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Assessment of Determinants of Willingness to Pay for Routine Immunization among Mothers of Children Under Five Residing in Rural Areas of Kano State

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Abstract

Introduction: Routine immunization remains one of the most cost-effective public health interventions; however, sustainability challenges persist in low-resource settings due to funding constraints. This study assessed the determinants of willingness to pay (WTP) for routine immunization among mothers of under-five children in rural areas of Kano State, Nigeria.
Methods: A community-based cross-sectional study was conducted among 420 mothers selected through multistage sampling. Data were collected using a structured interviewer-administered questionnaire and analyzed using descriptive statistics, bivariate analysis, and logistic regression. A p-value of < 0.05 was considered statistically significant.
Results: The proportion of mothers willing to pay for routine immunization services was 33.5%. The mean amount mothers were willing to pay was ₦20,029.40 $\pm$ 14,519.70. Factors significantly associated with willingness to pay included maternal age (OR = 0.75), maternal education (OR = 3.44), household income (OR = 1.67), healthcare expenditure (OR = 1.32), knowledge of immunization (OR = 2.72), and place of delivery (OR = 1.67).
Conclusion: Socioeconomic factors, place of delivery, and knowledge of the benefits of routine immunization significantly influence willingness to pay. Policies aimed at improving awareness and strengthening household economic capacity may enhance the financial sustainability of immunization programs.

Keywords: Routine Immunization; Determinants; Rural Areas; Payment; Kano State; Nigeria.

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Introduction

Determining the monetary value of healthcare services such as vaccinations, and their distribution as healthcare resources, poses significant challenges to policymakers in many health systems, particularly in under-resourced countries (Rezaei et al., 2020). There is no other health intervention as simple, powerful, and cost-effective as vaccines (Munk et al., 2019). With just a few doses, vaccines have protected billions of people from diseases such as smallpox, polio, and measles, which once posed major global health threats (Stéphenne, 2011).

Government spending on routine immunization per surviving infant has declined since 2006, indicating the need for increased immunization financing (Wonodi et al., 2012). By 2020, Nigeria was expected to become ineligible for additional support from the Global Alliance for Vaccines and Immunization (GAVI), facing an estimated annual vaccine cost of approximately US$426.3 million (Levine et al., 2011). GAVI support is time-limited, typically spanning five to eight years, and is designed to provide sufficient resources to support program im-

provements across key areas within a defined period (Gadhia & Mäkinen, 2005).

In Nigeria, immunization coverage remains suboptimal, with only 23% of children aged 12–23 months fully immunized and 29% receiving no vaccinations (Adedire et al., 2016). However, some progress has been recorded over time. The proportion of fully immunized children increased from 23% in 2008 to 31% in 2018, while the proportion of children receiving no vaccines declined from 29% to 19% during the same period (National Population Commission (NPC) [Nigeria] & ICF, 2019). Despite these improvements, coverage remains below the Sustainable Development Goal 3 target of over 90%. Several factors contribute to incomplete immunization in Nigeria, including vaccine unavailability, long distances to health facilities, lack of awareness, fear of side effects, and competing maternal responsibilities (Gidado et al., 2014; Ophori et al., 2014).

In 1974, the World Health Organization established the Expanded Programme on Immunization (EPI) to ensure universal access to essential vaccines for children. Since then, global coverage with core vaccines has increased from less than 5% to at least 84%, alongside the introduction of additional vaccines into routine schedules (Harris et al., 2017). Coverage with the third dose of the diphtheria–tetanus–pertussis (DTP3) vaccine by age 12 months remains a key performance indicator, with global coverage stabilizing at approximately 83%–84% since 2009 (Harris et al., 2017).

Global estimates for the second dose of measles-containing vaccine, first reported in 2013, indicated coverage of 35% by the end of the second year of life and 53% when older age groups were included (Harris et al., 2017). Improving equitable access to immunization services remains critical to ensuring protection against vaccine-preventable diseases. The EPI aimed to ensure that all children receive protection against tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus, and measles by one year of age. In Nigeria, the programme was introduced in 1978 (Ophori et al., 2014).

Nigeria achieved notable progress in immunization coverage between 1980 and 1990, reaching a peak coverage of 81.5% in the early 1990s (Ophori et al., 2014). However, this success was not sustained, as coverage declined steadily thereafter (Musgrove, 1993). By 1996, national coverage had dropped to below 30% for all antigens, further declining to 12.9% by 2003 (Ophori et al., 2014).

This figure, consistent with findings from the 2003 National Immunization Coverage Survey, was among the lowest globally and reflects the poor health status of children in the country (Ophori et al., 2014). The coverage has not changed significantly over the past two decades.

During the past thirty years, vaccines have experienced a renaissance. Advances in science, business, and distribution have transformed the field, positioning vaccines as a “best buy” in global health, a driver of pharmaceutical industry growth, and a key instrument of international development (Stéphenne, 2011). With many new vaccines available and others in development, the global community must explore innovative strategies to ensure equitable access in developing countries (Wang et al., 2013). These include tiered pricing models, innovative financing mechanisms such as advance market commitments, long-term high-volume procurement contracts, and technology transfer initiatives that enable sharing of intellectual property and production techniques. Such approaches can facilitate access to life-saving vaccines for diseases such as pneumonia, rotavirus, and malaria. However, many countries continue to face challenges in introducing new vaccines, particularly with respect to ensuring consistent and predictable financing and managing the costs associated with expanding immunization systems (Deogaonkar et al., 2012).

The cost of vaccination varies significantly across countries and depends on multiple factors, including available infrastructure, vaccine consumption and wastage rates, logistics for distribution, and vaccine pricing. The introduction of newer vaccines is expected to substantially increase overall costs (Kaddar et al., 2004). Securing reliable and adequate public funding for preventive services, even those considered highly cost-effective, remains a major challenge. Although traditional childhood vaccines are relatively inexpensive, funding in low-income countries is often unstable and influenced by political and donor priorities (Ojo et al., 2011). The introduction of newer and more expensive vaccines under initiatives such as the Global Alliance for Vaccines and Immunization (GAVI) has further intensified financial pres-

sures (Bill & Melinda Gates Foundation, 2001). Evidence suggests that adopting combination vaccines can significantly increase the costs of national immunization programmes (UNICEF, 2018). This has raised concerns regarding long-term affordability and highlighted the need for shared financial responsibility between national governments and international partners (Wang et al., 2013).

Inadequate funding disrupts multiple aspects of vaccine supply and service delivery. Financing strategies often include mechanisms to ensure predictable government funding and flexible donor contributions, such as state-level basket funds, dedicated federal budget lines for vaccine procurement, and donor-backed financial guarantees (International Vaccine Access Center, 2012). Under decentralized fiscal systems, states and local government areas (LGAs) are responsible for managing immunization funding. However, even when funds are allocated, delays in disbursement to LGAs and primary healthcare centres (PHCs) are common. Basket funding mechanisms combine state and LGA contributions to support service delivery, logistics, equipment maintenance, and other operational costs. Flexible donor funding can also enhance service delivery by improving cash flow at peripheral levels (International Vaccine Access Center, 2012). Despite these strategies, achieving sustainable and predictable financing remains a major challenge for universal vaccine access, particularly with the introduction of newer and often more expensive vaccines (Levine et al., 2011).

Therefore, assessing clients' willingness to accept (WTA) and willingness to pay (WTP) for healthcare services provides valuable insight into the monetary value individuals place on such services (Rezaei et al., 2020).

This study assessed willingness to pay for routine immunization and its determinants among residents of rural areas in Kano State.

Methods

Study Design and Setting

A cross-sectional descriptive study was conducted using the contingent valuation method (CVM) to estimate willingness to pay (WTP) for routine immunization services in rural areas of Kumbotso Local Government Area (LGA), Kano State, Northern Nigeria.

Population and Sampling

The study population comprised heads of households residing in selected rural communities (Dambare and Samegu) within Kumbotso LGA. Eligible participants were permanent residents who provided informed consent to participate in the study. A total sample size of 418 participants was determined using a standard sample size calculation formula. A multistage sampling technique was employed to select study participants.

Data Collection

Primary data were collected using a structured interviewer-administered questionnaire. Data collection was conducted by the researchers and trained research assistants. Information obtained included sociodemographic characteristics, knowledge of routine immunization, willingness to pay for routine immunization services, and determinants influencing WTP.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of the Kano State Ministry of Health. Written informed consent was obtained from all participants prior to data collection.

Data Analysis

Data were analyzed using Microsoft Excel and Stata. Descriptive statistics were presented as proportions and percentages for categorical variables, and as means with standard deviations for continuous variables. Bivariate analysis was conducted using the Chi-square test of independence. Multivariate analysis was performed using logistic regression to control for potential confounding variables. A p-value of < 0.05 was considered statistically significant.

Results

A total of 418 questionnaires were administered to participants in the study area, of which 406 were completed and retrieved, yielding a response rate of 97.1%. The mean age of the study participants was 39.2 ± 9.8 years. Approximately three-quarters of the participants were male, and the predominant ethnic group was Hausa/Fulani. Nearly one-quarter (25.9%) had at least secondary-level education, while about half (51.7%) were farmers. About three-quarters (73.9%) had a

Table 1: Socio-demographic Characteristics of Respondents ($n = 406$)

Variables	Frequency (n)	Percentage (%)
Age Group (years)		
20–29	102	25.1
30–39	125	30.8
40–49	86	21.2
50–59	71	17.5
60–69	22	5.4
Mean ± SD	39.2 ± 9.8	
Sex		
Male	366	90.1
Female	40	9.9
Ethnic Group		
Hausa/Fulani	303	74.6
Yoruba	24	5.9
Igbo	18	4.4
Others	61	15.0
Educational Status		
None	22	5.4
Non-formal	134	33.0
Primary	145	35.7
Secondary	64	15.8
Tertiary	41	10.1
Marital Status		
Married	366	90.1
Others	40	9.9
Occupational Status		
Civil servant	103	25.4
Farmer	210	51.7
Business	56	13.8
Housewife	20	4.9
Others	17	4.2
Household Size		
≤ 6	106	26.1
> 6	300	73.9
Monthly Income		
< ₦30,000	138	34.0
₦30,001–₦50,000	164	40.4
₦50,001–₦100,000	73	18.0
> ₦100,000	31	7.6
Place of Delivery		
Home	262	64.5
Hospital	144	35.5
Distance to Health Facility		
≤ 5 km	172	42.4
> 5 km	234	57.6
Healthcare Expenditure		
≤ ₦3,000	182	44.8
> ₦3,000	224	55.2

Percentages may not sum exactly to 100 due to rounding.

household size greater than six. Slightly more than one-quarter (25.6%) reported a monthly income exceeding ₦50,000. More than one-third (35.5%) delivered their index child in a hospital, and only 42.4% resided within a five-kilometre walking distance to a health facility. Additionally, more than half of the participants reported healthcare expenditure exceeding ₦3,000 in the month preceding the study (Table 1).

Table 2: Respondents' Knowledge and Willingness to Pay for Routine Immunization Services ($n = 406$)

Variables	Frequency (n)	Percentage (%)
Knowledge of:		
Importance of routine immunization	104	25.6
Immunization schedule in Nigeria	102	25.1
Benefits of routine immunization	102	25.1
Willingness to Participate in Routine Immunization	136	33.5

Percentages may not sum exactly to 100 due to rounding.

Table 3: Distribution of Respondents by Amount Willing to Pay for Routine Immunization Services ($n = 136$)

Amount WTP (₦)	Frequency (n)	Percentage (%)
<10,000	63	46.3
20,000	33	24.3
30,000	20	14.7
40,000	12	8.8
60,000	8	5.9
Total	**136**	**100.0**

*WTP = Willingness to Pay

Only about one-quarter (25%) of the participants demonstrated adequate knowledge of routine immunization, including its schedule and benefits. Approximately one-third (33.5%) were willing to pay for routine immunization services (Table 2).

Table 4: Relationship between socio-demographic variables and WTP for routine immunization services among study participants

Variables	YES	NO	χ^2	P-value
Age (years)				
20–29	33	69	2.62	0.623
30–39	40	85		
40–49	32	54		
50–59	21	50		
60–69	10	12		
Sex				
Male	121	245	0.243	0.623
Female	15	25		
Ethnic Group				
Hausa/Fulani	88	215	14.6	0.002
Yoruba	10	14		
Igbo	12	6		
Others	26	35		
Educational Status				
None	6	16	52.6	
Non-formal	31	101		0.0001
Primary	40	105		
Secondary	38	26		
Tertiary	31	10		
Marital Status				
Married	126	240	1.05	0.306
Others	10	30		
Occupational Status				
Civil servant	53	50	55.8	0.00001
Farmer	35	175		
Business	28	28		
Housewife	10	10		
Others	10	7		
Household Size				
≤ 6	76	30	91.7	0.0001
> 6	60	240		
Monthly Income				
< ₦30,000	21	117	88.3	0.0001
₦30,001–₦50,000	42	122		
₦50,001–₦100,000	52	21		
> ₦100,000	21	10		
Place of Delivery				
Home	36	226	126.9	0.0001
Hospital	100	44		
Distance to Health Facility				
≤ 5 km	94	78	59.9	0.0001
> 5 km	42	192		
Healthcare Expenditure				
≤ ₦3,000	36	146	27.9	0.0001
> ₦3,000	100	124		

Percentages may not sum exactly to 100 due to rounding.

The mean amount participants were willing to pay was ₦20,029.40 ± 14,519.70 (Table 3). At the bivariate level, educational status was significantly associated with willingness to pay for routine immunization at the 5% significance level, with participants who had at least secondary education being more likely to be willing to pay. Other statistically significant factors included occupation (civil servants: 36.7%), ethnicity (Hausa), monthly income greater than ₦50,000 (53.7%), household size of six or fewer members, healthcare expenditure exceeding ₦3,000, and distance to the nearest health facility. Age, gender, and marital status were not significantly associated with willingness to pay for routine immunization ($p > 0.05$) (Table **??**).

After adjusting for potential confounders, determinants of willingness to pay for routine immunization services that remained statistically significant included educational status, monthly income of the household head, place of delivery, healthcare expenditure in the preceding month, and knowledge of the benefits of routine immunization. Conversely, age of the household head was negatively associated with willingness to pay. The pseudo R^2 value of the model was 0.235 (Table **??**).

Discussion

Several studies across the globe, particularly in developed countries, have examined factors influencing willingness to pay (WTP) for routine immunization services (Onwujekwe et al., 2019; Walraven, 1996). Commonly documented determinants of WTP include age, income, educational status, household size, geographic location, occupation, healthcare expenditure, and distance to health facilities (Wonodi et al., 2012). In the present study, the mean age of participants was 39.2 ± 9.8 years. This finding was considerably higher than that reported by Ossai and Fatiregun in Enugu State, Nigeria, where the mean age of respondents in urban areas was 28.9±4.5 years and 26.7±5.1 years in rural areas (Ossai & Fatiregun, 2015).

This study found that approximately one-third (33.5%) of mothers were willing to pay for routine immunization services. This finding is consistent with reports from similar studies conducted

in Nigeria, where willingness to pay was

Table 5: Logistic regression analysis of the determinants of WTP for routine immunization services among the study participants

Variable(s)	Coefficient	Std. Err	OR	P-value	95% Conf. Interval	
Age (AGE)	-0.2899	0.1600	0.7483	$< 0.05^*$	0.4139	0.9000
Educational status (EDUC)	1.2359	1.2400	3.4415	$< 0.05^*$	1.4500	4.6800
Monthly income (MONI)	0.5117	0.2800	1.6681	$< 0.05^*$	1.0997	2.4279
Household size (HHS)	-0.3116	0.7719	0.7323	0.125	-0.0396	2.2453
Distance to health facility (DHF)	-0.1675	0.7139	0.8458	0.132	-0.0203	2.2451
Health care expenditure (HCE)	0.2753	0.1017	1.3169	$< 0.05^*$	1.1175	1.4186
Knowledge on importance of RI	1.0045	0.5891	2.7305	$< 0.05^*$	1.5759	3.3196
Place of delivery (PD)	0.5118	0.2198	1.6683	$< 0.05^*$	1.2375	1.9979
Constant	1.9993	2.6324	7.3839	$< 0.05^*$	2.2245	10.0163

$P < 0.05^*$ indicates significant factors affecting willingness to pay.

Logistic regression Number of obs = 406 LR $chi^2(8)$ = 51.67 Prob > chi^2 = 0.05 Log likelihood = -138.28 Pseudo R^2 = 0.235

strongly influenced by socioeconomic status and awareness levels (Onwujekwe et al., 2019). The relatively low willingness to pay observed in this study may reflect prevailing economic hardship, low household income, and the longstanding expectation that immunization services should remain free of charge in public healthcare facilities.

Maternal education emerged as a strong predictor of willingness to pay, likely due to improved health literacy and better understanding of the benefits of immunization. Similar findings have been reported in previous Nigerian studies (Ossai & Fatiregun, 2015). Education improves individuals' ability to access, interpret, and utilize health-related information, thereby influencing health-seeking behavior and healthcare financing decisions. Mothers with higher educational attainment may also be more likely to appreciate the preventive value of immunization and the long-term economic benefits associated with disease prevention.

Maternal age was found to be a significant predictor of willingness to pay, with older mothers demonstrating higher odds of willingness to pay compared to younger mothers. This may reflect increased exposure to child health experiences, including encounters with vaccine-preventable diseases, as well as greater autonomy in household decision-making. Similar findings have been reported in studies conducted in sub-Saharan Africa, where maternal age positively influenced healthcare-seeking behavior and valuation of preventive services (Ossai & Fatiregun, 2015; Uzochukwu et al., 2018). Older mothers may also possess accumulated experiential knowledge that reinforces the perceived importance of immunization, thereby increasing their readiness to incur out-of-pocket healthcare expenditures.

Maternal educational status showed a strong and statistically significant association with willingness to pay. Mothers with at least secondary education were significantly more likely to express willingness to pay compared to those without formal education. Education enhances health literacy, enabling individuals to better understand the benefits of immunization and the risks associated with non-compliance. This finding aligns with previous literature indicating that maternal education is a consistent determinant of both immunization uptake and healthcare financing decisions (Adepoju et al., 2020; Onwujekwe et al., 2019). Furthermore, education may positively influence attitudes toward modern healthcare services and reduce susceptibility to misinformation regarding vaccines and immunization programmes.

Household income emerged as one of the strongest predictors of willingness to pay, with higher-income households exhibiting significantly greater likelihood of willingness to pay for routine immunization services. This finding is consistent with economic theory, which posits that the ability to pay is a primary determinant of demand for healthcare services. In low-resource settings, financial constraints remain a major barrier to accessing healthcare services, even when such ser-

vices are nominally free, due to indirect costs such as transportation and opportunity costs (Ichoku et al., 2017; Ossai & Fatiregun, 2015). The observed association suggests that any cost-recovery mechanism for immunization services must be carefully designed to avoid worsening inequities in access to healthcare.

Healthcare expenditure was also significantly associated with willingness to pay. Households with higher prior healthcare spending were more likely to express willingness to pay for immunization services. This may indicate a greater valuation of health or increased familiarity with out-of-pocket payment systems. It is plausible that such households perceive immunization as a worthwhile investment capable of preventing more costly illnesses in the future. This finding is supported by previous studies demonstrating that prior healthcare spending behavior predicts future willingness to invest in preventive healthcare services (Dong et al., 2004).

Knowledge of the importance of routine immunization was identified as a key cognitive determinant of willingness to pay. Mothers with good knowledge of immunization benefits were significantly more likely to be willing to pay compared to those with poor knowledge. This reinforces the critical role of health education in shaping demand for preventive healthcare services. Knowledge influences risk perception and perceived benefits, both of which are central constructs in health behavior theories such as the Health Belief Model. Empirical evidence consistently demonstrates that improved awareness of immunization benefits is associated with higher uptake and acceptance of related healthcare costs (Babatunde et al., 2021).

Facility-based delivery was another significant determinant of willingness to pay for routine immunization services. Mothers who delivered in health facilities demonstrated greater willingness to pay compared to those who delivered at home. Facility-based delivery often provides opportunities for early exposure to immunization services, health education, and interaction with skilled healthcare personnel. Such exposure may enhance trust in the healthcare system and increase the perceived value of immunization services. Similar findings have been reported in previous studies, where utilization of formal healthcare services during childbirth was positively associated with subsequent uptake of child health services, including immunization (Fagbamigbe et al., 2017).

Overall, the multivariate findings indicate that willingness to pay for routine immunization is influenced not only by economic factors but also by educational, experiential, and cognitive determinants. These findings suggest that interventions aimed at improving maternal education, strengthening household economic capacity, enhancing knowledge of immunization benefits, and promoting facility-based delivery may collectively improve willingness to pay and contribute to sustainable immunization financing strategies.

Conclusion

Willingness to pay for routine immunization among mothers residing in rural areas of Kano State was relatively low and was significantly influenced by educational status, household income, healthcare expenditure, knowledge of routine immunization, and place of delivery. These findings suggest that both socioeconomic and cognitive factors play important roles in shaping demand for immunization services. Policymakers should consider these determinants when designing sustainable immunization financing strategies and interventions aimed at improving equitable access to routine immunization services.

Recommendations

There is a need for government and relevant stakeholders to strengthen awareness creation on the importance and benefits of routine immunization in rural communities of Kano State. Community-based health education campaigns should be intensified through the use of health workers, religious leaders, traditional leaders, and mass media in order to improve knowledge and acceptance of routine immunization services. Since educational status significantly influenced willingness to pay (WTP), adult literacy and female education programs should also be encouraged. Policymakers should improve accessibility of health facilities, especially in hard-to-reach rural areas, by establishing more primary healthcare centers and outreach services closer to communities. Economic empowerment programs targeted at rural households

may also improve their financial capacity to support child healthcare services. Health insurance schemes and community-based financing mechanisms should be strengthened to reduce the financial burden on households. Efforts should also be made to promote hospital delivery services because mothers who delivered in health facilities were more likely to be willing to pay for routine immunization services.

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Conflict of Interest Statement

The authors declare no competing financial interests or personal relationships that could have influenced this work.

Implications for Practice and Policy

The findings of this study have important implications for public health practice and policy formulation in Nigeria. The low level of willingness to pay for routine immunization among rural households suggests the need for sustained government funding and support for immunization services to ensure equitable access for vulnerable populations. Policymakers should recognize that socioeconomic factors such as education, income, and healthcare expenditure significantly influence healthcare-seeking behavior and utilization of immunization services. For practice, healthcare workers should intensify health education during antenatal care, delivery, and postnatal visits to improve community knowledge regarding the benefits and schedules of routine immunization. Community mobilization strategies involving local leaders and community influencers should be adopted to improve trust and participation in immunization programs. At the policy level, there is a need to integrate routine immunization financing into broader social protection and health insurance programs. Improving rural healthcare infrastructure and reducing geographic barriers to healthcare facilities may increase uptake and sustainability of immunization services. The study also highlights the importance of poverty reduction and educational advancement as long-term strategies for improving child health outcomes and immunization coverage.

What is Known About This Topic

Routine immunization is one of the most cost-effective public health interventions for reducing childhood morbidity and mortality associated with vaccine-preventable diseases. Despite the availability of immunization services in Nigeria, coverage remains suboptimal in many rural communities due to poor awareness, poverty, distance to health facilities, and sociocultural barriers. Previous studies have shown that socioeconomic characteristics such as educational level, income, occupation, and access to healthcare services influence utilization of routine immunization services. Evidence also suggests that households with better knowledge of immunization benefits are more likely to participate in and support immunization programs. In addition, willingness to pay for healthcare services has been widely used as an indicator of perceived value and sustainability of health interventions. However, limited studies have specifically examined the determinants of willingness to pay for routine immunization services among rural households in Kano State. This study therefore contributes to existing literature by identifying key socioeconomic and healthcare-related factors influencing willingness to pay for routine immunization services in rural communities.

Authors' Contributions

- **Gana Muhammad Lawan:** Contributed to the study design, data analysis, interpretation of findings, and drafting of the manuscript for intellectual content.
- **Aliyu Mohammed Maigoro:** Contributed to data collection, data analysis, discussion, and interpretation of study findings.
- **Mukhtar Muhammad Sa'idu:** Contributed from conceptualization of the research idea through analysis and interpretation of the research findings.

References

Adedire, E. B., Ajayi, I., Fawole, O. I., Ajumobi, O., Kasasa, S., Wasswa, P., & Nguku, P. (2016). 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*, *16*(1), 1–8. https://doi.org/10.1186/s12889-016-3531-x

Adepoju, A. O., Preston, M. A., & Gonzales, G. (2020). Health literacy and health outcomes among nigerian women. *BMC Public Health*, *20*(1), 1–10. https://doi.org/10.1186/s12889-020-08545-y

Babatunde, O. A., Oladipo, O. A., & Adebowale, A. S. (2021). Knowledge and uptake of routine immunization among mothers in rural nigeria. *African Journal of Primary Health Care & Family Medicine*, *13*(1), e1–e8.

Bill & Melinda Gates Foundation. (2001). Immunization focus: A vaccine for africa [Focus, June, 1–10].

Deogaonkar, R., Hutubessy, R., van der Putten, I., Evers, S., & Jit, M. (2012). Systematic review of studies evaluating the broader economic impact of vaccination in low- and middle-income countries. *BMC Public Health*, *12*(1), 1. https://doi.org/10.1186/1471-2458-12-878

Dong, H., Kouyaté, B., Cairns, J., & Sauerborn, R. (2004). Willingness-to-pay for community-based insurance in burkina faso. *Health Economics*, *13*(9), 877–890. https://doi.org/10.1002/hec.892

Fagbamigbe, A. F., Adebowale, A. S., & Morakinyo, O. M. (2017). Survival analysis of time to uptake of immunization among children in nigeria. *BMC Public Health*, *17*(1), 1–10.

Gadhia, R., & Mäkinen, M. (2005). Best practices in financial sustainability plans for immunization programs.

Gidado, S., Nguku, P., Biya, O., Waziri, N. E., Mohammed, A., Nsubuga, P., Akpan, H., Oyemakinde, A., Nasidi, A., Suleman, I., Abanida, E., Musa, Y., & Sabitu, K. (2014). Determinants of routine immunization coverage in bungudu, zamfara state, northern nigeria, may 2010. *Pan African Medical Journal*, *18*, 9. https://doi.org/10.11694/pamj.supp.2014.18.1.4149

Harris, J. B., Gacic-Dobo, M., Eggers, R., Brown, D. W., & Sodha, S. V. (2017). Global routine vaccination coverage, 2016. *Weekly Epidemiological Record*, *92*(46), 701–707. https://doi.org/10.15585/mmwr.mm6842a1

Ichoku, H. E., Fonta, W. M., & Onwujekwe, O. E. (2017). Incidence and intensity of catastrophic healthcare financing in nigeria. *Journal of Public Health*, *25*(3), 269–277.

International Vaccine Access Center. (2012). *Landscape analysis of routine immunization in nigeria: Identifying barriers and prioritizing interventions*.

Kaddar, M., Lydon, P., & Levine, R. (2004). Financial challenges of immunization: A look at gavi. *Bulletin of the World Health Organization*, *82*(9), 697–702. https://doi.org/10.1590/S0042-96862004000900012

Levine, O. S., Bloom, D. E., Cherian, T., de Quadros, C., Sow, S., Wecker, J., Duclos, P., & Greenwood, B. (2011). The future of immunisation policy, implementation, and financing. *The Lancet*, *378*(9789), 439–448. https://doi.org/10.1016/S0140-6736(11)60406-6

Munk, C., Portnoy, A., Suharlim, C., Clarke-Deelder, E., Brenzel, L., Resch, S. C., & Menzies, N. A. (2019). Systematic review of the costs and effectiveness of interventions to increase infant vaccination coverage in low- and middle-income countries. *BMC Health Services Research*, *19*(1), 1–10. https://doi.org/10.1186/s12913-019-4468-4

Musgrove, P. (1993). Investing in health: The 1993 world development report of the world bank. *Bulletin of the Pan American Health Organization*, *27*(3), 284–286.

National Population Commission (NPC) [Nigeria] & ICF. (2019). *Nigeria demographic and health survey 2018*. The DHS Program, ICF. Rockville, Maryland, USA.

Ojo, K., Yisa, I., & Soyibo, A. (2011). Cost of routine immunization in nigeria [Accessed June 2011]. http://www.checod.org/wp-content/uploads/2013/11/Publication-0011.pdf

Onwujekwe, O., Hanson, K., & Uzochukwu, B. (2019). Examining inequities in willingness

to pay for healthcare services in nigeria. *Health Policy and Planning*, *34*(2), 123–131. https://doi.org/10.1093/heapol/czz012

Ophori, E. A., Tula, M. Y., Azih, A. V., Okojie, R., & Ikpo, E. P. (2014). Current trends of immunization in nigeria: Prospects and challenges. *Tropical Medicine and Health*, *42*(2), 67–75. https://doi.org/10.2149/tmh.2013-13

Ossai, E. N., & Fatiregun, A. A. (2015). Clients' willingness to pay for immunization services in the urban and rural primary health centers of enugu state, nigeria. *Journal of Public Health in Africa*, *6*(1), 480. https://doi.org/10.4081/jphia.2015.480

Rezaei, S., Woldemichael, A., Mirzaei, M., Mohammadi, S., & Karami Matin, B. (2020). Mothers' willingness to accept and pay for vaccines for their children in western iran: A contingent valuation study. *BMC Pediatrics*, *20*(1), 307. https://doi.org/10.1186/s12887-020-02208-4

Stéphenne, J. (2011). Vaccines as a global imperative: A business perspective. *Health Affairs*, *30*(6), 1042–1048. https://doi.org/10.1377/hlthaff.2011.0338

UNICEF. (2018). *Immunization financing in MENA middle-income countries*. United Nations Children's Fund. https://www.unicef.org/mena/sites/unicef.org.mena/files/2018-04/immunization%20financing%20Web_0.pdf

Uzochukwu, B. S. C., Onwujekwe, O. E., & Akpala, C. O. (2018). Community perceptions and demand for immunization services in nigeria. *International Journal of Health Planning and Management*, *33*(2), e620–e634.

Walraven, G. (1996). Willingness to pay for district hospital services in rural tanzania. *Health Policy and Planning*, *11*(4), 428–437. https://doi.org/10.1093/heapol/11.4.428

Wang, S. A., Hyde, T. B., Mounier-Jack, S., Brenzel, L., Favin, M., Gordon, W. S., Shearer, J. C., Mantel, C. F., Arora, N., & Durrheim, D. (2013). New vaccine introductions: Assessing the impact and the opportunities for immunization and health systems strengthening. *Vaccine*, *31*(Suppl 2). https://doi.org/10.1016/j.vaccine.2012.10.116

Wonodi, B. C., Stokes-Prindle, C., Aina, M., Oni, G., Olukowi, T., Pate, M. A., Privor-Dumm, L., & Levine, O. (2012). *Landscape analysis of routine immunization in nigeria*. International Vaccine Access Center. http://www.jhsph.edu/research/centers-and-institutes/ivac/projects/nigeria/IVAC-Landscape-Analysis-Routine-Immunization-Nigeria-WhitePaper.pdf