

RESEARCH ARTICLE

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Can non-individual factors be associated with mothers' intention to complete childhood immunization? Findings from a cross-sectional study in Nigeria

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Abstract

Objective: Child immunization completion remains worrisome in Sub-Saharan Africa. Immunization completion is affected by individual and non-individual factors, although, the non-individual factors have not been well studied and documented in Nigeria. The study examined the non-individual factors influencing mothers' intention to complete immunization of children 0-2 years in Nigeria.

Methods: A cross-sectional study was conducted among mothers of children 0-2 years registered in three selected Primary Health Centres in a district of Lagos State who completed a self/interviewer-administered Socio-ecological model-based questionnaire. Descriptive and inferential statistics at a 5% level of significance were performed.

Results: Mean age of respondents was 32.68 ± 7.19 years. The mean level of interpersonal factors was (1.18 ± 0.39) and therefore low. Environmental and policy factors were also low with mean scores of (1.09 ± 0.28) and (1.06 ± 0.24) respectively. All mothers (100%) had the intention to complete immunization. There was no significant relationship between interpersonal factors ($r(421) = 0.089$, $p = 0.067$) and environmental factors ($r(421) = 0.057$, $p = 0.242$) and the mother's intention to complete child immunization, but, there was a significant relationship between policy factor ($r(421) = 0.100$, $p = 0.039$) and mother's intention to complete child immunization.

Conclusion: Continuous encouragement of mothers through policy-level mechanisms should continue, to aid the completion of childhood vaccination for the maintenance of health and welfare of both the mother and the child (ren).

Keywords: Childhood immunization, Interpersonal factor, Environmental factor, Policy factor, Mothers' intention

Plain English Summary

Child immunization completion remains a challenge in Sub-Saharan Africa. Although studies elsewhere have shown that factors outside of the individual influence immunization completion, these studies have been lacking in Nigeria. Thus, this study aimed to examine the non-individual factors influencing mothers' intention to complete immunization of children 0-2 years in Nigeria. A cross-sectional study was conducted among mothers of children 0-2 years registered in three selected Primary Health Centres in a district of Lagos State. Findings revealed that all mothers had the intention to complete immunization and although the non-individual factors (Interpersonal and environmental) were not associated with that intention, the

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non-individual factor (policy) was associated with the intention to complete childhood immunization in this population.

Background

Globally, routine immunisation has been one of the most impactful, cost-effective and protective interventions which are continually recommended to protect children under five years from vaccine-preventable diseases (VPDs) (1, 2). Immunizations are especially beneficial in the African region with an estimated 58% of VPD-related deaths (2). Worldwide, vaccination has been responsible for preventing up to 4 million deaths and could increase to 51 million deaths by 2030 globally (3). Despite great achievements with routine immunisation coverage over the years, a significant proportion of children living in developing countries are not completely immunised, exposing them to illness and untimely death (4). There are about 19.9 million children who are not vaccinated or who have received a portion of vaccinations globally (1). Particularly, in Sub-Saharan Africa incomplete vaccination rate of as high as 35.1% has been reported (5). Nigeria contributes largely to this inequality in vaccination completion which is largely exacerbated by a fragile healthcare system (6).

In Nigeria, vaccination rates have increased over the previous ten years. Children aged 0 to 2 years who received all recommended immunizations climbed from 23% in 2008 to 31% in 2018, while the number of children who received none of the recommended vaccinations decreased from 29% to 19% over the same period (7). The Sustainable Development Goal 3 aim of obtaining more than 90% coverage of all essential vaccines among children aged 0 to 2 years nationally (7) is yet unmet even though these trends indicate improvement. Subnational investigations are still advised to assist countries in prioritizing and appropriately addressing gaps in immunization coverage.

Studies investigating incomplete vaccination in Nigeria are few (8, 9, 10, 11). Moreover, these studies have most often investigated individual factors such as maternal education, child birth order, marital status, occupation, household decision-making, health services factors and knowledge of caregivers amongst others (8, 10, 11). Many studies (8, 9, 11), including studies in other similar settings (12) have given some indication that other non-individual factors such as the influence of significant others and health services factors could be associated with vaccination completion, but this gives an

incomplete picture to investigate further strategies for immunization completion in Nigeria.

Moreover, there are inconsistencies existing between studies because a large percentage of these researchers focus their findings solely on individual factors, with less attention to other non-individual factors which may benefit the immunization drive.

The socio-ecological framework provides a comprehensive lens within which the other factors outside the individual can be studied. The socio-ecological model views health from a broad and multifactorial perspective. It aids in the description of how population health is affected by intrapersonal, interpersonal, group/community and policy factors (13). This approach focuses on also integrating approaches outside of the individual to change the physical and social environments. The key construct (intention) in the theory of planned behaviour (14) was also used in this integrated framework to understand the caregivers' (primarily the mothers') strong desire to comply fully and complete the child's immunization standardized schedule. The motivating elements that affect action are presumed to be captured by intentions, which serve as indicators of how much effort people are prepared or willing to put forth to carry out the behaviour. Generally speaking, the more strongly an action is intended to be performed, the more likely its performance should be (14). Studies on intention in this regard have also been virtually non-existent. This study therefore sought to determine the level of the interpersonal, environmental, and policy level factors and their association with mothers' intention to complete the child's immunization amongst mothers registered in Primary Health Centres in a district of Lagos State, Nigeria.

Materials and Methods

Study Design

This was a cross-sectional study.

Study Setting

This study was carried out in Eti-Osa East Local Council Development Area of Lagos State. The population of Eti-Osa is 287,785. Eti-Osa has a diverse mix of ethnicities, although its indigenous people are of the Awori and Edo subgroups that make up the core of this area in Lagos. Of the six health centres within its wards three of them were accessed during data collection.

The study respondents were mothers of children 0-2 years who were registered in the Primary Healthcare Centres (PHCs) for postnatal care which includes child immunization services. Women who came in for an emergency visit and or were not registered at the clinics were excluded.

Sample size and sampling

A total sample of 423 mothers was derived using Andrew Fisher's formula. Given the absence of related literature on the outcome variable of intention to complete childhood immunization, the sample size for the study was calculated by taking the most probable proportion of mothers who would have an intention to complete childhood immunization as 50% and permissible error as 5% with 95% confidence interval. A 3-phase multi-stage sampling technique was used in selecting participants -- Phase 1 involved balloting to select three of the six wards. A second ballot was conducted to select one PHC facility from the 3 selected wards. In the third phase, women were conveniently sampled to attain the desired sample in each PHC using the formula; $\frac{x}{Y} \times \frac{\text{sample size}}{1}$, where x = total number of mothers present for child immunization in each Primary Healthcare Centre and Y = total number of mothers present for child immunization in the three PHCs. After explaining the study to women present at the time of data collection those who opted were approached. Verbal or written consent was obtained and women completed the survey until the desired sample was obtained.

Data collection and instrumentation

Data was collected from the respondents using a structured interviewer-administered questionnaire adapted from previous related health behaviour studies (15, 16) on interpersonal, environmental factors, policy factors and intention. The instrument comprised five sections including a section on socio-demographic characteristics. The section on interpersonal factors comprised nine (9) questions related to the influence of friends, spouses, mother-in-law, friends and health practitioners on participant's intentions. The section on environmental factors comprised ten (10) questions related to the influence of factors such as distance to health facilities, affordability of care at health centres, presence of information materials, activeness in health centres, home service availability and media exposure. The section on policy factors comprised five questions related to immunization packages at health sites, the presence of free services and the presence of

an international immunization standard and a question on the likelihood that a policy for completion could motivate intention. The section on intention comprised three questions based on intention (three forms of the same question). Following reliability testing, all three questions on intention were found to have high-reliability scores of about 0.9 and were therefore retained. In the analysis, these three questions were then computed to provide one intention score. Participants were asked to respond to sections on interpersonal, environmental and policy factors on a 4-point Likert scale from Strongly agree to Strongly disagree.

Description of Variables

The interpersonal level describes individuals' familial and social networks that may influence healthcare practices and contribute to various experiences (17). In this study, this refers to the familial and social networks that influence mothers' intentions. The environmental factor refers to the institutional level which further describes the functions that social institutions, such as healthcare facilities and their staff play in influencing decisions about health care, basic resources and the social and physical environment that make up the larger community. The policy factor refers to the laws and policies at the municipal, state, and federal levels that have an impact on health practices to complete the child's immunization. In this study, policy factors referred to the provisions made through policy such as free services and immunization cards, which could motivate immunization completion (17). Intention shows how much effort people are willing to put forth (14). In this study intention to complete childhood immunization, which was the outcome variable, was defined as the mother's strong desire to keep to the standard immunization schedule until the child had received all indicated immunizations.

Statistical analysis

Data entry and analysis were performed using IBM SPSS v. 26. Frequencies were used to describe the study respondents' sociodemographic characteristics. To assess the levels of the independent variables (interpersonal, environmental and policy factors), mean scores were computed while the relationship between the interpersonal, environmental and policy factors and the primary outcome variable; intention to complete immunization were tested with Pearson Moment Correlation. The interpersonal level factor was measured on a maximum of a 15-point rating

scale, the environmental level factor was measured on a 30-point rating scale and the policy level factor on a 27-point rating scale. Intention was measured on a 9-point rating scale. All significant values were tested at $p \leq 0.05$.

Results

Socio-demographic characteristics of Respondents

The mean age of respondents was 32.68 ± 7.19 . Less than half of respondents (49.2%) indicated that they are between 26 – 35 years. Most respondents (82%) were married. About half of the respondents (49.4%) indicated that they are of the Yoruba tribe in South West Nigeria and more than half were Christians (56.5%). More than half of the respondents (58.2%) had tertiary education and had at least 2 children (34.3%). (Table 1).

Table 1: Socio-demographic Distribution of Respondents (n = 423)

Demographic Variables	Frequency (N)	Percentage (%)
Age (in years)		
X= 32.68, S.D. = 7.19		
18 - 25 Years	80	18.9
26 - 35 Years	208	49.2
36 - 45 Years	121	28.6
45 - 55 Years	13	3.1
55 Years and above	1	.2
Marital Status		
Single	58	13.7
Married	347	82.0
Divorced	18	4.3
Ethnicity		
Igbo	146	34.5
Yoruba	209	49.4
Hausa	42	9.9
Others	26	6.1
Religion		
Christianity	239	56.5
Islam	165	39.0
Traditional	17	4.0
Others	2	.5
Level of education		
Primary	16	3.8
Secondary	161	38.1
Tertiary	246	58.2
Parity		
1	104	24.6
2	145	34.3
3	130	30.7
>=4	44	10.4

Level of Interpersonal Factor, Environmental factor, Policy Factor

The interpersonal factor had a mean of 1.18 (SD±0.39) measured on a 27-point rating scale. The level of Interpersonal Factors was computed as shown in Table 2. Given the mean score of 1.18, the interpersonal factor measured among these respondents was considered low. The environmental factor had a mean of 1.09 (SD±0.28) measured on a 30-point rating scale. Given the scaled units as shown in Table 2, the

mean score of 1.08, also showed the low existence of environmental factors that could influence the intention to complete immunization. Table 2 also shows a mean of 1.06 (SD±0.24) of the policy factors measured on a 15-point rating scale. The level of Policy Factors was computed as shown. Given the mean score of 1.06, the policy factors measure among these respondents was high. The results further revealed that all the mothers had an intention to complete their child's immunization (Table 3).

Table 2: Descriptive statistics of mean and standard deviation for interpersonal, environmental and policy factors in the study as reported by participants

Categories	Freq (n = 423)	Percentage (%)	\bar{x}	SD
Interpersonal factor				
Low (0-13.5)	345	81.6		
High (14-27)	78	18.4	1.184	0.388
Environmental factor				
Low (0-15.5)	386	91.3		
High (16-30)	37	8.7	1.088	0.283
Policy Factor				
Low (0-7.5)	398	94.1		
High (8-15)	25	5.9	1.059	0.236

Table 3: Proportion of the Respondents' Intention to Complete Child Immunization (n = 423)

Variables	Frequency (n)	Percentage (%)
No Intention (1-13.5)	0	0
Have Intention (13.6-27)	423	100
Mean \pm SD	2.0 \pm 0.0	

Tests of Hypotheses

To test the hypotheses and determine whether a relationship existed between interpersonal level factors, environmental factors and policy factors and mothers' intention to complete child immunization, the Pearson Moment Correlation was used. The correlation results showed a positive but insignificant correlation between the interpersonal level factors and environmental level factors and mothers' intention to complete

immunization ($r(421) = .89, p = .067$ (Table 4a) and $r(421) = .06, p = .242$ (Table 4b) respectively. Hence, the null hypotheses were accepted. However, results (Table 4c) showing the relationship between policy-level factors and mothers' intention to complete immunization indicates a positive and significant correlation ($r(421) = .10, p = .039$). Hence, the null hypothesis was not confirmed and thus rejected.

Table 4a: Pearson Correlation Analysis on the relationship of Interpersonal Level Factors on Mother's Intention to Complete Child Immunization

		Intention G	Inter G
Intention	Pearson Correlation	1	.089
	Sig. (2-tailed)		.067
	N	423	423
Interpersonal factor	Pearson Correlation	.089	1
	Sig. (2-tailed)	.067	
	N	423	423

Table 4b: Pearson Correlation Analysis on the Relationship of Environmental Level Factors on Mother Intention to Complete Child Immunization

		Intention	Environmental factor
Intention	Pearson Correlation	1	.057
	Sig. (2-tailed)		.242
	N	423	423
Environmental factor	Pearson Correlation	.057	1
	Sig. (2-tailed)	.242	
	N	423	423

Table 4c: Pearson Correlation Analysis on the Relationship of Policy Level Factors on Mother Intention to Complete Child Immunization

		Intention	Policy factor
Intention	Pearson Correlation	1	.100
	Sig. (2-tailed)		.039
	N	423	423
Policy factor	Pearson Correlation	.100	1
	Sig. (2-tailed)	.039	
	N	423	423

Discussion

This study builds on other previous studies related to factors associated with immunization completion (8, 9, 10, 11). These studies have shown that immunization completion can be influenced by non-individual factors such as familial factors and health services. This study further reiterates the importance of policy drive in pushing for optimal immunization uptake as it showed that, of the factors studied, policy was related to mothers' intention to complete childhood immunization. The study also affirms the socioecological theory which views health status as being influenced by multiple factors. However, what affects health and its behaviours vary across cultures and settings. In addition, this study focused on a distinct group of mothers in a suburb of Lagos, the cosmopolitan state in Nigeria.

Interpersonal factor

This study showed that the Interpersonal factor (social network involvement, significant others' involvement, interactions with health professionals) was not correlated with mothers' intention to complete vaccination of children 0-2 years. These results are at odds with a study conducted in Nigeria by (11), which discovered a substantial correlation between interpersonal factors and vaccine coverage. These differences could be attributed to some factors, including the culture of a large metropolitan state compared to Nigeria's other five geopolitical zones (North-central, North-east, North-west, South-east and South-south), where interpersonal influences have a greater impact on health behaviours, as well as education and other intrapersonal factors that were not measured in the current study. According to another study (12), "Support from close families, including husbands and parents, also strengthens participants' intention to immunise their children (12)," despite differences in our findings.

Environmental Factor

The Environmental factor comprised (availability and accessibility of healthcare services, geographic barriers, place of birth, availability of health centres, utilisation of community resources, socioeconomic characteristics and social norms) was also not associated with mothers' intention to complete vaccination of children 0-2 years. The following finding agreed with a study conducted in Remo-North LGA, Nigeria (8), which examined contextual factors such as the environment, community, and policy in association with child

immunisation. Health workers were reported by 85.2% of respondents, as the most important and common source of immunisation information. Community members' perceptions of the conditions of the health facilities, were mostly unfavourable, especially in terms of the environment, poor/inadequate infrastructure, and lack of equipment and supplies. The respondents viewed adverse events after immunisation as the leading reason for the loss of trust in the competency of the health staff and the quality of the vaccinations in both wards. These findings supported the current study because, as it was concluded, the contextual factors identified could not be easily addressed because they were ingrained in the cultural and political strata and may not be under the control of the health sector. A study (18) also observed that environmental factors statistically affect the adoption of childhood immunisation in Africa. Nevertheless, it was concluded that environmental factors do not have a direct relationship with childhood immunization uptake (16). Although a child's development can be substantially influenced by their environment. It was not the case in this study probably because of the metropolitan setting. If the study had been done in a rural area, the results might have been different.

Policy Factor

The findings from this study showed that the Policy factor (regulation of free immunization services, provision of child immunization cards, adequate immunization resource allocation) was associated with mothers' intention to complete vaccination of children 0-2 years. The various national and municipal policies have contributed immensely to the immunisation success (18). Participants in a study by Olaniyan and colleagues (19) affirmed the critical role policy played in motivating immunization uptake, through the provision of free immunization services including the provision of immunization cards. The vaccination programme is governed by defined policies, and there are systems in place to carry out the strategies and goals connected to policy (8). According to the same study, 60% of survey respondents said that becoming immunised had no direct or indirect costs; 29% believed the cost of the service was low, and 4% thought it was high. The lack of immunisation cards was also a significant issue that has been well-documented (8, 18) with some studies indicating that the provision of immunisation cards is vital.

Mothers' Intention to Complete Child Immunization

Mothers' intention to complete the child's immunization in line with this study is the mother's desire to comply with the standard immunization schedule until completion. The results of this study demonstrated that all mothers strongly desired to comply fully with childhood immunization. This is inconsistent with research in the Siantan Tengah district of Indonesia, which revealed that up to 60.9% of mothers were not willing to comply with the immunization schedule (12). However, among those who intended, the interpersonal factor element of social networks was associated with their intention to immunize fully (12). Another study also demonstrated that the mothers' intention was associated with interpersonal factors such as their relationship with their health worker and social networks (19).

Conclusion

The study found no association neither between the interpersonal and environmental factors and mothers' intentions but found an association between policy factors and mothers' intention to complete childhood immunization. Immunization is a cost-effective public health initiative aimed at reducing the burden of vaccine-preventable diseases, morbidities and mortalities among children (20) and is strongly backed by policy. It seems that policy remains the stronger non-individual factor that has contributed through the different levels of healthcare to immunization successes. Hence, there is a need for the government to focus on policy issues that can influence mothers' intentions to complete immunization.

List of Abbreviations

CDC: Center for Disease Control and Prevention

ICF: Internal Classification of Functioning, Disability and Health

NPC: National Population Council

PHC: Primary Healthcare Centres

VPDs: Vaccine-Preventable Diseases

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Babcock University Health Research Ethics Committee (BUHREC 932/21). Consent was obtained from all participants before data collection commenced

Consent for publication

The authors hereby give consent for the publication of our work under the Creative Commons CC Attribution-Non-commercial 4.0 license

Availability of data and materials

The data that support the findings of this study are openly available in "figshare" at <http://doi.org/10.6084/m9.figshare.20748337>

Competing interests

The authors declare no conflict of interest

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Authors' contributions

SA and PE conceptualized the study. PE and IO collected and collated data. IA analyzed and interpreted the data. SL interpreted the data and revised it for intellectual content and all five authors approved the final version of the study. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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References

1. Madhi SA, Rees H. Special focus on challenges and opportunities for the development and use of vaccines in Africa. *Hum Vaccin Immunother*. 2018; 14(10): 2335–9. <https://doi.org/10.1080/21645515.2018.1522921>
2. World Health Organization. Immunization [Internet]. Geneva (CH): Regional Office for Africa; 2022 [Updated 2022; cited 2022 February 8]. Available from <https://www.afro.who.int/health-topics/immunization#:~:text=Vaccines%20protect%20us%20throughout%20life,diseases%20can%20be%20life%2Dthreatening>
3. Centre for Disease Control and Prevention. Fast Facts on Global Immunization-Immunization Prevents Death Worldwide [Internet]. (USA): Atlanta (U.S): U.S Department of Health and Human Services;

- 2022 [Updated 2022; cited 2023 February 8] Available from <https://www.cdc.gov/globalhealth/immunization/data/fast-facts.html>.
4. Adedire EB, Ajayi EB, Fawole OI, Ajumobi O, Kasasa S, Wasswa P, Nguku P. Immunisation coverage and its determinants among children aged 12-23 months in Atakumosa-west district, Osun State Nigeria: a cross-sectional study. *BMC Public Health*. 2016 Aug 30; 16(1): 905. <https://doi.org/10.1186/s12889-016-3531-x>
 5. Bobo FT, Asante A, Woldie M, Dawson A, Hayen A. Child vaccination in sub-Saharan Africa: Increasing coverage addresses inequalities. *Vaccine*. 2022 Jan 3; 40(1): 141–150. <https://doi.org/10.1016/j.vaccine.2021.11.005>
 6. Adigwe, O. P., Oтуру, D., & Onavbavba, G. Healthcare professionals' views on access to vaccines in Nigeria: A cross-sectional study. *Vaccine*: X. 2022 Dec; 12, 100235. <https://doi.org/10.1016/j.jvaxx.2022.100235>
 7. National Population Commission [Nigeria] and ICF. Nigeria Demographic and Health Survey 2018 [Internet]. [Cited 2022 May 31]. Available from: <https://www.dhsprogram.com/pubs/pdf/FR359/FR359.pdf>.
 8. Akwataghibe NN, Ogunsola EA, Broerse JEW, Popoola OA, Agbo AI, Dieleman MA. Exploring Factors Influencing Immunization Utilization in Nigeria—A Mixed Methods Study. *Front. Public Health*. 2019 Dec 20; 7(392): 1-13. <https://doi.org/10.3389/fpubh.2019.00392>
 9. Abdulraheem II, Onajole AT, Jimoh AO, Oladipo AR. Reasons for incomplete vaccination and factors for missed opportunities among rural Nigerian children. *J. Public Health Epidemiol*. 2011 Apr; 3(4): 194-203. <https://academicjournals.org/journal/JPHE/article-full-text-pdf/31E14641343>
 10. Eze P, Agu UJ, Aniebo CL, Agu SA, Lawani LO, Acharya Y. Factors associated with incomplete immunisation in children aged 12–23 months at subnational level, Nigeria: a cross-sectional study. *BMJ Open*. 2021; 11(6): e047445. <https://doi.org/10.1136/bmjopen-2020-047445>
 11. Oleribe O, Kumar V, Awosika-Olumo A, Taylor-Robinson SD. Individual and socioeconomic factors associated with childhood immunization coverage in Nigeria. *Pan Afr Med J*. 2017 Apr 24; 26: 220. <https://doi.org/10.11604/pamj.2017.26.220.11453>
 12. Hadisuyatmana S, Krisnana I, Sipahutar MA. Factors Influencing Mothers' Intention to Immunize Children Younger than Five Years of Age in West Borneo: a Cross-Sectional Study. *Jurnal Ners*. 2019; 14 (1): 41. <http://dx.doi.org/10.20473/jn.v14i1.9406>
 13. Sallis JF, Owen N, Fisher EB. Chapter 20: ecological models of health behavior. In: *Glanz K, Rimer BK, Viswanath K*, editors. *Health behavior and health education: theory, research, and practice*. 4th ed ed. San Francisco: Jossey-Bass; 2008. p. 465–552.
 14. Ajzen I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50: 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
 15. Brunson EK. The Impact of Social Networks on Parents' Vaccination Decisions. *Pediatrics*. 2013 May 01; 131(5): e1397 – e1404. <https://doi.org/10.1542/peds.2012-2452>
 16. Mekonnen AG, Bayleyegn AD, Ayele ET. Immunization coverage of 12-23 months old children and its associated factors in Minjar-Shenkora district, Ethiopia: a community-based study. *BMC Pediatr*. 2019 Jun 14; 19(1): 198. <https://doi.org/10.1186/s12887-019-1575-7>
 17. McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q*. 1988;15 (4): 351-77. <https://doi.org/10.1177/109019818801500401>
 18. Galadima AN, Zulkefli NAM, Said SM, Ahmad N. Factors influencing childhood immunisation uptake in Africa: a systematic review. *BMC Public Health*. 2021 Jul 28; 21 (1):1475. <https://doi.org/10.1186/s12889-021-11466-5>
 19. Olaniyan A, Isiguzo C, Hawk M. The Socioecological Model as a framework for exploring factors influencing childhood immunization uptake in Lagos state, Nigeria. *BMC Public Health* 2021; 21 (867). <https://doi.org/10.1186/s12889-021-10922-6>
 20. Taiwo L, Idris S, Abubakar A, Nguku P, Nsubuga P, Gidado S, et al. Factors affecting access to information on routine immunization among mothers of under 5 children in Kaduna State Nigeria, 2015. *Pan Afr. Med. J*. 2017 Jul 10; 27: 186. <https://doi.org/10.11604/pamj.2017.27.186.11191>