Childhood vaccination uptake and associated factors among children 12–23 months in rural settings of the Gambia: a community-based cross-sectional study

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Abstract

Background: Globally, immunization prevents 2–3 million deaths annually from vaccine-preventable diseases such as diphtheria, tetanus, pertussis, influenza, and measles. In developing countries, several immunization programs have made progress, but the coverage remains a standstill in some areas. In order to inform policies and practices, the present study aimed at assessing vaccination uptake and contextual-associated factors among children aged 12–23 months in rural Gambia.

Methods: A community-based triangulated cross-sectional design was conducted in January 2020, with 200 caregivers with children aged 12–23 months in selected households in rural communities across Upper River Region of the Gambia using multistage sampling technique were recruited. A structured interview questionnaire was developed and Infant Welfare Cards were assessed to elicit information regarding contextual household characteristics towards childhood immunization uptake. Percentages, chi-square/fisher exact test for variables with \( p \)-value \( \leq 0.15 \) were considered for inclusion into logistic regression model. The significance level was set at \( p < 0.05 \). The adjusted Odds Ratio (aOR) with 95% Confidence Interval (CI) were reported to declare significance.

Results: The proportion of children who received all the required vaccines was 66%. At the level of antigen-specific coverage, about 88.5% received BCG, 71% received OPV 3, 82.5% received Penta 3, while 72 and 71% received Measles-Rubella and yellow fever, respectively. Caregivers who had primary education level 88.8% (aOR = 0.112; 95% CI = 0.029–0.434), secondary & above 87.2% (aOR = 0.128; 95% CI = 0.029, 0.561) and arabic/madrassa 95.7% (aOR = 0.043; 95% CI = 0.008–1.227) were less likely to be fully vaccinated when compared to those who have never been to school. Farmers are less likely by 88.9% (aOR = 0.111; 95% CI 0.020, 0.635) while children from family size of more than 20 members had reduced odds (aOR = 0.420; 95% CI = 0.197, 0.894) for their children to complete their vaccination schedule as compared to those with at most 20 household members.

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Background
Since the inception of Expanded Program on Immunization (EPI) by The World Health Organization (WHO) in 1974, immunization has become one of the most successful and cost-effective public health interventions. It was created with the ultimate purpose of vaccinating children throughout the world in the control and prevention of infectious diseases [1, 2]. Over the decades, remarkable achievements have been registered towards developing immunization programmes by saving millions of lives and lifelong disabilities worldwide [3]. Currently, immunization prevents 2–3 million deaths annually from communicable diseases such as diphtheria, tetanus, pertussis, influenza, and measles [4]. In the WHO-AFRO region, the immunization coverage in 2014 was at 77%, with 90% immunization coverage at the national level in up to 18 countries [5]. However, in sub-Saharan Africa, immunization coverage remained at 72% for the past five years and nearly 31 million children under the age of 5 years suffer from vaccine-preventable diseases annually [6].

Several immunization programs have made progress in developing countries, but the coverage remains at a standstill in some areas. A good number of children do not complete their immunization schedule due to certain challenges that span across caregivers, barriers, and other related factors [7]. Studies have reported high awareness level and perceptions of mothers towards childhood immunization [8, 9]. However, a study by Hassan et al. in 2019 [10] reported poor knowledge and perception of mothers towards supplementary immunization activities and showed no significant association between the socio-demographic, socio-economic factors and perception towards supplementary immunization activities. A similar study by Sarfaraz et al. 2017, showed a significant difference in mothers’ knowledge, attitude, and perception towards childhood immunization through counselling as an intervention with a score of 2–4 in pre-intervention to a score of 10–12 in post-intervention [11]. The unavailability of vaccine services and migration of caregivers have led to incomplete immunization of children [12]. Furthermore, mothers educational level, household income level, and trekking distance to the clinic sites as additional factors that hindered coverages [13].

Since the start of EPI services in May 1979, The Gambia has been registering high immunization coverage of over 85% in BCG, the third dose of DPT-Hep B-Hib, and measles vaccine [4, 14]. Despite this high immunization coverage, poor or marginalized communities have continued to register low immunization coverage, which has a near-stagnation on the immunization coverage for the past year to 92 and 93% in 2017 and 2018, respectively [4]. According to The Gambia’s Demographic Health Survey (DHS) 2019–2020, URR has a vaccination prevalence of 78.6% of all age-appropriate vaccinations 12–23 months, 13.6% less compared to the 2013 DHS [15, 16]. Low immunization coverage in developing countries has mostly been associated with socio-economic and demographic factors such as economic status, educational level of caregivers, geographical area, gender, and ethnicity [14]. Thus, this community-based triangulated study aimed at assessing childhood vaccination uptake and contextual-associated factors among children aged 12–23 months in rural Gambia. The study expands the body of knowledge on immunization services in rural areas and guides policymakers in improving the immunization programs as a whole.

Methods
Study area
The study was carried out in the Upper River Region (URR) of The Gambia. URR is one of the five local administrative regions with its administrative capital at Basse Santa Su. URR has a total population of 237, 220 with a population density of 115.93 persons/sq.km and a total fertility rate of 7.0% [17, 18]. It has an under five population of 11, 861 and under-five mortality of 56/1000 live births [15]. It has 15, 975 household in 369 settlements in 7 districts [15]. Most of the people in this area are involved in farming and business. It has one regional level health facility and 159 peripheral health centers [19].

Study design, population, and selection of participants
A community-based triangulated cross-sectional design was conducted in January 2020. The study was focused on understanding the perception of caregivers on vaccination, challenges faced in vaccinating their children, and the influence of the socio-demographic and proximate factors on vaccination status. Questionnaires were administered to caregivers in each selected households with children aged 12–23 months. A multistage sampling method was used in this study. Phase I: A cluster sampling strategy was used to select two districts out of the
seven districts, one from the northern part and the other from the southern part of URR, through simple random sampling. Phase II: At the selected districts, simple random sampling was done to select households in each catchment areas. Phase III: The target population at each of the selected communities in the catchment area was used to determine the number of caregivers to be interviewed. Participants were selected using a simple random sampling method.

**Sample size**
A sample size of 200 was estimated using cochrans’s formula with a childhood vaccination prevalence of 14.6% in one of the Local Government Areas for children under 3 years [16], z of 1.96 for 95% confidence level, and sampling error at 5%. However, the researchers adjusted the final sample size to 200 participants.

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n_o = \frac{z^2(p)(1-p)}{e^2}
\]

**Data collection tools and techniques**
Data were collected by trained students at the School of Public Health, Gambia College, using structured questionnaires. The information regarding socio-demographic factors, perception of vaccination, and challenges faced in routine vaccination activities were collected. Some aspects of the questionnaires were adapted from The Gambia Demographic Health Survey 2013, a thorough review of literature, and consultation with experts [15, 20]. The questionnaires were developed in English first, then translated into Mandinka, Fula, Wolof, and Serahule. The respondents were the primary caretakers of the child 12–23 months. Face to face interview was done with the caregivers to collect data. To determine the vaccination status, whether complete or partial, the Infant Welfare Cards were assessed. In a situation where caregivers’ did not have the child’s IWC, they were excluded from the study.

**Study variables**

**Outcome variables**
Immunization status of children. This was classified into two categories: “Fully vaccinated” a child within 12–23 months who received vaccination against tuberculosis (also known as BCG), three doses of DPT-HepB-Hib (Penta), three doses of polio vaccines, and one dose of vaccination against measles [16]; “Partially vaccinated” who missed at least one of any of the doses of the routine vaccines before turning 1 year or within 12–23 months old [15, 16].

**Independent variable**
The socio-demographic characteristics of caregivers include age, educational level, family type, caregiver, monthly income of caregiver, family size, occupation of child’s father, and decision-maker on child’s vaccination. The various proximate factors including aspects of caregiver’s perceptions towards childhood vaccination were also explored. The perception was measured using 9 items which span across participants willingness to vaccinate their child, general perception of vaccines, targeted diseases and side effects and were gauged using 5 likert scales: strongly agree, agree, undecided, disagree and strongly disagree.

**Ethical consideration**
The study protocol was reviewed and ethical clearance was issued by the Gambia College’s Research Committee for the study. Before the commencement of the study, ethical approval was obtained from the URR Regional Health Directorate of the Ministry of Health and the community leaders of sampled communities. The people were sensitized about the nature of the study in their local languages (Mandinka, Fula, Wolof, and Serahule). Participation in the study was entirely voluntary and only those that accept to be part of the study were recruited. A written informed consent form was signed by each participant who accepted to be enrolled in the study.

**Data analysis**
Data entry, cleaning and processing for preliminary data analysis was done using IBM SPSS version 25.0. Descriptive analysis was presented in frequencies, proportions, and graphs to summarize the data. Bivariate analysis was done using chi-square/fischer exact test as well as binary logistic regression analysis was done to identify the association between independent and dependent variables. The Chi-square/fisher exact test for variables with p-value ≤0.15 were considered for inclusion into logistic regression model. The adjusted odds ratios (aORs) and confidence intervals of 95% were calculated. A p-value < 0.05 was considered for statistical significance.

**Results**

**Socio-demographic characteristics of respondents**
In this study, a total of 200 respondents were recruited with an overall mean age of 29.7 ± 7.4 years. The response rate for the study was 100%. The majority of the respondents accounting for 53% were found to be between the ages of 26 and 35 years in the distribution. The entire respondents were female and about 53% had never been to school or attended formal education. Slightly more than half of the respondents (63%) live in an extended family with a family size of less than 20 at 69.5%. In terms of Caregivers’ occupation and that of
the child’s father, the majority were involved in farming at 47 and 61%, respectively. Almost half of the respondents (47.5%) earned less than D1,500 per month and about 47% reported being decision-makers regarding the child’s vaccination issues. Factor such as educational level, family size and occupation of child’s father were significantly associated with \( p < 0.05 \) as presented in Table 1.

**Overall vaccination coverage and antigen level coverage**

The total proportion of children who received all the required vaccines was 66% while 34% were found to be incompletely vaccinated as shown in Fig. 1.

At the level of antigen-specific coverage, about 88.5% received BCG, 71% received OPV 3, 82.5% received Penta 3, while 72 and 71% received Measles-Rubella and Yellow fever, respectively as shown in Fig. 2.

**Perception of caregivers on vaccination**

Of the 200 Caregivers interviewed, 94.5% wanted their children to be vaccinated, and 77.0% believed that their children should be vaccinated, as shown in Table 2. When asked if vaccination can prevent childhood illness, 95% reported that vaccination could prevent childhood illness. More than two-thirds of the respondents (74.0%) believe that vaccines are not harmful. When asked to name the disease conditions that vaccination prevents, the majority mentioned tuberculosis at 76.5%, pneumonia at 74.0%, poliomyelitis at 66.5% and rotavirus at 62.5%. Regarding the importance of routine vaccination and campaigns, 95.5% revealed that routine vaccinations and campaigns are important, while about 88.5% indicated that their children got vaccinated during those campaigns.

The study revealed that most caregivers strongly agree that vaccinating their child is necessary with mean of 4.5; all vaccine-preventable diseases are severe (mean 3.9), and all EPI targeted diseases have drugs for treatment (mean 3.8). Poliomyelitis could result in paralysis or even death (mean 3.8) as shown in Table 3.

**Association between vaccination status and some proximate factors**

Table 4 shows a significant association between child’s vaccination status with women’s total number of children and ever cancelled RCH clinic before at \( p = 0.009 \) and \( p = 0.036 \), respectively.

**Binary logistic regression model for predicting the association between vaccination status and socio-demographic characteristics**

As shown in Table 5, the variables in the model accounted for between 17.3–23.9% of the variation observed in the outcome variable (fully vaccinated status). The model predicted that respondents who had primary education had reduced odds for their children complete vaccination schedule compared with those who have never been to school (aOR = 0.112; 95% CI = 0.029–0.434) after adjusting for other confounding factors such as occupation of caregivers, family size and occupation of child’s father. There are reduction in the odds of caregivers with secondary & above (aOR = 0.128; 95% CI = 0.029, 0.561), and arabic/madrasa education (aOR = 0.043; 95% CI = 0.008–1.227), for their children to complete their vaccination schedules when compared to those who have never been to school after controlling for other confounders. Farmers among the caregivers had reduced odds (aOR = 0.111; 95% CI 0.020, 0.635) for their children to complete the vaccination schedule as opposed to those that are not working at the time of the study when controlled for other covariates. Children from household with family size of more than 20 members had reduced odds (aOR = 0.420; 95% CI = 0.197, 0.894) for their children to complete their vaccination schedule when in comparison with children from households with at most 20 members after adjusting for other confounding factors such as education, occupation of caregivers and that of child’s father.

**Discussion**

Considering the WHO vaccination schedule, a full vaccination uptake among children 0–24 months in rural Gambia was low at 66%. There are variations of coverage across regions, especially when compared to urban areas in the Gambia. These could be attributed to cultural receptivity towards childhood immunisation and potential inequalities in access to immunisation programs [21]. In rural areas of the Gambia, the patriarchal and low literacy level played an important role in influencing vaccination coverage. The available literature revealed that people concern about the child’s safety regarding vaccination had affected coverage, especially in rural settings [22].

In term specific antigens coverage, there are high uptake for OPV 1, pentavalent 1 and 2, while a decline was observed for others such as OPV3, yellow fever and measles-rubella. The current observed trend could be attributed to vaccine hesitancy as a proxy to factors influencing incomplete vaccination. This may be linked to vaccine hesitancy in developed countries due to cultural myths, adverse vaccine effects, and associated consequences [23, 24]. Furthermore, it is also documented that a responsive approach towards the management of adverse events following immunisation in both routine and supplementary immunisation activities could be attributed to parents not allowing their children to be vaccinated. Some vaccines such as measles and pentavalent, had some reactions in a form of abscess at the injection site, fever and irritability [25, 26].
often protects them from an unknown risks. Since these advantages are not readily evident, there is almost no encouragement for child caregivers to prioritize vaccination programs in the face of conflicting demands for their resources [27].

At least seven in ten of all children received BCG and OPV 3 vaccinations at the time of the study and about seven in ten children received yellow fever and measles-rubella before their first birthday. The study identified factors such as women with any education were less likely to get their children fully vaccinated; families with more than 20 members and women that are farmers were negatively associated with the uptake of vaccination in rural Gambia. Contextual factors such as the increased number of children in households, nonliterate caregivers, high illiteracy among the child’s father, or parents who were farmers, incomplete vaccination were found to be more common [26, 28].

| Table 1 Socio-demography characteristics of respondents in URR |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Variables       | N (%)           | Vaccination coverage | P-value       |
|                 | Partially vaccinated n (%) | Fully vaccinated n (%) |           |
| Age of respondents |                  |                  |               |
| 16–25           | 60 (30)          | 25 (12.5)        | 35 (17.5)     |
| 26–35           | 107 (53.5)       | 30 (15.0)        | 77 (38.5)     |
| 36 & above      | 33 (16.5)        | 13 (6.5)         | 20 (10.0)     |
| Educational level |                  |                  |               |
| Never been to School | 106 (53.0)    | 41 (20.5)        | 65 (32.5)     |
| Primary         | 41 (20.5)        | 13 (6.5)         | 28 (14.0)     |
| Secondary +     | 19 (9.5)         | 11 (5.5)         | 8 (4.0)       |
| Madarassa       | 34 (17.0)        | 3 (1.5)          | 31 (15.5)     |
| Family Type     |                  |                  |               |
| Single parenting | 7 (3.5)          | 5 (2.5)          | 2 (1.0)       |
| Nuclear         | 67 (33.5)        | 24 (12.0)        | 43 (21.5)     |
| Extended        | 126 (63.0)       | 39 (19.5)        | 87 (43.5)     |
| Occupation of Caregiver |            |                  |               |
| Currently not working | 18 (9.0)    | 11 (5.5)         | 7 (3.5)       |
| Farming         | 94 (47.0)        | 30 (15.0)        | 64 (32.0)     |
| Housewife       | 72 (36.0)        | 24 (12.0)        | 48 (24.0)     |
| Business        | 16 (8.0)         | 3 (1.5)          | 13 (6.5)      |
| Monthly earning of Caregiver |            |                  |               |
| Less than D1500 | 95 (47.5)        | 37 (18.5)        | 58 (29.0)     |
| D1500 - D3500   | 60 (30.0)        | 15 (7.5)         | 45 (22.5)     |
| More than D3500 | 45 (22.5)        | 16 (8.0)         | 29 (14.5)     |
| Family Size     |                  |                  |               |
| 1–20            | 139 (69.5)       | 54 (27.0)        | 85 (42.5)     |
| More than 20    | 61 (30.5)        | 14 (7.0)         | 47 (23.5)     |
| Occupation of Child’s Father |            |                  |               |
| Currently not working | 18 (9.0)    | 10 (5.0)         | 8 (4.0)       |
| Farming         | 122 (61.0)       | 34 (17.0)        | 88 (44.0)     |
| Civil Servant   | 7 (3.5)          | 3 (1.5)          | 4 (2.0)       |
| Business        | 53 (26.5)        | 21 (10.0)        | 32 (16.0)     |
| Decision maker on Child’s vaccination |          |                  |               |
| Mother/Caregiver | 94 (47.0)        | 36 (18.0)        | 58 (29.0)     |
| Father          | 32 (16.0)        | 8 (4.0)          | 24 (12.0)     |
| Both            | 74 (37.0)        | 24 (12.0)        | 50 (25.0)     |

*Statistical significance p < 0.05
more likely to be incomplete in children with multiple siblings. Larger families tend to put conflicting demands on mothers, restricting the time and resources available to care for each child. Other studies have identified this link, which has been attributed to the higher cost and demands on services caused by having more children in a family, which could have a negative impact on health-care utilization [29, 30]. According to some reports, the uptake of child vaccination services is linked to maternal education, antenatal care participation, and parity [26, 31, 32]. Furthermore, paternal literacy, which has been used in the Gambia as a surrogate indicator of socioeconomic status, tends to be inversely linked to inadequate immunisation. Similar studies have reported this association [31, 33–35].

If nothing is done about the delay in obtaining vaccines, a pool of children with incomplete immunisation may increase over time [32]. The existence of such a large group of vulnerable children makes outbreaks of vaccine-preventable diseases more likely [36]. Vaccinating children at an early age has institutional, programmatic, and financial implications [32, 37]. The current Gambian immunisation schedule provides additional vaccines such as pneumococcal, rotavirus and human papillomavirus vaccines to cover more vaccine preventable diseases across the country. The advent of emerging social myths regarding the CoVid-19 vaccines have some tendency of making vaccination programmes a challenging tasks for developing countries, including the Gambia. Thus, assessing the completion of vaccinations on time is even more critical for the EPI programme’s success.

Nonetheless, optimistic attitudes about vaccines did not seem to impact the vaccination of children in our sample substantially. In this study, most women (caregivers) desired and made sure their children were fully vaccinated, including those carried out during campaigns. According to this survey, parents strongly believe that vaccinations are essential for their children’s wellbeing, with the majority of respondents holding views that seem to favor immunisation. Children born to younger mothers, those with higher birth orders, and those from larger families have historically been shown to receive less health care services in general and preventive services in particular [35, 38–41]. Slightly less than half of them have the decision-making powers regarding their child’s utilisation of vaccines. As a result, these create rooms for the cancellation of some RCH
clinics where children are administered vaccines. These may be attributed to the biased-power dynamics against women, especially those who are majorly never been to school and engaged as farmers. It could mean that ANC services are well attended and could be a proxy to predict institutional deliveries reported from other studies [29, 42–44].

Study limitations
This research was carried out in the communities of URR, Gambia. As a result, our findings may have implications for vaccination programs in Gambia and, by extension, West Africa. Respondents who did not have Infant Welfare Cards were excluded from the sample, which may have resulted in distorted sampling. People without IWCs were likely to have only partially immunised their children, never received, or had more delayed vaccines than those with cards. Additionally, vaccine experiences may have affected certain caregivers’ beliefs, views, and attitudes. As a result, vaccination coverage in rural Gambia may be lower than what is recorded in this research. Exploring other potential and inventive means of reliable data sources for immunisation programmers will be one of the issues for additional research on childhood immunisation coverage. Furthermore, we recommend a follow-up study to understand the biased power dynamics against women in terms of decision making for children’s vaccination uptake in rural and urban areas.

Conclusion
Our analysis shows that a substantial number of children completed their vaccination as expected. There is moderately a burden of incomplete vaccination in rural Gambia. This burden is heavily influenced by factors such as the caregiver’s educational level, occupation, family size, and father’s occupation. Vaccination

| Perception items                          | Frequency (n) | Percent (%) |
|------------------------------------------|---------------|-------------|
| Wants my child to be vaccinated          |               |             |
| Yes                                      | 189           | 94.5        |
| No                                       | 11            | 5.5         |
| Vaccination can prevent childhood illness|               |             |
| Yes                                      | 191           | 95.5        |
| No                                       | 9             | 4.5         |
| Should your child be vaccinated           |               |             |
| Yes                                      | 154           | 77.0        |
| No                                       | 46            | 23.0        |
| Vaccines are harmful                     |               |             |
| Yes                                      | 52            | 26.0        |
| No                                       | 148           | 74.0        |
| Diseases vaccine prevents*               |               |             |
| Tuberculosis                             | 153           | 76.5        |
| Diphtheria Pertussis Tetanus (DPT)       | 69            | 34.5        |
| Measles-Rubella                          | 111           | 55.5        |
| Hepatitis B                              | 90            | 45.0        |
| Pneumonia                                | 148           | 74.0        |
| Meningitis                               | 115           | 57.5        |
| Poliomyelitis                            | 133           | 66.5        |
| Rota Virus                               | 125           | 62.5        |
| Yellow fever                             | 103           | 51.5        |
| Children vaccinated during campaigns     |               |             |
| Yes                                      | 177           | 88.5        |
| No                                       | 23            | 11.5        |
| Routine vaccinations and campaigns are important |
| Yes                                      | 191           | 95.5        |
| No                                       | 9             | 4.5         |

*Multiple responses

| Perception item                                         | N   | Mean | Std. Dev | Strongly Agree n(%) | Agree n(%) | Undecided n(%) | Disagree n(%) | Strongly Disagree n(%) |
|---------------------------------------------------------|-----|------|----------|---------------------|------------|----------------|----------------|------------------------|
| It is necessary to vaccinate a child                     | 200 | 4.5  | 0.68     | 41(20.5)            | 76(38.0)   | 32(16.0)       | 32(16.0)       | 19(9.5)                |
| Your child will not get Measles if it strikes            | 200 | 3.6  | 1.25     | 49(24.5)            | 58(29.0)   | 34(17.0)       | 49(24.5)       | 10(5.0)                |
| If a family member has Pneumonia your child will be infected | 200 | 3.5  | 1.13     | 34(17.0)            | 21(10.5)   | 31(15.5)       | 58(29.0)       | 56(28.0)               |
| Poliomyelitis can cause paralysis and result to death   | 200 | 3.8  | 0.97     | 55(27.5)            | 83(41.5)   | 43(21.5)       | 11(5.5)        | 8(4.0)                 |
| All the vaccine preventable diseases are severe         | 200 | 3.9  | 0.93     | 57(28.5)            | 91(45.5)   | 34(17.0)       | 16(8.0)        | 2(1.0)                 |
| All EPI targeted diseases have drug for treatment       | 200 | 3.8  | 1.02     | 51(25.5)            | 69(34.5)   | 62(31.0)       | 15(7.5)        | 3(1.5)                 |
| Incomplete vaccination is the same as complete vaccination | 200 | 2.6  | 1.43     | 33(16.5)            | 86(43.0)   | 39(19.5)       | 29(14.5)       | 13(6.5)                |
| A child with common cold should be vaccinated           | 200 | 3.4  | 1.24     | 44(22.0)            | 87(43.5)   | 24(12.0)       | 24(12.0)       | 21(10.5)               |
| A child with fever should not be vaccinated             | 200 | 3.4  | 1.25     | 119(59.5)           | 76(38.0)   | 0(0.0)         | 3(1.5)         | 2(1.0)                 |
programs should be constantly monitored and evaluated by the Ministry of Health, especially in rural areas. To increase societal awareness and vaccine acceptance, related initiatives such as ANC programs, nutritional surveillance, and postnatal care services must be strengthened and expanded. Strong community-based

| Variables | Overall vaccination coverage | P-value |
|-----------|-----------------------------|---------|
|           | Partially vaccinated n (%)  | Fully vaccinated n (%) |
| Rating vaccination service providers at a health facility | | 0.485 |
| Very Unfriendly | 26 (32.5) | 54 (67.5) |
| Unfriendly | 38 (38.4) | 61 (61.6) |
| Undecided | 3 (23.1) | 10 (76.9) |
| Friendly | 1 (16.7) | 5 (83.3) |
| Very friendly | 0 (0) | 2 (100.0) |
| Women total number of children | 0.009* | |
| < 5 | 40 (45.5) | 48 (54.5) |
| 5 to 10 | 28 (25.2) | 83 (74.8) |
| > 10 | 0 (0.0) | 1 (100.0) |
| Transportation difficulties to the vaccination site | 0.644 | |
| Yes | 24 (32.0) | 51 (68.0) |
| No | 44 (35.2) | 81 (64.8) |
| The convenience of vaccination timing | 0.143 | |
| Yes | 54 (37.0) | 92 (63.0) |
| No | 14 (25.9) | 40 (74.1) |
| Busy schedules allow attending vaccination sessions | 0.476 | |
| Yes | 34 (36.6) | 59 (63.4) |
| No | 34 (31.8) | 73 (68.2) |
| Child’s sickness prevents attending RCH clinic | 0.238 | |
| Yes | 12 (26.7) | 33 (73.3) |
| No | 56 (36.1) | 99 (63.9) |
| Ever canceled RCH clinic before | 0.036* | |
| Yes | 20 (47.6) | 22 (52.4) |
| No | 48 (30.4) | 110 (69.6) |
| Ever prevents your child from taking vaccination based on rumor | 0.229 | |
| Yes | 10 (45.5) | 12 (54.5) |
| No | 58 (32.6) | 120 (67.4) |
| Fear of vaccine side effects prevents you from taking your child to the RCH clinic | 0.409 | |
| Yes | 5 (45.5) | 6 (54.5) |
| No | 63 (33.3) | 126 (66.7) |
| Attending pre-clinic sessions on vaccination | 0.437 | |
| Every time | 19 (30.2) | 44 (69.8) |
| Sometimes | 49 (35.8) | 88 (64.2) |
| Waiting hours before your child gets vaccinated | 0.873 | |
| < 1 h | 26 (36.1) | 46 (63.9) |
| 1 - 2 h | 27 (32.1) | 57 (67.9) |
| > 2 h | 15 (34.1) | 29 (65.9) |

*Statistical significance p < 0.05
Table 5 Association between participants overall vaccination status and selected socio-demographic variables in URR

| Variables               | Adjusted Odd Ratio 95% CI |
|-------------------------|---------------------------|
| **Educational level**   |                           |
| None (Ref)              | 1                         |
| Primary                 | 0.112 (0.029–0.434)*      |
| Secondary               | 0.128 (0.029–0.561)*      |
| Madarasa                | 0.043 (0.008–0.227)*      |
| **Occupation of caregiver** |                       |
| Currently Not Working (Ref) | 1                        |
| Farming                 | 0.111 (0.020–0.635)*      |
| Housewife               | 0.242 (0.053–1.100)       |
| Business                | 0.230 (0.094–1.079)       |
| **Family size**         |                           |
| 1–20 (Ref)              |                           |
| More than 20            | 0.420 (0.197–0.894)*      |
| **Occupation of Child’s Father** |               |
| Currently not working (Ref) | 1                        |
| Farming                 | 0.695 (0.208–2.326)       |
| Civil Servant           | 2.084 (0.970–4.476)       |
| Business                | 0.351 (0.045–2.763)       |

*Statistical significance p < 0.05
Ref Reference category, CI Confidence Interval.

health education efforts are desperately needed as part of initiatives to increase vaccine service utilization for these high-risk classes.

Abbreviations
aOR: Adjusted odds ratio; BCG: Bacille Calmette-Guerin; DHS: Demographic Health Survey; DPT-HepB-Hib: Diphtheria, Pertussis, Tetanus, Hepatitis B, and Hemophilus influenza type B (Penta); EPI: Expanded Programme on Immunization; IWC: Infant Welfare Card; SPSS: Statistical Package for the Social Sciences; URR: Upper River Region; WHO: World Health Organization

Acknowledgements
We would like to express our sincere gratitude to the caregivers who participated in the study. Special thanks to the Regional Health Directorate at URR, Ministry of Health, Governor’s Office-URR, youth community leaders, village heads (Alkalos), and village health workers for their support in community mobilization. The authors finally acknowledge students of School of Public Health for their hardwork during fieldwork and the Gambia College Administration for their logistical support.

Authors’ contributions
ET, AB, BK, MN, SLSK, MB, JT & SPSJ conceptualized the study and prepared the study design. EB reviewed literature. ET, AB, BK, MN, MB, JT, LC and SLSK undertook fieldwork. ET performed data input. ET & AB performed data analysis, wrote the results, discussed the findings, and wrote the initial draft of the manuscript. All authors critically reviewed the manuscript for its intellectual content. All authors read and approved the final manuscript. AB had the final responsibility to submit for publication.

Funding
Partly funded by the Gambia College administration and the school alumni in a form of donations during our door-to-door visits to some public and private institutions in the Gambia.

Availability of data and materials
The data used to support the findings of this study are available upon reasonable request from the school administration at sph@gambiacollege.edu.gm.

Declarations
Ethics approval and consent to participate
The study protocol was reviewed and ethical clearance was issued by the Gambia College’s Research Committee for the study. All methods were carried out in accordance with relevant guidelines and regulations. Before the commencement of the study, ethical approval was also obtained from URR Regional Health Directorate of the Ministry of Health and the community leaders of sampled communities. The people were sensitized about the nature of the study in their local languages (Mandinka, Fula, Wolof, and Serahule). Participation in the study was entirely voluntary and only those that accepted to be part of the study were recruited. A written informed consent form was signed by each participant who accepted to be enrolled in the study.

Consent for publication
Not applicable.

Competing interests
No conflicts of interest was disclosed.

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Received: 6 April 2021 Accepted: 15 September 2021
Publicized online: 25 September 2021

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