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ORIGINAL ARTICLE

Knowledge and Perception of Diphtheria among Residents of a Rural Community in Kaduna State, Northwest Nigeria

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Keywords

Diphtheria,

Knowledge,

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ABSTRACT

Background: Diphtheria has reemerged as a public health concern in Nigeria, with outbreaks reported across several states. Catch-up vaccination, enhanced surveillance, and risk communication were instituted to curb this. This study determined knowledge and perception of diphtheria among members of a rural community in Kaduna State, Northwestern Nigeria.

Methods: Using a cross-sectional descriptive study design, data were collected from 590 respondents drawn through multistage sampling. Composite knowledge and perception scores were computed and graded using median values as cut-off points for good knowledge and perception. The data was presented using descriptive statistics, while the chi-square test of independence was used to check for association between socio-demographic variables and outcome variables at $p < 0.05$.

Results: The respondents comprised 226 (38.3%) males and 364 (61.7%) females, with a mean age of 33.6 (±6.0) years. Only 117 (19.8%) respondents had ever heard of diphtheria. Among those aware of the disease, only 28 (23.9%) identified germs as causative agents, 26 (22.2%) identified inhalation as a route of transmission, 24 (20.5%) knew diphtheria could cause an epidemic, and 31 (26.5%) identified vaccine as a preventive measure. Most of the respondents (81.2%) had poor knowledge and good perception (68.4%). No statistically significant relationship was observed between sociodemographic variables and Knowledge or perception of Diphtheria.

Conclusion: While the perception of diphtheria was good, knowledge of the disease was poor despite an ongoing outbreak. The Kaduna State government should redouble efforts in community health education and strategic risk communication on diphtheria.

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INTRODUCTION

Diphtheria is a potentially fatal infection caused by toxigenic strains of *Corynebacterium diphtheriae*. It is an acute respiratory infection characterized by the formation of a pseudo membrane in the throat.[1] Despite being a toxic

infection, diphtheria is vaccine-preventable. In Nigeria, the pentavalent vaccine, which contains diphtheria toxoid, is given to children based on the Routine Immunization (RI) schedule of the National Programme on Immunization (NPI).[2] The three doses of vaccine, given at 6, 10, and 14 weeks of life, provide 87% protection against symptomatic disease and a 60% reduction in disease transmission.[2]

The burden of diphtheria has long been reduced in developed countries, while significant successes continue to be reported in low- and middle-income countries.[3] Nigeria has endured several diphtheria outbreaks over the last decades, mirroring a sub-optimal immunity across several demographics within the country.[4] In Northern Nigeria, cases of diphtheria are routinely reported, indicating poor vaccine coverage among children.[2] Since 2022, there has been a re-emergence of diphtheria as a public health concern in Nigeria, with outbreaks reported across several states, including Kaduna State. An estimated seven million people remain unvaccinated and are at risk for infection in the country, especially people living in the Northern part of the country. Between June 30 and August 31, 2023, Nigeria recorded an unusual increase in the number of confirmed cases of diphtheria, where a total of 5898 suspected cases were reported from 59 local government areas in 11 states across Nigeria.[5] The majority (99.4%) of suspected cases of the disease were reported from six states: Kano (1816), Katsina (234), Yobe (158), Bauchi (79), Kaduna (45), and Borno (33).[5] Local health authorities have identified a historical gap in vaccine coverage as one of the major drivers of the current epidemic. As a result, catch-up vaccination, enhanced surveillance, and risk communication have been instituted.[6]

Understanding the knowledge and perception of Diphtheria among residents is important as it would allow the design of effective risk communication strategies to support the outbreak response and improve routine immunization uptake. However, no study has assessed the level of knowledge and Perception towards Diptheria and its outbreak in rural communities in Kaduna State. Thus, this study aimed to determine the knowledge and perception of diphtheria among residents of a rural community in Kaduna State, Northwest Nigeria.

METHODOLOGY

Study area

The study was conducted in Biye, a rural community in Giwa Local Government Area (LGA) of Kaduna State, Nigeria. With an estimated population of 4,785 people as of October 2023, Biye is a predominantly Muslim community with Hausa as the major ethnic group. Residents of the community engage mainly in farming and petty trading. The community has two public primary, one secondary, and several Qur'anic schools. The major health institutions in the community include the Health Centre Biye and two patent medicine stores. Regarding healthcare access, the two major referral centres for the community are General Hospital Giwa and Ahmadu Bello University Teaching Hospital.

Table 1: Sociodemographic characteristics of the respondents in Biye Community (n = 590)

Variable	Frequency	Percent
Age group		
15-24	133	22.5
25-34	212	35.9
35-44	133	22.5
45-54	70	11.9
55-64	31	5.3
65+	11	1.9
Mean ± SD	33.6 ± 6.0	
Sex		
Male	226	38.3
Female	364	61.7
Ethnicity		
Hausa	568	96.2
Fulani	21	3.6
Yoruba	1	0.2
Marital status		
Single	33	5.6
Married	535	90.6
Widowed	14	2.4
Divorced	8	1.4
Education		
None	18	3.1
Quranic	202	34.2
Primary	216	36.6
Secondary	139	23.6
Tertiary	15	2.5
Occupation		
None	92	15.6
Farming	152	25.8
Petty trading	253	42.9
Unskilled labourer	52	8.8
Artisan	24	4.1
Others*	17	2.9

*Others included students, big-time businesses, civil servants, and private workers

Table 2: Awareness and knowledge of diphtheria among residents of Biye Community

Knowledge item	Frequency	Percent
Ever heard of diphtheria (n = 590)		
Yes	117	19.8
No	473	80.2
Sources of information (n = 117) *		
Radio	44	37.6
TV	12	10.3
Newspaper	4	3.4
Family and friends	82	70.1
Health workers	19	16.2
Community outreach	6	5.1
Causes of diphtheria (n = 117)		
Germs	28	23.9
Weather	6	5.1
Don't know	83	71.0
Routes of transmission (n = 117) *		
Through inhalation	26	22.2
Contaminated water	8	6.8
Contaminated food	6	5.1
Skin-to-skin contact	5	4.3
Risk factors (n = 117) *		
Overcrowding	24	20.5
Poor hygiene	26	22.2
Lack of immunization	25	21.4
Malnutrition	14	12.0
Age group at highest risk of infection (n = 117)		
Children below 2 years	11	9.4
Children aged 2-14 years	24	20.5
Adults	5	4.3
Elderly	3	2.6
Don't know	74	63.2
Can diphtheria occur as an epidemic? (n = 117)		
Yes	24	20.5
No	3	2.6
Don't know	90	76.9
Is there an ongoing epidemic of diphtheria in Kaduna State? (n = 117)		
Yes	11	9.4
No	2	1.7
Don't know	104	88.9
Diphtheria prevention (n = 117) *		
Reducing overcrowding	21	18.0
Improving hygiene	19	16.2
Diphtheria vaccine	31	26.5
Improve nutrition	9	7.7
Age group routinely vaccinated (n = 117)		
New-borns	3	2.6
Children from 6 weeks of birth	8	6.8
Children under the age of 5 years	20	17.1
School age children	3	2.6
Adults only	4	3.4
Don't know	79	67.5

Age group vaccinated during epidemic (n = 117)		
Children aged 6 weeks to 14 years	6	5.1
Everyone	3	2.6
Don't know	108	92.3
Number of diphtheria vaccine doses (n = 117)		
0	47	40.2
1-2	28	23.9
3	35	29.9
4-5	7	6.0

*Multiple response set

Table 3: Perception of diphtheria among respondents in Biye Community (n = 117)

Perception	Agree n (%)	Neutral n (%)	Disagree n (%)
Every child is at risk of contracting diphtheria	56 (47.9)	58 (49.6)	3 (2.6)
Diphtheria is a life-threatening disease	72 (61.5)	44 (37.6)	1 (0.9)
Diphtheria vaccine causes kidney problems and other side effects	14 (12.0)	83 (70.9)	20 (17.1)
Diphtheria vaccine prevents infant against the disease	65 (55.6)	51 (43.5)	1 (0.9)
I will allow my child to be given diphtheria vaccine	79 (67.5)	36 (30.8)	2 (1.7)
If someone has had diphtheria before, he or she cannot get infected again	14 (12.0)	95 (81.2)	8 (6.8)
Diphtheria is no longer a problem in Nigeria	4 (3.4)	79 (67.5)	34 (29.1)
Diphtheria can be effectively treated with home remedies	11 (9.4)	81 (69.2)	25 (21.4)

Sample size determination

The minimum sample size was estimated using Fisher's formula.[7]

$$n = \frac{Z^2 pq}{d^2}$$

Where;

n = minimum sample size.

Z = standard normal deviate corresponding to 1.96 for the 95% confidence interval.

p = prevalence of awareness, taken as 69% (0.69) from a previous study.[8]

q = complementary proportion (1–p) = 1–0.69=0.31

d = margin of error based on desired precision = 5% (0.05)

Thus,

$$n = \frac{1.96^2 \times 0.69 \times 0.31}{0.05^2} = 329$$

Given the rural nature of the study area and the anticipated lack of awareness in the community, the minimum sample size was increased by 80%. Thus, the sample size targeted for the study was:

$$n = 329 + (0.80 \times 329) = 592$$

Thus, a sample size of approximately 592 male and female respondents was targeted.

Sampling technique

A two-stage sampling technique was adopted in the selection of respondents:

Stage 1 (selection of households): A comprehensive household list was generated for the community through house numbering and household listing. Enumerators identified 590 households in the community. Thus, fifty percent of the households were selected using systematic random sampling. A sampling interval of 2 was used in order to arrive at 50% of the total households. Sampling interval (n) = 50/100 = 2

Every 2nd household was interviewed. At the end of the data collection exercise, enumerators visited 295 households.

Stage 2 (selection of respondents): In each household selected, the head of the household was automatically selected for the study. In the absence of the head of household, the most senior adult male from the same household was interviewed as a replacement for the head of household. Similarly, one eligible woman from the same household was selected for the interview. Women were selected if they were aged 15 to 49 years and if they had a child younger than the age of five years. Only one was selected through balloting in households where two or more women met the inclusion criteria. At the end of five days of data collection, a total of 590 respondents were interviewed in the community.

Study instrument

A semi-structured interviewer-administered questionnaire was used in the study. The questionnaire, which was specifically designed for the study, had three sections including section A – Socio-demographic characteristics of the respondent, section B – Knowledge of diphtheria, and section C – Perception towards diphtheria. Validation of the tool was done by experts from the Community Medicine Department, Ahmadu Bello University, Zaria. The internal consistency was determined by calculating Cronbach's alpha, with a value of ≥0.7 indicating that the instrument is reliable. The questionnaire was pre-tested in a separate community, corrected and translated into Hausa language before it was deployed using Kobocollect® software.

Data collection technique

An interviewer-administered semi-structured electronic questionnaire was used as the data collection instrument. The interviews were conducted in the homes of the respondents at their convenience, and privacy was ensured in all cases. The researchers supervised the overall data collection exercise and ensured that data were collected according to the study protocol. Data collection was done over a period of 4 weeks.

Measurement of variables

In this study, the independent variables were the socio-demographic characteristics, all measured as categorical variables. The dependent variables were levels of knowledge and perceptions of diphtheria. Those variables were assessed as knowledge and perception scores. Each correct answer was awarded a score of 1, while a wrong or blank answer attracted a score of 0. The quantitative discrete scores were subsequently added together to form composite scores graded using the median scores as cut-off values.[9] The knowledge was graded on a scale of 0 to 17, and a score of 8 and above was considered good knowledge of diphtheria. Similarly, the perception was graded on a scale of 0 to 24.[9] Respondents who scored 18 and above were graded good perception, while those who scored less than 18 were graded as having poor perception.[9]

Data analysis

For data analysis, IBM SPSS Statistics (version 25.0) was used. Descriptive data regarding socio-demographic characteristics, knowledge and perception were presented using frequency distribution tables. The data was checked for normality of distribution using the Kolmogorov-Smirnov test. To check for a significant association between qualitative nominal and categorical variables, a chi-square test of independence was done and a *p*-value less than 0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Health Research Ethics Committee of Ahmadu Bello University Teaching Hospital Zaria (ABUTHZ/HREC/W20/2023). Verbal informed consent was obtained from all participants before data collection. Privacy and confidentiality of information were assured.

RESULTS

The mean age of the respondents was 33.6 (±6.0) years and the majority (35.9%) were between the ages of 25 to 34 years. More than half of the respondents (61.7%) were females, and the majority (96.2%) were from the Hausa ethnic group. Most of the respondents (90.6%) were married and only about a quarter had up to a secondary level of education. Petty trading accounted for 43% of the respondents' occupation (Table 1).

Regarding knowledge of diphtheria, only 117 (19.8%) had ever heard of the disease. The majority (70.1%) of those who were aware of diphtheria heard of it from family and friends. Among those who were of the disease the majority did not know the causes (71%), predisposing factors (78.6%) or the disease's mode of transmission (77.8%). Likewise, among those who had ever heard of diphtheria, 90 (76.9%) did not know that diphtheria can occur as an epidemic and up to 104 (88.9%) were unaware of the ongoing epidemic in the state (Table 2).

Table 4: Grading of knowledge and Perception towards diphtheria among respondents in Biye Community (n = 117)

Variable	Frequency	Percent
Knowledge		
Good	22	18.8
Poor	95	81.2
Perception		
Good	80	68.4
Poor	27	31.6

Table 5: Factors associated with knowledge on diphtheria among respondents in Biye Community

Variable	Good	Poor	χ^2	*p*-value
	n (%)	n (%)		
Age group				
15-24	8 (36.4)	23 (24.2)	3.067	0.403
25-34	4 (18.2)	35 (36.8)		
35-44	6 (27.3)	23 (24.2)		
45+	4 (18.2)	14 (14.7)		
Sex				
Male	7 (31.8)	21 (22.1)	0.926	0.336
Female	15 (68.2)	74 (77.9)		
Ethnicity				
Hausa	21 (95.5)	92 (96.8)	0.104*	0.571
Fulani	1 (4.5)	3 (3.2)		
Marital status				
Single	0 (0.0)	12 (12.6)	5.065*	0.138
Married	21 (95.5)	79 (83.2)		
Widowed	1 (4.5)	1 (1.1)		
Divorced	0 (0.0)	3 (3.2)		
Education				
None	0 (0.0)	8 (8.4)	5.046	0.169
Quranic	5 (22.7)	31 (32.6)		
Primary	6 (27.3)	29 (30.5)		
Post-primary	11 (50.0)	27 (28.5)		
Occupation				
None	2 (9.1)	26 (27.4)	10.306*	0.440
Farming	5 (22.7)	15 (15.8)		
Petty trading	8 (36.4)	43 (45.3)		
Manual labourer	7 (31.8)	9 (9.5)		
Others	0 (0.0)	2 (2.1)		

*FET = Fischer's Exact Test

Concerning the perception of diphtheria, about half of the respondents agreed that the disease is life-threatening and that every child is at risk of contracting the disease. However, in most other situations, the respondents could not agree or disagree with the statements, indicating a lack of knowledge and failure to develop any perception or opinion on the subjects. Concerning vaccine acceptance, 79 (67.5%) indicated that they would allow their children to receive diphtheria vaccine (Table 3).

Table 4 shows the grading of knowledge and perception of diphtheria based on the median cut-off values. The majority of the respondents (81.2%) who had ever heard of diphtheria had poor knowledge but regarding perception, up to two-thirds of the respondents (68.4%) had a good perception of diphtheria. (Table 4)

Table 5 shows the association between knowledge of diphtheria and certain socio-demographic characteristics of the respondents, including age, sex, ethnicity, marital status and educational attainment. Overall, there was no statistically significant association between knowledge and any of the socio-demographic characteristics ($p > 0.05$) (Table 5)

Table 6 shows the association between the perception and socio-demographic characteristics of the respondents, including age, sex, ethnicity, marital status, educational attainment and occupation. There was no statistically significant association between perception and socio-demographic characteristics ($p > 0.05$). Likewise, the association between level of knowledge and perception was not statistically significant ($\chi^2 = 2.264$, $p = 0.203$). (Table 6)

DISCUSSION

This study assessed the knowledge and perception of diphtheria among residents of a rural community in Kaduna State. The study found that only a fifth of the respondents were aware of diphtheria. In a similar study that examined awareness of vaccine-preventable diseases among rural and urban residents in Lagos State, only 15.7% of rural and 18.0% of urban residents mentioned diphtheria.[10] In contrast, a study conducted among 64 clients at Barau Dikko Teaching Hospital in the Kaduna metropolis noted that respondents knew about diphtheria, with up to 28.0% being aware of diphtheria vaccine booster dose.[11] Although awareness does not equate to adequate knowledge, a heightened level of awareness is often a crucial step toward achieving community health education and mobilization. The low level of awareness observed in this study poses a threat to a comprehensive public health response, considering that pockets of diphtheria outbreaks were already being recorded across the state.

Even among the respondents who had an awareness of diphtheria, the study revealed poor knowledge of the causes, routes of transmission, risk factors, age of highest vulnerability and common preventive measures. Studies conducted elsewhere in Asia have noted a similar pattern of poor knowledge of diphtheria. In Indonesia, for instance, a study conducted among parents of elementary school pupils in North Jakarta

reported that only 24 (21.8%) parents could be classified as having good knowledge of diphtheria.[12] Similarly, a study among medical students in Karachi, Pakistan, reported that only 127 (44.4%) students identified contact with nasal discharge as a route of transmission.[8] The study concluded that only 10.5% of the students could be regarded as well aware of diphtheria despite their medical backgrounds.[8] Such poor knowledge implies that community members would find it difficult to identify the predisposing factors to infection, recognize the early symptoms, assess the dangers associated with the disease and seek timely and appropriate care for their children.

Table 6: Factors associated with perception of diphtheria among respondents in Biye Community

Variable	Good	Poor	χ^2	*p*-value
	n (%)	n (%)		
Age group				
15-24	21 (26.3)	10 (27.1)	3.779	0.386
25-34	28 (35.0)	11 (29.7)		
35-44	22 (27.5)	7 (18.9)		
45+	9 (11.2)	9 (24.3)		
Sex				
Male	17 (21.3)	11 (29.7)	0.999	0.355
Female	63 (78.7)	26 (70.3)		
Ethnicity				
Hausa	79 (98.8)	34 (91.9)	3.604*	0.093
Fulani	1 (1.2)	3 (8.1)		
Marital status				
Single	10 (12.5)	2 (5.4)	3.202*	0.371
Married	66 (82.5)	34 (91.9)		
Widowed	1 (1.3)	1 (2.7)		
Divorced	3 (3.8)	0 (0.0)		
Education				
None	6 (7.5)	2 (5.4)	1.606	0.685
Quranic	22 (27.5)	14 (37.8)		
Primary	26 (32.5)	9 (24.3)		
Post-primary	26 (32.5)	12 (32.4)		
Occupation				
None	21 (26.3)	7 (18.9)	4.733*	0.376
Farming	10 (12.5)	10 (27.1)		
Petty trading	36 (45.0)	15 (40.5)		
Manual labourer	11 (13.7)	5 (13.5)		
Others†	2 (2.5)	0 (0.0)		
Level of knowledge				
Good	18 (22.5)	4 (10.8)	2.264	0.203
Poor	62 (77.5)	33 (89.2)		

*FET = Fischer's Exact Test

Additionally, most participants in our study were not aware of the ongoing diphtheria outbreak in the state. Such a lack of awareness may indicate ineffective risk communication, particularly in the state's rural areas. A community that is largely unaware of an outbreak would hardly recognize it as a problem and may not feel the need for any preventive measures against the outbreak. Regardless of how comprehensive the planned outbreak response is, poor community engagement and awareness will undermine its success, leading to an ineffective response and a long-protracted epidemic. Also, poor knowledge among community members could exacerbate the threat and worsen the impact of the epidemic, as well as loss of trust in the government's ability to protect communities against vaccine-preventable diseases.[13]

Interestingly, despite the lack of awareness and poor level of knowledge, a sizeable number of the respondents exhibited a good perception of the disease. This is similar to the findings from a study in Enugu State, South Eastern Nigeria, where most respondents perceived diphtheria as a significant threat, recognized the benefits of diphtheria booster vaccinations, and received supportive cues for vaccination.[14] Likewise, in a study conducted among 41 mothers of infants attending a health facility in Indonesia, it was observed that the respondents had a good perception of diphtheria.[15] The study concluded that perception was a significant factor influencing immunization compliance and completeness.[14] However, of particular relevance is that most of the respondents in this study expressed willingness to allow their children to receive the diphtheria vaccine. This finding presented an important opportunity for local health authorities to leverage the provision and scaling up of diphtheria among children in the community.

The study found no significant association between socio-demographic characteristics and knowledge or perception of diphtheria. This was contrary to observations made in Enugu State, South Eastern Nigeria, and Indonesia, where several factors, including maternal education levels and interpersonal reference groups, were associated with diphtheria.[13,14] This suggests potential variations in determinants of knowledge and perception across different cultural and geographical contexts.

Even though the study is limited by the fact that it is conducted within only one rural community, it has the strength of being community-based, having a large sample size and interviewing up to fifty percent of eligible people in the community and thus gives valid insight into knowledge and perception of rural dwellers towards Diphtheria and can potentially influence policies on behaviour change and risk communication strategies, especially during outbreaks. Future research can explore qualitative design to explore contextual factors responsible for the perception and acceptability or uptake of Diphtheria vaccines in rural communities in rural communities.

CONCLUSION

Despite an ongoing outbreak of diphtheria in Kaduna State, this study found a low level of awareness and poor knowledge of diphtheria among residents in a rural community. Among those who were aware of the disease, the perception of the disease was good, with many willing to allow their children to receive the vaccine. The study found no association between sociodemographic variables and knowledge or perception of diphtheria. The study recommended effective health education and public enlightenment campaigns on the cause, routes of transmission, predisposing factors, and preventive measures against diphtheria to be instituted by the Kaduna State Government, particularly targeting rural communities in the State.

REFERENCES

1. Sharma NC, Efstratiou A, Mokrousov I, Mutreja A, Das B, Ramamurthy T. Diphtheria. Nat Rev. 2019;5(81):1–18. https://doi.Org/10.1038/S41572-019-0131-Y

2. Olulaja ON, Anjorin ET, Ekerin O, Afolabi OT, Inuojo JM. A Looming Epidemic: Combating the Recurrent Outbreaks of Diphtheria in Nigeria. Pan Afr Med J. 2023;45(186):1–10. https://doi.org/10.11604/Pamj.2023.45.186.4138

3. Clarke KEN, Macneil A, Hadler S, Scott C, Tiwari TSP, Cherian T. Global Epidemiology of Diphtheria, 2000-2017. Emerg Infect Dis. 2019;25(10):1834–42. Https://Doi.Org/10.3201%2Feid2510.190271

4. Oduoye MO, Musa ZM, Tunde AM, Nazir A, Cakwira H, Abdulkareem L, et al. The Recent Outbreak of Diphtheria in Nigeria is a Public Health Concern for All. Int J Surg Glob Heal. 2023;6:E0274. Https://Doi.Org/10.1002%2Fhsr2.1804

5. Oduoye MO, Marsool MDM, Haider MU, Mukherjee D, Khan AW, Faloye TO, et al. Unmasking Diphtheria in Nigeria: A Multifaceted Approach to Tackle Outbreaks and Improve Immunization Rates among the Nigerian Population -An Updated Correspondence. Health Sci Rep. 2024; 7(1): E1804. Doi: 10.1002/Hsr2.1804.

6. Abdulrasheed N, Lawal L, Mogaji AB, Abdulkareem AO, Shuaib AK, Adeoti SG, et al. Recurrent Diphtheria Outbreaks in Nigeria: A Review of the Underlying Factors and Remedies. Immunity, Inflamm Dis. 2023;1–8. Https://Doi.Org/10.1002/Iid3.1096

7. Lwanga S, Lemeshow S. Sample Size Determination in Health Studies: A Practical Manual, 1991. 1st Ed. World Health Organization, Geneva. England: Macmillan; 1991. 88 P.

8. Siddiqui AA, Khan M, Khan JA, Haseeb SS, Mohib A, Kadri HM. Awareness, Knowledge, and Coverage of Vaccination Against Tetanus, Diphtheria, and Pertussis Among Medical Students of Karachi: A Cross-Sectional Analysis. Cureus. 2019;11(4):E4472. Https://Doi.Org/10.7759/Cureus.4472

9. Jamie D C. Best Practices for Using Median Splits, Artificial Categorization, and their Continuous Alternatives. Journal of Experimental Psychopathology. 2011; 2(2). 197-209

10. Okafor IP, Dolapo DC, Onigbogi MO, Iloabuchi IG. Rural-Urban Disparities in Maternal Immunization Knowledge and Childhood Health-Seeking Behavior in Nigeria: A Mixed Method Study. African Heal. 2014;14(2):339–47. Https://Doi.Org/10.4314/Ahs.V14i2.8

11. Ibrahim M, Saeed S. Diphtheria Vaccine Awareness Survey among the General Populace of Kaduna State. Bayero J Med Lab Sci. 2020;5(2):25–30. Https://Www.Ajol.Info/Index.Php/Bjmls/Article/View/230387

12. Arfimita N, Surjono E. Parental Knowledge, Attitude, and Behavioural Factors in Immunization Response Following Diphtheria Outbreak in Children in 2018-2019. Paediatr Indones. 2020;60(3):142–8. Http://Dx.Doi.Org/10.14238/Pi60.3.2020.142-8

13. Sell TK. When the Next Disease Strikes: How to Communicate (and How Not To). Heal Secur. 2017; 15(1): 28–30. Https://Doi.Org/10.1089%2Fhs.2016.0100

14. Ossai EN, Fatiregun AA. Urban-Rural Disparities on Clients Knowledge of Cause and Preventive Measures for Childhood Immunizable Diseases in Primary Health Centers of Enugu State, Nigeria. Int J Trop Dis Heal. 2016; 14(1): 1–11.

15. Prameswari AR. Knowledge, Attitude, and Reference Group, and Behavior of Diphtheria Immunization In Rural and Urban Areas. J Child, Fam Consum Stud. 2023; 2(3): 223–35. https://Dx.Doi.Org/10.9734/IJTDH/2016/24221