage sampling technique. Data was collected using a validated interviewer-administered questionnaire. Data was analyzed with the statistical software package (version 23). **Results:** More than half of the under-five children studied were males in both the nomadic (57.5%) and farming (52.0%) communities. The aggregated score of immunization knowledge was significantly ($P < 0.001$) better (Good 44.4%; Fair 49.8%) among farmers compared to their nomads' counterpart (Good 21.1%; Fair 43.6%). Conversely, almost all the respondents (98.2%) in nomadic community significantly had a good overall perception of childhood immunization compared to 77.1% in the farming community. More farmers' children (99.6%) had received immunization compared to 92.4% of the nomads' children. About 87.3% of farmers compared to 76% of the nomads' (76.0%) children reported immunization completion. About 50.5% of the farmers' and 41.4% of the nomads' children have achieved immunization on card inspection. **Conclusion:** This study revealed that average immunization completion reported among under-five children in both farming and nomadic communities is higher than the national average. It is recommended that more strategies are needed to intensify immunization campaigns targeted at populations in Nigeria.

Keywords: *Children, farmers, immunization completion, nomads*

Introduction

The introduction of appropriate vaccines for routine use on infants has resulted in drastic reductions in vaccine-preventable diseases.[1] The rapid impact of vaccines on communities and populations is almost immediate. For example, between 2000 and 2018, vaccination reduced global deaths from measles by 73% from 536,000 deaths to 142,000 deaths in 2018 preventing an estimated 23.2 million.[2] Except for safe water, no other strategy has had high impact in the reduction of mortality and morbidity and on population growth[3] To sustain the gains from the

Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/njcp.njcp_652_22

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How to cite this article: Nwachukwu BC, Alatishe-Muhammad BW, Ibizugbe S, Alake DI, Bolarinwa OA. Low immunization completion among under-five children: Are underserved nomadic and farming communities in a North Central State of Nigeria doing better? Niger J Clin Pract 2023;26:709-19.

global immunization program, both immunization coverage and completion of the eligible children are important. This is because, both immunization completion and coverage confer herd immunity. In 2011, nearly 107 million infants (83%) worldwide received at least three doses of the Penta vaccine; however, approximately 22.4 million failed to receive three doses, leaving large numbers of children susceptible to vaccine-preventable diseases and death.[4] Nearly 8.4 million received at least one Penta dose but dropped out before completing the three-dose series. One out of five infants worldwide does not receive three life-saving doses of diphtheria, tetanus, and pertussis vaccines (incomplete vaccination).[4]

In Nigeria, only 18.5% of children were appropriately immunized (complete immunization) for age by immunization card while 19.1% was appropriately immunized for age by card and history. Immunization rates in northern Nigeria are some of the lowest in the world. According to the National Demographic Health Survey (2018), the percentage of fully (complete) immunized infants in the targeted states was less than 16.2% in Jigawa, 12.9% in Yobe, 4.0% in Zamfara, and 10.8% in Katsina. According to the 2021 Multiple Indicator Cluster Survey/ National Immunization Coverage Survey (MICS/NICS), the percentage of fully (complete) immunized infants in the zones are as follows: North Central 32%, North East 24%, North West 25%, South East 57%, South West 50%, South South 49%, with a national average of 36%.[5] As a result, thousands of children are victims of vaccine-preventable diseases. Approximately, 29% of deaths in children under five are vaccine preventable.[6] Each year, an estimated number of two–three million children die of vaccine-preventable diseases.[6]

One of the major barriers to achieve higher immunization coverage and completion in Nigeria is the difficulty to reach underserved communities that were isolated from immunization services because of operational and sociocultural factors.[7] These underserved populations included nomadic Fulani pastoralist groups, migrant farmers and fishermen, and inhabitants of scattered, border, and other hard-to-reach settlements. Until recently, microplans for polio Supplemental Immunization Activities in most local government areas (LGAs) did not typically include migrant and mobile populations or scattered settlements.[7] The unavailability of data on under-five immunization completion rates among the nomadic and farming communities also make an adequate estimation of the gap in reaching the underserved population in Nigeria difficult. Only a few studies are available in Nigeria to have reported immunization status of pastoralists and agriculturalists (farmers). A study of the Fulani nomadic tribes in the northern state of Borno reported that 99% of the children younger than five years had not received any polio or routine immunization vaccines (so-called zero-dose children).[7] The World Health Organization as of August 24th, 2020, certified Nigeria and the rest of Africa were formally free of the Wild Polio Virus,[8] however, by May 2022, a case of wild poliovirus type 1 was reported in Mozambique.[9]

In Africa, nomads have the least access to any health services, and no satisfactory strategy has been devised to deliver proper health care to remote populations. Their major causes of mortality and morbidity are largely preventable infectious diseases.[10] Despite the efforts of national governments and international organizations, health programs for nomads have proved to be costly and sometimes ineffectual.[10] Given their lifestyle, systematic surveillance data on the health status of nomads are practically nonexistent. Most information is based on specific, often small-scale studies each providing a small part of the overall picture. This study in nomadic and farming communities is aimed at identifying the inequitable factors that affect immunization completion in these communities which are known as underserved communities. The information obtained from this study is expected to fill gaps seen in the availability of studies done on factors of vaccination incompletion and completion which may vary among communities. The result of the study will also help to inform program managers to consider the important contributing factors for incomplete vaccination while planning to improve vaccination programs.

Materials and Methods

The study was carried out in Bosso, LGA of Niger State in North-Central Nigeria among caregivers of under-five children (within nine months to five years) in the nomadic and farming communities. It was a cross-sectional analytical (comparative analysis) study of under-five immunization completion between the nomadic and farming communities. The sample size was calculated using the formula for the determination of a cross-sectional analytical (comparative) study.[11] We assumed a standard normal deviate corresponding to the power of 90% (1.28) and the confidence level of 95% for a tailed test (1.96). With immunization coverage for the nomadic communities of 6.5% from the past study,[12] 16% of the immunization coverage

for rural agrarian communities from a Nigerian survey[13] and an assumption of 90% response rate, a total of 275 respondents were estimated for caregivers of under five in each of the nomadic and farming communities. The mothers, caregivers, fosters, and guardians with children under five who had been living in nomadic and farming communities for about six months and were physically present at the time of the research were included in the study. Parents who were visitors, or recent settlers were excluded from the study.

A multistage sampling method was used to select the respondents in the nomadic and farming communities. All the eight wards in Bosso LGA that were predominantly rural areas were selected for this study. Four wards each were selected for farming and nomadic. For the nomadic sites, the wards were Kampala, Kodo, Maikunkele, and Garatu while the farming communities were Beji, Shatta, Chanchaga, and Maitumbi wards. Thereafter, two communities were selected from each of the four (4) wards in both the nomadic and farming communities using simple random sampling by balloting. There was a household listing from the selected communities for which the households were selected by systematic random sampling in the two communities. A sampling interval of one (1) was applied to all the communities starting from the village head household. In a house with a single mother with under-five children, all the under-five children were assessed. However, in a household with more than one mother with under-five children, a mother was selected by simple random sampling by balloting. In a house with more than one household, a simple random sampling by balloting was used to select a household. A household without under five was skipped until a household with under five was selected.

The research tool was pretested at a community in Chanchaga LGA, Niger State for validation. A semi-structured questionnaire was used to evaluate the sociodemographic characteristics, knowledge, and perception of caregivers on immunization and accessibility to childhood immunization services. Immunization cards were checked, and the history of immunization was obtained for those without immunization cards. The knowledge and perception were scored using the 0–1 scale, where "1" was assigned for every positive response and "0" for negative responses. Respondents who scored between 0 and 2 were regarded to have poor knowledge/poor perception of immunization, those who scored between 3 and 5 were regarded to have fair knowledge/ fair perception of immunization, while those who score 6–8 were regarded to have good knowledge/ good perception of immunization. Ethical approval was obtained from the Ethical Review Committee of University of Ilorin, Nigeria.

Data analysis was done using statistical software package version 23. Results were presented using tables, graphs, and charts as required. The correct intervals for immunization were calculated by comparing the dates of vaccination with the date of birth. The child was described as "completely immunized" if he/she had a Bacille Calmette-Guerin (BCG) scar and had received all the Expanded programme on immunization (EPI) vaccines within the minimum intervals of time as specified by Nigeria National Program on Immunization, that is Penta/ Oral polio vaccine (OPV) first dose, not before six weeks of age with an interval of at least four weeks between doses and measles vaccine not before nine months of age. Immunization completion status was obtained after a child has taken all the doses of vaccines required from birth to nine months. Associations between factors and complete immunization status were tested using the Chi-square test. A confidence interval level was set at 95% and *a P-value of* <0.05 was considered statistically significant.

Results

The mean age of the respondents in the nomadic communities was 29.66 ± 7.58 while the mean age of respondents in farming communities was 30.38 ± 7.48. Majority of the respondents (98.5%) in nomadic communities were Fulani whereas Gwari (84.7%) accounts for the majority of respondents in the farming communities [Table 1]. Islam was the religion practiced by most of the respondents, 99.3% and 89.8% in the nomadic and farming communities, respectively [Table 1]. The ability to read and write is significantly low among the nomads (3.6%) than the farmers (58.2%) while none of the nomads attained tertiary education [Table 2]. The farmers significantly ($P < 0.001$) have higher (21.5%) monthly income above minimum wage than the nomads (0.5%) [Table 2]. In both the nomadic and farming communities, the caregivers were predominantly females (99.3% and 94.1%, respectively) but some males were seen in both the nomadic (0.7%) and farming (5.5%) communities as caregivers. More than half of the under-five children surveyed were males in both the nomadic (57.5%) and farming (52.0%) communities with an age range of 9–30 months constituting 69.1% and

Table 1: Group equivalence of sociodemographic characteristics of caregivers in nomadic and farming communities

Variables	Communities		χ^2/t	*P*
	Nomadic (%) *n*=275	Farming (%) *n*=275		
Age group of caregiver			22.638	<0.001*
≤20	23 (8.4)	13 (4.7)		
21-30	142 (51.6)	159 (57.8)		
31-40	76 (27.6)	87 (31.6)		
41-50	31 (11.3)	7 (2.5)		
≥51	3 (1.1)	9 (3.3)		
Mean±SD	29.66±7.58	30.38±7.48	-1.126	0.261
Tribe				
Hausa	2 (0.7)	37 (13.5)		
Gwari	0 (0.0)	233 (84.7)		
Nupe	2 (0.7)	5 (1.8)		
Fulani	271 (98.5)	0 (0.0)		
Religion			23.833	<0.001*
Islam	273 (99.3)	247 (89.8)		<0.001
Christianity	2 (0.7)	28 (10.2)		
Gender			9.707	0.002*
Male	2 (0.7)	16 (5.9)		
Female	273 (99.3)	259 (94.1)		<0.001
Marital status			8.118	0.017
Single	5 (1.8)	0 (0.0)		
Married	267 (97.1)	275 (100.0)		
Widowed	3 (1.1)	0 (0.0)		0.249

**P* is significant, [f]=Fisher's exact in Blue, χ^2/t=Chi square/*t*-test

Table 2: Group equivalence of socioeconomic characteristics of caregivers in nomadic and farming communities

Variables	Communities		χ^2/t	*P*
	Nomadic (%) *n*=275	Farming (%) *n*=275		
Ability to read and write			191.563	<0.001*
Yes	10 (3.6)	160 (58.2)		
No	265 (96.4)	115 (41.8)		
Level of education			153.394	<0.001*
No formal education	262 (95.3)	131 (47.6)		
Basic education	13 (4.7)	130 (47.3)		
Tertiary	0 (0.0)	14 (5.1)		
Occupation			140.815[f]	<0.001*
Housewife	266 (96.7)	144 (52.4)		
Farming	3 (1.1)	78 (28.4)		
Herder	2 (0.7)	3 (1.1)		
Others	4 (1.5)	50 (18.1)		<0.001
Monthly income			40.805	<0.001*
≤18,000	181 (99.5)	146 (78.5)		
>18000	1 (0.5)	40 (21.5)		

**P* is significant, [f]=Fishers exact, χ^2/t=Chi square/*t*-test

62.9%, respectively. The second and the third child constitute 84 and 13 children in the nomadic and 64 and 23 children seen in the farming households, respectively [Table 3].

The caregivers from both communities got information on immunization majorly from the health facilities and places of worship. In addition, the farming communities reported community meetings, home visits by health workers, and television as other sources of receiving immunization information [Figure 1]. In general, the aggregated score for the immunization knowledge of the farming communities was significantly ($P < 0.001$) better (Good 44.4%; Fair 49.8%) compared to their nomads (Good 21.1%; Fair 43.6%) counterpart [Figure 2]. Specifically, knowledge about BCG vaccines was high and similar

Table 3: Group equivalence of under-five children biodata in nomadic and farming communities

Variables	Communities		χ^2/t	*P*
	Nomadic (%), *n*=275	Farming (%) *n*=275		
Age group of first child (Months)			2.342	0.126
9-35	190 (69.1)	173 (62.9)		
36-60	85 (30.9)	102 (37.1)		
Gender of the first child			1.651	0.199
Male	158 (57.5)	143 (52.0)		
Female	117 (42.5)	132 (48.0)		
Age group of the second child	*n*=84	*n*=61	12.439	<0.001*
9-35	19 (22.6)	31 (50.8)		
36-60	65 (77.4)	30 (49.2)		
Gender of the second child			10.445	0.001*
Male	56 (67.1)	24 (40.0)		
Female	28 (32.9)	37 (60.0)		
Age group of the third child	*n*=13	*n*=23	0.653	0.419
9-35	1 (7.7)	4 (17.4)		
36-60	12 (4.4)	19 (6.9)		0.267
Gender of third child			1.861	0.172
Male	4 (30.8)	13 (54.5)		
Female	9 (69.2)	10 (45.5)		0.293
Relationship with caregiver	*n*=275	*n*=275	11.930	0.008
Mother	270 (98.2)	254 (92.4)		
Father	2 (0.7)	15 (5.5)		
Grandparent	3 (1.1)	5 (1.8)		
Brother	0 (0.0)	1 (0.4)		1.000

*P is significant, [f]=Fisher's exact, χ^2/t=Chi square/t-test

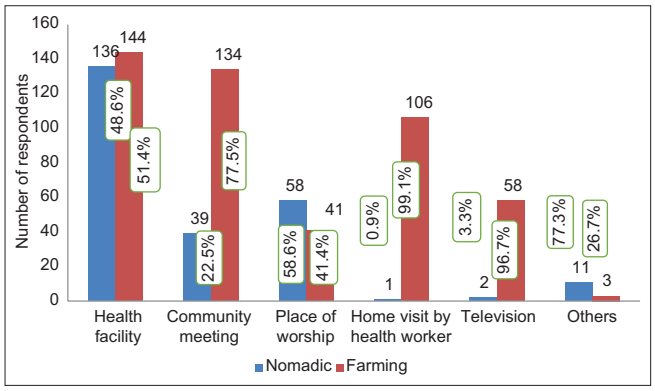

Figure 1: Sources of information of vaccines among the nomadic and farming communities

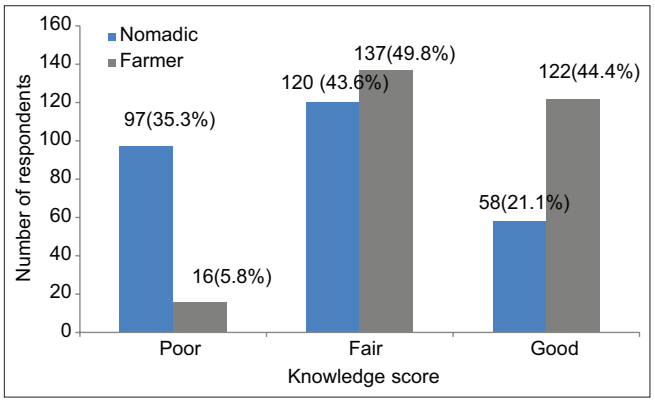

Figure 2: Overall knowledge score of immunization among the nomadic and farming communities. $\chi^2 = 81.942$, $\rho = < 0.001$

among the nomads (92.7%) and the farmers (93.8%) respondents [Figure 3]. Although, the knowledge about individual vaccines was progressively reduced from birth to nine months, the knowledge of the other vaccines was consistently better among the farmers than the nomads' respondents [Figure 3]. Almost all the respondents (98.2%) in the nomadic community had a good overall perception of childhood immunization compared to 77.1% in the farming community. This was found to be statistically significant ($P < 0.001$) (Figure 4).

More farmers' children (99.6%) were reported to have ever received immunization which was significantly higher than the 92.4% reported by the nomadic children from public health facilities [Table 4]. Of the nomadic children that have never received immunization, 66.7% was because the caregivers did not believe in immunization while 33.7% was due to the long distance of the immunization center [Table 4]. Almost all those who got their children immunized, reported a good attitude toward the health workers at the immunization center. More nomadic (73.3%) than the farmers (43.3%) reported complaints

Table 4: Childhood immunization services utilized in nomadic and farming communities

Variables	Communities		Total	χ^2	*P*
	Nomadic (%)	Farmer (%)			
Child ever had immunization				18.939	<0.001*
Yes	254 (92.4)	274 (99.6)	528		
No	21 (7.6)	1 (0.4)	22		
Location of immunization	*n*=254	*n*=274		0.929	0.335
Public PHC	254 (100.0)	273 (99.6)	527		
Others	0 (0.0)	1 (0.6)	1		
Reasons for not taking immunization for a child	*n*=21	*n*=1		1.833	0.400
Vaccination site too far	7 (33.3)	1 (100.0)	8		
Not in favor of immunization	13 (4.7)	0 (0.0)	13	0.0001	
Attitude of health worker	*n*=254	*n*=274		5.712	0.017
Good	254 (100.0)	268 (97.8)	522		
Not good	0 (0.0)	6 (2.2)	6		
Child suffered complaints					
Yes	186 (73.3)	120 (43.3)	306		
No	68 (26.7)	154 (56.7)	222		
Type of complaints	*n*=186	*n*=120		51.251	<0.0001*
Fever	97 (52.2)	32 (28.1)	129		
Pain	61 (32.8)	81 (65.8)	142		
Excessive crying	28 (15.1)	2 (1.8)	30		
Others	0 (0.0)	4 (1.5)	4		0.124
Other health services enjoyed	*n*=254	*n*=274		17.905	<0.001*
Treatment of minor injuries	162 (63.8)	135 (49.4)	297		
Treatment of minor ailments	42 (16.5)	47 (17.0)	89		
Antenatal care	50 (19.7)	84 (30.8)	134		
Drugs	0 (0.0)	8 (2.8)	8		
Missed opportunity					
Yes					
No					

**P* is significant, [f]=Fisher's exact

Table 5: Vaccine completion among under-five children in nomadic and farming communities

Variables	Communities		χ^2	*P*
	Nomadic (%)	Farmer (%)		
Child has a health passport			11.703	0.003*
Yes, with caregiver	209 (76.0)	240 (87.3)		
Yes, not with caregiver	43 (15.6)	22 (8.0)		
No	23 (8.4)	13 (4.7)		
Immunization completion			4.257	0.039
Yes	113 (41.4)	139 (50.5)		
No	162 (58.9)	134 (49.5)		

**P* is significant, [f]=Fisher's exact

after immunization which were mostly fever and pains. About 87.3% of farmers compared to 76% of the nomads (76.0%) claimed their children have completed immunization evident with vaccination card [Table 5]. However, on the inspection of the vaccination card, only 50.5% of the farmers' and 41.4% of the nomads' children have achieved immunization [Table 5]. Table 6 depicts the pattern of immunization completion gradient from full completion at birth with BCG and a gradual drop to an average at nine months with yellow fever and measles in both communities.

Among the nomad communities, age ($P = 0.017$), knowledge ($P < 0.001$), and child with vaccine reactions ($P < 0.001$) are major factors affecting under-five children immunization completion (Table 7) The significant factors influencing immunization completion among under-five children in farming communities were perception ($P < 0.001$),

Table 6: Pattern of vaccine completion among under-five children with vaccination card uptake for vaccines

Vaccine type	Nomadic (*n*=209)			Farmers (*n*=240)		
	1st child (*n*=209, %)	2nd child (*n*=30, %)	3rdd child (*n*=4, %)	1st child (*n*=240, %)	2nd child (*n*=58, %)	3rd child (*n*=18%)
BCG	207 (99.0)	30 (100)	4 (100)	240 (100)	58 (100)	18 (100)
HBV	193 (92.0)	29 (96.0)	4 (100)	229 (95.4)	52 (89.7)	16 (88.9)
OPV						
Dose 0	194 (92.8)	27 (90.0)	4 (100)	240 (100)	51 (87.9)	16 (88.9)
Dose 1	185 (88.6)	27 (90.0)	4 (100)	224 (93.3)	48 (82.8)	15 (83.3)
Dose 2	178 (85.2)	28 (93.3)	4 (100)	221 (92.1)	48 (82.8)	15 (83.3)
Dose 3	167 (79.9)	25 (83.3)	3 (75.0)	215 (89.6)	47 (77.6)	15 (83.3)
PENTA						
Dose 1	180 (86.1)	26 (86.7)	3 (75.0)	227 (94.6)	50 (86.2)	16 (88.9)
Dose 2	166 (79.4)	26 (86.7)	3 (75.0)	210 (87.5)	45 (77.6)	17 (94.4)
Dose 3	147 (70.3)	20 (86.7)	3 (75.0)	204 (85.0)	42 (72.4)	14 (77.7)
PCV						
Dose 1	169 (80.9)	26 (86.7)	3 (75.0)	208 (86.7)	41 (70.7)	15 (83.3)
Dose 2	156 (74.6)	25 (83.3)	3 (75.0)	194 (80.8)	37 (63.8)	13 (72.2)
Dose 3	132 (63.2)	18 (66.0)	3 (75.0)	186 (77.5)	36 (62.1)	12 (66.7)
IPV	120 (57.4)	20 (66.7)	2 (50.0)	176 (73.3)	31 (53.4)	12 (66.7)
Measles	113 (54.1)	22 (73.3)	3 (75.0)	132 (55.0)	40 (70.0)	16 (88.9)
Yellow fever	109 (52.2)	21 (70.0)	3 (75.0)	136 (56.7)	36 (62.1)	14 (77.7)

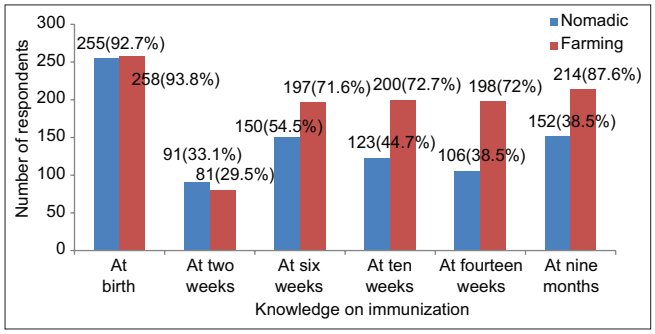

Figure 3: Knowledge on immunization schedules among the nomadic and farming communities

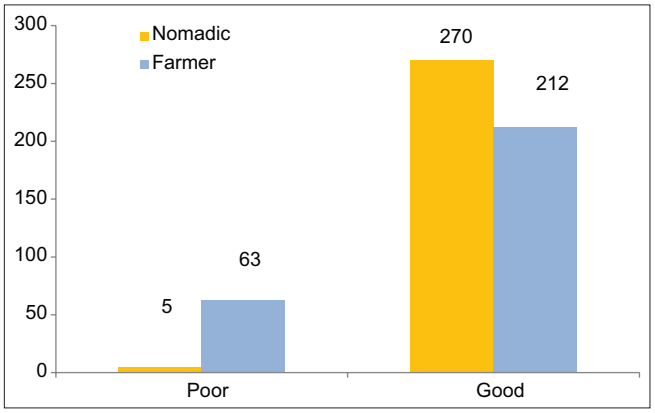

Figure 4: Overall perception of immunization among the nomadic and farming communities. $\chi^2 = 56.450$, $\rho = < 0.001$

missed opportunity ($P = 0.014$), and vaccine reactions ($P < 0.001$) (Table 8).

Discussion

Caregivers in the age group 21–30 years accounted for a greater part of both the farming and nomadic communities studied. This finding is corroborated by other studies in China,[14] Bauchi,[15] and North Central Nigeria[16] that reported similar mean age for caregivers and a higher proportion of respondents within the same age group. This implies that the majority of the respondents had birthed before the age of 30 years, thus high reproductive rate is envisaged among the study communities. The highest proportions of respondents are Gwari among farmers and Fulanis among the nomads.

The gender distribution among the under-five children shows that males were higher than females among the first and second born but was reversed by the third born. For both groups, the mothers were predominantly the caregivers. The ability to read and write (education) is an important determinant of an individual's attitude toward life. In this study, the highest proportion of caregivers in both communities had no formal education. This finding is similar to the finding of studies done in Katsina[17] and the National Demographic Health Survey[18] which reported that over 64.4% of women had no formal education in the North East Zone of the country with rural women less likely to be educated than their urban peers. The implication of this is that, uneducated women are less likely to take informed decisions as regards childhood immunization. Majority of nomads while a little more than half of farmers were full-time housewives, this is corroborated by similar reports from East

Table 7: Association between sociodemographic and economic characteristics and immunization completion

Variables	Nomadic			*P*	Farmers			*P*
	Yes (%)	No (%)	χ^2		Yes (%)	No (%)	χ^2	
Age group of caregivers			12.049	0.017*			4.848	0.303
≤20	6 (26.1)	17 (73.9)			6 (46.2)	7 (53.8)		
21-30	64 (45.1)	78 (54.9)			84 (52.8)	75 (47.2)		
31-40	23 (30.3)	53 (69.7)			41 (47.1)	46 (52.9)		
41-50	19 (61.3)	12 (38.7)			2 (28.6)	5 (71.4)		
≥51	1 (33.3)	2 (66.7)			2 (22.2)	7 (77.8)		
Gender			0.066[f]	1.000			0.194	0.660
Male	1 (50.0)	1 (50.0)			7 (43.8)	9 (56.3)		
Female	112 (41.0)	161 (59.0)			128 (49.4)	131 (50.6)		
Monthly income			0.843[f]	1.000			2.662	0.112
≤18,000	98 (54.1)	83 (45.9)			76 (52.1)	70 (47.9)		
>18000	1 (100)	0 (0.0)			15 (37.5)	25 (62.5)		
Ability to read and write			1.533	0.216	76	70	1.187	0.276
Yes	6 (60.0)	4 (40.0)			83 (51.9)	77 (48.1)		
No	107 (40.4)	158 (59.6)			52 (45.2)	63 (54.8)		

**P* is significant. [f]=Fisher's exact

Table 8: Association between individual/health facility factors and immunization completion

Variables	Nomadic			*P*	Farmers			*P*
	Yes (%)	No (%)	χ^2		Yes (%)	No (%)	χ^2	
Knowledge			62.946	<0.001*			2.357	0.308
Poor	14 (14.4)	83 (85.6)			5 (31.3)	11 (68.8)		
Fair	53 (44.2)	67 (55.8)			67 (48.9)	70 (51.1)		
Good	46 (79.3)	12 (20.7)			63 (51.6)	59 (48.4)		
Perception			3.185[f]	0.163			26.910	<0.001*
Poor	4 (80.0)	1 (20.0)			49 (77.8)	14 (22.2)		
Good	109 (40.4)	161 (59.6)			86 (40.6)	126 (59.4)		
Missed Opportunity			1.726	0.189			6.371	0.014*
Yes	8 (61.5)	5 (38.5)			31 (67.4)	15 (32.6)		
No	104 (43.0)	138 (57.0)			94 (46.8)	107 (53.2)		
Child with vaccine reaction			28.981	<0.001*			17.298	<0.001*
Yes	101 (54.0)	86 (46.0)			74 (63.8)	42 (36.2)		
No	11 (16.2)	57 (83.8)			58 (38.2)	94 (61.8)		
Transport time to immunization center			3.721	0.054			2.035	0.167
<30 mins	51 (52.6)	46 (47.4)			92 (48.7)	97 (51.3)		
>30 mins	41 (39.0)	64 (61.0)			10 (34.5)	19 (65.5)		

**P* is significant, [f]=Fisher's exact

China, Asia[14] and Lagos,[19] Nigeria where more mothers were unemployed. This finding from this study reflects a high level of uneducated among the farmers and nomadic caregivers. Similarly, less than a quarter of the respondents earned more than eighteen thousand (N18,000) minimum wage. Evidence is abounded on the strong associations between female education, empowerment, and child survival.

All the respondents in both communities were aware of immunization which was basically communicated across by health workers in the health facility in the region. Prior studies have shown that improving a caregiver's health literacy and knowledge about the benefits of vaccination were associated with an overall increase in full vaccination coverage.[20] High level of immunization awareness among respondents in this study could be attributed to continuous sensitization and education about the importance of immunization by health workers and continuous surveillance, provision and availability of immunization vaccines, and kits by the government to rural communities.

The study showed that the caregivers in both communities were knowledgeable about vaccine-preventable diseases. This was like a study on parent's knowledge and attitudes on childhood immunization in Taif, Saudi Arabia.[21] It is also

consistent with a study carried out in Lagos, Southwest Nigeria.[20] Most respondents in the farming community were aware of BCG, hepatitis B vaccine (HBV), Penta, Measles, and Yellow fever vaccines than their nomadic counterparts. In the nomadic community, most respondents identified five times the number of times a child should be taken for immunization than the respondents in the farming community. Understanding the number of times, a child should be taken for immunization among mothers and caregivers helped in improving children's immunization status against childhood diseases which gives an indication on how much priority the children's health is given in a country as immunization program is the essential intervention for the protection of children from life-threatening diseases.[20,22]

Generally, the immunization knowledge of the farming communities was significantly better than the nomads. This is like a study done in two counties in Kenya which also concluded that farmers had better knowledge compared to nomads[23] and another study in Africa, a systematic review of articles on immunization uptake in Africa reported a lack of knowledge on vaccines accounted for 50% reason for non-compliance.[24] The implication of this finding is that, when caregivers are provided with good knowledge of child immunization, it will improve immunization uptake and completion. Though the nomads had poorer knowledge, their perception was better than the farmers from this study. A study done among farmers in Gambia[25] also revealed a good perception about immunization completion among the wards. Another study in Enugu, Nigeria concluded that most mothers studied had good knowledge and positive perception and practice of immunization.[26]

Immunization is still one of the most successful public health interventions, despite this, coverage has plateaued over the last decade. The disruptions of the health system during the pandemic strained the system, thus leaving about 25 million children missing out on vaccination in 2021.[5] In this study, farmers' and nomads' children who were reported to have ever received immunization were significantly high. This finding is in contrast to a study at Mizan Aman town, South East Ethiopia where those who have ever received immunization were less than half of those studied.[27] Reasons given for not completing immunization were lack of belief in immunization by caregivers and long distance of the immunization center by both groups in this study. In contrast to this was a study done in the Southern district of Nigeria, which reported caregivers' unemployment and age as reasons for not completing immunization plan.[28] In another study, reasons for parent refusal included negative messages from a third party and belief that the disease was not harmful.[29]

Forum for health educating the caregivers and citing facilities at a closer distance to the farmers and nomads will improve the completion of vaccination for their wards. Almost all of those that have received immunization for their children reported good attitudes toward the health workers at the immunization center. This implies that when accessibility is enhanced, both the farming and nomadic communities will complete vaccination for their wards. More nomads than the farmers reported complaints after immunization, mostly fever and pains. Adverse reactions following immunization are not expected and caregivers should be adequately informed and prepared toward expected reactions. This has also been reported by several studies. In North India, it was reported that a few of the children were unwell following vaccination.[30] More farmers compared to the nomads claimed their children have completed immunization, evident with a vaccination card which doesn't correlate with the vaccination card, which showed a lesser number of completions of vaccination. This has been the case in most instances where vaccination recall is usually higher than that which was recorded on the cards. Comparison of vaccination coverage estimates according to the vaccination card or parental recall resulted in a 5–10% difference in another study in Senegal.[31] In such instances, many who had completed their vaccination may not be ascertained as the immunization cards cannot provide such information.

The national average (36%) and the North Central zonal average (32%) for completion of immunization among children in Nigeria[5] are lower than the findings from this study. This implies that the immunization completion among underserved nomads and farmers population is better than the national and regional average. The high level of awareness among these communities could be adduced to the average level of immunization completion observed in this study.

Among the nomad communities, age, knowledge, and child with vaccine reactions are major factors affecting under-five children immunization completion. The major significant factors influencing immunization completion among under-five children in farming communities are perception, missed opportunity, and vaccine reactions. Vaccine reaction is seen as a joint factor for both communities, and this is a common reason given by many mothers/caregivers for not completing immunization plans. Usually, these vaccine

reactions also known as adverse reactions or side effects are minor ranging from a low-grade fever, fussiness, soreness at the injection site, headache, fatigue, or loss of appetite.[32] A child may rarely experience a severe allergic reaction which must be reported immediately.

Caregivers need information to differentiate severe and minor reactions rather than just abstain from completion of immunization.[33] Other studies gave reasons why parents in their community may not have their children completely vaccinated, and the two most common responses were, being fearful of side effects and ignorance or disinterest.[34] Similarly, a study done in Malaysia reported that knowledge influenced immunization completion and in contrast to the nomad communities, the age of the caregiver was not a significant factor for the completion of immunization.[2] Completion of immunization schedules will have a positive impact in reducing infant, as well as childhood, morbidity, and mortality. Another study in Northwest Nigeria concluded that education, wealth index, religious affiliations, and cost of health care are factors that affect the completion of immunization in Nigeria.[35]

Conclusion

This study was carried out to compare the low immunization completion rate among under-five children in nomadic and farming communities of Bosso LGA, Niger State. In both communities, the major benefits of immunization mentioned by caregivers were that vaccination helps to prevent illness among the children and also identified general health education and counseling as the benefits associated with visiting immunization clinics. The high level of awareness of immunization among caregivers or mothers in both communities was responsible for the average immunization completion among both communities which is found to be higher than the national average. The major reasons were non-acceptance of immunization and vaccination site being too far mentioned. Hence, ensuring immunization completion involves improving the active participation of caregivers in both nomadic and farming communities and creating awareness of the benefits of vaccination.

Knowledge of respondents in nomadic community showed significant relationship with immunization completion while the association between knowledge of respondents in the farming community with immunization completion showed no significant relationship. The perception of respondents in the nomadic community showed no significant relationship with immunization completion while the association between perception and immunization completion in the farming community showed significant relationship. There was no significant relationship between a missed opportunity and immunization completion among the nomadic communities while there was a significant relationship between a missed opportunity and immunization completion for the farming communities.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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