The Impact of Second Year of Life Immunization on Childhood Routine Immunization Outcomes in Yenagoa, Bayelsa State, Nigeria.

Tarimobowei Egberipou[1*], Darius Fortunatus Gbeinbo[2]

[1]Department of Medical and Dental Services, Hospitals Management Board, Yenagoa, Bayelsa State, Nigeria.

[2]Department of Public Health, Bayelsa Medical University, Yenagoa, Bayelsa State, Nigeria.

[*]Corresponding author

DOI: https://dx.doi.org/10.51244/IJRSI.2025.1215PH000232

Received: 18 December 2025; Accepted: 24 December 2025; Published: 03 January 2026

ABSTRACT

Immunization is globally considered to be the zenith of cost-effectiveness when strategies for the prevention, control, elimination and eradication of diseases, particularly infectious diseases, are assessed. Consequently, it is noted that, over the course of the past quarter century, immunization of children and adolescents has significantly reduced communicable disease morbidity and mortality, worldwide, by a margin of some forty-five percent and counting. However, though there exist several diverse initiatives, within the compendium of healthcare interventions for the protection of infants and children, immunization particularly stands out in the opportunity it provides for the on-boarding of other essential health care services, including health promotion and treatment, within the context of integration and convergence of services. In consonance, thereof, 2YL immunization provides a platform for the introduction of new vaccines, improvement of routine immunization vaccine uptake and coverage, as well as the strengthening of health systems, at subnational and national levels, through the attainment of disease control and elimination goals. The foregoing premise is contingent upon considerations of the myriad inequities such as vaccine hesitancy, non-compliance, religious beliefs, sociocultural differences, economic barriers, and lack of awareness or sensitization, bedeviling immunization in infancy, in affected regions, worldwide. Thus, the concept of second year of life (2YL) immunization advocates for the vaccination of eligible children, with recommended vaccine antigens, as appropriate, with a view to increasing herd immunity, in fledging populations, such as those of Bayelsa state, Nigeria, where attainment of globally recommended vaccination coverage targets have been suboptimal. This study, therefore, seeks to assess the impact of 2YL immunization on childhood routine immunization outcomes in Bayelsa state, Nigeria.

Index terms: Second-Year-of-Life immunization, Herd immunity, Childhood routine immunization outcomes.

INTRODUCTION

Immunization is known to be one of the most cost-effective strategies for the prevention, control, elimination and eradication of diseases globally [40]. Immunization is further noted to have significantly reduced child mortality, worldwide, by a margin of forty-five percent over a period of twenty-eight years, spanning the years 1990 to 2018. Consistent with the foregoing, immunization continues to save about two to three million lives every year, globally [23], [34]. These positive outcomes have been from the implementation of established guidelines and policies in diverse health intervention programs, amid support from global stakeholders, for vaccine research, procurement and utilization in an integrated context [23], [28]. However, the foregoing positive outcomes have not been without surmounting myriad inequities in the delivery of health care that are all at once common, general, and locale specific [28].

Whereas, immunization is but one of a diverse compendium of health interventions available to ensure a healthy life for infants and children, it provides an opportunity for the on-boarding of other essential health care services such as micronutrient supplementation, deworming, growth monitoring, health promotion and treatment of common ailments [40], [42], [44]. In line with the foregoing, therefore, health facility access for other services can serve as opportunities for immunization of eligible children with missed doses of earlier scheduled vaccines

[40], [42], [44]. This context of programmatic integration belies the concept of immunization beyond infancy, which is one of the transformative actions from the World Health Organization's Global Routine Immunization Strategies and Practices (GRISP) [42]. Consequently, adoption of GRISP is noted to be very critical for the strengthening of routine immunization as it encourages expanded scheduled immunization even after infancy [42], [44].

To this end, therefore, the concept of second year of life (2YL) immunization advocates for the vaccination of children from twelve to twenty-four months and beyond, with the recommended vaccines antigens. The essential premise being to increase herd immunity as well as attain global vaccination coverage and disease control and elimination goals [11], [33]. 2YL immunization further serves as an opportunity to improve the uptake of new vaccines, when introduced, and strengthen health systems through integration of services with other intervention programs [11], [33], [42]. Consequently, the vaccination of eligible children, in the second year of life, with one of the recommended three booster doses of tetanus toxoid vaccine, as well as the second dose of the measles vaccine, is noted to increase protection against these target diseases and is a testament to the increasing significance of 2YL immunization, globally [28], [40].

In Low-and-Middle-Income-Countries (LMIC's), such as Nigeria, vaccine preventable diseases are noted to be the major contributors to high child morbidity and mortality, accounting for over seven hundred thousand deaths, in the year 2018 [10], [34] and two hundred thousand deaths per annum in Nigeria, particularly [40]. Therefore, administration of vaccines at appropriate ages and specified time periods, as well as, completeness of same, are crucial to the reversal of poor health outcomes for children, especially, and adults as well [45]. Thus, 2YL immunization significantly impacts disease morbidity and mortality through the provision of a window of opportunity for appropriate protection of vulnerable target groups [23], [41], [45].

Furthermore, in Nigeria and many LMIC's, where out of pocket expenditure is still the predominant form of payment for health care, 2YL has the advantage of preventing catastrophic expenditure, through post vaccination reduction in disease prevalence and incidence, mainly by aversion of cost of illness such as cost of medical consultation, hospitalization, drugs and procedures as well as productivity losses for caregivers [23], [41]. Consequently, about forty-one GAVI eligible LMIC's are projected to prevent expenditure of $4.6 billion in self provided funding through the implementation of 2YL immunization for measles, rotavirus, and pneumococcal vaccines [23], [41]. This has the ripple effect of reducing poverty through expenditure savings, from emergency medical expenses, which are estimated to amount to about ten to twenty-five (10 – 25%) percent of household income [23], [41].

Also, 2YL provides opportunities for administration of missed doses of vaccines occurring, during the infant years, for diverse reasons such as vaccine hesitancy, non-compliance, religious beliefs, sociocultural differences, economic barriers and lack of awareness or sensitization [23], [41]. These factors significantly impact childhood vaccination initiation and completion rates as gleaned from the presence of over 2.2 million estimated zero-dose children in the year 2021, particularly spread across many LMIC's [43]. The contextual significance of the foregoing is all the more critical when the contribution of the abysmally poor traditional childhood routine immunization coverage rates of Bayelsa State, Nigeria, on the DHIS2 reporting platform, put at 29% in 2019, 23.2% in 2020, 27.3% in 2021, 37% in 2022 and 55.1% in 2023, in this regard, is considered.

Lastly, whereas, there are quite a number of studies on childhood routine immunization in Nigeria and Bayelsa State, in particular, there is little documentation on 2YL immunization in this clime. Consequently, investigation of the impact of 2YL immunization on childhood routine immunization outcomes is considered warranted and tacit.

MATERIALS AND METHODS

Study design

An analytical cross sectional study design was adopted for this study.

Study Population

The study was conducted in Yenagoa Local Government Area of Bayelsa State, Nigeria. Yenagoa Local Government Area is one of the three local government areas that make up the central senatorial district of Bayelsa

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV December 2025 | Special Issue on Public Health

State, Nigeria. Yenagoa Local Government Area is made up of fifteen political wards and seventy-two indigenous communities. It has a total of thirty-six primary health care centers, thirty-four private health facilities, two public secondary health facilities and two tertiary public health facilities. The total projected population of the Local Government Area (using the 2006 population census figures as baseline) is five hundred and ninety-one thousand, one hundred and eighteen (591,118).

Sampling Frame

The sampling frame consisted of caregivers of children aged 0 - 24 months residing in the various communities of Yenagoa Local Government Area of Bayelsa State, Nigeria.

Sample size

The sample size was determined using the Cochran formula:

Sample size (n) = z^2pq/d^2

Where, z = 1.96 (95% confidence interval)

p = 57% (MICS/NICS, 2018)
q = 1 – p = 1 – 0.57 = 0.43
d = 0.05 (Margin of error)
Therefore, n = $(1.96)^2$ x 0.57 x 0.43/ $(0.05)^2$
n = 0.6592/0.0025 = 377

Adjustment for non-response

The adjustment factor for non-response adopted for the study was 10%.
Thus, $n_{adjusted} = n/1 – r$,
Where, r = 10%
Therefore, $n_{adjusted}$ = 377/1 -0.1 = 377/0.9
$n_{adjusted}$ = 419

Sampling technique

Multistage sampling technique was used to select eligible participants for the study.

1) Stage 1(selection of Senatorial District): The Central Senatorial District was selected from the three senatorial districts that make up Bayelsa State, Nigeria, using simple random sampling.
2) Stage 2(selection of Local Government Area): Yenagoa Local Government Area was selected from the three Local Government areas that make up the central senatorial district, using simple random sampling.
3) Stage 3(collection of secondary data): Secondary data, comprising of the list of all geo-political wards, their constituent communities, and local Primary Health Centers in Yenagoa Local Government Area, was collected from the offices of the Public Health Department of Yenagoa Local Government Area council.
4) Stage 4(selection of wards): Epie 2 ward, from the fifteen wards that make up Yenagoa Local Government Area was selected using simple random sampling. To do this effectively, secondary data from Yenagoa Local Government Area council was used.
5) Stage 5(selection of communities): Yenezue-gene community, out of the communities making up the ward was then selected using simple random sampling.
6) Stage 6(selection of Primary Health Center): Following the selection of the community, Yenezue-gene Primary Health Center was selected, using simple random sampling, and served as the location for data collection.
7) Stage 7(selection of participants): Following the selection of Primary Health Center, eligible participants for the study were selected using simple random sampling, and included in the study, based on on a set of inclusion criteria. This process was continued until the estimated sample size for the study was reached.

Inclusion Criteria

The following inclusion criteria were used to recruit participants for the study:

1. All caregivers of children aged 0 - 24 months residing in Yenagoa Local Government Area, Bayelsa State, Nigeria.
2. All caregivers of children aged 0 -24 months attending at the selected health facility for immunization.

Exclusion Criteria

1. All caregivers of children aged 0 -24 months who were visitors to Yenagoa Local Government Area, Bayelsa State, Nigeria, were excluded from the study.
2. All caregivers of children aged 0 - 24 months not attending at the selected primary health facility for immunization, were excluded from the study.
3. All caregivers of children aged 0 - 24 months who refused to give consent for the study were excluded from the study.

Data Extraction

A pretested and validated questionnaire was used to obtain data for the study. For ease of administration and completeness, the questionnaire was divided into sections, as follows:

1. Section A – Sociodemographic characteristics of the participants.
2. Section B – Level of awareness of 2YL immunization among caregivers.
3. Section C - Level of access and utilization of 2YL immunization among caregivers.
4. Section D - Impact of 2YL immunization on childhood routine immunization outcomes.

Data Management and Analysis

Extracted data was reviewed to check for impediments to seamless analysis following which analysis was carried out using Statistical Package for Social Sciences (SPSS) version 26. Analysed data was summarized using descriptive and inferential statistics. Whereas, Chi squared and Multiple Logistic Regression statistics were used to test association between variables, and between independent variables and the outcome, respectively, the magnitude of the intervention, measured by the effect size of 2YL immunization, was estimated using Eta^2 statistic.

Ethical considerations

Ethics approval was sought and obtained from the Research Ethics Committee of the Bayelsa State Ministry of Health with research approval documentation number BSHREC/Vol. 1/25/04/002. Written permission was obtained from the Public Health Department of Yenagoa Local Government Council, Bayelsa State, Nigeria, and informed consent was obtained from the hierarchy of the Primary Health Centre selected for the study as well as the caregivers participating in study.

RESULTS

Sociodemographic Characteristics of Respondents

The Sociodemographic characteristics of respondents revealed that most of the study participants were female {n =275(68.9%)} while the remainder were male {n = 124 (31.1%)}. The age of the children for which care was being given, were as follows: age less than 15 months {n = 35 (8.8%)}, and age 15 months or greater {n = 364 (91.2%)}. Concerning the relationship between the care giver and the child, two-thirds {n = 243 (60.9%)} of respondents were mothers, upwards of one-twentieth {n = 23 (5.8%)} were fathers, about one-third {n = 129 (32.3%)} were guardians and other forms or relatives accounted for a very miniscule proportion {n = 4 (1%)}. The statistics in respect of number of children under five years of age in the household was such that about two-thirds {n = 255 (63.9%)} of households had three or more children aged five years while about one-third {n = 144 (36.1%)} of households had children aged less than five years old. As per educational status of caregivers,

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV December 2025 | Special Issue on Public Health

upwards of one-half {n = 223 (55.9%)} of the respondents had no formal education, some one –tenth {n = 49 (12.3%)} had primary education, about one-fifth {n = 92 (23.1%)} had secondary education, and just under one-tenth {n = 35 (8.8%)} had tertiary education. Furthermore, whilst upwards of one-half {n = 231 (57.9%)} of the participant households were classified as low income households, about two-fifths {n = 168 (42.1%)} of participant households were classified as medium income households. See table 1.

TABLE 1 Sociodemographic Characteristics of Respondents

Variables	Frequency	Percentage (%)
Age of child		
<15months	35	8.8
15months and above	364	91.2
Caregiver Gender		
Male	124	31.1
Female	275	68.9
Caregiver Educational level		
No formal education	223	55.9
Primary	49	12.3
Secondary	92	23.1
Tertiary	35	8.8
Caregiver Relationship to child		
Mother	243	60.9
Father	23	5.8
Guardian	129	32.3
Other	4	1.0
Caregiver Household income Level		
Low- income	231	57.9
Medium - income	168	42.1
Number of children 5yrs and below		
Less than 3	144	36.1
3 and above	255	63.9

Occupation of Respondents

The interrogation of the occupation of respondents (caregivers) revealed that most of the caregivers {n = 204 (51.1%)} were engaged in one form of business or the other, approximately on-sixth {n = 58 (14.5%)} were farmers, slightly above one-tenth {n = 51 (12.8%)} were housewives, while somewhat above one-sixteenth were teachers {n = 23 (5.8%)}. Similarly, other notable occupations represented in the population included: tailors accounting for approximately one-twentieth {n = 19 (4.8%)} of the total respondents, civil servants amounting to approximately one- twentieth fifth {n = 14(3.5%)} of the total respondents, and self-employed individuals accounting for a further one-twentieth {n = 18 (4.5%)} of the population. Furthermore, the following significant yet scant representations were noted in the sample population: Health workers {n = 3 (0.8%)}, hairdressers {n = 1{0.3%)}, Students {n = 7 (1.8%)}, and drivers {n = 1 (0.3%)}. See figure 1.

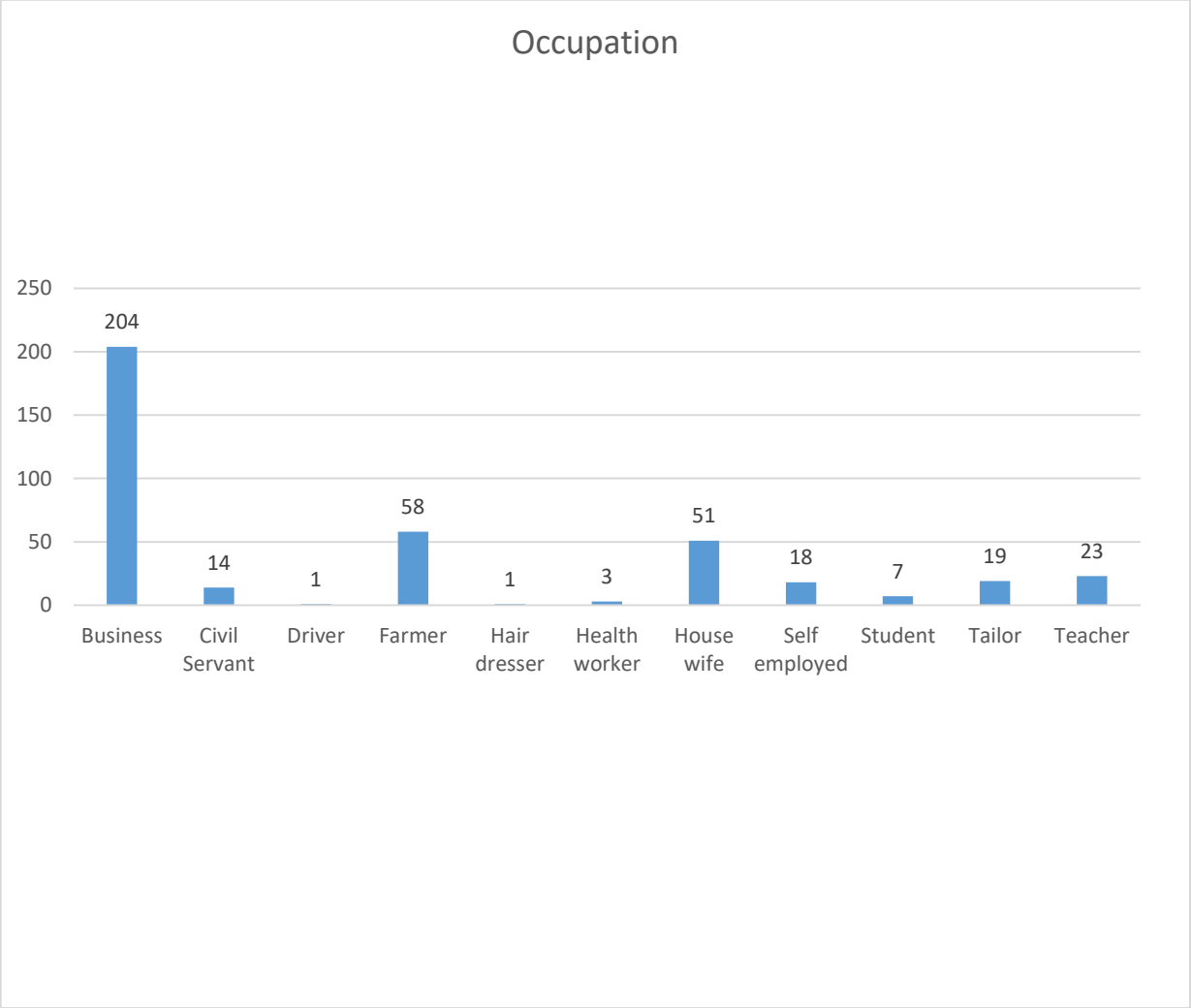

Figure 1: Occupation of respondents

Caregiver awareness and knowledge of Second Year of Life Immunization

The enquiry concerning caregiver awareness, and knowledge, regarding childhood immunization in the second year of life, revealed the following results: approximately one-half {n = 197 (49.4%)} of the respondents volunteered that they were unaware that a child requires immunization during the second year of life, while the reciprocal fraction {n =202 (50.6%)} did submit that they were aware of 2YL immunization.

Further enquiry concerning the vaccines typically administered during the second year of life, among those aware, upwards of one-half {n = 109 (54%)} did mention the measles vaccine (second dose of measles – MCV 2), upwards of one third of respondents {n =123 (60.9%)} identified vitamin A as one of the more commonly administered medicaments, while very few {n = 3 (1.5%)} and {n = 3 (1.5%)} respondents, mentioned Pentavalent vaccine (booster dose – Penta 4), and Polio vaccine (booster dose – OPV 4) as the more commonly administered vaccines during the 2YL. However, approximately one-tenth {n =22 (10.9%)} admitted they had no knowledge of the vaccines or types of vaccines administered in the second year of life.

Concerning the timing of vaccinations within the second year of life, upwards of two-thirds {n =158 (78.2%)} of respondents submitted that 12 -15 months was the right age for the administration of the second dose of the measles vaccine (MCV 2), while approximately one-sixth {n =33 (16.3%)} did opine that 18 months was the most appropriate time for administration of the second dose of measles vaccine (MCV2). However, some {n = 11 (5.4%)} respondents submitted that had no knowledge concerning the timing of second year of life vaccines.

Lastly, interrogation of the purpose of second year of life or booster dose vaccination, about one-half {n = 104 (51.5%)} of respondents posit that boosters are meant to shore up the child's level of immunity, while others {n = 79 (39.1%)} believed vaccine booster doses were essentially administered to prevent new infections of the attendant disease. However, an infinitesimal proportion of respondents {n =1 (0.5%)} did aver that vaccine

booster doses facilitated cure of diseases while some respondents {n =18 (8.9%)} lacked any knowledge of the purpose of vaccine booster doses. See table 2.

TABLE 2 Caregiver Awareness and Knowledge of Second Year of Life Immunization

Variables	Frequency	Percentage (%)
Are you aware that a child requires immunization in the second year of life (12–24 months)?		
No	197	49.4
Yes	202	50.6
Which vaccines are typically given during the second year of life? (Select all that apply) n=202		
Measles second dose (MCV2)	109	54.0
Vitamin A supplementation	123	60.9
Booster doses (Pentavalent vaccine, Polio)	3	1.5
Typhoid	0	0
Don't know	22	10.9
At what age should the second dose of measles vaccine be given?		
12–15 months	158	78.2
18 months	33	16.3
Don't know	11	5.4
What is the purpose of booster doses?		
Cure diseases	1	.5
Strengthen previous immunity	104	51.5
Prevent new infections	79	39.1
Don't know	18	8.9

Source of Caregiver knowledge on Second-Year-of-Life (2YL) immunization

Concerning source of knowledge of second year of life immunization, the leading source of knowledge reported by the respondents were health workers {n = 162 (80.2%)} while family and friends {n = 138 (68.3%)} did also account significantly for responses in this regard. Furthermore, Media channels {n = 29 (14.4%)} such as, and particularly, television and radio, were noted to be important sources of information just as were social media channels {n = 14 (6.9%)}. Lastly, other sources of information such as magazines, newspapers, newsletters, advertorials, as well as other print and electronic media, were considered by upwards of one-twentieth {n =7 (3.5%)} of respondents, as being veritable channels, for present knowledge on 2YL immunization. See figure 2.

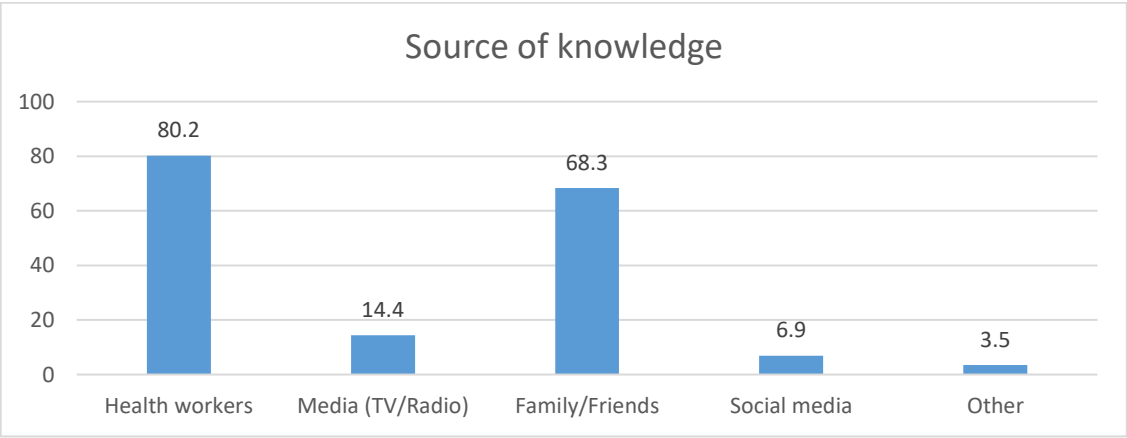

Figure 2: Source of caregiver knowledge on Second-Year-of-Life Immunization.

Availability, Access and Utilization of Second-Year-of-Life (2YL) Immunization

This section presents data on the availability, accessibility, and utilization of immunization services for children aged 12–24 months, inclusive of possible relevant bottlenecks in this regard. Consequently, concerning

availability of second-year-of-life immunization services, a significant portion {n = 190 (94.1%)} of respondents confirmed the availability of such services in their locale, while a scant segment {n = 10 (5%)} were not sure, and an infinitesimal proportion {n = 2 (1%)} were certain that such services were not available. In consonance, thereof, upwards of three quarters of respondents {n = 158 (78.2%)} of respondents volunteered that 2YL immunization services were provided regularly on scheduled days, about one- sixth {n = 30 (14.9%)} averred that services were only available occasionally, and upwards of one twentieth {n = 14 (6.9%)} of respondents were uncertain as to the availability of the service.

Also, regarding utilization of immunization services, most {n = 160 (79.2%)} caregivers did access immunization services for their wards aged 12-24 months, while {n = 42 (20.8%)} others had not. To this end, about one-fifth {n = 42 (20.8%)} of caregivers had never accessed 2YL immunization services, upwards of two-thirds {n = 137 (67.8%)} had sought these services just once during the second-year-of-life, about one-tenth {n=21(10.4%)} just twice, and a very insignificant proportion {n=2 (1%)} three or more times, with the critical motivating factors responsible for this action being: advice from health workers {n = 133 (83.1%)}, reminder messages {n = 119 (74.4%)}, encouragement from family and friends { n = 52 (32.5%)}, participation in community health campaigns { n = 32 (20%)}, and a multiplicity of other reasons {n = 1 (0.6%)}.

In consonance, thereof, relevant reasons for non-utilization of Second-Year-of- Life of Life immunization did include: lack of awareness about 2YL immunization {n = 4 (9.5%)}, poor personal time allotment to adhere to vaccination schedule {n = 2 (4.8%)}, difficulty reaching the health facility {n = 18 (42.9%)}, vaccine stock out {n = 15 (35.7%)}, fear of side effects of vaccination {n = 10 (23.8%)}, and other personal reasons {n =7 (16.7%)}. However, most respondents {n = 120 (59.4%)} still had their child's vaccination cards, about two-thirds {n = 71 (35.1%)} reported having lost it the vaccination cards, while a minute fraction {n = 11 (5.4%)} of respondents did not have vaccination cards for their wards. Furthermore, inquiry into common service delivery challenges, encountered by caregivers, at the health facility, did reveal overcrowding {n = 135 (66.8%)} as the most common problem, just as were long waiting times volunteered by upwards of one-third {n = 63 (31.2%)} of caregivers, vaccine stock-outs as posited by a further one-third{n = 62 (30.7%)} of caregivers, with about one-fifth of caregivers {n = 38 (18.8%)} reporting poor attitude of health workers, and only about one-tenth {n = 16 (7.9%)} of caregivers reporting no significant challenges.

Considering distance travelled to the health facility, upwards of one-half {n = 112 (55.4%)} of respondents reported traveling between 2–5 km, about two fifths {n = 81 (40.1%)} did travel some 2 km to the health facility, while a minimal fraction {n = 8 (4%)} of caregivers often commuted 5 km or more to the health facility, and a significantly infinitesimal proportion {n = 1 (0.5%)} were unsure as to the exact distances travelled when accessing 2YL immunization services. However, most caregivers {n = 119 (58.9%)} did submit that they relied on public transport for travel to service delivery points, with upwards of one-third {n = 68 (33.7%)} often walking to and from the health facility, while about one-tenth {n = 17 (8.4%)} made use of private vehicular transport, and a significantly small proportion {n = 1 (0.5%)} used bicycles for transportation to access 2YL services at the health facility. The corresponding times of travel to the health facility did further corroborate these access parameters with just under one-half of caregivers {n = 87 (43.1%)} admitting to commuting less than thirty minutes to the health facility, while about one-half {n = 105 (52%)} of caregivers volunteered commuting above thirty minutes but just under or about an hour to access services, and a scant proportion {n = 10 (5%)} did require over an hour to reach 2YL immunization service delivery points. See table 3.

TABLE 3 Availability, Access, And Utilization of Second Year of Life Immunization

Variables	Frequency	Percentage(%)
Are immunization services for children aged 12–24 months available in your area?		
Yes	190	94.1
No	2	1.0
Not sure	10	5.0
How are the services provided		
Regularly (on scheduled days)	158	78.2
Occasionally	30	14.9
Not sure	14	6.9

How far is the nearest health facility that offers child immunization?		
Less than 2 km	81	40.1
2–5 km	112	55.4
More than 5 km	8	4.0
Not sure	1	0.5
What is your main mode of transport to the health facility?		
Walking	68	33.7
Bicycle	1	.5
Public transport	119	58.9
Private vehicle	17	8.4
Other	0	0
How long does it take to reach the immunization site?		
Less than 30 minutes	87	43.1
30 minutes–1 hour	105	52.0
More than 1 hour	10	5.0
Have you ever experienced any of the following at the facility when seeking immunization for your child? (Check all that apply)		
Long waiting times	63	31.2
Vaccine stock-out	62	30.7
Poor staff attitude	38	18.8
Facility too crowded	135	66.8
None of the above	16	7.9
Has your child visited the health facility for immunizations between 12 and 24 months of age?		
Yes	160	79.2
No	42	20.8
How many times have you taken your child for immunization during the second year of life?		
None	42	20.8
Once	137	67.8
Twice	21	10.4
Three or more times	2	1.0
What encouraged you to take your child for 2YL immunization? (Check all that apply)		
Health worker advice	133	83.1
Community health campaign	32	20.0
Reminder messages	119	74.4
Family/friends	52	32.5
Other	1	0.6
If your child did not receive second-year vaccines, what were the reasons? (Check all that apply)		
Not aware of need	4	9.5
Too far or difficult to reach	18	42.9
No time	2	4.8
Vaccine not available	15	35.7
Fear of side effects	10	23.8
Other	7	16.7
Do you still have your child's vaccination card?		
Yes	120	59.4
No	11	5.4
Lost it	71	35.1

Childhood routine immunization completion following Second-Year-of-Life (2YL) Immunization

Data on the outcomes of second-year-of-life immunization among children aged 12–24 months, inclusive of relevant service delivery nuances, are presented herewith.

Consequently, about two-thirds {n = 134 (66.3%)} of caregivers volunteered that their wards had received all recommended 2YL vaccines, while upwards of one-fifth {n = 42 (20.8%)} did submit that their wards had not received all 2YL vaccines, as recommended, and slightly above one-tenth {n =26 (12.9%)} were uncertain as to their wards current vaccination status. Accordingly, about two-thirds {n = 102 (63.8%)} of respondents submitted that their wards received recommended 2YL vaccines in a timely manner, in accordance with the immunization schedule, about one-sixth {n = 27 (16.9%)} reported significant delays in vaccination with respect to some vaccine antigens, while {n =29 (18.1%)} reported significant delays in vaccination with respect to most vaccine antigens, and a very minuscule proportion {n = 2 (1.3%)} submitted that their wards did not receive any vaccines on the scheduled immunization date and time.

Lastly, interrogation of vaccination record keeping revealed that upwards of four-fifths {n =131 (81.9%)} had their wards vaccination cards regularly and consistently updated, while upwards of one-tenth {n = 22 (13.8%)} were uncertain as to the status of vaccination card update and immunization record keeping for their wards, and barely one-twentieth {n =7 (4.4%)} of respondents reported inconsistency in immunization record keeping, after each visit to the health facility for immunization. See table 4.

TABLE 4 Childhood Routine Immunization Completion Following Second Year of Life Immunization

Variables	Frequency	Percentage(%)
Has your child received all the recommended vaccines for the second year of life (12–24 months)?		
Yes	134	66.3
No	42	20.8
Not sure	26	12.9
Was the immunization card updated after each visit?		
Yes	131	81.9
No	7	4.4
Not sure	22	13.8
Did your child receive vaccines on time according to the immunization schedule?		
Yes	102	63.8
Some were delayed	27	16.9
Most were delayed	29	18.1
No	2	1.3

Effect of Second-Year-of-Life (2YL) Immunization on childhood routine immunization outcomes.

The findings in respect of immunization coverage during the first and second years, spanning the spectrum of 2YL immunization, for children aged 12- 24 months, is presented here with.

Consequently, about nine-tenths {n =181 (89.6%)} of caregivers confirmed that their wards had received all the recommended first year vaccine antigens, including BCG, Pentavalent vaccine, Oral Polio Vaccine (OPV), and Hepatitis B, while about one-twentieth {n = 9 (4.5%)} reported incomplete vaccinations in this regard, and just under one-twentieth {n =12 (5.9%)} were uncertain as to their wards vaccination status. Concerning specific 2YL vaccine antigen immunization, upwards of one-half {n =115 (56.9%)} of respondents reported that their wards received the second dose of measles vaccine (MCV2), a similar proportion {n =107 (53%)} reported 2YL vitamin A supplementation, while a very minuscule proportion {n = 3 (1.5%)} reported appropriate 2YL OPV booster doses. Also, a unitary proportion {n = 2 (1%)} reported relevant 2YL Pentavalent vaccine booster doses,

while barely one-twentieth {n = 8 (4%)} were uncertain as to their ward's 2YL vaccination status, and upwards of one-fifths {n = 42 (20.8%)} of caregivers reported no 2YL immunization.

Furthermore, regarding the timing of 2YL immunizations, about one-half {n = 76 (47.5%)} of respondents submitted that their wards were vaccinated between 12–15 months of age, another one-half {n = 74 {46.3%)} volunteered that their wards were vaccinated when aged 16–20 months, about one-twentieth {n=6 (3.8%)} did aver that their wards were vaccinated after 20 months of age, while a very miniscule fraction {n = 4 (2.5%)} could not tell the age at which 2YL vaccination took place. In keeping with the foregoing, upwards of two-thirds {n=134 (66.3%)} of respondents affirmed full 2YL immunization status, while about one-sixth {n =30 (14.9%)} partial 2YL immunization, and about one-fifth {n=38 (18.8%)} were uncertain as to their wards 2YL immunization completion status. In consonance thereof, caregiver reports of Vaccine Preventable Diseases (VPD), following completion of 2YL immunization and/or 24 months of child's age, were such that about three-quarters {n=119 (74.4%)} did report episodes of whooping cough, about one-quarter {n = 39 (24.2%)} reported episodes of measles, just under one-twentieth {n = 5 (3.1%)} reported poliomyelitis, about one-sixth {n = 23 (14.4%0} did not report any illness, and one-twentieth {n=8 (5%)} were uncertain as to VPD outbreaks following complete 2YL immunization.

Following on the above, interrogation of health facility visits for illness in the 12 months prior was such that, upwards of one-half {n = 90 (56.3%)} of respondents reported one to two visits, while upwards of two-fifths {n = 68(42.5%)} reported no visits, and a very miniscule fraction {n = 2 (1.3%)} reported three or more visits, in this regard. Further specifics in respect of the hospital visits did show that about three-quarters {n= 112 (70%)} of hospital visits resulted in hospital admission, while just under one-third {n = 48 (30%)} did not require any form of hospital admission. Overall, however, upwards of {n = 109 (68.1%)} of respondents perceived that, following immunization, their children were comparatively much healthier than unimmunized children in the same age bracket, while about one-third {n= 50 (31.3%)} did not perceive any difference in health status, and an infinitesimal number {n = 1(0.6%)} did perceive that the reverse was the case. See table 5.

TABLE 5 Effect of Second-Year-Of-Life (2yl) Immunization on Childhood Routine Immunization Outcomes.

Variables	**Frequency**	**Percentage (%)**
Has your child received all routine immunizations in the first year of life (e.g., BCG, Pentavalent vaccine, OPV, Hepatitis B)?		
Yes	181	89.6
No	9	4.5
Not sure	12	5.9
Has your child received any of the following second-year-of-life (2YL) immunizations? (Check all that apply)		
Measles second dose (MCV2)	115	56.9
Pentavalent vaccine booster	2	1
OPV booster	3	1.5
Vitamin A	107	53.0
None	42	20.8
Not sure	8	4
At what age did your child receive the 2YL immunizations (if applicable)?		
12–15months	76	47.5
16–20 months	74	46.3
After 20 months	6	3.8
Don't know	4	2.5
Did you complete the entire 2YL immunization schedule		
Yes	134	66.3

No	30	14.9
Not sure	38	18.8
Since completing the 2YL immunization (or by 24 months), has your child experienced any of the following illnesses? (Select all that apply in the past 12 months) n=160		
Measles	39	24.4
Poliomyelitis	5	3.1
Pertussis (Whooping cough)	119	74.4
Pneumonia	0	0
None	23	14.4
Don't know	8	5
How many times has your child visited a health facility due to illness in the past 12 months?		
None	68	42.5
1–2 times	90	56.3
3 or more times	2	1.3
Has your child been hospitalized in the past 12 months?		
No	112	70.0
Yes	48	30.0
In your opinion, how healthy is your child compared to other children their age?		
Much healthier	109	68.1
About the same	50	31.3
Less healthy	1	0.6

Hypothesis Testing

The hypotheses that required testing were:

a. Null hypothesis (H_0)

   There is no association between the factors influencing routine immunization in 2YL and childhood routine immunization outcomes in Bayelsa State, Nigeria.

b. Alternate hypothesis (H_1)

   The several factors influencing routine immunization in 2YL are associated with childhood routine immunization outcomes in Bayelsa State, Nigeria.

To this end, the under listed tests and results (inclusive of effect sizes of individual factors) delineate the necessary standpoints upon which H_0 and H_1 can be, and/or is, rejected or not.

Tests of association I (Chi Square & Eta^2 Statistic)

1. Factors influencing awareness of 2YL immunization among caregivers versus Awareness of 2YL immunization among caregivers (& Effect size of factors influencing awareness of 2YL immunization)

The test results presented, here with, represent the association between factors influencing awareness of 2YL immunization and awareness of 2YL immunization among caregivers, and the effect sizes of the individual factors on awareness on 2YL immunization, , in the study population.

In line with the foregoing therefore, whereas, upwards of three-fifths {n = 69 (65.6%)} of male caregivers submit that they were aware of 2YL immunization, slightly above two-fifths {n= 55 (44.4%)} did volunteer that they

were unaware of 2YL immunization. Also, while slightly above one-half {n = 147 (53.5%)} of female caregivers did submit that they were not aware of 2YL immunization, upwards of two-fifths {n = 128 (46.5%)} confirmed being aware of 2YL immunization. The relevant test statistic did not show statistically significant association between caregiver gender differences and awareness 2YL immunization {$X^2 = 2.831$, $p = 0.092$}. The Eta^2 statistic in this regard {$Eta^2 = 0.084$}, did show minimal effect of caregiver gender on awareness of 2YL immunization.

Consequently, whereas about one-half {n = 121 (49.8%)} of mothers confirmed that they were not aware of 2YL immunization, while the other half {n =122 (50.2%)} did volunteer that they were aware of 2YL immunization. Similarly, whereas slightly below two-fifths {n = 8 (34.8%)} of fathers confirmed that they were not aware of 2YL immunization, upwards of three-fifths {n = 15 (65.2%)} did submit that they were aware, just as upwards of one-half {n = 70 (54.3%)} of guardians averred that they were not aware of 2YL immunization while slightly above two-fifths {n = 59 (45.7%)} did aver that they were aware of 2YL immunization. Of the other caregivers, such as aunts, nannies, older siblings, categorized collectively as others, three-quarters {n =3 (75%)} were not aware of 2YL immunization while one-quarter {n = 1 (25%)} were aware of 2YL immunization. The relevant test statistic did not show statistically significant association between child-caregiver relationship with awareness of 2YL immunization {$X^2 = 4.011$, $p = 0.260$}. The Eta^2 statistic in this regard, indicated that being a father {$Eta^2 = 1.00$} had a stronger effect on awareness of 2YL immunization compared to being a mother {$Eta^2 = 0.46$}.

Furthermore, concerning the relationship between the number of children under five years of age and awareness of 2YL immunization, whereas upwards of three-fifths {n = 96 (66.7%)} of respondents with less than three children under five years of age, and about two-fifths {n =101 (39.1%)} of respondents did submit that they were aware of of 2YL immunization, while about three-fifths {n = 154 (60.4%)} of respondents with more three children under five years of age and about one-third {n = 48 (33.3%)} of respondents with less than three children under five years of age volunteered being unaware of 2YL immunization. The relevant test statistic did show a statistically significant association between number of children under five years of age {$X^2 = 26.957$, $p = 0.000$} and awareness of 2YL immunization. The Eta^2 statistic in this regard {$Eta^2 = 0.260$}, indicates showed a strong effect of number of children under five years of age on awareness of 2YL immunization.

In consonance thereof, concerning the relationship between the level of education of respondents and awareness of 2YL immunization, about three-fifths {n = 140 (62.8%)} with no formal education did submit that they were not aware of 2YL immunization while just about two-fifths {n = 83 (37.2%)} considered themselves aware. In the same vein, while about two-thirds {n = 32 (65.3%)} of respondents with primary level education did submit they were not aware of 2YL immunization, one-third {n = 17 (34.7%)} considered themselves aware of 2YL immunization. Also, of respondents with secondary level education, about one-third {n = 28 (30.4%)} were not aware of 2YL immunization while almost all {n=33 (94.3%)} respondents with tertiary level education did volunteer that they were aware of 2YL immunization. The relevant test statistic did show significant association between the level of education of respondents and awareness of 2YL immunization {$X^2 = 60.652$, $p = 0.000$}. The Eta^2 statistic in this regard {$Eta^2 = 0.366$}, indicated a strong effect of education on awareness of 2YL immunization.

Furthermore, concerning the relationship between household income and awareness of 2YL immunization, whereas upwards of two-thirds {n=163 (70.6%)} of respondents from low income households were not aware of 2YL immunization, about one-fifth {n = 39 (23.2%)} of respondents from medium income households were not aware while upwards of three-quarters {n =129 (76.8%)} were aware. The relevant test statistic did show a statistically significant association between household income and awareness of 2YL immunization {$X^2 = 87.235$, $p = 0.000$}. The Eta^2 statistic in this regard {$Eta^2 = 0.468$}, indicated a strong effect of household income on awareness of 2YL immunization. There were no differences in effect sizes between levels of household income.

Also, concerning the relationship between distance of caregiver residence from the nearest health facility and awareness of 2YL immunization, the results showed that whereas almost all {n = 77 (95.1%)} respondents residing less than two kilometres from the health facility were aware of 2YL immunization, almost all {n = 109 (98.1%)} respondents residing between two and five (2 – 5km) kilometres from the health facility were aware of 2YL immunization, while just under one-half {n = 4 (45.5%)} of respondents living between 2 – 5km from

the health facility were aware of 2YL immunization. Consequently, the relevant test statistic did show statistically significant association between distance of caregiver abode from the health facility and awareness of 2YL immunization {$X^2 = 46.574$, $p = 0.000$}. The Eta^2 statistic in this regard {$Eta^2 = 0.481$}, indicated a strong effect of distance of caregiver abode, under five kilometres, from the nearest health facility on awareness of 2YL immunization, with distance under two kilometres {$Eta^2 = 0.191$} being particularly significant.

Lastly, interrogation of the relationship between the time required to reach the immunization site and awareness of 2YL immunization did show that whereas almost all {n = 80 (97.6%)} respondents travelling less than thirty minutes to the vaccination site were aware of 2YL immunization, almost all {n= 100 (98.1%} respondents travelling between thirty minutes and one hour to the vaccination site were aware of 2YL immunization, while upwards of two-thirds {n = 10 (71.4%)} of respondents travelling more than one hour to the vaccination site were aware of 2YL immunization. Consequently, the relevant test statistic did show statistically significant association between travel time to the vaccination site and awareness of 2YL immunization {$X^2 = 23.409$, $p = 0.000$}. The Eta^2 statistic in this regard {$Eta^2 = 0.344$}, indicated a strong effect of travel time of under one hour to vaccination site on awareness of 2YL immunization, with less than thirty minutes' travel time {$Eta^2 = 0.201$} being particularly significant. See table 6.

TABLE 6 Chi-Square and Eta-Square Statistic Analysis of Factors Associated with Awareness of Second Year of Life Immunization among Caregivers.

Factors influencing awareness of 2YL immunization		**Awareness of 2YL immunization**					
		Frequency (count)		**Statistical Parameters**			
Variable	**Characteristic**	**No**	**Yes**	**df**	**X^2**	**P-value**	**Eta^2**
Number of children 5yrs and below in household	Less than 3 Children	33.3% (48)	66.7% (96)	1	26.957	0.000	0.260
	3 Children and above	60.4% (154)	39.1% (101)				
Caregiver Gender	Male	44.4% (55)	65.6% (69)	1	2.831	0.092	0.084
	Female	53.5% (147)	46.5% (128)				
Caregiver Level of Education	No formal education	62.8% (140)	37.2%(83)	3	60.652	0.000	0.366
	Primary	65.3% (32)	34.7%(17)				
	Secondary	30.4% (28)	59.6%(64)				
	Tertiary	5.7% (2)	94.3%(33)				
Caregiver - Relationship to child	Mother	49.8% (121)	50.2%(122)	3	4.011	0.260	0.046
	Father	34.8% (8)	65.2% (15)				0.100
	Guardian	54.3% (70)	45.7% (59)				
	Other	75% (3)	25% (1)				
Caregiver - Household income level	Low	70.6%(163)	29.4% (68)	1	87.235	0.000	0.468
	Medium	23.2% (39)	76.8% (129)				
How far , from the abode, is the nearest health facility that offers child immunization?	Less than 2 km	4.9% (4)	95.1%(77)	2	46.574	0.000	0.191
	2–5 km	1.8% (2)	98.1% (109)				0.481
	More than 5 km	55.5% (5)	44.5%(4)				

How long does it take to reach the immunization site, from the abode?	Less than 30 minutes	2.4% (2)	97.6%(80)	2	23.409	0.000	0.201
	30 minutes–1 hour	1.9% (2)	98.1% (100)				0.344
	More than 1 hour	28.6%(4)	71.4%(10)				

2. Factors influencing completion of 2YL immunization versus Completion of 2YL immunization in eligible children (& Effect size of factors influencing completion of 2YL immunization).

The results presented, here with, represent the association between factors influencing completion of 2YL immunization and the effect sizes of the individual factors on completion of 2YL immunization, in the study population.

In line with the foregoing, most {n = 145 (97.9%)} respondents who were aware that a child required immunization between 12–24 months (in the second year of life), reported very high 2YL routine immunization completion while those {n=3 (2.1%)} not so aware did report poor 2YL routine immunization completion. Consequently, the relevant test of association {X^2 = 279.417, p = 0.000} did show statistically significant association between awareness of immunization between 12 – 24 months - in the second year of life and completion of 2YL immunization. The Eta^2 statistic in this regard {Eta^2 = 4.25}, indicates an extremely strong effect of awareness of immunization in the second year of life on completion of 2YL immunization.

**In consonance, thereof, interrogation of the relationship between the child and the caregiver and the child was such that there was no statistically significant association {X^2 = 7.883, p = 0.247} between this variable and 2YL immunization completion. The Eta^2 statistic in this regard {Eta^2 = 0.124}, did, however, signify a moderate effect of child - caregiver relationship on completion of 2YL immunization. However, caregiver gender did not show any statistically significant {X^2 = 5.189, p = 0.075} association with 2YL immunization completion. The Eta^2 statistic in this regard {Eta^2 = 0.121}, indicates a strong effect of caregiver gender on 2YL immunization completion.

Furthermore, the results showed that most {n = 137(76.1%)} respondents who volunteered availability of immunization services for children aged 12 – 24 months in their locale, did summarily ensure completion of 2YL immunization for their wards. To this end, the relevant test of association {X^2 = 238.606, p = 0.000} did show statistically significant association between local availability of immunization services for children aged 12 -24 months and completion of 2YL immunization. The Eta^2 statistic in this regard {Eta^2 = 0.452}, indicates a strong effect of availability of 2YL immunization services on completion of 2YL immunization: implying that the availability of 2YL immunization services greatly influences completion of second-year immunizations.

Also, consideration of the relationship between caregiver educational level and 2YL immunization completion did reveal that, compared to caregivers with other forms of education, primary {n= 37} and secondary {n= 82}, upwards of four-fifths {n=29} of caregivers with tertiary level education did demonstrate higher 2YL immunization completion {n=29 (85.3%)} overall; while caregivers with no formal education {n = 122} did demonstrate high {n= 122 (61.9%)} 2YL immunization non-completion. The relevant test of association {X^2 = 63.275, p = 0.000} did show statistically significant association between caregiver level of education and completion of 2YL immunization. The Eta^2 statistic in this regard {Eta^2 = 0.261}, suggests a strong effect of caregiver level of education on completion of 2YL immunization: implying that the higher the level of caregiver education, the greater the level of 2YL immunization completion.

As a corollary to the above, the significance of distance between caregiver abode and the nearest health facility in respect of 2YL routine immunization completion was such that, most respondents who reported living 2 – 5km from the nearest health facility offering immunization services volunteered higher {n= 83 (72.7%)} 2YL routine immunization completion compared to others who lived about 2km {n = 56 (70%)} or more than 5km {n= 3 (37.5%)} from the nearest health facility. Consequently, the relevant test of association {X^2 = 12.993, p = 0.011} did show statistically significant association between distance of caregiver abode from nearest health facility and completion of 2YL immunization. The Eta^2 statistic in this regard {Eta^2 = 0.091}, did, however, signify a moderate effect of distance between caregiver abode and nearest health facility on completion of 2YL immunization.

In consonance thereof, concerning the relationship between the time of commute to an immunization site and 2YL immunization completion, approximately three quarters {n = 60 (74.1%)} and about four-fifths {n= 80 (79.2%)} of respondents who required less than thirty minutes and at most one hour of commute between their abode and the health facility did report higher 2YL immunization completion compared to those {n = 4 (28.5%)}who required upwards of one hour of commute between their abode and the health facility. Consequently, the relevant test of association {X^2 = 17.899, p = 0.001} did show statistically significant association between duration of commute between caregiver abode and nearest health facility, and completion of 2YL immunization. The Eta^2 statistic in this regard {Eta^2 = 0.240}, did, however, signify a moderate effect of duration of commute between caregiver abode and nearest health facility, on completion of 2YL immunization.

Lastly, concerning the relationship between household income level and completion of 2YL immunization among eligible children, the results show that showed that respondents from medium-income households {n = 106 (64.6%)} had much higher 2YL immunization completion compared to those from low-income households {n= 42 (22.6%)}. The relevant test of association {X^2 = 67.052, p = 0.000} did show statistically significant association between caregiver household income level and completion of 2YL immunization. The Eta^2 statistic in this regard {Eta^2 = 0.334}, suggests a strong effect of caregiver level of household income on completion of 2YL immunization: implying that the higher the level of household income, the greater the level of 2YL immunization completion, probably due to increased access to, information on 2YL immunization, and attendant services. See table 7.

TABLE 7 Chi-Square and Eta-Square Statistic Analysis of Factors Associated with Completion of Second Year of Life Immunization Among the Study Population

Factors associated with completion of 2YL immunization		**Completion of 2YL immunization**			**Statistical Parameters**			
Variable	**Characteristic**	**Frequency (Count)**			**(Chi Square & Eta^2 Statistic)**			
		Yes	**No**	**Not sure**	**df**	**X^2**	**P-value**	**Eta^2**
Are immunization services for children aged 12–24 months available in your area?	No	3.9% (5)	95.3% (123)	0.8% (1)	4	238.606	0.000	0.452
	Yes	76.1% (137)	9.4% (17)	14.4% (26)				
	Not sure	31.3% (5)	31.3% (5)	37.5% (6)				
How far is the nearest health facility that offers child immunization?	Less than 2 km	70% (56)	12.5% (10)	17.5% (14)	4	12.993	0.011	0.091
	2–5 km	72.7% (83)	8.2% (9)	16.4% (18)				
	More than 5 km	37.5% (3)	50% (4)	12.5% (1)				
How long does it take to reach the immunization site?	Less than 30 minutes	74.1% (60)	9.9% (8)	16% (13)	4	17.899	0.001	0.240
	30 minutes–1 hour	79.2% (80)	6.9% (7)	13.9% (14)				
	More than 1 hour	28.5% (4)	35.7% (5)	35.7% (5)				
Caregiver Gender	Male	49.6% (58)	44.4% (52)	6% (7)	2	5.189	0.075	0.121
	Female	38.6% (90)	49.8% (116)	11.6% (27)				

Educational level	No formal education	30.9% (61)	61.9% (122)	7.1% (14)	6	63.275	0.000	0.261
	Primary	27% (10)	62.2% (23)	10.8% (4)				
	Secondary	58.5% (48)	25.6% (21)	15.9% (13)				
	Tertiary	85.3% (29)	5.9% (2)	8.8% (3)				
Relationship to child	Mother	42.9% (90)	45.7% (96)	11.4% (24)	6	7.883	0.247	0.124
	Father	56.5% (13)	39.1% (9)	4.3% (1)				
	Guardian	39.8% (45)	53.1% (60)	7.1% (8)				
	Other	0	75% (3)	25% (1)				
Household income level	Low	22.6% (42)	67.2% (125)	10.2% (19)	2	67.052	0.000	0.334
	Medium	64.6% (106)	26.2% (43)	9.2% (15)				
Are you aware that a child requires immunization in the second year of life (12–24 months)?	No	9.5% (16)	90.5% (152)		2	279.417	0.000	4.250
	Yes	97.9% (145)	2.1% (3)	0				

Tests of association II (Multiple Logistic Regression)

1. Factors influencing Completion of 2YL immunization versus Completion of 2YL immunization among study populatiobn.

The results of the Multiple Logistic Regression analysis on the predictive factors associated with completion of the 2YL immunization, in the study population, following cross tabulation of the relevant factors against 2YL immunization completion, are presented here with:

In consonance, thereof, concerning the association between caregiver-child relationship and completion of 2YL immunization, whereas male gender (caregiver) was not noted to be statistically significantly associated with completion of 2YL immunization {Wald = 2.176; df = 1}, female gender (caregiver) was noted to be statistically significantly associated with completion of child 2YL immunization {Wald $\rightarrow$ 0; df = 0}. Also, concerning specifics, the following caregiver-child relationships were noted to be statistically significantly associated with 2YL immunization completion: Guardian {Wald$\rightarrow$ 0 ; df 1}, and other {Wald $\rightarrow$ 0; df = 0}.

Consequently, consideration of the association between caregiver formal education and 2YL immunization completion, showed that while all other levels of caregiver formal education were noted to be statistically insignificant when association with 2YL immunization completion was deduced, caregiver tertiary education {Wald $\rightarrow$ 0; df=0} was statistically significantly associated with 2YL immunization completion.

Furthermore, concerning the association between caregiver occupation and completion of 2YL immunization completion, the following caregiver occupations were noted to be statistically significantly associated with completion of 2YL immunization: civil servant {Wald = 0.000; df = 1}, driver {Wald = 0.000; df =1}, hair dresser {Wald = 0.000; df =1}, health worker {Wald = 0.000; df =1}, student {Wald = 0.000; df = 1}, and teacher {Wald $\rightarrow$ 0; df =0}.

Lastly, concerning the association between between household income level and 2YL immunization completion, medium-income households {Wald $\rightarrow$ 0 ; df = 0}, were noted to have statistically significant association with 2YL immunization completion compared to low-Income households {Wald= 4.470; df = 1}. See table 8.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV December 2025 | Special Issue on Public Health

TABLE 8 Multiple Logistic Regression Analysis Ofactors Associated with Completion Of 2yl Immunization

Variable	Statistical Parameters						
Did you complete the entire 2YL immunization schedule?	**Standard Error**	**Wald**	**df**	**P-value**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
						Lower Bound	Upper Bound
Intercept	23099.471	0.000	1	0.998			
Caregiver Gender							
Male	0.579	2.176	1	0.140	2.349	0.755	7.307
Female	.	.	0	.	.	.	.
Caregiver Level of Education							
No formal education	0.862	0.019	1	0.891	0.888	0.164	4.812
Primary	1.094	0.094	1	0.759	1.398	0.164	11.932
Secondary	0.892	0.008	1	0.928	0.922	0.161	5.294
Tertiary	.	.	0	.	.	.	.
Caregiver Occupation							
[Occupation=Business]	1.130	1.153	1	0.283	0.297	0.032	2.722
[Occupation=Civil Servant]	5646.640	0.000	1	0.998	1540491 1.147	0.000	
[Occupation=Driver]	9166.322	0.000	1	0.999	1756578 8.275	0.000	
[Occupation=Farmer]	1.373	1.086	1	0.297	0.239	0.016	3.524
[Occupation=Hair dresser]	9166.322	0.000	1	0.998	1227888 73.514	0.000	
[Occupation=Health worker]	12493.366	0.000	1	0.999	1364472 0.877	0.000	
[Occupation=House wife]	1.352	1.207	1	0.272	0.226	0.016	3.206
[Occupation=Self employed]	1.473	0.837	1	0.360	0.260	0.014	4.660
[Occupation=Student]	6188.610	0.000	1	0.998	1265185 3.754	0.000	
[Occupation=Tailor]	1.317	3.346	1	0.067	0.090	0.007	1.188
[Occupation=Teacher]	.	.	0	.	.	.	.
Caregiver Relationship to child							
Mother	0.561	2668. 726	1	0.000	3877803 215709.1 72	1291148 335422.7 85	1164649 8986377. 447
Father	1.253	566.8 03	1	0.000	9053464 725529.5 68	7765052 67109.08 7	1055565 5834964 6.480
Guardian	0.000	.	1	.	6189815 396086.4 12	6189815 396086.4 12	6189815 396086.4 12

Other	.	.	0	.	.	.	.
Household income							
[Household income level=Low]	0.519	4.470	1	0.034	0.334	0.121	0.923
[Household income level=Medium]	.	.	0	.	.	.	.
Caregiver awareness of 2YL immunization							
[Are you aware that a child requires immunization in the second year of life (12–24 months)?=No]	1653.810	0.000	1	0.986	1987140 210628.9 45	0.000	
[Are you aware that a child requires immunization in the second year of life (12–24 months)?=Yes]	.	.	0	.	.	.	.

DISCUSSION

The summary debates on the nascent points concerning 2YL immunization, deduced from the outcomes of this study, are presented, here with, under the under listed subheadings, which address: common presumptions about and for 2YL immunization, supportive evidence from previous similar studies, common regulatory frameworks and practices, and evidence based recommendations, respectively.

Premise, Prospects and Platitudes

The principal premise of Second-year-of-life immunization (2YL) is that it is more commonly considered a critical opportunity for shoring up herd immunity, introducing new vaccines, and improving immunization uptake and service delivery, through catch-up on missed doses of routinely scheduled vaccines as well as missed opportunities for vaccination (MOV's).

Consequently, principal among the more common, and several, themes that impinge upon immunization completion in children under five years of age, for which 2YL is volunteered as a panacea, is the subject of caregiver awareness of the need for immunization of the child, and completion of same, within the appointed time period using the stipulated, internationally recommended, and nationally implemented vaccination schedule. To this end, the findings in this study suggest that vaccine hesitancy is a significant impediment to optimizing routine immunization uptake and immunization completion rates among eligible children. The prevailing themes in this regard revolved around the following: lack of awareness and poor knowledge on the premise, necessity, importance and requirements for immunization (especially within the context of 2YL), increased number of administrable vaccines, increased number of injectable and fear of negative outcomes therefrom (particularly Adverse Events Following Immunization - AEFI). These findings are in keeping with those of Abdu et al, Muluneh et al, Saeed et al, Ullah et al, and Zewdie et al, in their studies in Ethiopia, Eritrea, and Pakistan, when they submit that lack of, and/or poor parental knowledge and inappropriate information on vaccines, vaccination, vaccination outcomes and complications therefrom, as well as, poor parental attitude and maternal counselling (pre and post-vaccination) were critical determinants of immunization outcomes and completion among eligible children [1]; [22]; [29]; [38]; [47].

Furthermore, vaccine hesitancy is noted to be contingent upon a number of sociocultural factors that ignite, fuel and propagate myths, misconceptions and cultural restrictions about immunization, inclusive of local cultural/religious practices that prescribe seclusion of the mother and child during the first few days and/or weeks following confinement at birth (until and after the naming ceremony – which often takes place on the seventh day of life), the view by certain groups that vaccines are foreign and thus harmful to the child (especially those requiring administration via injections), the necessity for nursing mothers to be accompanied by a male family

member during immunization sessions or that nursing mothers not leave the house without their husbands. These findings are in keeping with those of Butt et al, Muluneh et al, Duru et al, and Ullah et al, in their respective studies in Ethiopia, Pakistan and Bayelsa State, when they posit that local traditions and culturally sensitive norms prevent female caregivers from exercising autonomy concerning decisions and activities centered around vaccination of their wards, with resultant poor child immunization outcomes and attendant indices [4]; [6]; [22]; [38].

In consonance with the foregoing, it is pertinent to note that access to and utilization of immunization services further complicate this already taciturn picture via pressure on fledging and decadent health systems, epitomized and characterized by non-existent and or dilapidated infrastructure, unavailable or irregular immunization services, poor immunization services and immunization service delivery occasioned by poor scheduling of immunization sessions, overcrowding at service delivery points, long waiting times, poor immunization record keeping, as well as poor patient counselling and follow up. Consequently, the findings in this study suggest that unavailability, poor access to, and/or under utilization of immunization services are at the centre of service delivery impediments to appropriate, full and complete immunization of eligible children. These findings are corroborated by those of Sally et al, Sukirman et al, Haq et al, Muluneh et al, Powelson et al, Duru et al, and Ullah et al in their studies in Ghana, Indonesia, Ethiopia, Mozambique, Bayelsa State, and Pakistan, respectively, when they volunteer that poor and irregular scheduling of immunization sessions (fixed post, mobile, and outreach sessions), time wasted during appointments due to long waiting times and overcrowding, poor patient follow up in respect of immunization appointments, deficits in appropriate immunization service delivery exemplified by vaccine stock outs and poor immunization staff attitude, and difficulties in gaining access to the health facility occasioned by poor roads and other infrastructure, were veritable and significant contributors to suboptimal immunization outcomes in eligible populations [6]; [12]; [22]; [27]; [30]; [38].

Also, whereas the paramount presumptive prospect is that 2YL will improve immunization coverage and completion among target groups, reduce total default, compliment catch-up immunization, and aid convergence of essential child health services, immunization (as with all other health related activity) is not a strait jacketed exercise or proposition. Therefore, it is pertinent to consider the subjects of immunization completion as against immunization coverage rates within the ambits of immunization default and noncompliance, immunization record keeping, convergence of immunization with other maternal and child health services, disease epidemics, pandemics, and the engaging bagger of emerging and re-emerging diseases. With respect to the foregoing, therefore, the findings in this study suggest that, immunization dropout, default, and non-compliance (significantly influenced by religion and caregiver education), child illness due to outbreaks of vaccine preventable diseases as well as other common diseases, disease epidemics and pandemics (including emerging and re-emerging diseases), and poor immunization record keeping (particularly, lost immunization cards) were mainly responsible for deficient immunization completion and poor immunization coverage rates when immunization in the second year of life, is considered. Consequently, the respective studies by Moss et al, Sally et al, Sedain et al, Mekonnen et al, Hansen et al, Muluneh et al, Umer et al, Kayembe-Ntumba et al , and Ullah et al, in the Democratic Republic of Congo, Ghana, Ethiopia, Nepal, and Pakistan corroborate this position when they aver that non-compliance due to poor caregiver prioritization of child immunization and adherence to stipulated routine immunization schedules, immunization default due to non-compliance during episodes of common childhood illnesses such as diarrhoea, and pneumonia, epidemic prone diseases such as measles, as well as during pandemics such as the recent COVID-19 pandemic, were central to deficits in immunization completion and suboptimal coverage rates. Other volunteered complicit propositions include improper or missing entries in, carelessness regarding care of, and/or misplacement of, child vaccination cards, as well as task shifting in respect of attendance at child routine immunization sessions due to poor time management, carelessness, and personal competing interests [11]; [19]; [21]; [22]; [30]; [31]; [37]; [39].

The above common prospects, premises, and platitudes, further corroborated by the results of tests of association, give impetus for rejecting the Null hypothesis (H_0) while failing to reject the alternate hypothesis (H_1) concerning the association between factors influencing completion of 2YL immunization and childhood routine immunization outcomes in Bayelsa State, Nigeria.

Comparative Bridgepoint's

The foregoing treatise summarily presupposes that the overriding platitude upon which 2YL resonates is that

catch-up vaccination can be provided through the common and regular channels for routine immunization without recourse to increased costs in terms of time, personnel and material. However, healthcare is an ever evolving discipline with new innovations which are, not only niche specific, but cost dependent, with the costs transcending development and introduction of new vaccines, ever increasing personnel costs (inclusive of recurrent and training costs), and prevailing local financial and economic circumstances.

To this end, it is noted that the local economy and economic climate which impinges upon and is determined in turn by opportunities for employment (and remaining employed), the markets, wealth quintiles and income, budgets (including the healthcare budget), capital infrastructural investments (including foreign direct investments and investments in housing, local health facilities, and utilities), available finance and financing mechanisms (including program financing and health insurance), cost and cost drivers (including personnel costs and cost of locally produced, and imported, hospital consumables), as well as service delivery contingent upon demand and supply within the context of the extant level of technological development are critical to the outcomes of 2YL immunization, especially in Low-and-Middle income countries (LMIC).

In line with the foregoing, the findings in this study suggest that caregiver awareness and knowledge of 2YL, caregiver level of education, caregiver relationship with child, number of children under five years of age, caregiver occupation and employment status, household income levels, caregiver locale and/or residence, distance between residence and nearest health facility, mode of commute between residence and health facility, as well as duration of commute between residence and health facility are significant determinants of immunization completion and coverage rates, in the second year of life, in this clime. These Bridgepoint's, most of which are cross cutting, are corroborated by results from several separate studies in Ghana, Ethiopia, Malaysia, Mozambique, Nepal, and Pakistan by Zewdie et al, Sally et al, Krishna et al, Saeed et al, Thapa et al, and Powelson et al, when they submit that maternal education, residence, occupation, employment, and household income were veritable contributors to immunization completion and coverage. Thus, higher maternal education, urban residence, formal vocations and employment, and household income above the poverty line were noted to significantly contribute to positive routine immunization outcomes in respect of immunization completion and coverage. Furthermore, improved access to immunization services arising from convenient mode of transport to the health facility, low cost and reduced time of travel between the residence and the health facility as well as the nascent social relationship between the caregiver and the child did make for better immunization completion and coverage outcomes among eligible children in the second year of life [15]; [27]; [30]; [31]; [36]; [47].

Notarized transitions and transformations

As a follow-up and addendum to the above, it is noted that a critical, and seemingly, over riding, determinant of childhood routine immunization uptake, inclusive of the decision to vaccinate or not, and the determination to follow through until completion, is parental or caregiver preferences. These preferences are further noted to be determined by individual prioritization of immunization, and perception of the principal dictates of orthodox medicine, especially when considered within the contexts of the nutritional and epidemiological transitions: which significantly impact communicable disease epidemiology including Public Health Emergencies of International concern (PHEIC's).

To this end, several authorities have proposed the development, enactment and implementation of vaccination policy, and/or policies, related to immunization in the immunocompromised, immunization in emergencies and disasters, targeted immunization (such as SIA's), as well as immunization related to school entry in infants: as a means to ensuring adequate uptake of routine immunization, as well as improved and optimum routine immunization completion, and coverage rates [3]; [14]; [16]; [21]; [26]; [32]; [48]. The primal thrust, within the context of routine immunization in 2YL being that all eligible children should be fully vaccinated (as of date) prior to admission into any educational institution, as appropriate and recommended for age [3]; [14]; [16]; [21]; [26]; [32]; [48].

The Redoubt

Lastly, whereas missed opportunities for vaccination (MOV's) are quite common and are principally considered to be significant in the, often undulating, relationship between immunization uptake and completion, 2YL immunization gives ample opportunity for optimizing immunization coverage and outcomes in eligible children,

and that vaccine hesitancy, immunization default, vaccination dropout, and the need for caregivers to avail themselves of the opportunity for vaccination of their wards with relevant vaccine antigens, play significant roles in the negative or positive outcomes, thereof. However, the concept of 2YL further complicates the routine immunization completion picture, through the introduction of new vaccines whilst simultaneously extending the time frame within which immunization can be completed. Thus, whereas the introduction of new vaccines within 2YL improves and increases the range of primary protection, it further deepens the conflict of interest among caregivers concerning immunization [3], [5], [13], [25].

Furthermore, whereas higher-income households may have better access to healthcare services, media, and educational resources that promote health awareness and decision modelling, the myriad inequities in the distribution, delivery, access, and utilization of immunization services, in this clime, simply make achieving set vaccination goals and targets, quite difficult and engaging. Therefore, simply earning above the poverty line does not summarily translate to being able to afford and ensure full and complete immunization of eligible children under any given caregiver [3], [13], [25].

Limitations of The Study

The study was encumbered by a number of limitations, principal among which were: the data being subject to recall bias, the subjective nature of the professed plausible causes affecting uptake of 2YL immunization due to the non-involvement of the primary recipients in respect of vaccination decision modelling, and the considerably small sample size which makes heterogeneity of the study findings circumspect.

CONCLUSION

The aforementioned limitations, notwithstanding, we submit that the findings of this study emphasize the importance of 2YL immunization as a significant panacea to complete immunization of children aged under two years. We further posit that the findings can support the development and implementation of actionable programs for the vaccination of target groups with a view to shoring up routine immunization completion rates, in the short, medium and long terms, as well as give impetus for the development and operationalization of relevant, niche specific financing mechanisms for routine immunization, in this clime.

Declaration Of Competing Interests

The authors declare that there are no competing interests, of any nature, that have influenced or appeared to influence the findings in this work. Lastly, it is pertinent to note that the declared views are entirely those of the authors.

REFERENCES

1. Abdu N, Mosazghi A, Yehdego T, Tesfamariam EH, Russom M (2022). Knowledge and perceptions of nurse practitioners on adverse events following immunization and barriers to reporting in the Central Region, Eritrea: a cross-sectional study. Drug Healthcare Patient Safety; 14: 125-34.
2. Biset G, Woday A, Mihret S, Tsihay N (2021) Full immunization coverage and associated factors among children age 12 – 23 months in Ethiopia: systematic review and meta-analysis of observational studies. Human vaccines and immunotherapies; 17(7): 2326 – 2335. https://doi.org/10.1080/21645515.2020.1870392.
3. Blank NR, Caplan AL, Constable C. (2013). Exempting school children from immunizations: states with few barriers had highest rates of nonmedical exemptions. Health Aff (Millwood); 32(7): 1282-1290.
4. Butt M, Mohammed R, Butt E, Butt S, Xiang J (2020). Why have immunization efforts in Pakistan Failed to achieve global standards of vaccination uptake and infectious disease control? Risk Management Healthcare Policy; 13: 111 -124.
5. Dempsey AF, Schaffer SE (2011). Human Papilloma Virus vaccination rates and state mandates for tetanus containing vaccines. Preventive Medicine; 52 (3-4): 268-269.
6. Duru CO, Oyeyemi AS, Adesina AD, Nduka I, Tobin-West C, Nte A (2023). Sociocultural practices, beliefs, and myths surrounding newborn cord care in Bayelsa State, Nigeria: A qualitative study. PLOS Global Public Health, 3(3):1-16. https://doi.org/10.1371/journal.pgph.0001299

7. Garib Z, Vargas AL, Trumbo SP, Anthony K, Diaz-Ortega JL, Bravo-Alca'ntara P, et al. (2016). Missed Opportunities for vaccination in the Dominican Republic: Results of an Operational investigation. Biomedical Research International. https://doi.org/10.1155/2016/4721836. PMID: 27819003
8. Girmay A, Dadi AF (2019). Full immunization coverage and associated factors among children aged 12-23 months in the hard-to-reach areas of Ethiopia. International Journal of Pediatrics;2019. doi:10.1155/2019/ 1924941.
9. Francis MR, Nuorti JP, Lume-Sandt K, Kompithra RZ, Balraj V, Kang G, Mohan VR (2021). Vaccination coverage and the factors influencing routine childhood vaccination uptake among communities experiencing disadvantages in vellore, southern India: a mixed methods study. BMC Public Health; 21: 1807. https://doi.org/10.1186/s12889-021-1181-8.
10. Frenkel LD (2018). Infectious diseases as a cause of global childhood mortality and morbidity; Progress in recognition, prevention, and treatment. Advanced Pediatrics Research.5: 14. Doi: 10:24105/apr.2018.5.14.
11. Hanson CM, Mirza I, Kumaplay R, Ogbuanu I, Kezala R, Nandy R (2018). Enhancing immunization during second year of life by reducing missed opportunities for vaccination in 46 countries. Vaccine; 36: 3260-3268. https://doi.org/10.1016/j.vaccine2018.04.070. PMID:29731113.
12. Haq Z, Shaikh BT, Tran N, Hafeez A, Ghaffar A (2019). System within systems: challenges and opportunities for the expanded programme on immunization in Pakistan. Health Research Policy Systems; 17: 51.
13. Hutchins SS, Jansen HA, Robertson SE, et al. (1993). Studies of missed opportunities for immunization in developing and industrialized countries. Bulletin of the World Health Organization; 71: 549-560.
14. Kharbanda EO, Stockwell MS, Colgrove J, Natarajan K, Rickert VI. (2010). Changes in Tdap and MCV4 vaccine coverage following enactment of a statewide requirement of tdap vaccination for entry into sixth grade. American Journal of Public Health; 10099); 1635-1640.
15. Krishna D, MohdZulkefli NA, Md Said S, Mahmud A. (2019). Sociodemographic and healthcare factors in determining immunization defaulters among preschool children in Petaling District, Selangor: a cross sectional study in Malaysia. BMC Public Health; 19: 1275.
16. [Larson A, Minnick DR, Choudhury S, Hughes IV R (2024). School-Entry Vaccine Policies: States' Responses to Federal Recommendations Varied from Swift to Substantially Delayed. Children's Health, 43(11): 1 – 8.
17. Magadzire BP, Joao G, Bechtel R, Matsinhe G, Lochlainn LN, Ogbuanu IU (2020). Reducing missed opportunities for vaccination in Mozambique: findings from a cross-sectional assessment conducted in 2017. British Medical Journal Open, 11: 1 – 10.
18. Mborigaba E, Nderu D, Chen S, Denkinger C, Geldsetzer S, McMahon S, Banighausen T (2021). Childhood vaccine uptake in Africa: threats, challenges, and opportunities. Journal of Global Health Reports; 5: e2021080.
19. Mekonnen AG, Bayleyegn AD, Ayele ET (2019). Immunization coverage of 12 – 23 months old children and its associated factorsin Minjar-Shenkora district, Ethiopia; a community based study. BMCPeadiatrics; 19(1): 198.
20. MICS/NICS, Nigeria (2021). Nigeria 2021 Multiple Indicator Cluster Survey (MICS) & National Indicator Cluster Survey (NICS). National Bureau for Statistics, National Primary Healthcare Development agency & Partners. https://www.unicef.org.
21. Moss JL, Reiter PL, Truong YK, Rimer BK, Brewer NT (2016). School Entry Requirements and Coverage of Non-Targeted Adolescent Vaccines. Pediatrics, 138(6): 1 – 10.
22. Muluneh F, Wubetu M, Abate A (2020). Missed Opportunity for Routine Immunization and Its Associated Factors in Gozamen District Health Centers, Northwestern Ethiopia. Global Pediatric Health, 7: 1 – 7.
23. Nandi A, and Shet A (2020). Why vaccines matter: understanding the broader health, economic, and child development benefits of routine vaccination. Human Vaccines and Immunotherapeutics, 16(8)1900 – 1904.
24. Nyaku M, Wardle M, Eng JV, Ametewee L, Bonsu G, Opare JKL, Conklin L (2017). Immunization delivery in the second year of life in Ghana: the need for a multi-faceted approach. Pan African Medical Journal, 27(3):4 – 12. https://doi.org/10.11604/pamj.supp.2017.27.3.12182.

25. Ogbuanu IU, Li AJ, Anya B-PM, et al. (2019). Can vaccination coverage be improved by reducing missed opportunities for vaccination? Findings from assessments in Chad and Malawi Using the new WHO methodology. PL0S One; 14: e0210648.
26. Omer SB, Pan WK, Halsey NA, et al. (2006). Nonmedical exemptions to school immunization requirements: secular trends and association of state policies with pertussis incidence. Journal of American Medical Association; 296(14): 1757-1763.
27. Powelson J, Magadzire BP, Draiva A, Denno D, Ibraimo A, Benate BBL, et al. (2022). Determinants of immunization dropout among children under the age of 2 in Zambezia province, Mozambique; a community based participatory research studyusing photovoice. BMJ Open; 12(3): e057245.
28. Rodrigues CMC, Plotkin SA (2020). Impact of vaccines; health, economic and social perspectives. Frontiers in Microbiology, 11(1526):1 – 15.
29. Saeed R, Hashmi I (2021). Pakistan ranks third globally with the most unvaccinated children; is the impact of parental perception and attitude on immunization an essential contributing factor to an unsuccessful vaccination coverage? Cureus; 19: e1975.
30. Sally ET, Kenu E (2017). Evaluation of access and utilization of EPI services amongst children 12 – 23 months in wahu Afram Plains, Eastern region, Ghana. Pan African Medical Journal; 28: 238.
31. Sedain B (2018). Mortality patterns of adolescent and youth in SAARC countries: findings from the global of disease. Nepal Population Journal.; 18(17): 141-50.
32. Sull M, Eavey J, Papadouka V, Hansen MA, Zucker JR (2014). Adolescent vaccine co-administration and coverage in New York City: 2007 – 2013. Paediatrics; 134(6). www.pediatrics.org/cgi/content/full/134/6/e1576
33. Tchoualeu DD, Harvey B, Nyaku M, Opare J, Traicoff D, Bonsu G, Quaye P, and Sandhua HS (2021). Evaluation of the impact of immunization second year of life training interventions on health care workers in Ghana. Global Health: Science and Practice, 9(3):498 – 507.
34. Tesema GA, Teshale AB, Tessema ZT (2021). Incidence and predictors of under-five mortality in East Africa using multilevel Weibull regression modeling. Archives of Public Health, 79, pp. 1 – 3.
35. Tesfaye TD, Temesgen WA, Kasa AS (2018). Vaccination coverage and associated factors among children aged 12–23 months in Northwest Ethiopia. Human Vaccines Immuno-Therapeutics;14(10):2348–54. doi:10.1080/21645515.2018.1502528.
36. Thapa k, Adhikary P, Faruquee MH, Suwal BR (2021). Associated factors for dropout of first vs third doses of diphtheria tetanus pertussis (DPT) vaccination in Nepal. Advanced Preventive Medicine;2021: 1-9.
37. Ullah K, Saleem J, Ishaq M, Ali Khattak F, Majeed F (2022). Effects of the COVID-19 pandemic on the uptake of routine immunization vaccines in Swat district in Pakistan. Avicenna; 2: 11.
38. Ullah K, Saleem J, Zakar R, Ishaq M, Khattak FA, Majeed F, Sadiqa HA, Fischer, F. (2024). Exploring the reasons for defaulting from childhood immunization: a qualitative study in Pakistan. Biomedical Central Public Health. 24: 408 – 418.
39. Umer MF, Zofeen S, Hu W, Qi X, Zhuang G. (2020). Spatiotemporal clustering analysis of Expanded program on Immunization (EPI) vaccination coverage in Pakistan. Science Report; 10 (1): 10980.
40. Umoke PCI, Umoke MJ, Nwalieji CA, Igwe FO, Umoke UG, Onwe RN, Nwazunku AA, Nwafor IE, Chukwu OJ, Eyo N, UgwuA , Ogbonnaya K, Okeke E, Eke D (2021). Investigating Factors Associated with Immunization Incompletion of Children Under Five in Ebonyi State, Southeast Nigeria: Implication for Policy Dialogue. Global Pediatric Health; 8:1 –18.
41. Wagstaff A, Flores G, Smitz MF, Hsu J, Chepynoga K, Eozenou P (2018). Progress on impoverishing health spending in 122 countries: a retrospective observational study. Lancet Global Health, 6: e180 – 192. https://doi.org/10.1016/S2214-109X(17)30486-2.
42. World Health Organization (2018). Establishing and Strengthening Immunization in the Second Year of Life: Practices for Vaccination Beyond Infancy. https://www.who.int/immunization/programmes_systems/policies_ strategies/2YL/en/
43. World Health Organization (2021). Immunization coverage. WHO fact sheet 2021. https://www.who.int/news-room/fact-sheets/detail/immunization-coverage.
44. World Health Organization (2023). Immunization coverage. WHO fact sheet 2023. https://www.who.int/news-room/fact-sheets/detail/immunization-coverage.
45. [45] WHO and UNICEF (2019). Estimates of immunization coverage 2018 revision. WHO and UNICEF estimates of national immunization coverage. Updated 2019; 1 – 30. https://www.google.com/url

46. Woyessa AB, Shah MP, Azmeraye BM, Pan J, Lisanwork L, Yimer G, Wang, S, Nuorti JP, Artama M, Matanock AM, An Q, Samuel P, Tolera B, Kenate B, Bekele A, Deti T, Wako G, Shiferaw A, Tefera YL, Kokebie MA, Anbessie TB, Wubie HT, Wallace A, Sugerman CE (2021). Factors associated with uptake of routine measles-containing vaccine doses among young children, Oromia regional state, Ethiopia. Vaccines, 12(762): 1 – 17. https://doi.org/10.3390/vaccines12070762
47. Zewdie A, Letebo M, Mekonnen T (2016). Reasons for defaulting from childhood immunization program: a qualitative study from Hadiya zone, Southern Ethiopia. BMC Public Health;16: 1240.
48. Zimet G, Lim E, Matsunaga M, Liebermann E, Kornides M, Fontenot HB (2025). Early Adolescent Immunization Schedule Preferences: U.S. National Online Survey of Parents of Children Aged 9 – 10 Years. Journal of Adolescent Health, 77: S14 – S17.