



INSTITUTE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

**DETERMINANTS OF SECOND-DOSE MEASLES VACCINE
DROPOUT AMONG CHILDREN AGED 15-24 MONTHS IN SIBU
SIRE WOREDA, EAST WOLLEGA ZONE, ETHIOPIA, 2025**

BY: DAMTO BACHIRU (BSc)

**A RESEARCH THESIS SUBMITTED TO THE SCHOOL OF
PUBLIC HEALTH, WALLAGA UNIVERSITY, IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF PUBLIC HEALTH IN EPIDEMIOLOGY**

MAY, 2025

NEKEMTE, ETHIOPIA

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STATEMENT OF THE AUTHOR

I, Mr. Damto Bachiru, hereby declare and affirm that the thesis entitled “Determinants of second-dose Measles vaccine dropout among Children Aged 15-24 Months in Sibu Sire Woreda, East Wollega zone, Ethiopia, 2025”. My work was conducted under the supervision of Mrs. Rut Oljira and Mr. Worku Fikadu. I have followed all the ethical principles of scholarship in the preparation, data collection, data analysis, and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I have adequately cited and referenced all the sources. I also declare that I have adhered to all principles of academic honesty and integrity, and I have not misrepresented, fabricated, or falsified any idea/data/fact/source in my submission. This thesis is submitted in partial fulfillment of the requirement for a degree from Post Graduate Studies at Wallaga University. I further declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

I understand that any violation of the above will be cause for disciplinary action by the University and can also evoke penal action from the sources that have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABBREVIATIONS AND ACRONYMS

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
CI	Confidence Interval
COR	Crude Odds Ratio
COVID	Coronavirus Disease
DRC	Democratic Republic of Congo
EDHS	Ethiopian Demographic Health Survey
EPI	Expanded Program on Immunization
HEWs	Health Extension Workers
HF	Health Facility
HICs	High Income Countries
IA	Immunization Agenda
IDPs	Internally Displaced Persons
LMIC	Low Middle Income Countries
MCV1	Measles Containing First-Dose Vaccine
MCV2	Measles Containing Second-Dose Vaccine
MMR	Measles, Mumps, and Rubella
PNC	Postnatal Care
SIAs	Supplementary Immunization Activities
SNNPR	Southern Nation Nationalities & Peoples Representatives
TT	Tetanus Toxoid
UNICEF	United Nations International Children's Emergency Fund
VPDs	Vaccine Preventable Diseases
WHO	World Health Organization

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ABSTRACT

Background: Measles remains a significant public health threat worldwide, particularly in areas with low vaccination coverage, despite being a vaccine preventable disease. Although the World Health Organization recommends a two-dose measles containing vaccine regimen to ensure adequate immunity, high dropout rates between the first and second doses hinder Ethiopia's goal of eliminating measles. The specific reasons for high dropout rates between first and second doses in Ethiopia remain understudied. Therefore, this study aimed to identify determinants of second-dose measles vaccination dropout among children aged 15-24 months in Sibu Sire Woreda, East Wollega Zone, Ethiopia.

Objective: This study aimed to assess the determinants of second-dose measles vaccine dropout among children aged 15-24 months in Sibu Sire woreda, East Wollega zone, Ethiopia, 2025.

Methods: A community-based unmatched case-control study design was conducted between January 2025 and May 2025 in Sibu Sire Woreda, East Wollega Zone, Ethiopia. Data were collected using a pretested structured questionnaire, coded and entered into Epi-data version 4.6, cleaned, and exported to SPSS version 27 for analysis. Descriptive analyses like frequency, mean, and percentage were calculated. Binary and multivariate logistic regression analysis was done, and variables with a $p < 0.05$ in the multivariate analysis were considered statistically significant.

Results: A total of 567 mothers and caregivers (189 cases and 378 controls) were interviewed, achieving a 100% response rate. Mother's educational status (AOR=3.74, 95% CI: 1.12–12.44), low number of postnatal care visits (AOR=3.29, 95% CI: 1.34–8.09), infrequent home visits by health extension workers (AOR=7.52, 95% CI: 2.21–25.61), long waiting time at vaccination sites (AOR=13.88, 95% CI: 4.10–46.97), and cancellations or postponement of the schedule at health facilities (AOR=2.39, 95% CI: 1.09–5.30) were significant determinants of second-dose measles vaccination dropout.

Conclusion: Measures such as improving maternal education, strengthening postnatal care follow-up services, increasing the frequency and quality of home visits, enhancing service delivery efficiency, and avoiding schedule cancellations are crucial measures to reduce second dose measles-containing vaccination dropout.

Keywords: MCV2, vaccine, children, Sibu Sire, dose, dropout, determinants

1. INTRODUCTION

1.1. Background

Measles is a viral illness characterized by high infectious rates and continues to pose a significant threat to public health in many parts of the world. Vaccination is an important tool in controlling measles disease. Vaccines, particularly the measles, mumps, and rubella (MMR) vaccine, play a critical role in eliminating measles. An alternative measles-containing vaccine that is effective is the two-dose schedule that the World Health Organization (WHO) recommends for adequate protection of children, as the first dose is at 9 months and the second at between 15 and 18 months, depending on the country's immunization schedule. A total of 57 million deaths were prevented through measles vaccination between 2000 and 2022. As WHO reports, there were approximately 136,000 measles-related deaths in 2022 despite the availability of a safe and affordable vaccine, and the majority of victims were young children who had not, or partially, received a vaccine, and many of the deaths occurred in Sub-Saharan Africa, with nearly 30,000 measles-related deaths estimated there (1,2).

In Africa alone, where the majority of measles deaths are seen, there have been improvements in measles vaccination through some approaches as the Expanded Program on Immunization (EPI) and supplementary immunization activities (SIAs). However, there is a massive gap that exists in completing the immunization process, especially in hard to reach and other remote places. For example, the administrative coverage of the first dose of measles vaccine in sub-Saharan Africa in 2022 was 70%, lower than 81% in 2019. Also, the coverage for the second dose is still low and prevents the discontinuation of further outbreaks; in 2022, it was at about 55%, down from 63% in 2019 (3).

In 2022, Ethiopia recorded a high number of measles cases, with an estimate of more than 9,200 confirmed cases compared to previous years. This was happening on the backdrop of elevated measles incidence in several other parts of the country. Some of these include low vaccination coverage, conflict, forced displacement, and synchronized diseases that have led to this increase. According to the WHO report, about 45% of the measles cases mentioned in 2022 were children under the age of five years (4).

Measles vaccination is administered as part of the national EPI in Ethiopia. The first dose of measles vaccine is administered at the age of 9 months and the second one at 15 months of age. Despite all these efforts, the dropout rate between the first and second doses remains a challenge, especially in the distant and hard to reach areas. Research also indicates that though there have been increases in the first dose coverage, second dose defaulting remains a major setback to the elimination of measles in the country (3). Currently, the proportion of the first dose of measles containing vaccine (MCV1) administered nationally in Ethiopia as estimated at 70% and the proportion of second dose MCV2 was estimated at 53% in 2022 (5). Such findings raise the question of vaccine dropout, especially for the second dose, which is essential for immunity to last. Second-dose measles vaccine dropout refers to the proportion of children who receive the first dose of the measles-containing vaccine (MCV1) but fail to receive the second dose (MCV2) within the recommended schedule. The analysis of reasons why parents discontinue vaccinations is crucial in order to optimize immunization efforts and decrease the risk of high infant mortality (6).

However, all sorts of measures have been taken locally and internationally to cover the immunization deficiencies. Immunization Agenda 2030 seeks to promote equal use of vaccines and the eradication of vaccine preventable diseases by increasing vaccination in targeted and hard to reach communities (7). In this regard, Ethiopia has embarked on activities that aim at increasing access to immunization through health focused health campaigns, Health Extension Workers training's and community mobilization. Nevertheless, new problems persist including socioeconomic issues, accessibility to health services, knowledge about parents' vaccination still hinders achievement of full vaccination (8).

Studies have isolated numerous factors that lead to the dropout of measles vaccines in different situations. As research carried out in several Ethiopian regions demonstrates, maternal education, knowledge of vaccination times, and distance to health centers were some of the factors affecting complete vaccination status (9). Lack of education about the benefits of vaccines, misconceptions about vaccine safety, and religious belief were the other reasons that accounted for low vaccine acceptance and high dropout (10). Others include vaccine stock-outs, poor cold chains, and limited health worker training are also other causes of partial vaccination (11).

1.2. Statements of the Problem

Measles is still one of the causes of childhood morbidity and mortality across the world even though a safe and effective vaccine exists (1). Whereas the first vaccine dose of MCV1 is generally well administered across many regions, the second dose of MCV2 is much less administered, especially in Low and Middle Income Country's. Prevalence of MCV1 in 2022 by UNICEF and WHO is about 84%, while that of MCV2 is only 71% showing LMICs greatest challenge in achieving full measles two-dose vaccination (12). The gap between MCV1 and MCV2 is significantly to blame for persistent measles incidences, hence death and complications, which are preventable. Ethiopia is evidenced by typing the differences in MCV1 and MCV2 that show a widening gap that contributes to outbreaks from time to time (13).

Globally, the World Health Organization in 2022 approximated the fatalities resulting from measles to be more than 136000, with the majority from the under-five-year group (1). It can also be evident that the disease burden of measles is comparatively higher in Low Middle Income Countries than in High Income Countries (HICs), because of poor access to health care, and MCV2 still lies far below the 95% target for herd immunity (2). The most recent subsequent reports, including MCV1, indicate that it is in an increasing trend but comes with a concern that the MCV2 is low and declining in rural areas (13,14). This gap is enhancing the occurrence of measles within childhood, thus raising the health care costs within these regions.

Failure to administer MCV2 exposes children to the risk of measles infection, hence leading to more complications, which range from pneumonia to encephalitis and sometimes death (15). Furthermore, the poor immunization of MCV2 has often led to continued epidemics of the disease in Ethiopia, which puts pressure on the fragile health sector (16). Beyond health effects, economic costs of measles cases alongside thermostatic and especially among the poorest in developing nations deepen poverty and stunt progression (17). Children who drop out between MCV1 and MCV2 will experience more adverse long-term health effects on their general quality of life and have a higher likelihood of costly health issues (18).

There are several factors that influence the dropout of the MCV2. Some of the factors that are known include maternal education, household income, place of residence, and distance to the

health facility (13). Ethiopian rural children are also more prone to drop out than those in urban areas, to name a few reasons related to logistics, travels to health facilities, and costs of transport. Moreover, sociocultural barriers such as lack of information, misinformation, and mistrust perpetuate low MCV2 coverage (19).

There are many interventions that have been made by the Ethiopian government to increase MCV2 coverage. They include Incorporating the MCV2 into the national immunization calendar in 2019 and increase on the outreach activities as well as the use of mobile clinics. However, even with these measures, MCV2 coverage remains low, and more approaches, including better training of health care personnel, efficient vaccine distribution systems, and others, including continuing public health campaigns, are required (20). Other partners, such as WHO and UNICEF, have also supported the country technically and financially to enhance immunization activities in the health facilities (21).

However, through these interventions, there is still a substantial gap in the coverage of MCV2, more so in the rural areas (12). However, there is limited general research exploring sociocultural and economic factors that hinder MCV2 utilization, especially in the unreachable region of Ethiopia (19). Further, although there are strategies targeting enhancement of vaccine coverage, there are barriers including, unpredictable availability of vaccines, lack of coordination between health care providers and caregivers (20). Although studies have found that conspiracy theories, mistrust, and negative emotions remain unconquered challenges in attaining full vaccine acceptance, there is a deficiency of research about misinformation and vaccine hesitancy (22).

Thus, the dropout between MCV1 and MCV2 remains a significant public health concern in Ethiopia, particularly in Sibu Sire Woreda, where measles outbreaks continue to pose a threat to children. Identifying the factors that contribute to the second-dose measles vaccine dropout among children aged 15-24 months in this area is crucial for developing effective action plans. These plans would aim to increase the uptake of MCV2, thereby reducing the prevalence of measles and its associated health and socioeconomic impacts within the community. This study aims to identify and analyze the specific determinants of MCV2 dropout using a case-control study among children aged 15-24 months in Sibu Sire Woreda, East Wollega Zone, Ethiopia.

1.3. Significance of the Study

This study advanced knowledge on factors affecting MCV2 dropout rates among children aged 15–24 months in Sibu Sire Woreda and contributed to filling critical gaps in understanding vaccine utilization challenges in rural settings with limited health infrastructure. By identifying key determinants of MCV2 dropout, the findings provided valuable insights into the barriers faced by caregivers and health care providers, establishing a foundation for future research and targeted strategies to improve vaccination coverage. The evidence generated from this study was useful for Expanded Programme on Immunization (EPI) implementers, policymakers, and health care planners in designing more effective interventions. Additionally, international partners such as WHO, UNICEF, and other immunization stakeholders could utilize these findings to strengthen immunization support in Ethiopia. The study directly benefited the target population children and their caregivers by informing interventions to increase MCV2 uptake, thereby reducing measles infection risks and improving child health outcomes. Furthermore, it helped alleviate the socioeconomic burden associated with measles-related illnesses and supported national and global efforts toward measles control and elimination.

2. LITERATURE REVIEW

2.1. Overview of Second-Dose Measles Vaccine Dropout

The second-dose measles-containing vaccine (MCV2) plays a critical role in ensuring sufficient immunity in children and achieving the 95% herd immunity threshold necessary for measles elimination. Despite this, global coverage of MCV2 remains significantly lower than that of the first dose (MCV1), particularly in low- and middle-income countries (LMICs). In 2022, the World Health Organization (WHO) and UNICEF estimated MCV1 coverage at 84%, while MCV2 coverage was only 71%, highlighting the challenges faced in maintaining two-dose vaccine compliance in LMICs, where health systems are often underdeveloped and access to health care is limited (23,24). The dropout between MCV1 and MCV2 continues to perpetuate measles outbreaks and preventable childhood deaths, disproportionately affecting vulnerable populations (25).

2.2. Determinants of Second Dose Measles Vaccine Dropout

2.2.1. Socioeconomic and Demographic Factor

Worldwide studies have revealed that factors such as low income, poverty, illiteracy, and rural background are some of the predictors of early dropout of the second measles vaccine. Studies conducted in Bangladesh in 2020 showed that children from low socioeconomic families had a low likelihood to a second dose of measles vaccine due to economic constraints and accessibility to immunization services (26). Likewise, a study conducted in Pakistan in 2021 pointed towards these important findings to understand how schedule non-adherence happens and identified that poor households are particularly at odds in this regard (27).

A cross-sectional study conducted in Kenya in 2020 established that mother's education and household income are key predictors of immunization drop-out because the lower the education level, the higher the likelihood of children to dropping out on the second measles vaccine (28). A similar study conducted in Malawi in 2021 also pointed out that children in rural areas and those from low-income households had high second-dose dropout risk due to parental education and household wealth (29).

Locally in Ethiopia socioeconomic factors have also been attributed to play the major role. Research conducted in the Somali region in 2023 revealed the following trends, basically vulnerable groups such as nomadic people and the extremely poor dropped out of vaccination due to lack of access infrastructure and mobility problems (30). A study conducted in the Oromia region, Ambo town in 2021 revealed that the breakdown of vaccination before receiving the second dose of the vaccine was more common among children from families with low income and least education because of cost and limited access to health facilities. This trend is most observed in rural and remote places where health care services are scarce (31).

2.2.2. Health Care Access and Delivery

Insufficient Medical Centers and weak delivery structures are among the causes of Measles Vaccine Dropout. A cross-sectional study conducted in India (2019) showed that factors related to health care infrastructure, appropriate storage, transportation and cold chain management, and inadequate health workforce were major challenges to the completion of immunization (32). The COVID-19 Vaccine Barriers in Nigeria in 2021 also focused on the issues of poor health care facilities, namely, inadequate and irregular vaccination in the rural areas to which the existing higher dropout rate is attributed (33).

Another 2022 study from Uganda revealed that children who reside in the regions with occasional and poor-quality road networks are more likely to fail to receive the second dose of the measles vaccine due to limited transportation facilities and greater distances to the health care centers (34). The same barriers were also pointed out in a 2020 cross-sectional study in Nepal, where, shortage of health workers and irregular supplies of vaccines in the centers escalated the drop-off rate of the second dose of the measles vaccine (35).

Similar studies have been reported in Ethiopia. A systematic review and meta-analysis study carried out in Ethiopia, in 2021 also revealed that children from rural areas who had to travel over an hour to access healthcare facilities received the second dose less frequently because of the travel burden and inconsistent outreach services (36). Another cross-sectional study conducted in Tigray in 2020 showed that children from rural settings who could not access health facilities frequently failed to attend the second dose due to transport complications (37). A

lack of outreach services in some regions also contributes to the problem because, for many families, mobile vaccination services are unreliable or nonexistent (36).

2.2.3. Maternal and Child Health Services

Maternal and Child Health (MCH) services have a vital function with regard to vaccines since immunization is among the essential preventive measures for maternal and child health. A cross-sectional study conducted in Bangladesh found that lack of antenatal care (ANC) follow-up was associated with measles vaccine dropout. Mothers who did not attend ANC visits regularly were less likely to bring their children for subsequent vaccination doses (38). Similarly, a study carried out in Uganda in 2020, Showed that weak integration of child health services and follow-up mechanisms contributed to vaccine dropouts (34). Likewise, a study conducted in India in 2020 also concluded that poor coordination between the MCH services and vaccination programs led to missed opportunities for immunization, contributing to higher dropout rates (32).

In Sub-Saharan Africa, a study done in 2020 in Zambia showed that the women who attended four or four more ANC clinics were 4 times more likely to ensure that their children completed the measles vaccination schedule since the clinics constantly reminded them (39). Similarly, a study conducted in Nigeria in 2022 showed that those mothers who did not seek postnatal follow-up services had their children dropout from the second dose of the vaccine (40).

In Ethiopia, systematic review and meta-analysis studies conducted in 2023 identified that lack of coordination between child health and immunization services in the primary healthcare facilities led to missed opportunities for promoting vaccine uptake, contributing to higher dropout rates (41). Another cross-sectional study conducted in 2021 in Amhara region showed that mothers who did not seek postnatal care services, were more likely to miss vaccinating their children with the second dose of the measles vaccine (42). Similarly, poor coordination between maternal health services and immunization programs in rural health centers was identified as a significant barrier to completing the vaccination schedule (43).

2.2.4. Parental Knowledge

Influence by parental knowledge and awareness about vaccination and the proper schedule is highly important for the vaccination process. A cross-sectional study conducted in 2020 in

Pakistan revealed that failure to give the second dose of the measles vaccine due to parents having incorrect beliefs that measles does not require the second dose, made more children drop out. The present study stressed the significance of ensuring enhanced interaction between health workers and parents in order to enhance awareness (44). In Myanmar, a 2021 cross-sectional study identified that those parents who received incomplete information about vaccination schedule were more likely to skip the second dose for their children (45).

The study conducted in Ghana in 2019 stated and revealed that the mothers who had no knowledge on the next dose of MMR vaccine were significantly more likely to miss it (46). Another study from Zambia, in 2020 also showed that lack of proper communication from the health care providers regarding the importance of mandatory completion of full vaccination could be one of the reasons for the high dropout rate (47). In Nigeria research carried in 2021 indicated that lack of communication between the healthcare providers and parents regarding the vaccine schedule was a factor for second dose dropout (48).

In Ethiopia, a cross-sectional study conducted in the Amhara region in 2020 pointed that lack of parental knowledge on the second dose of measles vaccines were a major reason for vaccine drop out (13). Another cross-sectional study conducted in the Harari region in 2021 revealed that the parents, who unaware about the vaccination schedule, were more likely to miss their child's second dose (43). Based on the study, there is a need for enhanced health education and consistent communication to raise awareness among parents, especially in rural areas.

2.2.5. Cultural Beliefs and Practices

Cultural beliefs and practices significantly impact vaccine uptake, especially in rural and marginalized communities. In Afghanistan, a cross-sectional study conducted in 2021 showed that how traditional beliefs and religious opposition to vaccines contributed to vaccine refusal and dropout (49). Likewise a study done in Chad in 2019 established that some ethnic groups were less likely to complete measles vaccination because of some cultures that prevailed in those regions (50). Traditional beliefs, a desire to rely only on natural healers rather than conventional medicine was also positively related with second dose dropout rate in rural India (51).

In Ethiopia, cultural aspects have been described in studies from 2021 such as in Afar region that cultural attitude to illness and health resulted to parents' non-use of modern child immunization services hence increased second dose dropout rates (52). This resistance was often rooted in traditional beliefs about illness and treatment, as well as skepticism about modern health care interventions. A cross-sectional study conducted in 2022 on Somali nomadic families reported that they delay or dropout especially the second dose of measles vaccine due to reliance to traditional medicine systems (53).

2.2.6. Vaccine Hesitancy

Fear of immunization is also rising due to false information about vaccines, and doubts in the efficacy of the health care sector. According to a study conducted in the United States in 2022, the main reasons for Measles Vaccine Dropout were due to stories that circulated in the social media feeds and injection phobia resulting to belief in side effects of vaccines (54). The worldwide analysis in 2020 observed that vaccine doubt has continuously increased in the last 5 years because of safety concerns (55). Another more recent study conducted in Brazil in early 2022 also established the fact that vaccine hesitancy could be attributed to issues of vaccine safety hence high dropout rates (56).

In Ethiopia, vaccine hesitancy has been linked to both misinformation and fear of adverse reactions. The cross-sectional study, conducted in 15 health facilities within Addis Ababa in 2020, identified misconceptions about safety and the effectiveness of vaccines as reasons for second-dose dropout (57). This led to a reduction in the second-dose coverage for measles despite awareness campaigns.

2.3. Conceptual Framework

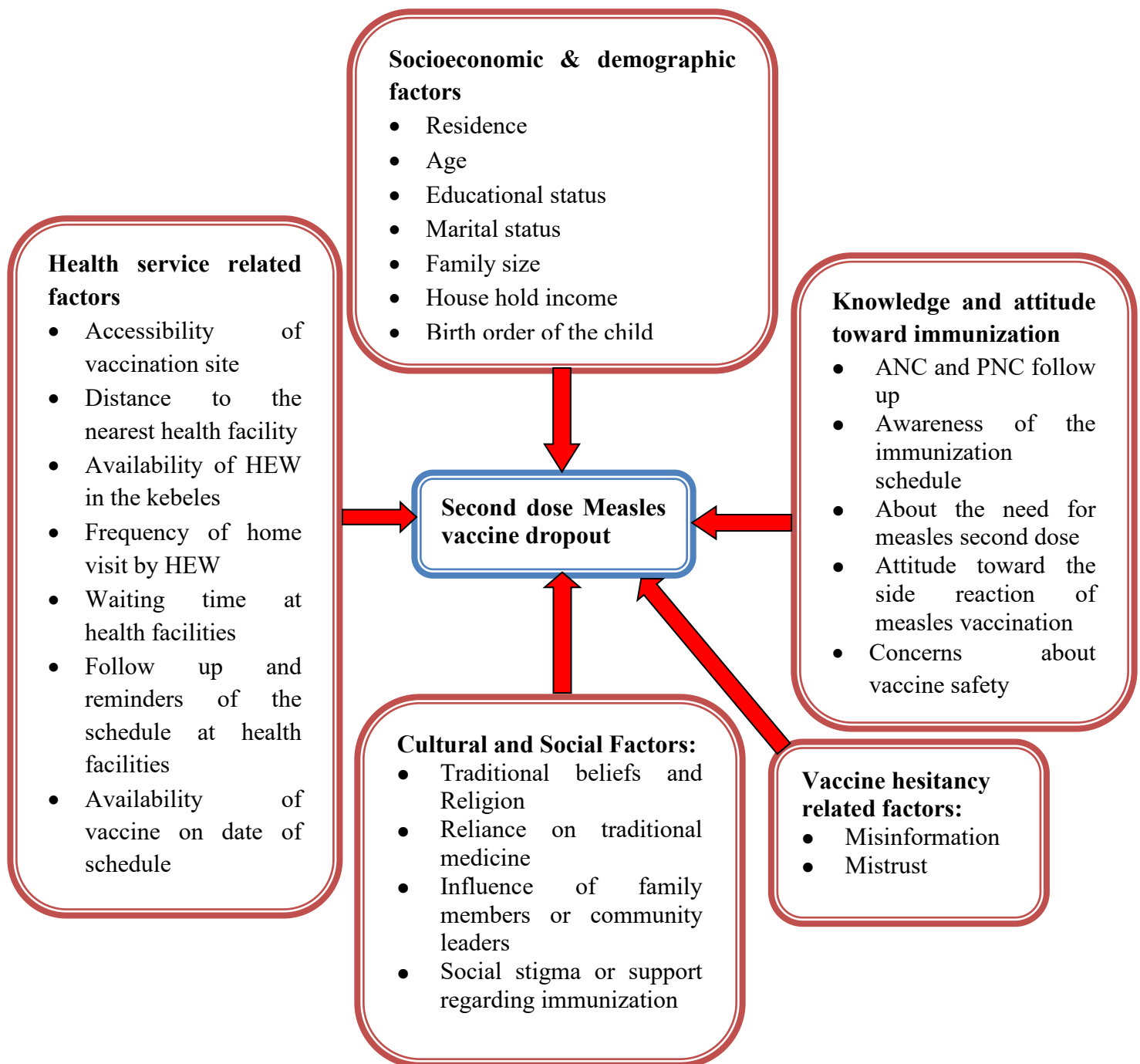


Figure 1: Conceptual framework of Determinants Second dose measles vaccine dropout adapted after reading different literature's (27,29,30,41,53,58).

3. OBJECTIVES

3.1. General Objective

- ❖ To assess the determinants of second-dose measles vaccine dropout among children aged 15-24 months in Sibu Sire Woreda, East Wollega Zone, Ethiopia, 2025.

3.2. Specific Objectives

- To determine determinants of second-dose measles vaccine dropout among children aged 15-24 months in Sibu Sire Woreda, East Wollega Zone, Ethiopia, 2025.

4. METHODS AND MATERIALS

4.1. Study Area and Period

The study was conducted in Sibu Sire Woreda, located in the East Wollega Zone of the Oromia Region, Ethiopia. Geographically, Sibu Sire is located 285 km from Addis Ababa to the west and 50 km to the east from Nekemte town of the East Wallaga zone. It is bordered on the south by Wama Bonaya, on the west by Guto Wayu, and on the north and east by Bila Seyo. The administrative center of the woreda is Sire town. Administratively, Sibu Sire is divided into 24 kebeles (5 urban and 19 rural), supported by a healthcare network consisting of one hospital, four health centers, and 22 health posts. These facilities are essential in providing health care and immunization services to the community, with the support of 48 Health Extension Workers (HEWs).

It consists of both urban and rural populations, with the total population being 160,819. The majority of the population resides in rural areas, accounting for 135,088 individuals, while the urban population is 25,731. The population under five years of age, a key demographic for immunization programs, accounts for 26,423 children, which is 16.43% of the total population. Within this group, there are approximately 2,847 children aged 24 to 35 months, representing 10.5% of children under five. This age group is critical for the study of second-dose measles vaccine dropout, as they are in the targeted window for receiving this vaccine.

There are 33,504 households in the woreda, and the role of the HEWs and health care infrastructure is crucial in maintaining and improving immunization coverage, particularly in rural areas where access to health care can be more challenging. This study was conducted between January 2025 and May 2025 G.C.

4.2. Study design

A Community-based unmatched case-control study design was conducted to determine determinants of second dose measles vaccine dropout among children aged 15-24 months in Sibu Sire woreda of East wollega Zone, Ethiopia.

4.3. Source and Study Population

4.3.1. Source Population:

All children aged 15-24 months residing in Sibu Sire Woreda.

4.3.2. Study Population

The study population consisted of children aged 15-24 months in the selected kebeles within the woreda during study period

- Cases were children who received the first dose of measles vaccine (MCV1) but failed to receive the second dose (MCV2).
- Control was children who received both the first and second doses of the measles vaccine.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion Criteria

- ❖ Children aged 15-24 months.
- **For cases:** Children who received MCV1 but did not receive MCV2 (dropouts)
- **For controls:** Children who received both MCV1 and MCV2 (fully vaccinated)
- ❖ Mothers or caregivers of the children who:
 - Had resided in the Sibu Sire woreda for at least six months prior to the study.
 - Were able to provide informed consent for participation.

4.4.2. Exclusion Criteria:

- Mothers or caregivers of children who cannot hear and respond.
- Children with incomplete or missing vaccination records (e.g., no documented proof of MCV1 or MCV2 on immunization cards or health facility registers).

4.5. Sample Size Determination and Procedure

4.5.1. Sample Size Determination

Sample size was determined using Epi-info version 7.2.6.0 statistical package for the specific objectives as follows, considering;

- $r = n_1/n_2 = \text{population allocation ratio} = 2$ (1 number of cases and 2 controls in this study)

- In this study Waiting time for vaccination at HF (>1 hr) was the variable that gives the maximum sample size. Accordingly, by adding a 10% non-response rate and using a design effect of 1.5, the final sample size became 567, and 189 cases and 378 control participants were employed in this study.

Table 1: Sample size for determinant of second dose measles vaccine dropout among children aged 15-24 months in Sibu Sire Woreda, East Wallaga Zone, Ethiopia, 2025.

Variable	CI	Power	Ratio of control to cases	Proportion in exposed	Proportion in unexposed	AOR	Final sample size	10% non - response rate	Design effect (x1.5)	Reference
Distance to reach health facilities (spent ≥ 30 min)	95 %	80	2:1	42.7	68.4	2.76	240	24	x1.5	(6)
Mother's knowledge (poor)	95 %	80	2:1	57.3	40.1	3.20	125	12.5	x1.5	
Waiting time for vaccination at HF (>1 hr)	95 %	80	2:1	20.5	9.4	2.61	344	34.4	x1.5	

4.5.2. Sampling Procedure

The study participants were selected using a multistage sampling technique. The district was classified into two strata: urban and rural kebeles. The 6 (30%) of rural kebeles and 2 (30%) of urban kebeles were selected randomly from 19 rural and 5 urban kebeles, respectively. For each selected kebele, a list of cases and controls with their full addresses was taken from the Expanded Program Immunization (EPI) registration logbook of nearby health centers and health posts. Then, a sampling frame was prepared for each selected kebele for the case and control groups separately and sorted in consecutive order. To provide an equal chance in the selection of both cases and controls, a proportional allocation technique was performed across each selected kebele. All eligible households were identified through house-to-house visits with the help of health extension workers. Finally, a random sampling technique was applied to access cases and controls from the sampling frame of both cases and controls. (Figure 2)

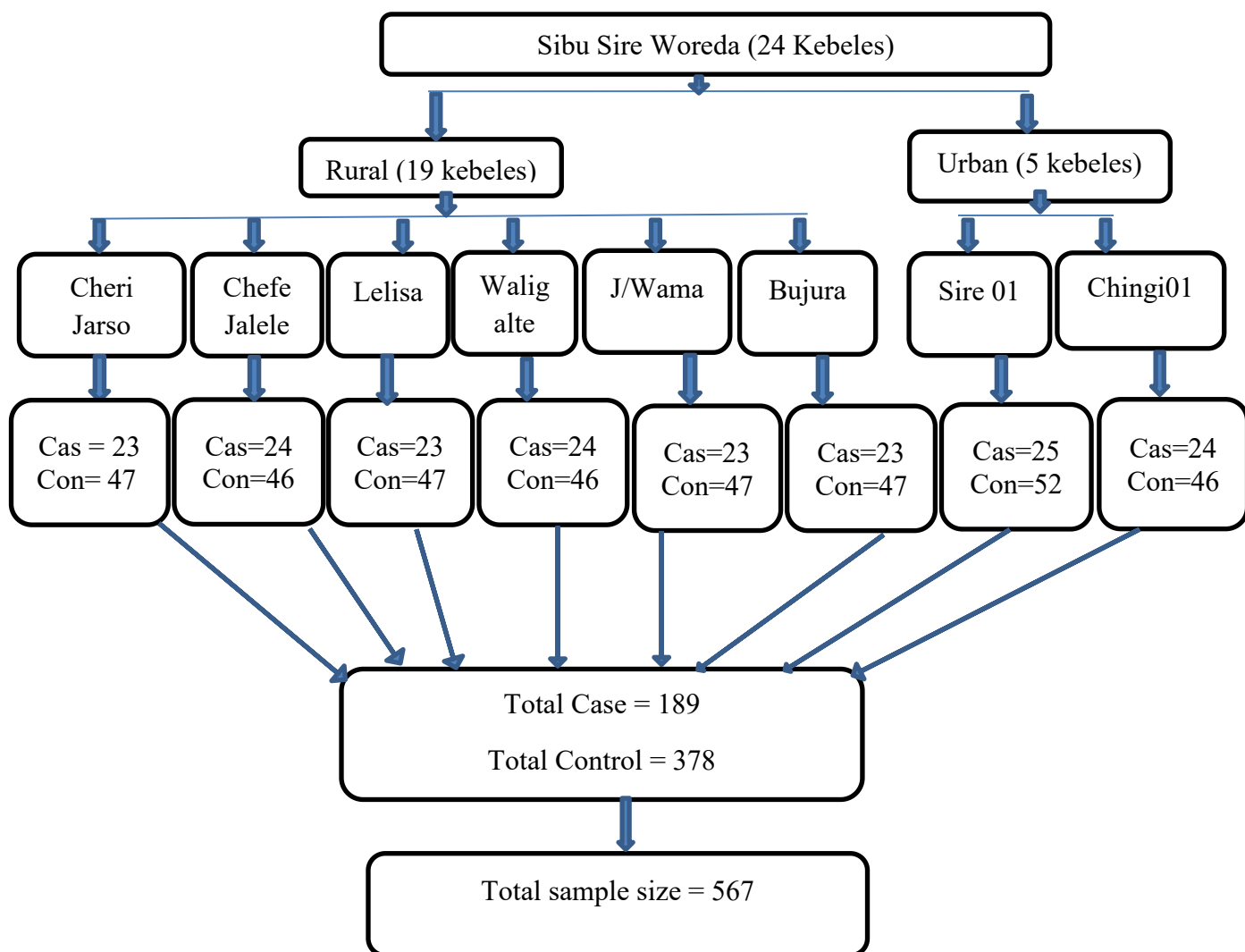


Figure 2: Diagrammatic presentation of sampling procedures used in assessment of determinants of second-dose measles vaccine dropout among children aged 15-24 months in Sibru Sire woreda, East Wallaga Zone, Ethiopia, 2025.

4.6. Variables

4.6.1. Dependent Variable:

- Second-dose measles vaccine dropout.

4.6.2. Independent Variables:

- Socio-demographic characteristics (residence, age, sex, parental educational status, marital status, occupation, monthly income, family size, birth order).
- Health care-related factors (availability of vaccination sites, distance to vaccination sites, availability of HEW, frequency of home visits by HEW, waiting time at vaccination sites, and vaccine availability on the date of the schedule).
- Maternal knowledge and attitudes (ANC and PNC follow-up, awareness of the MCV2 vaccine, awareness of vaccine schedules, side effects of vaccines, and belief in vaccine importance).
- Other potential barriers (transport difficulties, household responsibilities, cultural factors).

4.7. Operational Definition

- **Second-dose vaccine dropout:** Children who did not receive the second dose of the measles vaccine within the recommended age range (21).
- **Completed vaccination:** Children who received all recommended doses of vaccines within the specified age range (21).

4.8. Data Collection Tools and Procedures

Data were collected using a structured questionnaire administered through face-to-face interviews with caregivers of children aged 15-24 months. Immunization cards or health facility EPI registers were used as secondary data sources for verification. The questionnaire was adapted from a community-based matched case-control study (6) to align with the study context. It was initially developed in English and then translated into Afan Oromo, a language spoken by study participants, to ensure clarity and ease of understanding for the participants. Before the main data collection, a pre-test was conducted involving 5–10 caregivers from a similar setting outside the study area to assess the clarity and relevance of the questions, the time required for completion, and any logistical issues. Data collection was carried out by five trained health professionals on data collection. A unique code was assigned to each of the completed questionnaires. Two nurses with BSc degrees were assigned to supervise the overall data collection process, conduct spot checks, and provide support to the team to ensure high-quality data. Informed consent was obtained from all participants before the interviews, with a guarantee of confidentiality and the option to withdraw from the study at any time.

4.9. Data Quality Assurance

The questionnaire was pretested among women who resided in a similar setting outside of the study area. Based on the pre-test results, a necessary adjustment was made to the questionnaire. Data collectors received training on the objectives of the study, ethical considerations, and data collection procedures. Supervisors monitored the data collection process daily, checking the completeness and consistency of the collected data. Any discrepancies will be addressed immediately.

4.10. Data Processing and Analysis

Following data collection, all questionnaires were coded and entered into Epi-Data version 4.6 for initial data management before being exported to SPSS version 27 for statistical analysis. Descriptive statistics were analyzed to summarize the Sociodemographic characteristics of the participants and other relevant variables. These descriptive statistics were presented by frequencies, percentages, and measures of central tendency like means, depending on the distribution of the data.

For the analytical part, binary logistic regression was utilized to identify the factors associated with second-dose measles vaccine dropout. The analysis was conducted in two stages. In the first stage, bivariate analysis was performed to explore the relationship between each independent variable and the outcome variable (vaccine dropout). Variables that showed a significant association with a p-value of <0.25 in the bivariate analysis were considered for inclusion in the multivariate logistic regression model.

In the second stage, multivariate logistic regression was applied to determine the adjusted odds ratios for each factor, controlling for potential confounding variables. A p-value of <0.05 was considered statistically significant in the final model. The results of the multivariate analysis would provide insight into the most important factors influencing second-dose measles vaccine dropout after adjusting for other variables. The model's goodness of fit was assessed using the Hosmer-Lemeshow test ($P=0.55$). A Multicollinearity test was conducted, and all the significant variables have variance inflation factor of less than 10 ($VIF = 1.3$). The backward regression was used with selected variables in the final model. The findings were presented with 95% confidence intervals for each of the factors identified as significant predictors.

4.11. Ethical Considerations

Ethical clearance with Ref.no IHSREC/03/105/2025 was obtained from the Wallaga University Institute of Health Sciences Research Ethics Review Committee. Permission would also be sought from the East Wollega Zone Health Department and the Sibu Sire Woreda Health Office. Informed verbal consent was obtained from the caregivers of the children before participation in the study. Participation would be voluntary, and caregivers would be assured of the confidentiality and anonymity of the data.

4.12. Dissemination of Results

The findings of this study will be disseminated to relevant stakeholders, including the Sibu Sire Woreda Health Office, the East Wollega Zone Health Department, and the Ministry of Health. The results will also be presented at scientific conferences and submitted for publication in peer-reviewed journals.

5. RESULTS

5.1. Socio-demographic Characteristics of Study Participants

Out of the total 567 sampled mothers and caregivers, all 567 (189 cases and 378 controls) were interviewed, achieving a 100% response rate.

Table 2: Socio-demographic characteristics of study participants in Sibru Sire Woreda, East Wollega Zone, Ethiopia, 2025 ($n = 567$)

Variables	Category	Frequency		
		Cases (%)	Control (%)	Total (%)
Residence	Urban	59 (31.2)	87 (23.0)	146 (25.7)
	Rural	130 (68.8)	291 (77.0)	421 (74.3)
Mother's/caregiver's age (in complete years)	15-24	22 (11.6)	49 (13)	71 (12.5)
	25-34	145 (76.8)	275 (72.9)	420 (74.2)
	≥35	22 (11.6)	53 (14.1)	75 (13.3)
Marital status of the mothers/caregivers	Married	176 (93.1)	370 (97.8)	546 (92.3)
	Divorced	6 (3.2)	2 (0.5)	8 (1.4)
	Widowed	7 (3.7)	6 (1.5)	13 (2.3)
Ethnicity	Oromo	178 (94.2)	356 (94.2)	534 (94.2)
	Amhara	10 (5.3)	17 (4.5)	27 (4.8)
	Others	1 (0.5)	5 (1.3)	6 (1.0)
Religion	Protestant	121 (64.0)	242 (64.0)	363 (64.1)
	Orthodox	58 (30.7)	122 (32.3)	180 (31.7)
	Muslim	10 (5.3)	14 (3.7)	24 (4.2)
Education status of the mothers/caregivers	No formal education	105 (55.6)	104 (27.5)	209 (36.9)
	Primary (Grades 1-8)	68 (35.9)	214 (56.6)	282 (49.7)
	Secondary & above	16 (8.5)	60 (15.9)	76 (13.4)
Occupation of the mothers/caregivers	Farmer/House wife	154 (81.5)	303 (80.2)	457 (80.6)
	Merchant/Private employment	28 (14.8)	59 (15.6)	87 (15.3)
	Government employee	7 (3.7)	16 (4.2)	23 (4.1)
Family size	≤ 5	99 (52.4)	253 (66.9)	352 (62.1)
	>5	90 (47.6)	125 (33.1)	215 (37.9)
Age of child	15-19	118 (62.4)	213 (56.3)	331 (58.4)
	20-24	71 (37.6)	165 (43.7)	236 (41.6)
Sex of child	Male	83 (43.9)	229 (60.6)	312 (55.0)
	Female	106 (56.1)	149 (39.4)	255 (45.0)
Birth order of the child	≤ 3	101 (53.4)	253 (66.9)	354 (62.4)
	>3	88 (46.6)	125 (33.1)	213 (37.6)
Parity	1	1 (0.6)	57 (15.0)	58 (10.8)
	2-4	116 (72.9)	260 (68.9)	376 (70.0)
	≥5	42(26.5)	61 (16.1)	103 (19.2)

Many cases and controls were rural residents, with 130 (68.8%) of cases and 291 (77.0%) of controls lived in rural areas. The mothers were mostly aged between 25–34 years, and the total mean age was 29.2 (SD $\pm$ 4.57) years. The majority were married and Oromo by ethnicity, with Protestant being the most common religion. In terms of education, 105 (55.6%) of the case group and 104 (27.5%) of the control group had no formal education. Most mothers were housewives or farmers. Regarding family size, 90 (47.6%) of cases and 125 (33.1%) of controls had families with more than five members. For the children, the age group 15–19 months was slightly more prevalent in both groups, while female children and higher birth order (>3) were observed among cases. (Table 2)

5.2. Maternal and child service utilization characteristics of study participants

Among the study participants, most mothers in both groups attended antenatal care (ANC), received tetanus toxoid (TT) vaccination, and delivered at health institutions. (Table 3)

Table 3: Maternal and child service utilization characteristics of study participants in Sibire Woreda, East Wollega Zone, Ethiopia, 2025 ($n = 567$)

Variable	Category	Frequency		
		Case (%)	Control (%)	Total (%)
ANC	Yes	184 (97.3)	377 (99.7)	561 (98.9)
	No	5 (2.7)	1 (0.3)	6 (1.1)
Number of ANC visits	First visit only	16 (8.7)	25 (6.6)	41 (7.3)
	Second visit	89 (48.4)	172 (45.6)	261 (46.5)
	Third visit- fourth visit	79 (42.9)	180 (47.8)	259 (46.2)
TT vaccination	Yes	186 (98.4)	375 (99.2)	561 (98.9)
	No	3 (1.6)	3 (0.8)	6 (1.1)
Number of TT vaccination	First dose	17 (9.1)	22 (5.8)	39 (6.9)
	Second dose	160 (86.0)	309 (82.4)	469 (83.6)
	Third dose and above	9 (4.9)	44 (11.8)	53 (9.5)
Place of delivery	Home	26 (13.8)	32 (8.4)	58 (10.3)
	Health institution	163 (86.2)	346 (91.6)	509 (89.7)
PNC visit	Yes	94 (49.7)	324 (85.7)	418 (73.7)
	No	95 (50.3)	54 (14.3)	149 (26.3)
Number of PNC visits	First checkup only	37 (39.4)	51 (15.7)	88 (21.1)
	Two and above	57 (60.6)	273 (84.3)	330 (78.9)
Sickness of child during first (PENTA3, PCV3) vaccination	Yes	52 (27.5)	105 (27.8)	157 (27.7)
	No	137 (72.5)	273 (72.2)	410 (72.3)
Child missed measles vaccination due to fear of side effect	Yes	39 (20.6)	28 (7.4)	67 (11.8)
	No	150 (79.4)	350 (92.6)	500 (88.2)

Postnatal care (PNC) visits were reported by 94 (49.7%) of cases and 324 (85.5%) of controls, with cases also having fewer PNC visits. A higher proportion of children in the case group missed vaccinations due to fear of side effects, 39 (20.6%). Additionally, 27.5% (n=52) of cases reported sickness during the first dose of vaccination. (Table 3)

5.3. Maternal/caretaker's Knowledge- related characteristics of study participant

Maternal knowledge about MCV2 differed across groups. Smaller proportions of cases had heard about MCV2 128 (67.7%), knew the MCV2 schedule 108 (57.1%), or were aware of the need for a second dose 89 (47.1%). Awareness of the benefits of MCV2 was also lower in the case group, and fewer mothers used vaccination cards to verify completion. (Table 4)

Table 4: Maternal/Caretaker's knowledge related characteristics of study participant in Sibire Woreda, East Wollega Zone, Ethiopia, 2025 (n = 567)

Variables	Category	Frequency		
		Case (%)	Control (%)	Total (%)
Heard about measles immunization?	Yes	170 (89.9)	370 (97.9)	540 (95.2)
	No	19 (10.1)	8 (2.1)	27 (4.8)
Heard about MVC2 vaccination?	Yes	128 (67.7)	361 (95.5)	489 (86.2)
	No	61 (32.3)	17 (4.5)	78 (13.8)
Know about the schedule of MCV2?	Yes	108 (57.1)	364 (96.3)	472 (83.2)
	No	81 (42.9)	14 (3.7)	95 (16.8)
Months of age the child's gets MCV2	At 15 to 18 months	108 (99.1)	362 (99.4)	470 (99.4)
	At 9 to 12 months	1 (0.9)	2 (0.6)	3 (0.7)
Awareness of the need for measles second dose	Yes	89 (47.1)	355 (93.9)	444 (78.3)
	No	100 (52.9)	23 (6.1)	123 (21.7)
Benefits of MVC2	Protect children who remained unprotected after the first dose.	59 (60.8)	293 (82.5)	352 (77.9)
	Control epidemic	18 (18.6)	24 (6.8)	42 (9.3)
	Both	20 (20.6)	38 (10.7)	58 (12.8)
Does measles vaccination had side reactions?	Yes	56 (29.6)	113 (29.9)	169 (29.8)
	No	133 (70.4)	265 (70.1)	398 (70.2)
What are the side reactions of measles vaccination?	Fever	48 (85.7)	95 (84.1)	143 (84.6)
	Pain	7 (12.5)	18 (15.9)	25 (14.8)
	Vomiting	1 (1.8)	0 (0)	1 (0.6)
	By reviewing the card	63 (33.3)	215 (56.9)	278 (49.0)
Means of knowing MCV completion	By asking HEW	116 (61.4)	161 (42.6)	277 (48.8)
	Have no means to know	10 (5.3)	2(0.5)	12 (2.2)

5.4. Facility (service accessibility) - related factors for the study participants

Facility-related factors revealed marked differences between groups. Among cases, 69.8% (n=132) received home visits from health extension workers, with only 28.8% (n=38) of these being monthly visits. Counseling on MCV2 reached 45.5% (n=86) of case mothers. In terms of access, while most participants reported having vaccination sites available, 59.3% (n=112) of cases faced travel times of 30 minutes or longer, experienced extended waiting times, and encountered service disruptions such as canceled appointments (43.9%, n=83). In contrast, all control group children were vaccinated, with most having documented proof of vaccination. (Table 5)

Table 5: Facility (Service accessibility) related factors for the study participants in Sibru Sire Woreda, East Wollega Zone, Ethiopia, 2025 (n = 567)

Variables	Category	Frequency		
		Case (%)	Control (%)	Total (%)
HEW home visit?	Yes	132 (69.8)	344 (91.0)	476 (83.9)
	No	57 (30.2)	34 (9.0)	91 (16.1)
Frequency of HEW home visits	Monthly	38 (28.8)	277 (80.5)	315 (66.2)
	Every two month	50 (37.9)	56 (16.3)	106 (22.3)
	Quarterly	44 (33.3)	11 (3.2)	55 (11.5)
Counseled on MCV2?	Yes	86 (45.5)	349 (92.3)	435 (76.7)
	No	103 (54.5)	29 (7.7)	132 (23.3)
Is there accessible vaccination site?	Yes	188 (99.5)	375 (99.2)	563 (99.3)
	No	1 (0.5)	3 (0.8)	4 (0.7)
What are accessible vaccination site	Health center	7 (3.7)	31 (8.3)	38 (6.78)
	Health post	167 (88.8)	319 (85.1)	486 (86.3)
	Outreach	14 (7.5)	25 (6.6)	39 (6.9)
Travel time to the nearest accessible site	<30 min.	77 (40.7)	260 (68.8)	337 (59.4)
	≥30 min.	112 (59.3)	118 (31.2)	230 (40.6)
Gone to vaccinate child's for MCV2?	Yes	85 (45.0)	377 (99.7)	462 (81.3)
	No	104 (55.0)	1 (0.3)	105 (18.7)
Child immunized for MCV2	Yes, by card	0 (0)	315 (83.3)	315 (55.5)
	Yes, by mothers' verbal reports	0 (0)	63 (16.7)	63 (11.1)
	No	189 (100)	0 (0)	189 (33.3)
Waiting time for vaccination at the nearest HF	15-30 min	29 (15.3)	291 (77.0)	320 (56.4)
	30-60 min	103 (54.5)	75 (19.9)	178 (31.4)
	Above 60 min	57 (30.2)	12 (3.1)	69 (12.2)
Schedule canceled or postponed?	Yes	83 (43.9)	105 (27.7)	188 (33.1)
	No	106 (56.1)	273 (72.3)	379 (66.9)
Returned without getting the vaccine?	Yes	53 (28.1)	66 (17.5)	119 (21.0)
	No	136 (71.9)	312 (82.5)	448 (79.0)

5.5. Determinants of Second dose measles vaccination dropout among children aged 15-24 months in Sibu Sire woreda, East Wollega Zone, Ethiopia, 2025 (*n* = 567)

In binary logistic regression analysis, Residence, educational status, current marital status, family size, child sex, birth order, ANC attendance, number of times PNC visits, heard MCV2 schedule, knowing MCV2 schedule, awareness on need of MCV2, health extension home visit, frequency of home visits by health extension worker, MCV2 counsel, length of travel time, waiting time and postponing or cancellation of the schedule were considered as candidate variables for multivariate logistic regression at $P < 0.25$. On multivariate logistic regression analysis, educational status, number of postnatal care (PNC) follow-ups, infrequent home visits by health extension worker's, longer waiting times at vaccination sites, and schedule cancellations or postponements were identified as independent determinants of second-dose measles vaccine dropout.

Educational status emerged as a key determinant; the odds of MCV2 dropout were 3.74 times higher among children of caregivers having no formal education than those with secondary education or higher (AOR = 3.74, 95% CI: 1.12–12.44). Postnatal care (PNC) follow-up also played a critical role, as children whose mothers attended only the first PNC check-up had 3.29 times higher dropout odds than those with two or more visits (AOR = 3.29, 95% CI: 1.34–8.09). Additionally, infrequent home visits by health extension workers significantly increased dropout rates, with quarterly visits associated with 7.52 times higher odds compared to monthly visits (AOR = 7.52, 95% CI: 2.21–25.61). Longer waiting times at vaccination sites (30–60 minutes and >60 minutes) substantially raised dropout likelihood (AOR = 4.67 and 13.88, respectively). Finally, schedule cancellations or postponements doubled the odds of dropout (AOR = 2.39, 95% CI: 1.09–5.30). These findings highlight the importance of maternal education, consistent health system engagement, and efficient vaccination services in improving MCV2 coverage. (Table 6)

Table 6: Determinants of MCV2 dropout among children aged 15-24 months in Sibu Sire Woreda, East Wollega Zone, Ethiopia, 2025 (*n* = 567)

Variable	Category	Frequency		Bi-variate analysis (P<0.25)		Multivariate analysis (P<0.05)	
		Case (%)	Control (%)	COR 95% CI	P-Value	AOR 95% CI	P-Value
Residence	Urban	59 (31.2)	87 (23.0)	1		1	
	Rural	130 (68.8)	291 (77.0)	1.52(1.03-2.24)	0.04*	0.81(0.25-2.598)	0.73
Educational status	No formal education	105 (55.6)	104 (27.5)	3.79(2.05-7.00)	<0.001*	3.74(1.12-12.44)	0.03**
	Primary	68 (35.9)	214 (56.6)	1.19(0.64-2.20)	0.57	1.15(0.37-3.55)	0.80
Marital status	Secondary & above	16 (8.5)	60 (15.9)	1		1	
	Married	176 (93.1)	370 (97.8)	1		1	
	Divorced	6 (3.2)	2 (0.5)	6.30(1.26-31.56)	0.02*	3.89(0.22-69.14)	0.35
	Widowed	7 (3.7)	6 (1.5)	2.45(0.81-7.41)	0.11*	0.41(0.02-10.13)	0.58
Family size	≤5	99 (52.4)	253 (66.9)	1		1	
	>5	90 (47.6)	125 (33.1)	1.84(1.29-2.56)	<0.001*	0.44(0.15-2.64)	0.13
Child sex	Male	83 (43.9)	229 (60.6)	1		1	
	Female	106 (56.1)	149 (39.4)	1.96(1.38-2.79)	<0.001*	1.28(0.62-2.64)	0.50
Birth order ¹	≤3	101 (53.4)	253 (66.9)	1		1	
	>3	88 (46.6)	125 (33.1)	1.76(1.23-2.52)	0.002*	0.99(0.36-2.73)	0.99
ANC attendance	Yes	184 (97.3)	377 (99.7)	1		1	
	No	5 (2.7)	1 (0.3)	10.24(1.19-88.32)	0.03*	0.74(0.01-86.05)	0.90
Number of times for PNC follow up	First check up only	37 (39.4)	51 (15.7)	3.47(2.09-5.79)	<0.001*	3.29(1.34-8.09)	0.01**
	Two and above	57 (60.6)	273 (84.3)	1		1	
Heard about MCV2	Yes	128 (67.7)	361 (95.5)	1		1	
	No	61 (32.3)	17 (4.5)	10.12(5.70-17.97)	<0.001*	1.69(0.32-8.92)	0.54
Know MCV2 schedule	Yes	108 (57.1)	364 (96.3)	1		1	
	No	81 (42.9)	14 (3.7)	19.50(10.63-35.76)	<0.001*	2.78(0.62-12.56)	0.18
Awareness on need of measles second dose	Yes	89 (47.1)	355 (93.9)	1		1	
	No	100 (52.9)	23 (6.1)	17.34(10.42-28.86)	<0.001*	3.08(0.72-13.09)	0.13
Frequency of home visit	Monthly	38 (28.8)	277 (80.5)	1		1	
	Every two months	50 (37.9)	56 (16.3)	6.51(3.91-10.84)	<0.001*	1.70(0.64-4.60)	0.29

by HEW	Quarterly	44 (33.3)	11 (3.2)	29.16(13.87-61.27)	< 0.001 *	7.52(2.21-25.61)	0.001 **
Counseled on MCV2	Yes	86 (45.5)	349 (92.3)	1		1	
	No	103 (54.5)	29 (7.7)	14.41(8.96-23.17)	< 0.001 *	2.35(0.74-7.46)	0.15
Length of time travel to nearest vaccination site in minute	<30 min	77 (40.7)	260 (68.8)	1		1	
	≥ 30 min	112 (59.3)	118 (31.2)	3.20(2.23-4.61)	< 0.001 *	0.89(0.36-2.21)	0.80
Waiting time until vaccination at site in minutes	15-30	29 (15.3)	291 (77.0)	1		1	
	30-60	103 (54.5)	75 (19.9)	13.78(8.49-22.36)	< 0.001 *	4.67(2.03-10.72)	< 0.001 **
	>60	57 (30.2)	12 (3.1)	47.66(22.96-98.82)	< 0.001	13.88(4.10-46.97)	< 0.001 **
cancellation/postponing of the schedule	Yes	83 (43.9)	105 (27.7)	20.36(1.41-2.93)	< 0.001	2.39(1.09-5.30)	0.03 *
	No	106 (56.1)	273 (72.3)	1		1	

1= Reference, *significant variables for bivariate, **significant variables for multivariate, AOR=Adjusted Odd Ratio

6. DISCUSSION

Creating successful interventions requires an understanding of the factors that contribute to second-dose measles vaccination dropout. This study identified several significant factors contributing to measles second-dose vaccine dropout among children aged 15–24 months in Sibu Sire Woreda, Ethiopia. Mothers/caregivers with no formal education had 3.74 times higher odds of dropping out than those with secondary education and above, consistent with findings from Ethiopia (6,52,59,60) and Kenya (61) where maternal education was a strong predictor of immunization completion. A possible explanation is that mothers with higher education levels are more likely to understand the importance of vaccines, recognize vaccination schedules, and comprehend health information provided by health care workers. Although this study found that low maternal education greatly raised the probability of MCV2 dropout, other studies have found no significant link between maternal education and vaccine completion. A study done in rural Uganda, for instance, revealed that even among mothers with low educational attainment, community vaccination initiatives and vigorous social mobilization efforts helped to preserve high vaccine coverage (62). This implies that although maternal education is a key element, its influence can be lessened by strong community-based interventions, so stressing the need for customized health education initiatives together with more general immunization efforts.

This study also showed that children whose mothers attended just the first postnatal care (PNC) visit had 3.29 times greater odds of dropping out than those with two or more PNC visits, aligning with findings from Ethiopia (6,63,64), Sub-Saharan Africa (39), and the Democratic Republic of the Congo (65), that emphasize the importance of regular maternal health service use. Likewise, while rare postnatal care (PNC) follow-up was a key predictor of dropout in this study, studies from rural Bihar, India, indicated that PNC visits had no significant independent impact on vaccination rates when other variables, such as community health promotion, were strong (66). These different results imply that although PNC visits are crucial for strengthening immunization messages, their efficacy might vary depending on the larger health system setting. This implies that including immunization counseling with other maternal and child health services could improve vaccine compliance.

With respect to health extension worker home visits, this study found that children from homes visited quarterly had notably greater 7.52 odds of dropout than those visited monthly, therefore stressing the need for regular community health interactions, as supported by earlier Ethiopian studies (52,67,68). Some studies from Tanzania indicated that even quarterly home visits were successful when coupled with mass media communication and outreach initiatives, suggesting that the quality of interaction might occasionally offset lower visit frequency (69). This suggests that although raising the number of HEW visits is good, especially in resource-limited environments, improving the quality of interaction via targeted messaging and multimedia support could also improve vaccination compliance.

This study also found a strong correlation between waiting time at vaccination sites and the likelihood of dropping out; children who waited more than 60 minutes had 13.88 times higher odds of dropping out compared to those who waited 15–30 minutes, in keeping with studies done in different areas of Ethiopia that show lengthy waiting times to be a barrier to immunization (19,60,70–72). While long waiting times were strongly associated with dropout in this study, a study conducted in Nepal found that despite long queues, parental motivation and trust in the health system kept vaccine uptake high (73). This emphasizes that while reducing waiting times is essential for enhancing service delivery, increased community trust and motivation via open communication and effective procedures can lessen the adverse effects of delays.

Lastly, the study noted that vaccine session cancellations or postponements were significantly linked to 2.39 times higher dropout rates, which is in line with findings from other settings where service disruption negatively impacts vaccine completion (70,74). While postponement or cancellation of sessions was a significant factor in this study, a study conducted in Bangladesh found that even in cases where vaccination sessions were delayed, effective rescheduling and communication strategies helped prevent dropout (75). These results emphasize the need for strong contingency planning in vaccination programs by showing that, although session cancellations can jeopardize the continuity of immunizations, their effects can be reduced through proactive communication, alternate scheduling, and community involvement.

6.1. Strength and Limitation of the Study

6.1.1. Strength of the study

This study's primary strength is its large sample size and community-based, unmatched case-control design, which covered both urban and rural areas. The findings were extremely pertinent for guiding interventions because they included localized and recent (2025) data.

6.1.2. Limitation of the study

A bias was introduced into the study because it relied on self-reported data from in-person interviews. Therefore, it is impossible to rule out recall biases, which may lead to either over reporting or under reporting. Others, the qualitative information of cultural and perception-related factors that contribute to measles vaccination second dose dropout was not covered in this study.

7. CONCLUSION AND RECOMMENDATIONS

7.1. Conclusion

Maternal illiteracy, a low number of PNC visits, infrequent home visits by health extension workers, prolonged vaccination wait times, and postponing or canceling vaccination schedules at vaccination sites are some of the major factors linked to MCV2 vaccination dropout, according to the study's findings. The findings demonstrated the importance of raising maternal awareness and education because mothers who do not have a formal education are much more likely to drop out. Regular postnatal care (PNC) visits offer opportunities to reinforce immunization counseling and set up tracking systems for missed appointments, so strengthening PNC follow-up services is also crucial. Since infrequent home visits by health extension workers, especially quarterly ones were associated with higher dropout rates, increasing the frequency and efficiency of home visits by health extension workers is another crucial step. Improving the efficiency of vaccination service delivery is equally important, as long waiting times discouraged caregivers. Finally, avoiding schedule cancellations and enhancing communication with communities is vital, given that schedule disruptions significantly contributed to dropouts.

7.2. Recommendations

Depending on the findings of this study, the following recommendations are made:

- Implement targeted maternal health education programs, especially in rural areas, to improve awareness of immunization benefits.
- Strengthen Postnatal Care follow-up services by integrating immunization counseling and establishing tracking systems for missed vaccinations.
- Ensure monthly Health Extension Worker home visits (instead of quarterly) with standardized immunization messaging.
- Improve vaccination service efficiency by optimizing staffing, queue management, and introducing mobile/outreach vaccination units in high-demand areas.
- Minimize vaccination schedule disruptions by improving logistics, advance community communication, and backup planning.
- Conduct regular monitoring and evaluation of vaccination dropout rates to identify and address gaps.

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9. ANNEXES

9.1. Information sheet and informed voluntary consent for mother/care-takers of study participant

1. **Introduction:** My name is _____. I am working as data collector for study being conducted in this community by Damto Bachiru who studying for his Master's degree at Wollega University, Institute of Health Sciences Department of Public Health. I kindly request you to lend me your attention to explain you about the study and being selected as the study participant.

2. **The study/project title:-**Determinants of Second Dose measles vaccination dropout among 15-24months old children in Sibu sire Woreda, East Wollega Zone, Ethiopia.

3. **Purpose/aim of the study:** The Purpose of this study is to identify Determinants of Second Dose measles vaccination dropout among 15-24 months old children in Sibu sire Woreda. Identifying these factors is important for the Woreda health office to plan intervention programs to remove those obstacles in immunization and to reduce the child morbidity and mortality that are associated with unvaccinated. Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfillment of a Master's Program in Epidemiology for the principal investigator.

4. **Procedure and duration:** I will be interviewing you using a questionnaire to provide me with pertinent data that is helpful for the study. There are 44 questions to answer where I will fill the questionnaire by interviewing you. The interview will take about 1hour, so I kindly request you to spare me this time for the interview.

5. **Risks and benefits:** The risk of being participating in this study is very minimal, only taking 60 minutes from your time. There would not be any direct payment for participating in this study. But the findings from this research may reveal important information for the local health planners.

6. **Confidentiality:**

The information you will provide us will be confidential. There will be no information that will identify you in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual persons or housing. The questionnaire will be coded to exclude showing names. No reference will be made in oral or written reports that could link participants to the research

7, Rights:- Participation for this study is fully voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits which you otherwise are entitled. You do not have to answer any question that you do not want to answer

8, Contact address:- If there are any question or inquires any time about the study or procedures, please contact principal investigator, Damto Bachiru at mobile phone 0912858346 and Email damtobachiru29@gmail.com as well as contact address of the responsible Ethics Review Committee (ERC) at office phone 0576611079 or P.O. Box: 395, Nekemte, Ethiopia.

9. Declaration of informed voluntary consent:

I have read/ was read to me/ the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study with my initials (signature).

Name and signature of participant: _____ Date _____

Name and signature of Data Collector: _____ Date _____

9.2. Data collection tool (questionnaire)

Part i			
Socio-demographic characteristics of respondent			
S. No.	Question	Response categories	Skip to
	Code <u>NO</u>	_____	
1	Kebele (lower residence)	_____	
2	Mother's/caregiver's age (in complete year)	_____	
3	What is your current marital status?	1. Married 2. Divorced 3. Windowed	
4	Ethnicity	1. Oromo 2. Amhara 3. Others _____ specefy	
5	What is your religion?	1. Orthodox 2. Muslim 3. Protestant 4. Other _____	
6	What is your current educational status	1. No formal education 2. Primary (Grade 1-8) 3. Secondary & above)	
7.	What is your occupation?	1. Farmer /House wife 2. Merchant/ Private employment 3. Government employee	
8	Family size (Number)	_____	

No	Question	Response	
9	Family monthly income in Birr for Government NGO employee/merchant		
	Income from farm Annually in kuntal for farmer/ house wife		
	Wheat	_____	
	Barley	_____	
	Teff	_____	

	Others	_____	
10	Age of child	_____	
11	Sex of Child	1. Male 2. Female	
12	Total number of children ever born by mother		
13	Birth order of the child	_____	
Part ii	Maternal and child service utilization related question		
14	Have you attended ANC during your pregnancy? For index child	1. Yes 2. No	If no skip to q.no16
15	If yes for above Q, how many times did you attend?	1. 1st visit only 2. 2nd visit 3. 3rd visit - 4th visit	
16	Have you ever been vaccinated TT?	1.Yes 2.No	If no skip to no 18
17	If yes, for the above Q how many times	_____	
18	Where did you deliver your last baby?	1. At home 2. At health institution	
19	Have you visited PNC visit? For index child	1.Yes 2.No	If no, skip to q no 22
20	If yes how many times?	1. 1st checkup only 2. Two and above	
21	Was your child sick during first(PENTA3, PCV3) vaccination ??	1.Yes 2. No	
22	Have you missed your child measles vaccination do to fear of side effect	1. Yes 2. No	

Part iii	Maternal/Caretaker's knowledge related question		
No	Question	Response	
23	Have you heard about measles immunization	1. Yes 2. No	
24	Have you Heard about MCV2 vaccination?	1. Yes 2. No	
25	Did you know about schedule of MCV 2?	1. Yes 2. No	If no pass to qn26
26	if yes for q.no 25, at what months of age your child's get MCV2?	1. At 15 to 18 months 2. At 9 to 12 months	

27	Are you aware on the need for measles second dose?	1. Yes 2. No	
28	If person responded Yes to question number 21, What are the benefits of immunization the child with MCV2?	1. Protect children who remained unprotected after the first dose. 2. Control epidemic 3. Both	
29	Does measles vaccination have side reaction	1. Yes 2. No	
30	What are the side reactions of measles vaccination?	1. Fever 2. Pain 3. Vomiting	
31	How do you know whether or not your child completed the immunization schedule for MCV	1. By reviewing card 2. By asking HEW 3. Have no means to know	

Part iv	Facility(Serves accessibility) related determinant		
32	Is there Presence of HEW s in the kebele	1.Yes 2.No	If no pass to qno34
33	If to q32 yes ,HEW's visited your home	1.Yes 2.No	
34	How frequent your house visited by HEW	1. Monthly 2. Every two month 3. Quarterly	
35	Had you counseled on MCV2 vaccination	1.Yes 2.No	
36	Is there accessible vaccination site to your residing area?	1.Yes 2.No	
37	If yes for q 36 what is available vaccination site in your area	1. Health Canter 2. HP 3. Outreach	
38	Travel time to Nearest Vaccine site (in walk time)	1. < 30 min 2. >= 30 min	
39	Do you ever gone to vaccinate your child's for MCV2	1. Yes 2. No	
40	Did your child's have immunized for MCV2?	1.Yes by card 2. Yes by mothers' verbal reports 3. No	
41	For how long did you waited to vaccinate you child at vaccination provider site	1. <30 min 2. 30 – 60 min 3. >one hour	
42	Is there any cancelation or postponed of vaccine schedule?	1.Yes 2.No	
43	Did you ever return without	1.Yes 2.No	

	getting vaccine?		
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44, Check for vaccination status in the immunization card and tick where appropriate

Vaccine	Received	
	Yes	No
OPV3		
PENTA 3		
PCV3		
MCV1		
MCV2		

9.3. Information sheet and informed voluntary consent for mother/caretaker of study participant (Afan Oromo version).

Akkam jirtuu? Maqaan kiyya _____/qorannaa hawaasa kana keessatti Obbo Daamxoo Baaciruu tiin geggeefamaa jiru, kana keessatti gaheen kiyya ragaaa sassaabuu yoo ta'u, Obbo Daamxoon baruumsa isaa kan digrii lammaffaa Dippartimentii fayyaa Hawaasaa Yuuniveristii Wallaggaatti Inistitiyuutii Saayisii fayyaatti Dippartimentii Fayyaa Hawaasaa damee Epidemiology tiin barachaaa jiraniif qo'annaa kana geggeessu. Kanaafuu haala qo'annaa kanaaf, qonnichaaf filatamuu kessan siniif ibsuufin deema waan ta'eef yeroo keessan akka naaf kennitan kabajaan sin gaafadha.

Mata dureen qorannoo kanaa: Harcaatii fi Hudhaalee harcaatii talaallii dhibee shiftoo marsaa lammaffaa daa'imman umrii baatii 15-24 jiran akka aanaa Sibuu Sireetti adda baasuudha.

Barbaachisummaa Qorannoo Kanaa: Bu'aa qorannoo kanaan hudhaalee harcaatii talaallii daa'imman umrii baatii 15-24 jiran biratti mul'atu akka aanaa Sibuu Sireetti adda baasuu yoo ta'u, hudhaalee adda bahan irratti karoorfame hojjechuun du'aatii fi miidhama gama hanqina talaallii tiin dhufu hambisuuf gargaara , gama biroon kaayyoon qorannoo kanaan qorataan kun baruumsa digrii lammaffaa sagantaa epidimooloojjidhaan akka xumuratuuf isa gargaara.

Adeemsa fi yeroo qorannoo kanaa: Gaaffilee qorannoo kanaaf barbaachisan isinin gaafadha, kanaaf gaaffileen 44 kanan isin gaafadhuuf deebisaa naaf kennitu. Kunis hanga daqiiqaa ja'atamaa fudhachuu danda'a. Kanaafuu yeroo keessan irraa yeroo jedhame kana akka naaf kennitan fedha keessan gaafadha.

Miidhaa fi Bu'aa qorannoo Kanaa: Qorannoo kana keessatti hirmaachuun miidhaan dhaqabuu baay'ee xiqqaadha. Kunis yeroo kessan irraa sa'a tokko fudhachuu qofa. Haa ta'u malee Bu'aa qorannoo kanaan naannoo kana irratti karoora fuula duraaf rakkoo addaan bahan ittiin furan ni argamsiisa.

Iccitii: Odeeffannoon isin nuuf kennitan icciitiin isaa ni eegama. Akkasumas bu'aan qorannoo akka waliigalaatti kan ibsamu malee yaada nama dhuunfaan kan ibsinu miti. Gaaffii gaafatamtu irratti maqaan kee koodiin kan ibsamu ta'a.

Mirga gaafatamaa: Qorannoo kana keessatti hirmaachuun fedhakee irratti hundaa’a. Hirmaachuu dhiisuus ni dandeessa. Yoo hirmaattes gaaffii deebisuu fedha hin qabne dhiisuu ni dandeessa.

Gaaffii ykn odeeffannoo dabalataaf:-

Daamxoo Baaciruu Email; damtobachiru29@gmail.com, Bilb; 0912858346 Akkasumas koree seera qorannoo fayyaa irratti xinxaalaa gaggeessan (ERC) Bilbila 0576611079 Saanduqa poostaa 395, Naqamtee, Karaalee kanaan yaada keessan dhiyeessu ni dandeessu.

Ibsa waliigaltee Hirmaannaa fedhii irratti hundaa’e :- Waa’ee qorannoo kanaa ilaalchisee barbaachisummaa qorannaa kanaa, faayidaa, haala kamiin akka gaggeeffamu fi hirmaannaa kana keessatti icciitiin odeeffannoo ani kennuu eegamaa akka ta’e fi deebii deebisuuf fedha hin qabne dhiisuu akkan danda’u fi carraan waanan gaafachuu fedhu gaafachuu akkan danda’u hubadhee fedhii kootii qorannoo kana keessatti hirmaachuuf mallattoo koon nan mirkaneessa.

Maqaa fi Mallattoo gaafatamaa _____, _____ Guyyaa _____

Maqaa fi mallattoo nama gaafatee _____, _____ Guyyaa _____

Galatoomaa !

9.4. Data collection tool (questionnaire) Afaan Oromoo version

Toora	Gaafillee Ragaalee bu'uraa matii daa'imaatiin walqabatan		
Lakk	Gaaffii	Deebii	Ce'umsa gara fuula
	Lakk. Koodii		
1	Bakka Jireenyaa		
2	Umriin kee (Haadha ykn Tajaajiltuu) waggaa Meeqa?	Waggaa_____	
3	Haala fuudhaa fi heerumaa kee naaf ibsi.(Filannoo dubbisiif)	1. Kan heerumte 2. Kan adda bahan 3. Kan irraa du'e	
4	Sanyii dhalootaa?	1. Oromoo 2. Amhaaraa 3. Kanbiroo...	
5	Amantiin kee Maalii?	1. Ortodooksii 2. Musliima 3. Pirotestaantii 4. Kanbiroo...	
6	Sadarkaan barnootaa kee (Haadhaa/Tajaajiltuu) hangamii?	1. Baruumsa idilee hin qabu 2. Sadarkaa 1ffaa (Kutaa 1- 8) 3. Sadarkaa 2ffaa fi isa ol	
7	Hojaan kee (Haadhaa / Tajaajiltuu) maalii?	1. Qotee bulaa/ Haadha manaa 2. Daldaaltuu4.Hojii dhunfaa 3. Hojjettuu mootummaa	
8	Baay'ina maatii (lakkoofsan)		

Lakk	Gaaffii	Deebii	
9	Galii ji'aa, kan maatii Maallaqaan	_____	
	Galii waantoota adda addaarraa argamu (Qonnarraa waggaatti hangam argattuu?(Kuntaalan		
	Qamadii		
	Garbuu		
	Xaafii		
	Kannen biro ibsi		
10	Saala Daa'ima?	1 Dhi 2. Dha	
11	Umrii Daa'imaaa ji'aan?	_____	
12	Baay'inni daa'imman haati		

	mucaa/ttii kanaa deesse meeqaa?		
13	Mucaan kee daa'ima meeqaffaadhaa?		
Toora ii	Gaaffii haala itti fayyadama fayyaa hadholee fi daa'immaniin walqabatu		
14	Yeroo daa.ima kana ulfa turtetti tajajila Da'umsa duraa ni hordofta turtee?	1. Eeyyee 2. lakkii	Yoo lakki ta'e gara gaaffii 16ffaa darbi
15	Yoo gaffi 14n eeyyee ta'e yeroo meeqaaf?	1. Yeroo tokko 2. Yeroo lama 3. Yeroo 3 - afuri	
16	Talallii dhibee manjjalloo(TT) fudhateetaa?	1. Eyyee 2. Lakkii	Yoo lakki ta'e gara gaaffii 18ffaa darbi
17	Gaffii 6 yoo eeyyee ta'e yeroo meeqaaf?		
18	Daa'ima kana eessatti deessee?	1. Manattiin da'e 2. Mana yaalattin da'e	
19	Yeroo mucaa/mucatii kana deesse sana ta jaajila da'umsa booda hordoftee jirtaa?	1.Eeyyee 2.Lakkii	Yoo lakki ta'e gara gaaffii 21ffaa darbi
20	Gaaffii 19n yoo eeyyee ta'e , yeroo meeqaaaf fudhatee turte	-----	
21	Da.imni kee guyyaa beellama talalii dhibee shiftoo fudhatutti dhibemtee /dhibamee beekaaa?	1. Eeyyee 2. Lakkiii	
22	Daa'ima kee sababa talaliin shifto midha qaba jedhuun osoo hin talaalchisin haftee beektaa?	1. Eeyyee 2. Lakkiii	

Toora iii	Gaaffii hubano haati/kununsituun daa'ima talaalii dhibee shiftoo irrati qabdu		
No	Gaaffii	Deebiii	
23	Wa'ee talaalii dhibee shiftoo /waan dhageessee/ beektu jiraaa?	1. eeyyee 2.lakkii	
24	Waa'ee talaalii dhibee shiftoo	1. eeyyee 2.lakkii	

	marsaa lammaffaa(MCV2) hoo hubannaa qabdaa ?		
25	Sagantaa/yeroo(schedule)talaalliin dhibee shiftoo marsaa lammaffaa(MCV2) itti kennamu beektaa ?	1. eeyyee 2.lakkii	
26	Gaaffii 24n, yoo eeyyee ta'e, yeroo daa'imni umrii ji'a(age in months) meeqa ta'e talaalliin dhibee shiftoo marsaa lammaffaa(MCV2) kenamaaf ?	1. umrii daa'ima Ji'a 15 hang ji'a 18 yoo ta'u 2, umrii daa'ima Ji'a 9 hang ji'a 12 yoo ta'u	
27	Waa'ee barbaachisummaa talaallii dhibee shiftoo marsaa lammaffaa(MCV2) irratti hubannaa qabdaa?	1. eeyyee 2.lakkii	lakkii yoo ta'e gaaffii 29tii darbi
28	Gaaffii 26ffaan deebiin isaa eeyyee yoo ta'e bu'aan talaalliin shiftoo marsaa lammaffaa (MCV2) daa'imaaf qabu maali?	1. Daa'imni gutumaan guutuu dhibee shiftoon akka hinqabamne gargaara 2. weerarri shiftoo akka hin kaaneef gargaara 3. lamaanuu	
29	Daa'imni kee talaallii dhibee shiftoo fudhatee fixuu isaa akkamiin beektaa?	1.kardii laaluudhaan 2,hojjetuu hojjetuu ekstenshinii fayyaa gaafachuun 3 .beekuun hin danda'amu	
30	Taallalliin dhibee shiftoo rakkoo fayyaa moogaa(side effect) daa'ima irratti ni fidaa ?	1. eeyyee 2.laakii	
31	Yoo gaaffii 29ffaan deebiin eeyyee ta'e rakkoo fayyaa moogaa(side effect) daa'ima irratti fidu maali ?	1. ni hoo'isa 2. dhukkubii 3. ni haqisiisa	

Toora	Gaafilee argamu tajaa jila talaalii wajiin walqabatan
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iv			
	Gaaffii	Deebii	dherbi
32	Ganda keessan keessa hojjettoon eksteenshiinii fayyaa ni jiruu?	1.eeyyee 2.lakkii	Yoo lakki ta'e gara gaaffii 33ffaa darbi
33	Yoo deebiin gaaffii 31n eeyyee ta'e hordoffii manaa manaa sinif godhuu turee?	1.eeyyee 2.lakkiii	
34	Yoo gaaffiin 32 eeyyee ta'e yeroo meeqa meeqa	1 ji'a ji'a 2.ji'a lama laman 3 kurmanan	
35	Hojjetooni ekstenshiniin fayyaaa Hubannoo t allaallii shiftoo marassaa lamaaffaaa(MCV 2) irratti hubanoo siniif kennanii 2.lakkiii ture?	1.eeyyee 2.lakkiii	
36	Naannoo jireenyaa keetii iddoon talaalliin itti kennamuu jiraa ?	1.eeyyee 2.lakkii	Yoo lakki ta'e gara gaaffii 36ffaa darbi
37	I Yoo deebiin gaaffii 34n eeyyee ta'e talaaliin nannoo keetitti eessatti kennama?	1 Buffata fayyaa 2 keellaa fayyaa 3 Outreach	
38	Iddoo talaalii sitti dhihaatu bira gahuuf sa'aatii/daqiiqa meeqa sitti fudhata?	1. < 30 2. daqiiqaa 30 oli	
39	Da'ima kee talaalii dhibee shiftoo marsaa lammaffaa (MCV 2) talaalchiisuuf deemtee turtee?	1. eeyyee 2. lakkii	
40	Da'imni kee talaalii dhibee shiftoo marsaa lammaffaa (MCV 2) dhaaf talaalamee jiraa?	1.eeyyee kaardii illaaluun 2.eeyyee deebii haati kennitu 3. l;akkii	

41	Yoo deebiin gaaffii 39ffaa deebiin waan yeroo dheeraa iddoo talaalli turuuf ta’e , talaallii argachuuf hangam Buufata turtu?	1.daqqiiqaa 15 – 30 2. daqqiiqaa 30 – 60 3. Sa’a tokkoo oli	
42	Yeroo itti sagantan(schedule) talaalii akk keellaa fayyaatti jijjirame/haqamee jiraa?	1.eyyee 2.lakkii	
43	Yeroon qoricha talaalii shiftoo dhabdee daa’immaa kee osoo hin talaalchisin deebite jiraa?	1.eeyyee 2.lakkii	

44. Kaardii talaalii daa'immaa lalun gabatee arman gadii irratti gosa talaalli eramee qofa guuti

Gosa talaalii	Fudhatee/tee jiraa/jirti	
	Eeyyee	lakkii
OPV3		
Pant3		
PCV3		
MCV1		
MCV2		