

Knowledge, Attitudes, Behavioural and Social Determinants of Childhood Immunisation Among Caregivers and Healthcare Workers in Sierra Leone: A Convergent Mixed-Methods Study

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Abstract

Background

Childhood immunisation remains one of the most effective strategies for preventing vaccine-preventable diseases and reducing under-five mortality. In Sierra Leone, despite progress, subnational disparities, misinformation, and health system barriers continue to contribute to under-immunisation and zero-dose children. This study assessed caregivers' knowledge, attitudes, perceptions, and behavioural and social determinants of childhood immunisation, while exploring healthcare workers' perspectives on factors influencing vaccine uptake.

Methods

A convergent mixed-methods cross-sectional study was conducted in six districts of Sierra Leone between May and June 2026. Quantitative data were collected from 1,411 caregivers of children aged 12–35 months using structured interviewer-administered questionnaires. Qualitative data were obtained through ten focus group discussions involving 80 caregivers and 60 key informant interviews with healthcare workers. Quantitative data were analysed using descriptive statistics and multivariable logistic regression, while qualitative data underwent thematic analysis guided by the WHO Behavioural and Social Drivers framework.

Results

Overall, 66.0% of caregivers demonstrated good knowledge, 82.8% had positive attitudes, and 67.4% had positive perceptions towards childhood immunisation. Most respondents had heard of childhood vaccination (96.2%), recognised the importance of completing all vaccine doses (98.2%), and trusted information provided by healthcare workers (96.4%). Positive perceptions of vaccine safety were reported by 87.0% of caregivers. Tertiary education (AOR = 0.27; 95% CI: 0.13–0.55) and formal employment (AOR = 0.38; 95% CI: 0.18–0.80) were associated with lower odds of poor knowledge, while married caregivers had higher odds of poor knowledge (AOR = 3.33; 95% CI: 1.35–8.24). Qualitative findings identified misinformation, transportation difficulties, vaccine stock-outs, inadequate staffing, and competing livelihood priorities as major barriers to vaccination.

Conclusion

Although caregivers generally demonstrated favourable knowledge and attitudes, behavioural, social, and health system barriers continue to hinder optimal vaccine uptake. Strengthening community engagement, healthcare worker communication, outreach services, and health system capacity will be essential for improving equitable immunisation coverage in Sierra Leone.

INTRODUCTION

Routine childhood immunisation remains one of the most successful and cost-effective public health interventions, preventing an estimated 3.5-5 million deaths annually from vaccine-preventable diseases (VPDs) (1,2). Vaccination has substantially reduced childhood morbidity, mortality, and disability worldwide while contributing to increased life expectancy and improved population health (3). Despite these achievements, global immunisation coverage has plateaued over the past decade, and approximately 14.5 million children remained completely unvaccinated (zero-dose) in 2023, the majority residing in low- and middle-income countries (LMICs) (4). These persistent inequities threaten progress toward achieving the Immunisation Agenda 2030 targets, whose central vision is to ensure that everyone, everywhere, at every age benefits from vaccines (5).

Sub-Saharan Africa continues to bear a disproportionate burden of under-immunisation. Weak health systems, socioeconomic inequalities, geographical inaccessibility, vaccine stock-outs, inadequate healthcare workforce, misinformation and fragile community trust continue to limit equitable access to routine immunisation services (6). Although considerable investments have strengthened immunisation programmes across many African countries, marked disparities in vaccine coverage persist between and within countries, particularly among rural, underserved and socioeconomically disadvantaged populations (7).

Sierra Leone has made remarkable progress in rebuilding its Expanded Programme on Immunization (EPI) following years of civil conflict and the 2014-2016 Ebola Virus Disease outbreak. National coverage for key childhood vaccines has improved considerably, with WHO and UNICEF estimates indicating that coverage for the third dose of pentavalent vaccine (Penta3) and the first dose of measles-containing vaccine exceeded 80% nationally by 2023-2024 (9). Nevertheless, national averages conceal substantial subnational inequities. Several districts continue to report routine immunisation coverage below national targets, while zero-dose and under-immunized children remain concentrated in geographically remote and socioeconomically disadvantaged communities. According to the UNICEF Sierra Leone Annual reports, the number of zero-dose children fell to about 10,000, continuing a downward trajectory from roughly 15,000 in 2024 (10).

Growing evidence indicates that improving vaccine availability alone is insufficient to achieve equitable immunisation coverage (11). Caregivers' vaccination decisions are shaped by a complex interaction of behavioral, social, cultural and health-system factors. Knowledge regarding vaccine-preventable diseases, confidence in vaccine safety and effectiveness, trust in healthcare providers, perceptions of service quality, social norms, religious influences, misinformation, gender dynamics, and practical barriers such as transportation costs and competing livelihood priorities all influence childhood vaccination uptake (12). These determinants are comprehensively conceptualized within the World Health Organization Behavioral and Social Drivers (BeSD) Framework, which recognizes vaccination Behaviour as the product of four interrelated domains: Thinking and Feeling, Social Processes, Motivation, and Practical Issues (13).

Previous studies conducted across LMICs have consistently demonstrated that caregiver education, household socioeconomic status, maternal autonomy, vaccine confidence, and positive interactions with healthcare workers are associated with higher childhood vaccination coverage (14,15). Conversely, misconceptions regarding vaccine safety, fear of adverse events following immunisation, inadequate communication by health workers, cultural beliefs, vaccine misinformation, and limited access to health services contribute to delayed or incomplete vaccination (16). Although these determinants have been extensively investigated in several African settings, evidence from Sierra Leone remains limited, fragmented, and largely focused on vaccination coverage rather than the behavioural and social determinants underlying vaccine acceptance (17).

Understanding these determinants has become increasingly important as Sierra Leone seeks to eliminate zero-dose children and achieve the Immunisation Agenda 2030 targets. While routine administrative data provide information on vaccination coverage, they offer limited insight into why caregivers accept, delay or refuse childhood vaccination (18). Comprehensive evidence integrating caregivers' knowledge, attitudes, perceptions and behavioural determinants with healthcare workers' experiences is therefore required to inform context-specific interventions capable of improving routine immunisation performance.

To investigate caregivers' knowledge, attitudes, perceptions, behavioural and social determinants of childhood immunisation and explore healthcare workers' perspectives on factors influencing childhood immunisation uptake in selected districts of Sierra Leone using a convergent mixed-methods design.

Guided by the WHO Behavioural and Social Drivers (BeSD) Framework, this study employed a convergent mixed-methods design to investigate caregivers' knowledge, attitudes, perceptions, and behavioural determinants of childhood immunisation while simultaneously exploring healthcare workers' experiences of vaccine acceptance, service delivery, and community engagement. Quantitative and qualitative data were collected concurrently, analysed independently, and integrated during interpretation to provide complementary evidence regarding behavioural and social determinants influencing childhood immunisation uptake. By combining both forms of evidence, the study generated a more comprehensive understanding of childhood vaccination behaviour than would have been possible using either quantitative or qualitative methods alone, thereby providing context-specific evidence to inform national immunisation policies and interventions aimed at reducing zero-dose children and improving equitable vaccine coverage in Sierra Leone.

METHODS

2.1. Study design

A community-based cross-sectional mixed-methods study was implemented among caregivers of children aged 12-35 months and healthcare workers in selected districts. The quantitative component generated population-level estimates of caregivers' knowledge, attitude, perception, and childhood

immunisation and examined the influence of healthcare workers' behaviour and social drivers on immunisation uptake, while the qualitative component explored contextual and behavioural factors influencing immunisation decisions. Findings from both strands were triangulated using the WHO Behavioural and Social Drivers (BeSD) framework to provide a comprehensive understanding of immunisation-related behaviours.

2.2. Study Setting

The study was conducted in six selected districts in Sierra Leone. The district comprises four low-performing districts (Bonthe, Moyamba, Kono, and Tonkolili) and two high-performing districts (Koinadugu and Western Area Urban) identified by the Expanded Programme on Immunisation (EPI) administrative and survey data. The study includes communities served by government hospitals, community health centres (CHCs), community health posts (CHPs), and maternal and child health posts (MCHPs).

2.3. Study Population

The study population comprised a total of 1411 primary caregivers of children aged 12-35 months residing in selected communities within the study districts. Primary caregivers include mothers, fathers, grandparents, Guardians, and other adults directly responsible for the child's healthcare decisions. Also, healthcare workers directly providing immunisation services in the selected districts were enrolled in the study.

2.4. Sample Size Calculation

The sample size was calculated using Cochran's formula for prevalence studies, assuming a 50% prevalence, 95% confidence level, and 5% margin of error, yielding a minimum sample size of 384 caregivers. Considering the multistage sampling design, a design effect of 3.0 and a 10% allowance for non-response were applied, resulting in a minimum required sample size of 1,267 caregivers. A total of 1,411 caregivers were successfully interviewed and included in the final analysis.

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

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

$$n = \frac{3.8416 \times 0.25}{0.0025}$$

$$n = 384$$

The minimum required sample size was therefore 384 caregivers.

Considering the multistage sampling design used across the selected districts, a design effect of 3.0 was applied to account for clustering:

$$384 \times 3 = 1,152$$

To compensate for potential non-response and incomplete questionnaires, a 10% adjustment was applied:

$$1,152 \times 1.10 = 1,267$$

This gives a required sample size of approximately 1,267 caregivers.

However, during the survey implementation, additional eligible caregivers were successfully recruited, resulting in a final achieved sample size of 1,411 caregivers included in the analysis.

2.5. Case definitions

Low-performing districts: defined as districts reporting childhood vaccination coverage $\geq$

95% national target of the pentavalent third dose or measles-containing vaccine or above (19).

High-performing districts: defined as districts reporting childhood vaccination coverage below the 95% national target of the pentavalent third dose or measles-containing vaccine (20).

Zero-dose children: Zero-dose children are those who have not received even a single vaccine shot. For operational purposes, Gavi defines zero-dose children as infants who have not received the first dose of diphtheria, tetanus, and pertussis-containing vaccine or PENTA by the end of their first year of life (21).

Defaulter: An individual who started the recommended vaccination schedule but missed a scheduled appointment or failed to return for subsequent follow-up doses within a designated timeframe (often within 30 days of when the vaccine was due) (22).

Fully Immunised: A child or individual who has received the complete recommended series of routine vaccines as defined by their national immunisation schedule by a specific age (typically 12 months for children). This provides maximum protection against preventable diseases (23).

Partially Immunised: An individual who has received some, but not all, of the prescribed doses of vaccines required for full protection. They may have missed specific booster shots or failed to complete a multi-dose vaccine series (24).

Good knowledge: Caregivers obtaining at least 80% of the maximum knowledge score according to Bloom's cut-off criteria (25).

Positive attitude: Caregivers achieving scores equal to or above the predetermined attitude threshold based on Likert scale responses according to modified Bloom's cut-off criteria. (25).

Positive perception: Caregivers demonstrating favourable perceptions toward childhood immunisation according to the validated perception scale (25).

2.6. Sampling strategy

A three-stage cluster sampling design was employed. In the first stage, six districts were selected through simple random sampling after stratification by immunisation performance (high- and low-performing districts) to ensure representation across different immunisation contexts and enhance comparability while minimising selection bias. In the second stage, enumeration areas were randomly selected by balloting. In the third stage, households were selected using random compact segment or random-walk sampling following a rapid listing of households with children aged 12-35 months, while systematic sampling was applied where a complete household listing was available. In households with more than one eligible child, one index child was randomly selected to minimise intra-household correlation.

For the qualitative component, maximum-variation purposive sampling was used to recruit caregivers representing different vaccination statuses (zero-dose, under-immunised, and fully immunised but delayed), alongside healthcare workers. Data collection continued until thematic saturation was achieved through ten focus group discussions, stratified by sex and urban/rural residence, and 60 key informant interviews.

2.7. Eligibility Criteria

Eligible participants were primary caregivers (biological parents, legal guardians, or adults with primary responsibility for the child's daily care and health) of children eligible for routine childhood immunisation. Participants were required to be aged 18 years or older, able to provide informed consent, and capable of communicating in English, Krio, or a major local language to facilitate effective participation and ensure valid informed consent.

Individuals who were not the primary caregiver, temporary residents, or those not permanently residing in the selected zero-dose communities were excluded. Trained healthcare professionals were also excluded to minimize potential information bias arising from their professional knowledge of immunisation. In addition, individuals with severe cognitive impairment, acute illness, or communication barriers that prevented meaningful participation or informed consent were excluded to uphold ethical standards and ensure the quality and credibility of the study findings.

2.8. Ethical considerations and participant protection

Ethical approval was obtained from the Sierra Leone Ethics and Scientific Review Committee and the relevant institutional review board of the sponsoring institution. Permissions were sought from the Ministry of Health, EPI Programme and DHMTs. Community entry respected local norms through engagement with chiefs and leaders while preserving voluntariness and confidentiality. Written informed consent was obtained from all participants; for caregivers with low literacy, the consent form was read aloud in the preferred language, with a thumbprint and an impartial witness signature documented. No biological specimens were collected. Potential risks are minimal and pertain mainly to breach of confidentiality and discomfort discussing previous negative experiences; mitigation includes private interview spaces, coded identifiers, encrypted data, and an option to skip any question.

2.9. Data Collection Instrument

The required data for this research were collected using a set of pre-validated questionnaires. The questions were written in English and designed after a detailed review of relevant literature. Precisely, a template of questions from similar studies was adopted (14)(15).

Participants were interviewed (face-to-face) using an adapted structured questionnaire, which consists of six sections for the quantitative aspect. This includes Section A: Enumerator information and caregivers' consent (Identification and Consent, name of enumerator, phone number of enumerator, chiefdom, district, and community). Section B: Sociodemographic Characteristics for Caregiver (age of caregiver, sex of caregiver, marital status, MCH hand book, household size, monthly household income range (local currency). Section C: Child and caregiver characteristics, including the child's age, birth order, vaccination card availability, caregiver relationship to the child, educational level, occupation, religion, residence, marital status, and household size, Section D: Child's Vaccination Status contains four questions, Section E: Knowledge of Caregiver Towards Childhood Routine Immunisation contains 16 questions, Section F: Attitudes of Caregiver Towards Childhood Routine Vaccination contains 12 questions, and Section G: Perceptions of Access and Service Delivery contains 15 questions. For the qualitative aspect interview guides were developed as per the study objectives.

The qualitative data collection tools for this study consisted of semi-structured Key Informant Interview (KII) guides and Focus Group Discussion (FGD) guides, which were developed to explore caregivers' and healthcare workers' experiences, perceptions, and behaviours related to childhood immunisation. These tools allowed participants to express their views freely while ensuring that all relevant study topics were consistently covered.

The guides were structured around the Behavioural and Social Drivers (BeSD) framework and included open-ended questions across four key domains: thinking and feeling, which explored knowledge and perceptions of vaccines; social processes, which examined sources of vaccine information and levels of trust; motivation, which assessed willingness and factors influencing vaccination decisions; and practical issues, which explored accessibility to vaccination services and barriers to uptake.

Data generated from the interviews and discussions provided detailed contextual information that complemented the quantitative findings and supported thematic analysis using NVivo software.

Internal consistency reliability was assessed using Cronbach's alpha coefficients. Cronbach's alpha values above 0.70 were considered acceptable indicators of reliability. The scale for Attitude, consisting of 10 items, demonstrated good internal consistency with a Cronbach's alpha of 0.749, while the Perception scale, comprising 12 items, showed very good reliability with an alpha of 0.817.

2.10. Data collection procedures

Data were collected electronically using Kobo Toolbox-encrypted tablets with built-in range checks, skip patterns, and soft validations. Teams began each cluster with a brief engagement of community leaders and CHWs to explain the study and obtain support without compromising voluntariness. After household selection, enumerators obtained written informed consent and proceeded with the structured interview; vaccination information was verified using child health cards whenever available; caregiver recall was used when cards were unavailable. (with confidence ratings), and, where feasible, captured GPS coordinates at the household centroid. Qualitative data were collected by experienced facilitators in private, neutral venues; FGDs were homogeneous with respect to caregiver characteristics to encourage open discussion, audio-recorded with permission, and accompanied by detailed field notes.

Vaccination status was verified using child under-fives cards and Maternal and Child Health books whenever available. For children whose vaccination cards were unavailable, caregiver recall was used as a secondary source of information.

2.11. Data management and quality assurance

The quality of data was ensured through the training of data collectors and the pretesting of the questionnaire. The principal investigator and field supervisors conducted daily reviews of completed questionnaires to ensure completeness, consistency, and data quality, and ensure daily-based corrections were made accordingly. Electronic data were uploaded daily to a secure server; dashboards were designed to monitor enrolment, cluster completion, missingness, interviewer effects, and outliers. Automated validation scripts flagged inconsistent vaccination records and improbable dates for supervisor review. A daily debriefing was conducted to address protocol deviations and refresh standardisation. Qualitative recordings were transcribed verbatim, translated to English where needed, de-identified, and stored in encrypted folders with controlled access.

2.12. Statistical analysis

Data was exported from Kobo Toolbox to Microsoft Excel and analysed using IBM SPSS Statistics version 29. Descriptive statistics were used to summarise participants' socio-demographic characteristics and responses to knowledge, attitude, and perception items. Continuous variables were

presented as means and standard deviations or medians with interquartile ranges, while categorical variables were summarised using frequencies and percentages.

Knowledge was assessed by assigning one point for each correct response and zero for incorrect or "don't know" responses. Total scores were converted to percentages and categorised using Bloom's cut-off criteria as good (80-100%), moderate (60-79%), or poor (<60%) knowledge (25). Attitude and perception were measured using 5-point Likert scales, with negatively worded statements reverse-coded before analysis. Using the modified Bloom's cut-off, scores of $\geq 75\%$ indicated positive attitude or perception, while scores <75% indicated negative attitude or perception (25).

Factors associated with caregivers' knowledge were examined using binary logistic regression. Variables significant at $p < 0.05$ in bivariable analysis, together with variables identified *a priori* from the literature, were entered into the multivariable model. Associations were reported as Adjusted Odds Ratios (AORs) with 95% Confidence Intervals (CIs).

Qualitative data from Key Informant Interviews (KIs) and Focus Group Discussions (FGDs) were audio-recorded, transcribed verbatim, translated into English where necessary, anonymised, and analysed using NVivo software. A thematic analysis approach combining deductive coding based on the study objectives and conceptual framework with inductive coding of emerging themes was employed. Two researchers independently coded selected transcripts, and discrepancies were resolved through discussion to enhance analytical reliability.

RESULTS

3.1. Sociodemographic Characteristics of Caregivers

A total of 1,411 caregivers were recruited from six districts, with the highest proportions from Kono, Tonkolili, and Moyamba districts, each accounting for 250 (17.7%) respondents, followed by Bonthe and Western Area Urban with 230 (16.3%) each, and Koinadugu with 201 (14.2%).

Most caregivers were aged 18–25 years, 634 (44.9%), followed by those aged 26–35 years, 545 (38.6%). Female caregivers constituted the majority, 1,204 (85.3%), while males accounted for 207 (14.7%). Most respondents were married, 933 (66.1%), whereas 259 (18.4%) were single, 104 (7.4%) were cohabiting, 85 (6.0%) were widowed, and 30 (2.1%) were divorced.

Regarding occupation, 587 (41.6%) were farmers and 461 (32.7%) were traders. Most respondents were Muslims, 967 (68.5%), while 436 (30.9%) were Christians. Mothers represented the majority of caregivers, 1,158 (82.1%), followed by fathers, 118 (8.4%), and grandparents, 94 (6.7%).

In terms of education, 552 (39.1%) had attained secondary education, 525 (37.2%) had no formal education, 221 (15.7%) had primary education, and 113 (8.0%) had tertiary education. Most respondents resided in rural areas, 1,143 (81.0%). Concerning employment status, 667 (47.3%) were self-employed,

652 (46.2%) were unemployed, and 92 (6.5%) were employed. More than half of the households reported a monthly income below 800 SLL, 799 (56.6%). (Table 1).

Table 1
Sociodemographic Characteristics of Caregivers, May 2026 (n = 1411)

Variable	Sub-variable	Frequency	Percent
Age	18–25	634	44.9
	26–35	545	38.6
	36–45	149	10.6
	46 years and older	83	5.9
Sex	Male	207	14.7
	Female	1204	85.3
Marital status	Single	259	18.4
	Married	933	66.1
	Widowed	85	6.0
	Divorced	30	2.1
	Cohabiting	104	7.4
Occupation	Farmer	587	41.6
	Trader	461	32.7
	Civil servant	55	3.9
	House wife/House husband	176	12.5
	Others (Taylor, carpenter...)	132	9.4
Religion	Christianity	436	30.9
	Islam	967	68.5
	Others	8	0.6
Relationship to the child	Mother	1158	82.1
	Father	118	8.4
	Grandparent	94	6.7
	Guardian	35	2.5
	Others	6	0.4
Highest level of education attained	No formal education	525	37.2
	Primary School	221	15.7
	Secondary School	552	39.1

Variable	Sub-variable	Frequency	Percent
Residence	Tertiary	113	8.0
	Urban	241	17.1
	Peri-Urban	27	1.9
	Rural	1143	81.0
Primary Occupation	Unemployed	652	46.2
	Self-employed	667	47.3
	Employed	92	6.5
Monthly household income (NLe)	< 800	799	56.6
	800–1,000	313	22.2
	1,000 or above	299	21.2

3.2. Overall, Knowledge of Caregivers on Childhood Immunisation in Sierra Leone

In terms of knowledge of caregivers, the majority 931 (66.0%) of the caregivers had good knowledge, whereas 367 (25.9%) had moderate knowledge and 113 (8.1%) had poor knowledge, respectively (Fig. 1).

3.3. Knowledge of Caregivers on Childhood Vaccination in Sierra Leone

In relation to the knowledge of caregivers on childhood immunisation. The majority of the respondents, 1357 (96.2%) had heard about childhood vaccination, and most, 1241 (88.0%) of the caregivers correctly identified its primary purpose as protecting children from preventable diseases.

A total of 1240 (87.9%) caregivers reported that vaccination should commence at birth. Nearly all respondents 1386 (98.2%) recognized the importance of completing all scheduled vaccine doses, while 1285 (91.1%) indicated that healthy children should still be vaccinated and 1302 (92.3%) reported that exclusively breastfed children also require routine immunisation. Furthermore, 1288 (91.3%) stated that vaccination should continue following a missed appointment, 1086 (77.0%) acknowledged that mild post-vaccination side effects are normal, and 1024 (72.6%) agreed that childhood vaccination contributes to community protection against disease outbreaks (Table 2).

Table 2
Knowledge of Caregivers on Childhood Vaccination in Sierra Leone, May 2026

Variable	Sub-variable	Frequency	Percent
Have you heard about childhood vaccination/immunisation?	Yes	1357	96.2
	No	54	3.8
What is the primary purpose of childhood routine vaccination?	To make the child sick	37	2.6
	To protect children from dangerous, preventable diseases	1241	88.0
	To cure a child when they already have a disease	55	3.9
	I do not know	78	5.5
At what age should a child begin vaccination?	At birth	1240	87.9
	6 weeks	52	3.7
	9 months	8	0.6
	Do not know	111	7.9
At what age should a child complete their routine childhood vaccinations?	At birth	113	8.0
	At 6 weeks	10	0.7
	9 months	89	6.3
	At 1 year three months	517	36.6
	Only when they start school	516	36.6
	I do not know	166	11.8
Is it important for a child to complete all their scheduled vaccine doses, rather than just getting the first one?	Yes, all doses are needed for full protection	1386	98.2
	No, one dose is enough	25	1.8
If a child is looking healthy and strong, do they still need to be vaccinated?	Yes	1285	91.1
	No	74	5.2
	I do not know	52	3.7
Does a child need to receive routine vaccinations even if they are only exclusively breastfed?	Yes	1302	92.3
	No	38	2.7

Variable	Sub-variable	Frequency	Percent
	I do not know	71	5.0
If a child misses a vaccination appointment, what should happen	Continue vaccination later	1288	91.3
	Restart all vaccines	30	2.1
	Stop vaccination	16	1.1
	Don't know	77	5.5
Is it normal for a child to experience mild side effects	Yes	1086	77.0
	No	258	18.3
	I do not know	67	4.7
Vaccinating children helps protect the whole community from disease outbreaks	Agree	1024	72.6
	Disagree	230	16.3
	Not sure	157	11.1

3.4. Overall Attitude of Caregivers on Childhood Immunisation in Sierra Leone

In terms of the attitude of caregivers towards childhood immunisation. The majority, 1168 (82.8%) of the caregivers have a positive attitude (Fig. 2).

3.5. Attitude of Caregivers on Childhood Immunisation in Sierra Leone

Regarding the attitude of caregivers on childhood immunisation, most of the respondents 1339 (94.9%) agreed that routine vaccination is the most effective means of protecting children from deadly diseases. Furthermore, the majority of the caregivers 1335 (94.6%) agreed that vaccines provided at health facilities are safe for children. 1093 (77.4%) of caregivers agreed that mild side effects following vaccination are expected. Additionally, 1326 (94.0%) of the caregivers agreed that healthcare workers in health facilities treated them with respect during vaccination visits whereas 1360 (96.4%) of the caregivers expressed trust in information provided by healthcare workers regarding routine immunisation.

In terms of family support, the majority 1274 (90.3%) of caregivers agreed they received family support and most of them 1259 (89.2%) agreed that religious and traditional leaders encourage routine childhood vaccination. In addition, the majority 1292 (91.5%) of the caregivers indicated their willingness to wait in long queues to ensure their children receive scheduled vaccinations. (Table 3)

Table 3
Attitude of Caregivers on Childhood Vaccination in Sierra Leone, May 2026

Statement	SA n (%)	A n (%)	N n (%)	D n (%)	SD n (%)
Routine vaccination is the most effective way to protect my child from deadly diseases	785 (55.6)	554 (39.3)	33 (2.3)	28 (2.0)	11 (0.8)
Getting my child vaccinated helps protect other children in our community from getting sick	414 (29.3)	436 (30.9)	161 (11.4)	327 (23.2)	73 (5.2)
Traditional medicine or prayer alone cannot replace the protection that routine vaccines provide	460 (32.6)	585 (41.5)	132 (9.4)	144 (10.2)	90 (6.4)
Childhood routine vaccines provided at the clinic are safe for my child.	629 (44.6)	706 (50.0)	48 (3.4)	13 (0.9)	15 (1.1)
Temporary side effects like mild fever or pain are expected results of protecting my child	442 (31.3)	651 (46.1)	128 (9.1)	157 (11.1)	33 (2.3)
Healthcare workers at our local facility treat me with respect when I bring my child for vaccines	615 (43.6)	711 (50.4)	48 (3.4)	26 (1.8)	11 (0.8)
I trust the advice and information given to me by health workers about routine vaccination	621 (44.0)	739 (52.4)	32 (2.3)	9 (0.6)	10 (0.7)
My spouse, family, and elders support my decision to routinely vaccinate my child	470 (33.3)	804 (57.0)	95 (6.7)	22 (1.6)	20 (1.4)
Religious and traditional leaders in my community actively encourage routine childhood vaccination	486 (34.4)	773 (54.8)	79 (5.6)	36 (2.6)	37 (2.6)
I am willing to wait in long lines at the health centre to ensure my child gets their scheduled vaccine	493 (34.9)	799 (56.6)	60 (4.3)	40 (2.8)	19 (1.3)
Note: SA = Strongly agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree					

3.6. Overall Perception of Caregivers on Childhood Immunisation in Sierra Leone

In terms of caregivers' perceptions towards childhood immunisation. The majority 951 (67.4%) of the caregivers have positive perception (Fig. 3).

3.7. Perception of Caregivers on Childhood Immunisation in Sierra Leone

Regarding caregivers' views on childhood vaccination, 1094 (77.5%) agreed that routine childhood vaccines are effective in preventing serious illness, and 1148 (81.4%) agreed that vaccinated children are

healthier than unvaccinated children. Furthermore, most of the caregivers 1018 (72.1%) agreed that adherence to the recommended vaccination schedule is important, while 1228 (87.0%) of them perceived routine vaccines as safe for new-borns and infants.

A total of 1055 (74.7%) of caregivers agreed that the risk of severe childhood illness is greater than the risk of vaccine-related side effects, and 841 (59.6%) of the caregivers considered the administration of multiple vaccines during a single clinic visit to be safe.

Trust in vaccine safety information provided by healthcare workers was reported by 1268 (89.9%) caregivers. Additionally, 1215 (86.1) of caregivers agreed that their religious beliefs support routine vaccination, 1165 (82.5%) reported that their cultural traditions view childhood vaccination positively, and 1235 (87.5%) indicated that they would be comfortable openly stating that their child is fully vaccinated. Regarding vaccine-related misinformation, 804 (57.0%) disagreed that rumours about vaccine harm make them hesitant to vaccinate their children, while 1,002 (71.0%) disagreed with the belief that vaccines are designed to cause infertility or reduce population sizes. (Table 4)

Table 4
Perception of Caregivers on Childhood Vaccination in Sierra Leone, May 2026

Statement	SA n (%)	A n (%)	N n (%)	D n (%)	SD n (%)
Routine childhood vaccines are highly effective at preventing serious illnesses	407 (28.8)	687 (48.7)	61 (4.3)	81 (5.7)	175 (12.4)
Vaccinating a child makes them much healthier than a child who is not vaccinated	477 (33.8)	671 (47.6)	51 (3.6)	69 (4.9)	143 (10.1)
It is critical to follow the exact vaccine schedule given by health workers rather than delaying it	294 (20.8)	724 (51.3)	109 (7.7)	163 (11.6)	121 (8.6)
Outline childhood vaccines are completely safe for newborn babies and infants	460 (32.6)	768 (54.4)	39 (2.8)	36 (2.6)	108 (7.7)
The risk of a child getting a severe illness is much higher than the risk of experiencing a vaccine side effect	294 (20.8)	761 (53.9)	104 (7.4)	135 (9.6)	117 (8.3)
Giving a baby multiple vaccine injections during a single clinic visit is perfectly safe for their body	209 (14.8)	632 (44.8)	156(11.1)	181 (12.8)	233 (16.5)
I completely trust the information provided by local nurses and doctors regarding vaccine safety	420 (29.8)	848 (60.1)	40 (2.8)	30 (2.1)	73 (5.2)
My religious beliefs and faith community openly support the use of routine vaccines	315 (22.3)	900 (63.8)	73 (5.2)	40 (2.8)	83 (5.9)
My traditional culture and heritage view routine childhood vaccination as a positive practice	274 (19.4)	891 (63.1)	99 (7.0)	57 (4.0)	90 (6.4)
I would feel comfortable openly telling my family and neighbours that my child is fully vaccinated	401 (28.4)	834 (59.1)	63 (4.5)	45 (3.2)	68 (4.8)
Stories or rumours I hear about vaccines causing harm make me hesitate to vaccinate my child	168 (11.9)	290 (20.6)	149(10.6)	440 (31.2)	364 (25.8)
I believe that certain vaccines are intentionally designed to cause infertility or reduce population sizes	109 (7.7)	170 (12.0)	130 (9.2)	485 (34.4)	517 (36.6)
Note: SD = Strongly agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree					

3.8. Factors Associated with Caregivers' Knowledge on Childhood Immunisation

Multivariable logistic regression showed that marital status, religion, educational attainment, occupation, and employment status were independently associated with caregivers' knowledge of childhood

immunisation. Married caregivers had higher odds of poor knowledge than single caregivers (AOR = 3.33, 95% CI: 1.35–8.24; $p = 0.009$). Compared with caregivers with no formal education, those with tertiary education had significantly lower odds of poor knowledge (AOR = 0.27, 95% CI: 0.13–0.55; $p < 0.001$). Similarly, employed caregivers (AOR = 0.38, 95% CI: 0.1–0.80; $p = 0.010$) and those in other occupations (AOR = 0.25, 95% CI: 0.07–0.98; $p = 0.047$) had lower odds of poor knowledge. Muslim caregivers also had lower odds of poor knowledge compared with Christians (AOR = 0.16, 95% CI: 0.03–0.81; $p = 0.027$). Caregiver age, sex, relationship to the child, residence, and household income were not significantly associated with knowledge ($p > 0.05$) (Table 5).

Table 5
Multivariable Regression of Factors Associated with Caregivers' Knowledge on Childhood Vaccination, May 2026

Variable	Sub-variable	COR (95% CI)	P-value	AOR (95% CI)	P-value
Age of the caregiver	18–25	1		1	
	26–35	1.569 (0.633–3.890)	0.331	0.344 (0.077–1.536)	0.162
	36–45	2.157 (0.836–5.569)	0.112	0.567 (0.130–2.468)	0.449
	46 years and older	1.373 (0.460–4.103)	0.570	0.546 (0.147–2.038)	0.368
Sex of caregiver	Male	1		1	
	Female	1.100 (0.663–1.824)	0.712	1.016 (0.360–2.862)	0.977
Marital status	Single	1		1	
	Married	1.658 (0.694–3.958)	0.255	3.332 (1.348–8.235)	0.009
	Widowed	2.757 (1.274–5.963)	0.010	1.173 (0.320–4.305)	0.810
	Divorced	0.800 (0.303–2.114)	0.653	-	—
	Cohabiting				
Occupation	Farmer	1		1	
	Trader	0.624 (0.215–1.810)	0.385	0.482 (0.135–1.718)	0.261
	Civil servant	0.624 (0.211–1.842)	0.393	0.903 (0.263–3.094)	0.871
	House wife/House husband	-	—	-	—
Note: Statistical significance was set at $p < 0.05$.					

Variable	Sub-variable	COR (95% CI)	P-value	AOR (95% CI)	P-value
	Others (Taylor, carpenter)	0.580 (0.175–1.925)	0.373	0.254 (0.066–0.982)	0.047
Religion	Christianity	1		1	
	Islam	0.267 (0.066–1.090)	0.066	0.162 (0.032–0.809)	0.027
	Others	0.347 (0.086–1.397)	0.136	0.203 (0.041–1.003)	0.050
Relationship to the child	Mother	1		1	
	Father	0.300 (0.060–1.493)	0.141	0.302 (0.053–1.723)	0.178
	Grandparent	0.475 (0.092–2.464)	0.375	0.563 (0.092–3.432)	0.533
	Guardian	0.382 (0.072–2.017)	0.257	0.425 (0.066–2.760)	0.370
	Others	1.551 (0.713–3.371)	0.268	-	-
Highest level of education attained	No formal education	1		1	
	Primary School	0.917 (0.405–2.073)	0.835	-	-
	Secondary School	1.300 (0.616–2.742)	0.492	-	-
	Tertiary	0.422 (0.243–0.732)	0.002	0.267 (0.130–0.546)	< 0.001
Residence	Urban	1		1	
	Peri-Urban	1.638 (0.621–4.320)	0.319	-	-
Note: Statistical significance was set at p < 0.05.					

Variable	Sub-variable	COR (95% CI)	P-value	AOR (95% CI)	P-value
	Rural	2.082 (0.795–5.452)	0.136	-	-
Primary Occupation	Unemployed	1		1	
	Self-employed	0.571 (0.266–1.223)	0.149	0.653 (0.282–1.514)	0.321
	Employed	0.403 (0.202–0.805)	0.010	0.382 (0.184–0.796)	0.010
Monthly household income (NLe)	< 800	1		1	
	800–1,000	0.580 (0.288–1.166)	0.126	0.575 (0.261–1.265)	0.169
	1,000 or above	1.319 (0.514–3.389)	0.565	1.368 (0.499–3.753)	0.543
Note: Statistical significance was set at $p < 0.05$.					

3.9. Qualitative analysis of Caregivers behaviour and Healthcare Workers Social Drivers on Childhood Immunisation

The socio-demographic characteristics of caregivers are presented in Table 6. The majority of caregivers were aged 26–35 years (30, 37.5%), followed by those aged 18–25 years (25, 31.25%). Most caregivers were female (70, 87.5%), while males accounted for 10 (12.5%). Half of the caregivers were married (40, 50.0%), with 15 (18.75%) being single and 15 (18.75%) cohabiting.

Regarding the relationship with the child, most respondents were mothers (50, 62.5%), while fathers, grandparents, and guardians each represented 10 (12.5%). In terms of occupation, half of the caregivers were unemployed (40, 50.0%), followed by self-employed caregivers (25, 31.25%) and employed caregivers (15, 18.75%). (Table 6)

Table 6
Characteristics of Caregivers Interviewed on Childhood Vaccination in Sierra Leone, May 2026 (N = 80)

Variable	Sub-variable	Frequency	Percent
Age of the caregiver	18–25	25	31.25
	26–35	30	37.5
	36–45	20	25.0
	46 years and older	10	12.5
Sex of caregiver	Male	10	12.5
	Female	70	87.5
Marital status	Single	15	18.75
	Married	40	50.0
	Widowed	5	6.25
	Divorced	5	6.25
	Cohabiting	15	18.75
Relationship to the child	Mother	50	62.5
	Father	10	12.5
	Grandparent	10	12.5
	Guardian	10	12.5
Primary Occupation	Unemployed	40	50.0
	Self-employed	25	31.25
	Employed	15	18.75

The socio-demographic characteristics of participants are presented in Table 7. The largest proportion of participants were aged 18–25 years 20 (33.3%), followed by those aged 26–35 years and 46 years and older, each accounting for 15 (25.0%). Participants aged 36–45 years represented 10 (16.7%) of the respondents.

The majority of participants were male 50 (83.3%), while females accounted for 10 (16.7%). Regarding marital status, more than half of the participants were married (35, 58.3%), followed by single participants 12 (20.0%), cohabiting participants 8 (13.4%), and widowed participants 5 (8.3%). (Table 7)

Table 7
Characteristics of Healthcare Workers Interviewed on Childhood
Vaccination in Sierra Leone, May 2026 (n = 60)

Variable	Sub-variable	Frequency	Percent
Age	18–25	20	33.3
	26–35	15	25
	36–45	10	16.7
	46 years and older	15	25
Sex	Male	50	83.3
	Female	10	16.7
Marital status	Single	12	20
	Married	35	58.3
	Widowed	5	8.3
	Cohabiting	8	13.4

Theme 1: Vaccine Knowledge, Perceptions, and Misconceptions

Healthcare workers consistently reported that caregivers possess increasing awareness of the benefits of routine immunisation, particularly its role in preventing disease and improving child survival. Nevertheless, persistent misconceptions regarding adverse events following immunisation (AEFI), infertility, and vaccine overload continued to undermine vaccine confidence. These findings indicate that knowledge alone is insufficient to ensure vaccine acceptance, as caregivers often interpret vaccination through cultural beliefs, personal experiences, and prevailing community narratives. Although most participants observed improved community awareness, opinions differed on the magnitude of vaccine hesitancy, with some reporting widespread acceptance and others describing continued resistance and refusal.

"Some parents are afraid of the side effects after vaccination, such as fever, swelling, or pain." [HCW 001]

"Some caregivers trust traditional beliefs more than health information." [HCW 002]

"Most parents are refusing to take their children to the centre for the HPV vaccine, citing that the vaccine is not good for their children as it will cause them to be infertile." [HCW 001]

"Many caregivers in this town have developed positive attitudes toward immunization because of continuous sensitization." [HCW 003].

Theme 2: Trust in Healthcare Workers as a Driver of Vaccine Acceptance

Trust in healthcare workers emerged as a key facilitator of vaccine uptake. Caregivers were reported to rely primarily on nurses, community health workers, and health facilities for immunisation information, with trust strengthened through repeated interactions, respectful communication, community outreach, and perceived competence. While participants consistently recognized healthcare workers as the most trusted information source, they also noted that service interruptions, irregular outreach activities, and vaccine stock-outs could weaken public confidence in immunisation services.

"Most parents trust health workers, Community Health Workers, and local leaders for vaccine information." [HCW 004]

"Parents mostly trust the healthcare workers, CHWs, and community stakeholders' information about the vaccine." [HCW 001]

"The health centre is the main source most parents in this community trust for information when it comes to vaccines." [HCW 005]

"The simple reason for this is the way we have been treating them in the centre." [HCW 002]

Theme 3: Social and Cultural Influences on Immunization Decisions

Participants described childhood vaccination as a socially negotiated practice shaped by household and community power structures. Fathers were frequently identified as primary decision-makers, while grandparents, traditional leaders, and religious leaders exerted substantial influence on caregivers' vaccination decisions. Although male authority remained prominent in many communities, some healthcare workers observed increasing maternal autonomy resulting from improved health education and awareness, reflecting changing decision-making dynamics.

"Sometimes mothers are willing to vaccinate their children, but they still need permission or support from their husbands." [HCW 006]

"If the father does not agree for the child to be vaccinated that child will not be vaccinated." [HCW 006]

"Fathers, grandmothers, traditional leaders, and religious leaders have a strong influence on parents' decisions." [HCW 006]

"Many caregivers now make independent decisions to vaccinate their children." [HCW 001]

Theme 4: Community Engagement and Behaviour Change Mechanisms

Community-based interventions were consistently identified as effective approaches for improving vaccine uptake. Healthcare workers highlighted health education, community sensitization, outreach services, home visits, defaulter tracing, and collaboration with community leaders as essential strategies for addressing both informational and behavioral barriers to immunisation. While participants

unanimously supported community engagement, opinions varied regarding which intervention generated the greatest impact within their respective communities.

"Health education and community sensitization are very effective in motivating parents." [HCW 008]

"Defaulter tracing and house-to-house follow-up have also improved vaccination attendance." [HCW 008]

"Home visits help remind caregivers about clinic dates." [HCW 008]

"Community outreach and health education have been very effective in encouraging parents." [HCW 003]

Theme 5: Livelihood Priorities and Competing Demands

Healthcare workers reported that caregivers frequently faced competing livelihood demands that limited attendance at immunisation services. Farming, mining, trading, and household responsibilities often took precedence over clinic visits, suggesting that missed vaccinations were more commonly driven by socioeconomic constraints than vaccine refusal. Although participants agreed that livelihood activities affected immunisation attendance, some viewed missed appointments as limited commitment, whereas others considered them unavoidable consequences of economic survival.

"Most parents are not getting our campaign messages due to their mining work." [HCW 009]

"Some parents prioritize business activities, trading, or other work over clinic attendance." [HCW 010]

"Most caregivers here are engaged in farming and mining." [HCW 010]

"Many fail to come back on time." [HCW 010]

Theme 6: Health System and Service Delivery Constraints

Health system and logistical challenges were widely identified as major barriers to immunisation service delivery. Participants reported that transportation difficulties, vaccine stock-outs, malfunctioning cold-chain equipment, inadequate staffing, and poor road infrastructure substantially restricted access to vaccination services, particularly in remote communities. Although these challenges were consistently reported across districts, one facility described relatively adequate logistical support, highlighting contextual variations in health system capacity.

"Transportation remains a major challenge during outreach activities." [HCW 011]

"Our refrigerator is faulty and not working now." [HCW 011]

"One of the logistical issues we are faced with most of the time is the shortage of vaccine." [HCW 12]

"Poor road conditions during the rainy season." [HCW 013]

Theme 7: Healthcare Worker Motivation and Resource Needs

Healthcare workers emphasized that strengthening immunisation services requires greater investment in workforce support and operational resources. Participants identified transportation, fuel, outreach motorbikes, continuous training, financial incentives, and logistical support as critical requirements for improving service delivery and expanding outreach activities. Many reported relying on personal resources to conduct immunisation activities, underscoring the need to strengthen health system capacity alongside community demand for vaccination.

"Provision of transportation support, fuel, and outreach motorbikes would greatly improve immunization services." [HCW 013]

"Motivation for health workers would also encourage better service delivery." [HCW 013]

"Government providing training for staff at the health centres." [HCW 014]

"Additional financial and logistical support for outreach activities would help us reach more children on time." [HCW 014]

Theme 1: Vaccination as Child Protection and Responsible Parenthood

Caregivers consistently perceived vaccination as a vital intervention that protects children from illness, disability, and death while promoting healthy growth and family wellbeing. Vaccination was widely regarded as a moral responsibility and an essential component of responsible parenthood. Although participants demonstrated strong awareness of the benefits of immunisation, some correctly identified vaccines as preventive measures, whereas others mistakenly perceived them as treatments for existing illnesses.

"Vaccines are very important as they have over the years prevented many diseases such as polio, measles, tuberculosis and pneumonia." [Caregiver 3, FGD]

"Any mother knows about vaccines unless you are someone who is neglectful or careless." [Caregiver 6, FGD]

"I want my child to be protected from those vaccine-preventable diseases and for my child to grow healthy." [Caregiver 9, FGD]

"Vaccines are medicines that help protect children from getting serious diseases." [Caregiver 4, FGD]

Theme 2: Trust as the Foundation of Vaccine Acceptance

Trust emerged as the strongest facilitator of vaccine acceptance. Caregivers expressed high confidence in healthcare workers, community health workers, and government immunisation programmes, with trust largely shaped by positive personal experiences and the observed health of vaccinated children rather than technical knowledge. While some participants trusted healthcare providers because of their

professional expertise, others based their trust on consistently favourable outcomes following childhood vaccination.

"The health centre is the most reliable source I trust concerning vaccines." [Caregiver 10, FGD]

"We trust the nurses and CHWs 100% because they work in the health facility and always treat our children." [Caregiver 11, FGD]

"Government will never mean bad for our children." [Caregiver 12, FGD]

"We trust the nurse very much." [Caregiver 6, FGD]

Theme 3: Healthcare Worker Behaviour as a Driver of Demand

Healthcare worker attitudes and interpersonal communication strongly influenced caregivers' willingness to utilize immunisation services. Respectful treatment, empathy, patience, clear communication, and the use of local languages encouraged caregivers to attend clinics, seek information, and maintain confidence in vaccination services. Although experiences were predominantly positive, some caregivers indicated that poor provider-client relationships could discourage continued clinic attendance.

"The way they welcome you will encourage you to come to the clinic." [Caregiver 1, FGD]

"The way and manner in which the health care worker talks to me will give me the zeal and courage." [Caregiver 3, FGD]

"We would be more comfortable talking with health workers if they speak our local languages." [Caregiver 4, FGD]

"If the nurse and I don't get along well, it will discourage me." [Caregiver 5, FGD]

Theme 4: Social Networks and Community Influence

Vaccination decisions were strongly influenced by family members, spouses, community health workers, peers, and community leaders. Community support and shared social norms reinforced positive vaccination behaviours, with caregivers frequently encouraging one another to immunise their children. However, participants also acknowledged that rumours circulating within communities could negatively influence vaccination decisions for some caregivers.

"I first of all talk to my husband." [Caregiver 5, FGD]

"If one of us is not taking their child to the clinic, we advise them." [Caregiver 1, FGD]

"We mostly talk to nurses, CHWs, husbands, mothers and elderly women." [Caregiver 2, FGD]

"I have always been telling my husband, friends and neighbours." [Caregiver 3, FGD]

Theme 5: Balancing Confidence with Fear and Misinformation

Despite widespread confidence in childhood vaccination, caregivers reported concerns about common post-vaccination reactions, including fever, pain, and swelling. Misinformation and community rumours were additional sources of apprehension, although many participants indicated that their trust in vaccination outweighed these concerns. While some caregivers admitted that rumours could influence their decisions, others maintained confidence in immunisation regardless of misinformation.

"We sometimes fear fever or swelling after vaccination." [Caregiver 5, FGD]

"Rumours about vaccines making children sick would make me hesitate." [Caregiver 2, FGD]

"If someone tells me a bad rumour about Marklate, I will still go." [Caregiver 6, FGD]

"If the child shows severe signs of sickness after vaccination like high fever." [Caregiver 5, FGD]

Theme 6: Structural and Health System Barriers

Caregivers identified several structural and health system challenges that limited access to immunisation services despite their willingness to vaccinate their children. Frequently reported barriers included long distances to health facilities, transportation difficulties, poor road conditions, vaccine stock-outs, shortages of healthcare workers, and prolonged waiting times. Access varied across districts, with some communities reporting relatively easy access to services, while others experienced substantial geographic and logistical constraints. Outreach vaccination services were recognised as an important strategy for improving access and reducing these barriers.

"The health facility is far from my village and transportation is difficult during the rainy season."
[Caregiver 5, FGD]

"Stock out of vaccines can discourage us from coming." [Caregiver 3, FGD]

"There is a shortage at times." [Caregiver 4, FGD]

"Outreach services by nurses help reduce the burden." [Caregiver 3, FGD]

3.3. Thematic Saturation

Thematic saturation was achieved after approximately 80 caregiver interviews and 60 healthcare worker interviews, when no new codes or concepts emerged. Subsequent interviews confirmed the existing themes without generating additional insights, indicating that thematic completeness had been reached.

DISCUSSION

This mixed-methods study assessed caregivers' knowledge, attitudes, and perceptions towards routine immunisation while exploring the influence of healthcare workers' behaviour and behavioural and social drivers of vaccination in low-performing districts of Sierra Leone. By integrating quantitative findings from caregivers with qualitative evidence from healthcare workers, the study provides a comprehensive understanding of the factors influencing routine immunisation uptake. The findings demonstrate that although caregivers generally possess good knowledge and positive attitudes towards routine immunisation, vaccination uptake remains influenced by a complex interaction of behavioural, social, cultural, economic and health system factors.

The study found that approximately two-thirds of caregivers demonstrated good knowledge of routine immunisation. Most respondents correctly identified the purpose of vaccination, the appropriate age for vaccine initiation, and the importance of completing the recommended immunisation schedule. These findings suggest that routine health education activities implemented through the Expanded Programme on Immunisation (EPI), maternal and child health services, and community-based sensitisation programmes have contributed substantially to caregiver awareness. Similar findings have been reported in Ghana, Nigeria, and Liberia, where routine health education and maternal and child health services have been associated with improved caregiver knowledge and increased vaccine acceptance (26,27). Recent evidence from the global vaccination coverage report further demonstrates that caregiver awareness remains one of the strongest predictors of routine immunisation uptake, particularly in low- and middle-income countries where health literacy strongly influences health-seeking behaviour (28).

Despite the generally favourable knowledge levels, important gaps remained. A substantial proportion of caregivers lacked adequate understanding of herd immunity, community protection and the management of Adverse Events Following Immunisation (AEFIs). These findings are particularly important because misconceptions regarding vaccine safety continue to undermine immunisation programmes globally. Qualitative interviews revealed persistent rumours to infertility, vaccine overload, and harmful side effects. Similar misconceptions have been documented across Sub-Saharan Africa and have been identified as major contributors to vaccine hesitancy and delayed childhood vaccination (29–31). Recent studies conducted in Uganda, Kenya, and Nigeria reported that misinformation disseminated through social networks, religious groups, and informal community discussions often exerts a stronger influence on vaccination decisions than formal health education messages (32). Consequently, knowledge acquisition alone may not be sufficient to ensure optimal vaccine uptake unless accompanied by interventions that directly address misinformation and strengthen vaccine confidence.

The multivariable analysis revealed that marital status, religion, educational attainment, and employment status were independently associated with caregivers' knowledge (Table 6). Married caregivers had significantly higher odds of poor knowledge than single caregivers (AOR = 3.33, 95% CI 1.35–8.24), a finding that may reflect the demands of household and childcare responsibilities limiting married caregivers' exposure to health education sessions relative to single caregivers. Caregivers with tertiary education (AOR = 0.27, 95% CI 0.13–0.55) and those in formal employment (AOR = 0.38, 95% CI 0.18–0.80) had significantly lower odds of poor knowledge, consistent with the well-documented protective

effect of education and occupational exposure on health literacy reported in Ethiopia, Nigeria, and Ghana (33,34). Residence, age, sex, relationship to the child, and household income were not significantly associated with knowledge in the adjusted model ($p > 0.05$); this study therefore did not find the rural-urban knowledge disparity reported elsewhere in West Africa (35,36), and this null finding should be reported rather than a significant one implied. These findings underscore the need for targeted communication strategies focused on married caregivers and those with lower educational attainment.

An important finding of this study was the exceptionally high prevalence of positive attitudes towards childhood immunisation. Nearly all caregivers perceived routine immunisation as the most effective strategy for protecting children against vaccine-preventable diseases. High levels of trust in vaccines and healthcare workers were also observed. These findings are encouraging and suggest that vaccine confidence remains relatively strong within the study communities despite increasing global concerns regarding vaccine hesitancy. Similar levels of trust in healthcare workers have been reported in Senegal, The Gambia, Rwanda and Ghana where trust in frontline healthcare providers has been identified as one of the strongest determinants of vaccine acceptance (37).

Caregivers also demonstrated predominantly favourable perceptions regarding vaccine effectiveness and safety. Most respondents believed that vaccines prevent severe childhood illnesses, are safe for infants and improve child health outcomes. Trust in information provided by healthcare workers was particularly high, reinforcing the critical role of frontline health personnel in shaping vaccine-related decisions. Similar findings have been reported in Sierra Leone, Uganda and Kenya, where caregiver trust in healthcare workers was consistently associated with increased vaccination completion rates (38–40).

Nevertheless, concerns regarding multiple vaccine administration during a single clinic vaccine-related adverse effects persisted among a considerable proportion of caregivers. Such concerns have been increasingly documented across Africa and Asia. Studies conducted in Nigeria, Ghana, Sri Lanka and Pakistan found that caregivers frequently express anxiety regarding multiple injections, vaccine safety and potential long-term adverse consequences despite generally positive perceptions towards immunisation programmes (41–43). These findings underscore the importance of strengthening risk communication strategies and ensuring that healthcare workers are adequately equipped to explain vaccine safety and respond effectively to caregiver concerns.

The qualitative findings provide critical insight into the behavioural and contextual determinants of immunisation uptake. Healthcare workers consistently identified misinformation, transportation difficulties, poor road infrastructure, outreach limitations, vaccine stock-out, staff shortages, and competing economic priorities as key barriers to vaccination. Distance to health facilities emerged as the leading reason for missed vaccinations among caregivers. Similar findings have been documented in Sierra Leone, Ethiopia, Nigeria and Uganda, where geographical accessibility remains one of the strongest predictors of immunisation completion (44–46). The continued importance of distance and transportation barriers highlights the need for expanded outreach services and improved last-mile service delivery approaches.

These findings strongly support the applicability of the World Health Organisation Behavioural and Social Drivers (BeSD) Framework. Across the Thinking and Feeling domain, caregivers generally demonstrated confidence in vaccines but continued to express concerns regarding adverse events and misinformation. Within the Social Processes domain, healthcare workers, family members, fathers, grandparents, religious leaders and traditional authorities exerted substantial influence over vaccination decisions. Consistent with recent BeSD studies conducted in Kenya and Nigeria, healthcare workers emerged as the most trusted source of immunisation information (39,47). The motivation domain was characterised by strong willingness among caregivers to vaccinate their children, while the Practical Issues domain emerged as the most significant obstacle to vaccination uptake due to transportation challenges, outreach limitations, staff shortages and occasional vaccine stock-out.

The integration of quantitative and qualitative findings demonstrates that childhood immunisation behaviour cannot be adequately explained by knowledge or attitudes alone. Instead, vaccination uptake reflects the interaction between caregiver beliefs, social norms, healthcare worker engagement and the broader health system environment. This observation aligns with recent evidence supporting socio-ecological models of vaccination behaviour, which emphasise the interconnected influence of individual, interpersonal, community, institutional and policy-level factors on immunisation outcomes.

Policy Recommendations

From a policy perspective, the findings suggest that future immunisation interventions in Sierra Leone should prioritise strengthening community-based behavioural and social change communication, expanding outreach services to underserved communities, improving transportation and logistics systems, enhancing healthcare worker communication skills, and systematically addressing vaccine misinformation. Equally important is the integration of Behavioural and Social Drivers indicators into routine EPI monitoring systems to facilitate early identification of emerging barriers to vaccination and support evidence-based programme adaptation.

CONCLUSION

Overall, this study demonstrates that childhood immunisation uptake in Sierra Leone is influenced by a dynamic interaction of knowledge, perceptions, social influences, healthcare worker behaviour, and health system performance. Although caregivers generally possess favourable attitudes and substantial knowledge regarding routine childhood immunisation, persistent misinformation, accessibility challenges, and health system constraints continue to impede optimal vaccine utilisation. Sustainable improvements in vaccination coverage will therefore require integrated, people-centred approaches that simultaneously strengthen demand generation, healthcare worker capacity, community engagement, and equitable service delivery. Such interventions will be critical for reducing zero-dose children, improving routine immunisation coverage, and achieving the goals of the Immunisation Agenda 2030.

Declarations

Author contributions:

ENS, AC, and DMK contributed to the conception of the study. ENS, AC, DMK, NMK, and AKK contributed to the study design. NMK, ENS, and AKK contributed to data analysis. NMK, ENS, AKK, and DMK contributed to the interpretation of findings. AC, ENS, MMK, AKK, and NMK contributed to data collection. ENS, NMK, and DMK contributed to manuscript drafting. ENS, NMK, and DMK contributed to the critical revision of the manuscript. ENS, AC, NMK, AKK, NCK, UB, MMK, MTMK, SL, EE, SM, MOA, PBJ, and DMK contributed to the review, writing, and editing of the manuscript, all authors reviewed and approved the final version of the manuscript.

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Ethics Approval and Informed Consent

Ethical approval for this study was obtained from and the Sierra Leone Ethics and Scientific Review Committee (SLESRC), Ministry of Health, under approval number SLRC/26/2026, prior to the commencement of the study. Written informed consent was obtained from all participants before enrolment. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without any consequences. Confidentiality and anonymity were maintained throughout the study in accordance with ethical principles for research involving human participants.

Competing interests

The authors declare no conflict of interest.

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Figures

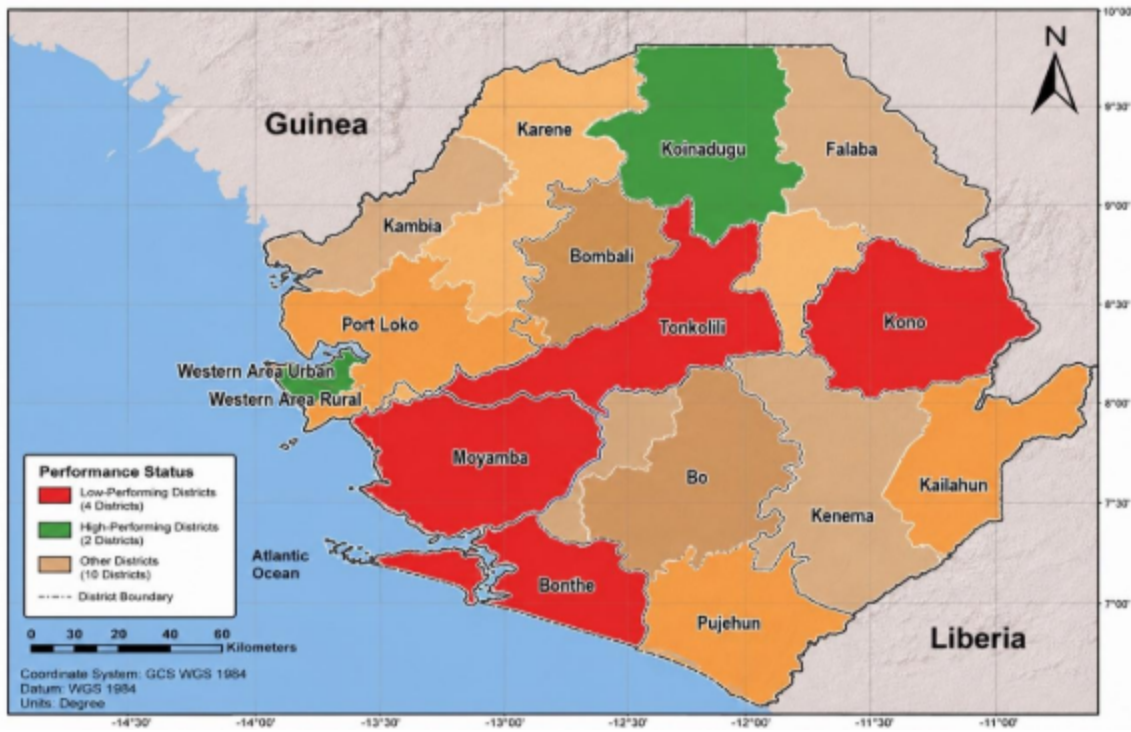


Figure 1

Map of Sierra Leone Showing High-performing Immunization and Low-performing Immunization Districts, May 2026

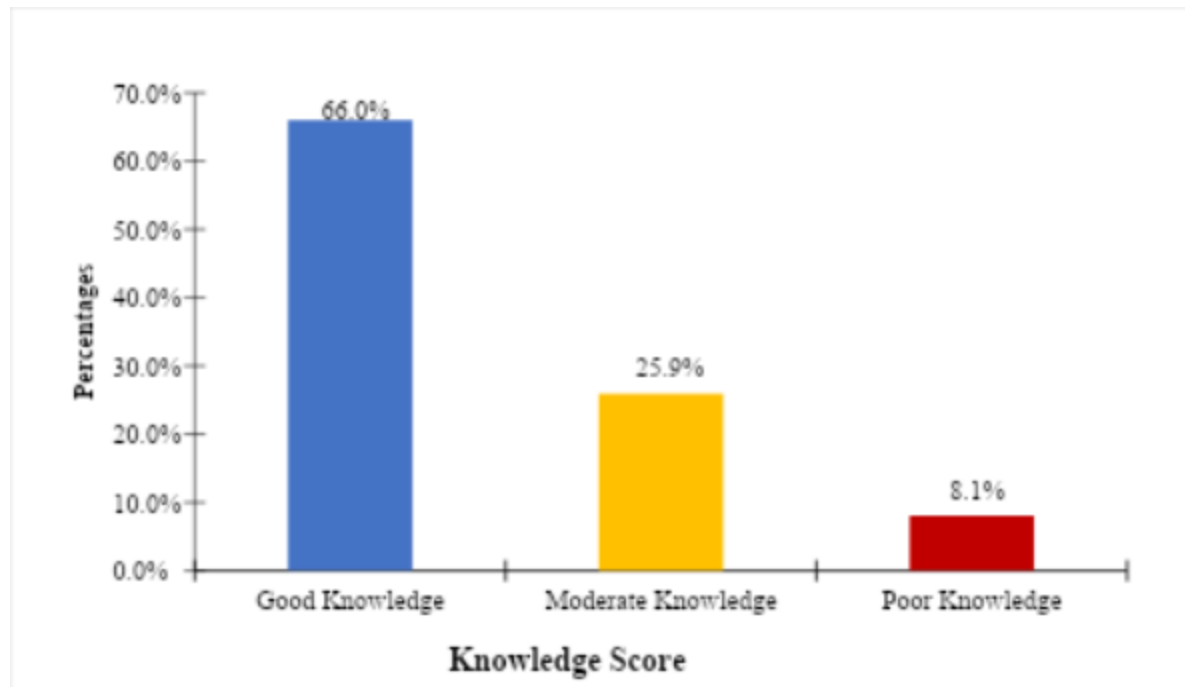


Figure 2

Figure 1. Overall, Knowledge of Caregivers on Childhood Immunisation, Sierra Leone, May 2026

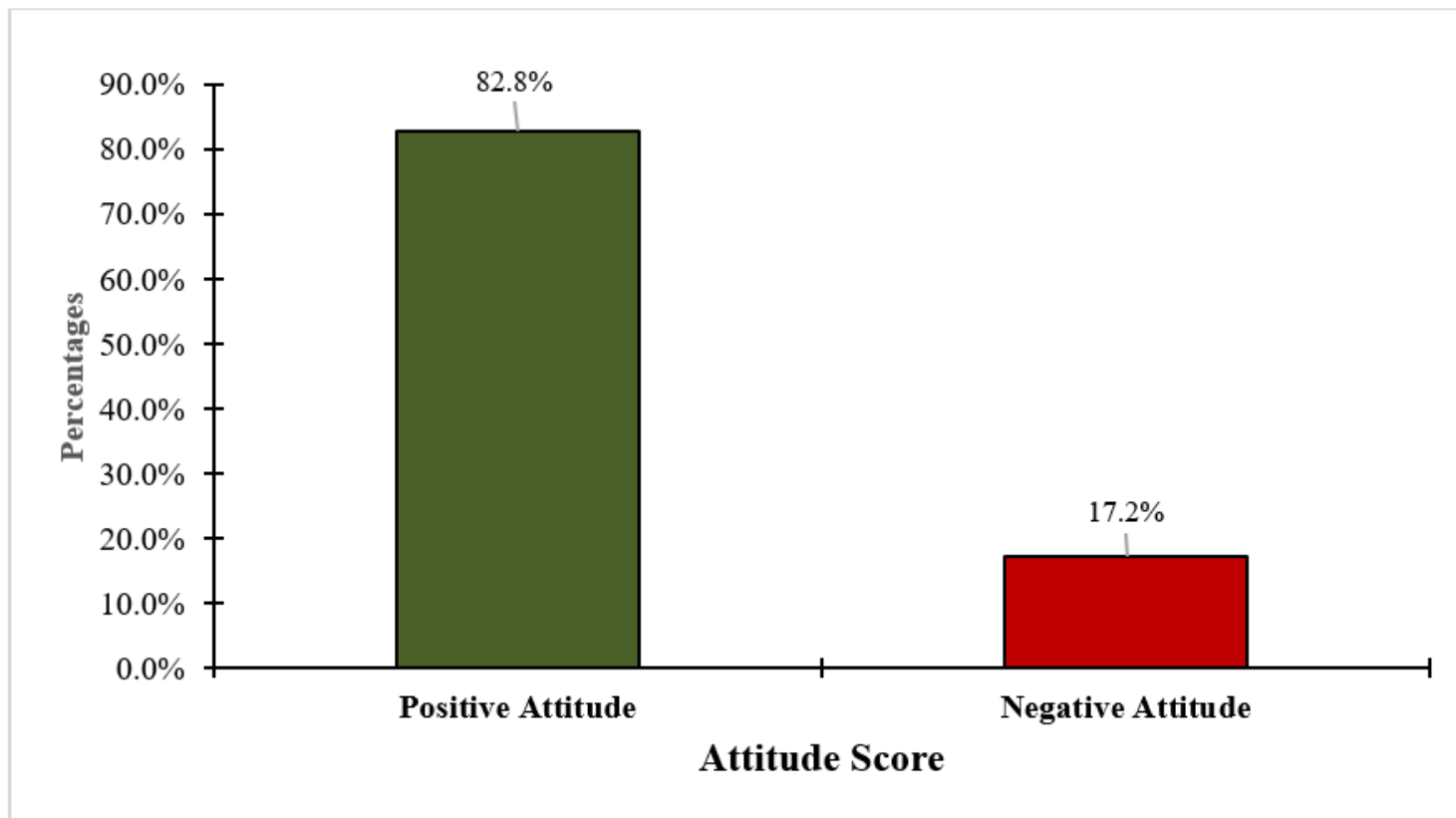


Figure 3

Figure 2: Overall Attitude of Caregivers on Childhood Vaccination in Sierra Leone, May 2026

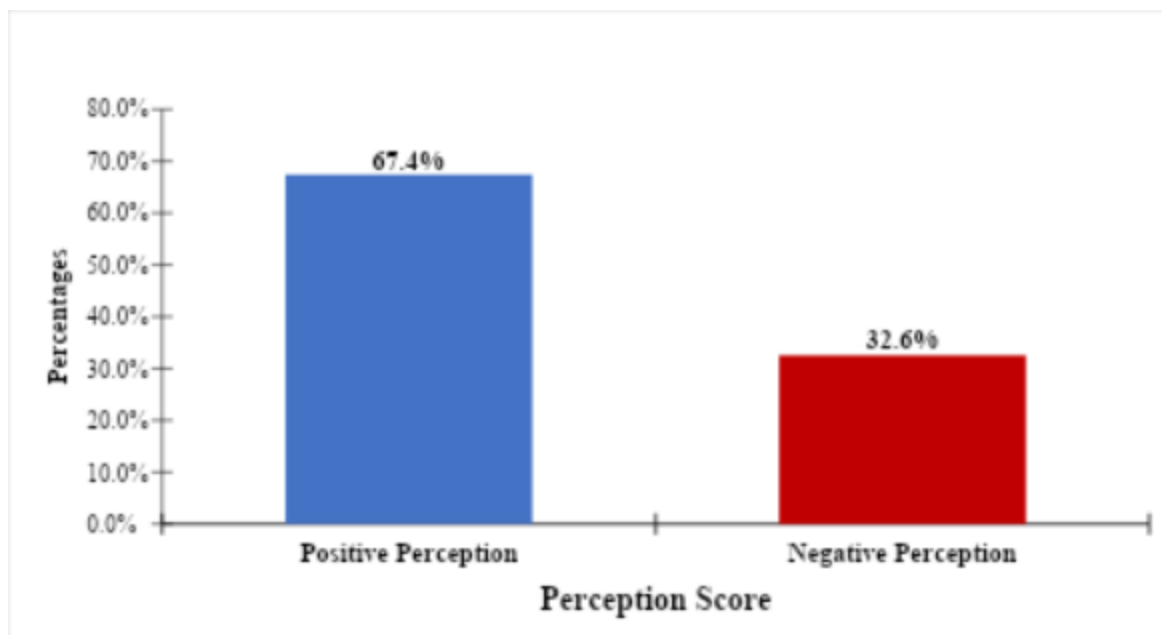


Figure 4

Figure 3. Perception of Caregivers on Childhood Vaccination in Sierra Leone, May 2026