

Research Article

Utilization of Measles Immunization Services Among Children Under 5 Years in Lira District Northern Uganda A Community-Based Cross-Sectional Study

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Received: 📅 2026 Mar 01**Accepted:** 📅 2026 Mar 20**Published:** 📅 2026 Mar 31**Abstract****Introduction**

Measles remains a global health concern with high mortality rate, particularly in regions with low vaccine utilization, despite progress in measles control globally. In sub-Saharan Africa, first-dose measles vaccine utilization stands at 74%, well below the 95% target for herd immunity recommended by the World Health Organization (WHO). In northern Uganda, the proportion of children under five who receive the recommended doses of vaccines lags below the national average. This study therefore examined the level and factors influencing measles immunization utilization among children under five in Lira district, northern Uganda.

Methodology

This was a community-based cross-sectional study in two sub counties in Lira district, northern Uganda that utilized both quantitative and qualitative methods of data collection. We surveyed 409 children under five, selected through systematic random sampling. Data were analyzed using SPSS for univariate, bivariate, and multivariate logistic regression. Qualitative data from in-depth interviews with healthcare providers, opinion leaders, and district health officials were analyzed using thematic analysis. Ethical approval was obtained from Lira University Research and Ethics Committee.

Results

Measles vaccination completion was 19.6% (79/402). Factors that positively influenced utilization included antenatal (ANC) attendance ($aOR=1.65$, $p=0.002$), higher education level ($aOR=1.40$, $p=0.023$), and vaccine availability ($aOR=1.40$, $p=0.020$). Barriers included high transportation costs ($aOR=0.60$, $p=0.010$), cultural beliefs ($aOR=0.55$, $p=0.006$), and denial of vaccination on non-vaccination days ($aOR=0.65$, $p=0.010$). Qualitative findings highlighted vaccine shortages, cultural beliefs, and poor health facility access as barriers.

Conclusion

Measles vaccine utilization rate in the study setting of 19.6% was low. Antenatal care attendance, education level, vaccine availability, transportation costs, and cultural beliefs were key determinants of utilization. There is need develop and implement targeted strategies to address this gap, including community sensitization and health education, with emphasis of the benefits of childhood immunization in general.

Keywords: Utilization of Measles Services, Measles Vaccine Doses, Immunization, Vaccination, Children, Unimmunized, Immunized and Lira District

Abbreviations

aOR: Adjusted odd Ratio; CI: Confidence interval; COVID-19: Coronavirus Disease 2019; DHIS2: District Health Information Software 2; DHMIS: District Health Management Information System; HHs: Households; HMIS: District Health Management Information System; KIIs: Key Informant Interviews; LUREC: Lira University Research and Ethics Committee; NGOs: Non-governmental organizations; PPE: Personal Protective Equipment; SPSS: Statistical Package for the Social Sciences; UDHS: Uganda Demographic and Health Survey; VHTs: Village Health Teams; WHO: World Health Organization.

1. Introduction

Immunization is one of the most effective public health interventions globally, significantly reducing childhood morbidity and mortality [1-3]. Among the vaccines, measles immunization plays a crucial role in preventing severe illness and death in children under five years. Measles is highly contagious and poses a significant threat in children with insufficient immunity [5-10]. Despite global progress in measles control, with a 73% reduction in measles-related deaths from 2000 to 2019, measles outbreaks remain a concern, particularly in regions with low immunization coverage [11,43]. Sub-Saharan Africa continues to bear a disproportionate burden of measles cases and deaths, accounting for almost 60% of the global measles cases and three-quarter (74%) of measles-related deaths in 2019 [43]. Uganda, one such country, while has had progressive decrease in the under-five mortality rate to the current 43 deaths per 1,000 live births, vaccine-preventable diseases, including measles, among others, remain important causes of morbidity and mortality [40]. Although the national measles immunization coverage stands at 83% [40]. There persists great regional disparity – being much lower in northern Uganda, including Lira district - exposing approximately 9,475 children under five in the district to measles-related risks [40]. The Uganda National Expanded Program on Immunization (UNEPI) aims to achieve high vaccination coverage, but challenges that lead to regional and local disparities persist [12,13].

Several general and context-specific factors, including demographic characteristics, infrastructure and healthcare accessibility, vaccine availability, socio-economic disparities, and cultural perceptions and beliefs, have been reported to influence immunization efforts [14]. The recent evidence indicating a decline in vaccination rates in Lira district in northern Uganda, from 69% in 2021 to 58% in 2023 (DHIS2, 2023) underscores the significance of context-specific factors and the need for a focused evaluation. This study therefore examined measles immunization utilization among children under five in Lira district to understanding the barriers and facilitators of utilization which is essential for designing targeted interventions to improve utilization.

2. Methods

2.1. Study Design and Setting

This was a community-based cross-sectional study that

employed both quantitative and qualitative approaches to data collection. The study was conducted in selected villages within two sub-counties (Agali and Ogur) in Lira district, northern Uganda, between June and July 2024. Lira district is located in northern Uganda and is part of the Lango sub-region, and has an estimated population of approximately 540,000 people, about 9.475 of which are children under five years of age [40]. The district has a mixed urban and rural composition, with the majority of residents engaged in subsistence farming and small-scale trade. Health services in Lira are provided through government health facilities, private clinics, and non-governmental organizations, although access remains a challenge due to infrastructure constraints and economic barriers.

2.2. Study Population and Sample Size Determination

The study population included children under five years in the selected villages in the two sub counties. The sample size for the quantitative data was estimated using Leslie Kish formula (1965) for single proportion, $n = (Z\alpha/2)^2 pq/d^2$ with a standard normal value corresponding to a 95% confidence interval (1.96), absolute errors between the estimated and true value of 5%, and an estimated proportion of measles vaccine utilization among children under 5 years of 59% [43]. The estimated sample size of 372 was adjusted for a design effect of 10%, giving a total of 409. Participants for the qualitative data included selected healthcare providers, opinion leaders and officials at the district health office. Determining the number of respondents for the qualitative data collection was based on the concept of data saturation. Data saturation was reached after nine respondents, with an additional two respondents being interviewed, giving a final sample size of 11 respondents.

• Inclusion Criteria

Children under 5 years in the selected villages of Agali and Ogur sub counties in Lira District.

• Exclusion Criteria

Children whose caregivers declined consent were excluded from the study

2.3. Sampling and Study Procedures

We purposively selected Ogur and Agali sub counties in Erute county, Lira district, because of their reported poor utilization of immunization services [40]. We then selected one parish from each of the selected sub counties using simple random sampling. All 18 villages in the selected parishes were studied. The Village Health Teams (VHTs) listed all the households (HHS) with children under 5 years in their respective villages in the selected parishes. Systematic random sampling was used to pick the HHs to be included in the study. The sampling interval was obtained by dividing the number of households by the sample size. The overall sample size for the study was 409 participants, distributed in a ratio of 1:1 for the two parishes. Given that each parish consisted of 9 villages, the average number of participants per village was calculated based on the specific household count of each village, which ranged from 70 to 90 households. We determined the starting point by throwing lot with numbers and we picked only one lot which was

used as the starting point. We then sampled every fourth HHs until we got the required sample size. In cases where we didn't find anybody at home, we attempted to come back twice before declaring them non-respondents.

• Data Collection Tools

We used a structured interviewer-administered questionnaire to collect quantitative data. This included sociodemographic characteristics (child and caregiver), socio-economic/cultural characteristics, child's immunization, and health system related factors. Qualitative data was collected from the respondents using an in-depth interview guide, to provide insights into the contextual and cultural factors influencing immunization decisions. The questionnaires and interview guides were developed by the investigators in line with the study objectives. These were written in English as well as translated and administered in the local language (Leb Lango) understood by the participants. The data collection tools were pretested to find out the suitability, ease of use, relevance of the questions, and any ambiguity so as to address the issues accordingly before the actual data collection was done.

• Study Variables

Utilization of measles immunization services was the outcome variable, and the independent variables included sociodemographic characteristics, socio-economic / cultural characteristics, and health system factors. Utilization in this study was defined as receiving measles vaccination according to the recommended national or World Health Organization (WHO) immunization schedules. Measles vaccine utilization was measured as the proportion of children under 5 years who received the recommended doses of measles-containing vaccine (MCV1 and MCV2) based on their age, as per national vaccination guidelines.

2.4. Data Management and Statistical Analysis

2.4.1 Quantitative Data Analysis

Quantitative data was entered into an excel spreadsheet, cleaned, and exported to Statistical Package for Social Scientists (SPSS) (IBM) Statistics v23 for analysis. Descriptive statistics for categorical variables were presented as frequencies and percentages, while continuous variables were summarized as mean with standard deviation if normally distributed or median with interquartile range if non-normally distributed [21]. The Chi-square test or Fischer's exact test with Odds ratios and 95% confidence intervals were performed to determine the association between the predictor variables and utilization of measles immunization. The multivariate logistic regression model was used to assess the factors that were independently associated with utilization of measles immunization and reported by an adjusted odds ratio (aOR) at 95% confidence level. A two-sided p-value <0.05 was considered for statistical significance. Variables that were statistically significant at the bivariate level ($p < 0.05$) and

those with p values <0.2 were included in the multivariate model.

2.4.2. Qualitative Data Analysis

Qualitative data from the in-depth interviews were analyzed using manual thematic analysis to identify key themes and patterns [22]. The analysis followed multiple stages. First, interview recordings were transcribed verbatim and reviewed for familiarization. Initial codes were generated by identifying key phrases, concepts and patterns in the data relevant to the research objectives. Related codes were then grouped into broader themes that reflected recurring ideas in the data, which were reviewed, refined, and clearly defined. Themes were developed inductively, emerging from the data rather than being predefined. The final themes were interpreted in relation to the research objectives. Findings from the qualitative analysis were triangulated with quantitative results to provide a comprehensive and holistic understanding of factors influencing measles immunization utilization in the study context. Results were presented as themes alongside the representative quotes from participants.

2.5. Ethics Approval and Consent to Participate

All methods were carried out in accordance with relevant guidelines and regulations and the study was conducted in accordance with the Declaration of Helsinki. The study was approved by Lira University Research and Ethics Committee (LUREC-2024-185). Voluntary informed consent was obtained from the parents/caretakers of the children before participating in the study after an explanation of the nature and purpose of the study, the potential benefits and risks.

3. Results

3.1. Description of the Study Participants

During the study period, a total of 402 responses were obtained from the caregivers of children under five years, resulting in a response rate of 98.3% (402/409). The median age of the children was 24 months (interquartile range [IQR]: 12–36 months) and the majority were female, 291 (72.4%). A total of 393 (97.8%) of the children were delivered from the health facilities, and 394 (98.0%) had a child health card (simply understood by caregivers as an immunization card) available at the time of the survey (Table 1). The median age of caregivers was 30 years (IQR: 25–35 years). Most of the primary caregivers were female, 287 (71.4%) and the biological mothers of the children, 272 (67.7%). A total of 143 (35.6%) caregivers had attained a primary level of education, 201 (50.1%) had post-primary education, and 58 (14.3%) had no formal education. Up to 283 (70.4%) of the biological mothers attended antenatal care during the pregnancy with the study child. The median parity of the female caregivers was three children (Table 1).

Variable	n	%
<u>Child characteristics</u>		
Sex		
Male	111	27.6
Female	291	72.6
Place of delivery		
Health facility	393	97.8
Home	9	2.2
Birth order		
1 st child	98	24.4
2 nd – 4 th Child	178	44.3
≥5 th Child	126	31.3
Birth weight		
<2.5 kg	37	9.2
≥2.5 kg	365	90.8
Immunization card		
Yes	394	98.0
No	8	2.0
<u>Caregiver's characteristics</u>		
Relationship to the child		
Mother	272	67.7
Father	95	23.6
Other Relatives	35	8.7
Sex		
Male	115	28.6
Female	287	71.4
Marital status		
In marital relationship	311	77.4
Not in marital relationship	91	22.6
Parity		
1-2 children	68	25
3-4 children	100	36.8
>4 children	104	38.2
Antenatal Care (ANC) attendance		
Yes	283	70.4
No	119	29.6
Education level		
Primary	143	35.6
Secondary	112	27.9
Tertiary	89	22.2
No formal education	58	14.3

Table 1: Sociodemographic Characteristics of Study Population (N=402)

3.2. Socio-Economic / Cultural and Health Systems Characteristics

About a third of the caregivers, 119 (29.6 %) held cultural beliefs against immunization. Transportation costs was a concern to more than one-quarter, 114 (28.4%) of the caregivers, and bicycle was the primary mode of transportation for most respondents, 244 (60.4%). At least 89 (22.1%) of the respondents had experienced

unavailability of vaccines during their visits at the health facilities for vaccination. A total of 146 (36.4%) of the respondents reported being denied vaccination services at least once when they visited the facilities on non-vaccination days, and over a third, 277 (68.9%) of the respondents had experienced delay in getting vaccination services at health facilities (Table 2).

Variable	n	%
Do you hold cultural beliefs against immunization		
Yes	119	29.6
No	283	70.4
Is transport cost a problem for you?		
Yes	114	28.4
No	288	71.6
What is your primary mode of transport?		
Walking	43	10.7
Bicycle	244	60.4
Public transport	113	28.0
Private vehicle	2	0.5
Experienced vaccines unavailability at the facility?		
Yes	89	22.1
No	313	77.9
Been denied vaccination on non-vaccination day?		
Yes	146	36.4
No	256	63.6
Are vaccinators always available at the facility?		
Yes	126	31.3
No	276	68.7
Have you experienced delay in getting vaccination		
Yes	277	68.9
No	125	31.1

Table 2: Socio-Economic and Health Systems Characteristics (N=402)

3.3. Utilization of Measles Vaccine Among Children Under Five Years

The overall utilization of the measles vaccine among

children under five years in our study population was 19.6% - 44 (11%) of whom were males and 35 (9%) were females (Figure 1).

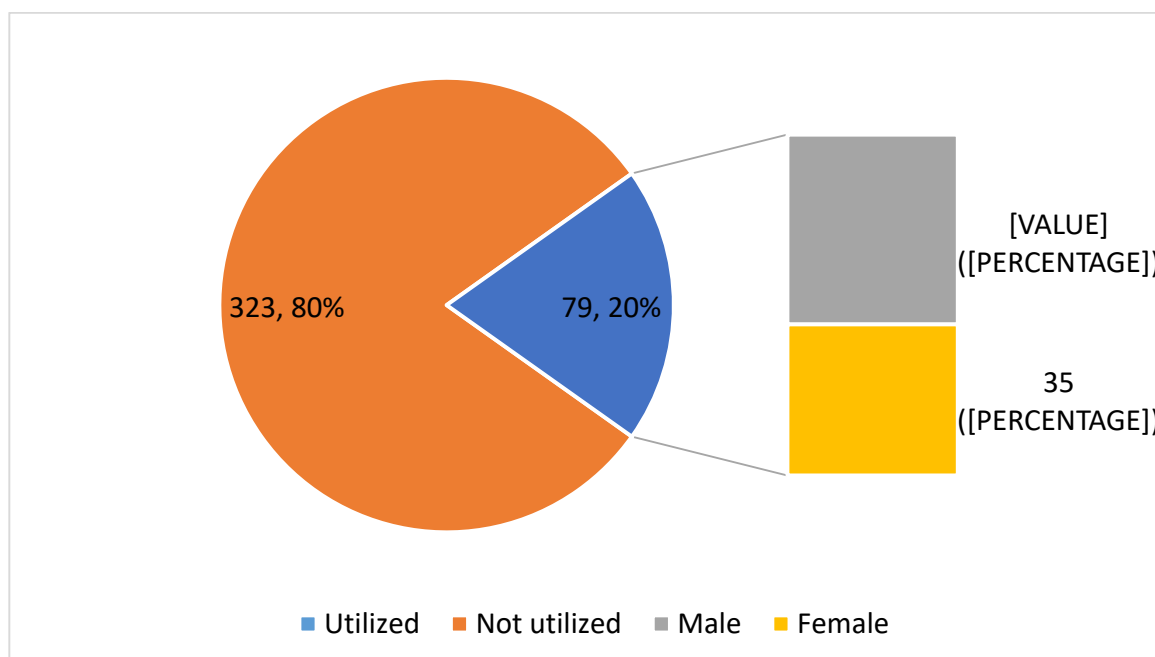


Figure 1: Utilization of Measles Immunization Services

Considering the utilization of measles immunization services across different age groups, children within the age group of 25-36 months had the highest vaccination rate of 25.5%, followed by the 13-24 months age groups at 22.0% (Figure 2).

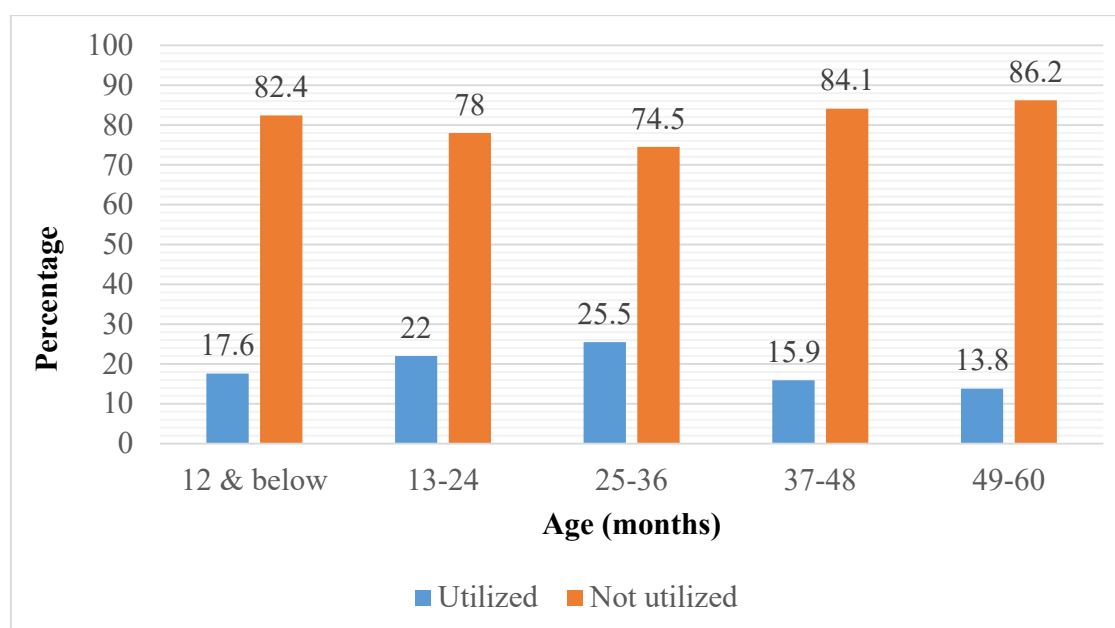


Figure 2: Age Distribution by Level of Utilization of Measles Immunization Services Bivariate Analysis of Factors Affecting Measles Immunization Utilization

The factors significantly associated with measles immunization utilization on bivariate analysis included: Parity ($\chi^2 = 2.00$, $p = 0.0367$), antenatal care (ANC) attendance ($\chi^2 = 7.18$, $p = 0.007$), education level (primary) ($\chi^2 = 3.50$, $p = 0.321$), cultural beliefs about immunization ($\chi^2 = 4.75$, $p = 0.029$), transportation costs ($\chi^2 = 0.32$, $p = 0.570$), and vaccine availability ($\chi^2 = 4.45$, $p = 0.035$) (Table 3).

Variable	Utilized measles immunization		χ^2	p-value
	Yes, n (%)	No, n (%)		
Sex of the child				
Male	118 (29.5 %)	109 (27.1%)	0.50	0.48
Female	282 (70.5%)	293 (72.9%)		
Place of delivery				
Health facility	393 (98.2%)	393 (97.5%)	0.19	0.662
Home	9 (1.8%)	10 (2.5%)		
Immunization card				
Yes	394 (98.0%)	394 (98.0%)	0.00	1.000
No	8 (2.0%)	8 (2.0%)		
Relationship to the child				
Parent	342 (85.0%)	324 (80.6%)	1.35	0.245
Other relatives	60 (15.0%)	78 (19.4%)		
Sex of caregivers				
Male	105 (26.0%)	125 (31.2%)	1.83	0.176
Female	294 (74.0%)	276 (68.8%)		
Marital status				
Married	296 (76.8%)	313 (78.1%)	0.11	0.740
Unmarried	89 (23.2%)	88 (21.9%)		
Parity				
1-2 children	113 (23.6%)	102 (25.3%)	2.00	0.367
3-4 children	165 (34.5%)	130 (32.1%)		
>4 children	201 (41.9%)	201 (42.6%)		

Antenatal Care (ANC) attendance				
Yes	283 (74.3%)	271 (66.7%)	7.18	0.007*
No	98 (25.7%)	135 (33.3%)		
Education level				
Primary	143 (36.1%)	120 (32.0%)	3.50	0.321
Secondary	112 (27.0%)	114 (28.4%)		
Tertiary	89 (21.8%)	91 (22.7%)		
No formal education	58 (15.1%)	68 (17.0%)		
Cultural beliefs on immunization				
Yes	110 (27.3%)	125 (31.9%)	4.75	0.029*
No	290 (72.7%)	266 (68.1%)		
Transport cost influence				
Yes	109 (27.0%)	115 (29.5%)	0.32	0.570
No	291 (73.0%)	276 (70.5%)		
Vaccine availability				
Yes	115 (77.5%)	100 (71.2%)	4.45	0.035*
No	34 (22.5%)	40 (28.8%)		
No vaccine on non-vaccination day				
Yes	67 (37.0%)	66 (35.0%)	0.34	0.558
No	284 (63.0%)	287 (65.0%)		
Vaccinator availability				
Yes	122 (32.0%)	127 (31.4%)	0.15	0.698
No	264 (68.0%)	278 (68.6%)		
Delay in service delivery				
Yes	287 (68.4%)	278 (69.2%)	0.005	0.823
No	133 (31.6%)	124 (30.8%)		

* Statistically significant values, χ^2 =Chi-square value, df = degrees of freedom

Table 3: Bivariate Analysis of Factors Affecting Measles Immunization Utilization (N=402)

3.4. Multivariate Analysis for the Factors Associated with Utilization of Measles Immunization Services

On multivariate analysis, children whose mothers attended antenatal care were 1.65 times likely to utilize measles immunization services compared to children whose mothers did not attend ANC (aOR 1.65; 95% CI 1.20-2.15, $p=0.002$). Children whose caregivers had at least a primary level of education were 1.40 times likely to utilize measles immunization services compared to those whose caregivers had no formal education (aOR 1.40; 95% CI 1.05-1.85, $p=$

0.023). Children whose caregivers held negative cultural beliefs about immunization (aOR 0.55, 95% CI 0.40-0.76, $p=0.002$), had concern about transportation costs (aOR 0.60, 95% CI 0.45-0.80, $p=0.010$), and experienced denial of vaccination due to visiting the facility on a non-vaccination day (aOR 0.65, 95% CI 0.50-0.85, $p=0.010$) were less likely to utilize measles immunization services compared to their counterparts. Availability of vaccines was associated with a 1.40 times likely to utilize measles immunization services (aOR 1.40; 95% CI 1.05-1.85, $p=0.020$) (Table 4).

Variable	aOR	95% CI	p-value
Antenatal Care (ANC) attendance			
Yes	1.65	1.20-2.15	0.002*
No	Ref		
Education level			
Primary	1.40	1.05-1.85	0.023*
Secondary	1.10	0.85-1.44	0.0285*
Tertiary	1.05	0.80-1.38	0.645
No formal education	Ref		
Cultural beliefs on immunization			
Yes	0.55	0.40-0.76	0.002*
No	Ref		
Transport cost influence			
Yes	0.60	0.45-0.80	0.010*
No	Ref		
Vaccine availability			
Yes	1.40	1.05-1.85	0.020*
No	Ref		
No vaccine on non-vaccination day			
Yes	0.65	0.50-0.85	0.010*
No	Ref		
Vaccinator availability			
Yes	1.30	0.98-1.71	0.080
No	Ref		

aOR = Adjusted odds ratio, * Statistically significant, CI=Confidence interval

Table 4: Multivariate Analysis for the Factors Associated with Utilization of Measles Immunization Services (N=402)

3.5. Qualitative Analysis Results from the Key Informant Interviews (KIIs)

The qualitative component of this study aimed to explore the underlying factors affecting the utilization of measles immunization services among children under five in Lira district, northern Uganda. The analysis identified several themes that highlight the barriers and facilitators to immunization, revealing critical areas for intervention to improve utilization of measles vaccination. Five themes were identified that details the qualitative insights regarding measles vaccine utilization in the context of the study setting.

3.5.1. Themes Identified

• Awareness of Measles Vaccine Importance

The Key Informant Interviews (KIIs) revealed a widespread lack of awareness about the importance of measles vaccination among parents and guardians. Many respondents did not understand the severity of measles or the necessity of vaccination. This is exemplified by reports from two respondents below, which seems to support the finding of low measles vaccine immunization rates in the quantitative results. *"Many parents do not understand the seriousness of measles and thus do not prioritize vaccination."* (A 30-year-old male respondent) *"There is generally low uptake of the measles vaccine in our community."* (A 44-year-old facility in-charge.)

• Cultural Beliefs

Cultural misconceptions and traditional beliefs were identified as critical barriers to vaccination, supporting the findings from the quantitative data which showed that cultural beliefs against immunization negatively impact utilization of measles immunization services in the study setting. A common view from the respondents in the qualitative study was that some communities held beliefs that vaccinations were harmful and preferred traditional medicine over modern medical practices, as a community leader and a male teacher observed; *"Some communities believe that vaccinations are harmful and rely on traditional medicine instead."* (A 55-year-old male community leader) *"Educational programs targeting parents and caregivers could help in changing the attitudes towards vaccination."* (A 29-year-old male teacher).

• Access to Immunization Services

Geographical barriers and inadequate healthcare infrastructure were frequently mentioned by the respondents as major obstacles to accessing immunization services. The distance to health facilities and high transportation costs were important issues reported to affect many families, making it difficult to access and utilize measles immunization services in the study setting, as exemplified by a statement from a 45-year-old female respondent; *"The distance to the health facility and high cost of transport*

are major issues for many families.”

• Healthcare System Issues

Frequent reports of vaccine stock-outs in the quantitative data were corroborated by the qualitative insights as important systemic issues within healthcare facilities that present significant barriers to consistent immunization utilization. This, coupled with the long waiting time at the health facilities to receive the immunization services are reported to demotivate some caregivers from seeking these services, as two of the respondents asserted thus; *“We often face vaccine shortages, and long queues in the health facility which discourage the parents from coming for vaccinations.”* (A 38-year-old female healthcare worker) *“...a lack of trust in healthcare providers and the healthcare system overall is a barrier to vaccine acceptance and utilization by a number of caregiver.”* (A 30-year-old female respondent).

4. Discussion

The level of uptake in Ogur and Agali was quite low (19.6%). Key study findings on utilization of measles services were antenatal care attendance, education level, vaccine availability, transportation costs, and cultural beliefs. This study investigated the level of, and the factors influencing the utilization of measles immunization services among children under five years in Lira District, northern Uganda. The findings revealed a low measles immunisation utilization, with caregivers' education level, antenatal care (ANC) attendance, cultural beliefs regarding vaccination, socioeconomic barriers, and health facility-related factors, as key determinates.

4.1. Utilization of Measles Vaccination

Our study revealed a low level of utilization of measles immunization services in the study setting. Only about one in five children under five received the recommended doses of the measles vaccination. The level of measles immunization in the current study falls way short of the World Health Organization's (WHO's) target of 90% immunization utilization necessary for achieving herd immunity [43]. The current finding aligns with that from other studies in similar low-resource settings. For instance, studies in Pakistan and Nigeria reported comparable results of immunization levels of 44% and 32%, respectively [1,2,3]. Such similarities could be attributed to common barriers in low-resource contexts, including logistical challenges and systemic issues within health facilities. Low measles immunization utilization is a well-documented issue, often exacerbated by access, misinformation, and logistical challenges- highlighting the need for more effective outreach and education strategies [30,26]. The discrepancy between possession of an immunization card-which was high, and utilization of measles vaccination, as found in the current study, is worth noting and deserves some attention. This phenomenon, which was similarly reported in a Kenyan study, reflects a lack of understanding and appreciation of the importance of immunization and the child health cards. This could, in addition, be attributed to the fact that in Uganda, the child health card - simply known to the caregivers and the broader community as “immunization card”, are also important and

used for other purposes, including enrolment in school for pre-primary and primary levels - making it a necessity to have for this face value. This underscores the need for educational and community awareness interventions [20].

Antenatal care (ANC) attendance emerged as a strong predictor of measles immunization utilization in this study, with a positive association between ANC attendance and the likelihood of a child being vaccinated against measles. As similarly reported in India [4]. Bangladesh and Sweden – a high-income country, regular ANC visits are linked to enhanced health education, leading to increased vaccine uptake [4,10,15]. Thus, the universal and crucial role of ANC as a platform for providing health education and raising awareness about the importance of immunization, and providing access to necessary resources, such as vaccination schedules, should be leveraged on as a targeted strategy to improve utilization of immunization services. The results from this study also highlights the impact of educational attainment on utilization of immunization services. Achieving at least a primary level of education increased the likelihood of utilizing measles immunization services. This finding accords with similar findings in Ethiopia and Nigeria, showing a positive relationship between caregivers' higher educational levels achievement and vaccination rates [16,17]. Educated mothers are more likely to comprehend the importance of vaccination and adhere to immunization schedules, a notion supported by a finding from one systematic review and meta-analysis [18]. As the qualitative data also highlighted, there is a clear need for enhanced educational campaigns to improve knowledge about the benefits of immunization among parents and caregivers in this and similar contexts. Our findings also underscores the influence of culture on childhood immunization services. Strong negative cultural beliefs against immunization was a substantial barrier to utilizing measles immunization. This finding is of public health importance given its implication on the potential to drive vaccine hesitancy or refusal. The impact of culture transcends geographical and socioeconomic contexts, and is observed in low-and middle-income countries [21,31]. and developed countries alike [19]. This parallel suggests that cultural beliefs, whether rooted in local traditions or broader societal narratives, can similarly impact public health interventions globally, though often overlooked in most public health interventions. On the socioeconomic front, high costs of transport to the health facility was a significant barrier to unitization of measles immunization services, underscoring the economic challenges associated with accessibility of healthcare. This finding echoes similar findings from studies in Bangladesh, South Africa and Kenya [8,32,36]. which identified transportation costs as a major obstacle to healthcare access, including immunization services - just as also reported in China and Congo [22,23]. The qualitative data also highlighted geographical barriers and inadequate healthcare infrastructure, suggesting a need for improved access. This should include affordable transportation options, as well as bringing immunization services closer to communities through initiatives such as community outreaches and village-level immunization

posts, among others. The availability of vaccines at health facilities was another significant determinant of measles vaccine utilization among the study population. Ensuring consistent vaccine availability increased the likelihood of utilizing measles vaccination services, reflecting similar findings from South Africa and Ethiopia where frequent vaccine stock-outs and logistical issues presented major barriers to vaccination uptake [8,33]. Similar findings were reported in other settings, including Rwanda and Nigeria [9,24]. The importance of vaccine availability in utilization was further supported by the findings from the qualitative data where vaccines stock-outs was noted as a barrier.

Ensuring a consistent supply of vaccines through improved vaccine supply chains and service delivery efficiency is therefore vital, particularly in low and middle-income countries where supply chain challenges are abound. In the current study, factors such as marital status, sex of the child, and place of delivery were not significantly associated with vaccine uptake. This aligns with findings from Burkina Faso Sweden, suggesting that healthcare access and parental attitudes may outweigh demographic characteristics in influencing vaccination decisions [19,24]. The non-significant association of these demographic factors in this study and the referenced studies may indicate that, in various contexts, other determinants like healthcare availability or parental beliefs are more influential in vaccination decisions. Despite the comprehensive approach taken in this study, several limitations should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships between the identified factors and measles immunization services utilization. Second, the reliance on self-reported data introduces the possibility of recall bias, especially regarding vaccination history and reasons for non-vaccination. To minimize recall bias, the study used vaccination cards, where available, in addition to the use of standardized questionnaires administered by trained data collectors to ensure consistency and accuracy in data collection. In addition, the study may have been limited by the unavailability of data on certain variables, such as detailed socioeconomic indicators or specific cultural practices. The above notwithstanding, the study also collected qualitative data which complemented the quantitative findings, providing a more comprehensive understanding of the factors influencing measles immunization utilization.

5. Conclusion

This study investigated the level of, and the factors influencing the utilization of measles immunization services among children under five years in Lira District, northern Uganda. The findings revealed a low measles immunisation utilization, with only 19.6% of children receiving the recommended two doses of measles vaccines. Key determinants of measles immunization services utilization were sociodemographic characteristics, education level, antenatal care (ANC) attendance, cultural beliefs regarding vaccination, socioeconomic barriers like high transport cost, and health facility-related factors such as vaccine availability. This underscores the need for actionable strategies to bridge

the existing gap, including enhanced educational outreach and community engagement, strengthening antenatal care services, ensuring reliable vaccine supply, and strengthening the health system capacity, among others.

Competing Interests

The authors declare that they have no competing interests.

Availability of Data and Materials

All data were presented in the manuscript.

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