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Measles Second Dose Vaccine Uptake and Determinants among 15–23 Month Old Children at Bahir Dar, Northwest Ethiopia

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ABSTRACT

Background & aim: Measles is a highly infectious disease and can cause lifelong complications and death. Most studies focused on children who received a first dose measles vaccine rather than second doses. Therefore, this study aimed to determine second dose measles vaccine uptake proportion and its associated factors among children aged 15–23 months in Bahir Dar, Northwest Ethiopia.

Methods: A community-based cross-sectional study was employed from September 20 to November 25, 2022. A multi-stage cluster sampling technique was applied to select 633 children aged 15 to 23 months. Data were collected through face-to-face interviews using a structured questionnaires. Data were entered into Epidata version 3.1 and univariate and multivariate binary logistic regressions were carried out.

Results: The study revealed that the proportion of second dose measles vaccine uptake was 53.08%. Having parents who were primary guardians (AOR=1.54,CI,95%(1.05, 2.27), antenatal care visit (AOR=1.97 CI, 95%(1.26, 3.07), child delivery at health facility (AOR=1.66, 95%CI: 1.14, 2.42), no child illness in previous vaccination time (AOR=1.53, 95%CI: 1.07, 2.18), and no long waiting time at the vaccination site (AOR= 2.54, 95%CI: 1.05, 2.21) were identified as determinants of measles second dose vaccine uptake.

Conclusion: The measles-containing second-dose vaccine uptake was low. Children with parents as primary guardians, having antenatal care follow-up, health facility child delivery, absence of child illness during previous vaccination, and short waiting time were determinants. The findings suggests that increasing maternal antenatal care visits and encouraging women to give birth in a health institution would increase MCV2 vaccine uptake.

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Introduction

Measles is a highly infectious disease and can cause lifelong complications and death (1-2) Despite its highly contagious, measles can be prevented by vaccines (1). A vaccine is a biological substance intended to stimulate the body to produce antibodies against specific infectious diseases by activating changes in the immune system (3).

Globally, due to measles infections annually, 60,000 were causes blindness and more than two million deaths (4). According to reports children mortality due to measles has increased from 89,780 in 2016 to 207,500 in 2019 (5) and case fatality in low-income countries range case fatality rate between 0.05% and 6% (6). It has lifelong complications and illness (7). The illness presents with fever, cough, and conjunctivitis before progressing to the classic rash after 2–4

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days (8). Complications are more common in the very young and include otitis media, pneumonia, diarrhea, keratitis, and encephalitis (8, 9). To avert this high child mortality due to measles, the plan stresses the importance of strong routine immunization systems that provide whole doses of measles vaccine, supplemented by campaigns, laboratory-backed surveillance, outbreak preparedness, and case management, as well as research development (10).

Although national immunization programs has recommended to routine immunization schedule (11), national immunization MCV1 has been achieved (80%) and MCV2 (67.8%) in 2019 in globally (12). According African study, the prevalence of MCV2 coverage varied from 36% to 94% (13) due to high dropout rates (14). Even though, strong routine immunization systems plan, estimating the magnitude of measles deaths is problematic (15) and large drop-out rates in most countries (16) which showed that ranging from 2.9% to 52.9% in Ethiopia (17). For measles elimination, vaccination coverage needs to reach at or exceed 95% with each of the two doses of MCV at the district and national levels (18). To eliminate this vaccine-preventable disease reaching every district strategic approach is recast as the "reaching every child or community strategic approach were adopted (19). National immunization programs must improve the implementation of MCV2 using the standard introduction and evaluation guidelines available for EPI program planning (20).

Some factors attributed for low second dose measles vaccine uptake were child illness, waiting time, maternal education, fear of side effects, poor attitude about the potency of the vaccine, and the beliefs and perceptions of healthcare providers (21-23). Most of the studies in developing countries, including Ethiopia, focused on children who had MCV1 but not MCV2 and associated factors. Therefore, this study aimed to determine measles second dose vaccine uptake proportion and its associated factors among children aged 15–23 months at Bahir Dar, Northwest Ethiopia.

Materials and Methods

A community-based cross-sectional study was conducted from September 20 to November 25, 2022 in Bahir Dar City. The city is the administrative center of Amhara Regional State and is 560 kilometers away from Addis Ababa, the capital city of Ethiopia. It has nine sub-cities and 22 kebele (the lowest administrative units in Ethiopia), ten public health facilities and three public hospitals. All these health facilities offer immunization services. According to Bahir Dar city health office administration, in the catchment population, there are currently 332,856 children aged less than 2 years.

The source of population was all children aged 15 to 23 months who lived in Bahir Dar city, while all children aged 15 to 23 months who lived in the selected kebeles in Bahir Dar city during the data collection period were study populations. Children who aged 15–23 months and permanently resided in the Bahir Dar city were included and children aged 15–23 months who didn't get their first dose of MCV1 vaccine were excluded.

The study participants were determined by taking 50% proportions. The percentage of the second dose is 50% the confidence level was 95%, Za/2 is 1.96, margin of error is 5%, non-response rate was10%, and design effect was 1.5. $n = (za/2)^2/d^2=384$. Adding a 10% non-responder rate and multiplying by 1.5, final sample size was 633.

A multi-stage cluster sampling method was used to select sub-cities and households in the selected sub-cities. From a total of nine sub-cities, three (Belayzeleke, Tana, and Fasilo) was selected randomly using a lottery method, considering the representativeness of the sample and logistical considerations. Then respondents in each of the sub-cities were allocated proportionally. Lastly, study participants selected using a simple random sampling technique. Study participants were interviewed until the allocated sample was reached.

Data collection tools were adopted from different related literatures (24-25). The questionnaire consisted of two parts: (1) Socio-demographic variables, institutional-related, and child vaccination status data variables, 2) vaccination caregivers' vaccination cards, (3) MCV2 status and related questions were asked to parents/caretakers and then confirmed with the record in their vaccination card. Only

written vaccination records were included in the data collection. Four bachelor degree holders in midwifery for data collection and one master's degree older in clinical midwifery for supervisor were engaged in the data collection process. To ensure a common understanding, one-day training was given to both the data collectors and the supervisor regarding the objective of the study, the data collection process, and how to maintain confidentiality. Children's age were confirmed with the mother and child health book. Other variables were asked of parents/caregivers, thus there might have been recall bias in the survey. All processes involved in the study strictly followed standard operating procedures. A pretest was done on 5% of the questionnaires at Zenzelima Town by the principal investigator, supervisors, and data collectors before real data collection. Appropriate measures and corrections were taken on time by supervisors and investigators. Moreover, the tool's reliability was checked for its internal consistency with a Cronbach's (α) test, 0.802 for proportion of knowledge and practice, respectively. Multicollinearity was also checked by using a standard error and variance inflation factor to see the linear correlation between the independent variables. Variables with a standard error of >2 and a variance inflation factor (VIF) with a Cronbach's (α) test, 0.802 for proportion of MCV2. Moreover, Hosmer Lemeshow goodness of fit test was used to check for model fitness by looking at the cut point p-value > 0.05.

Data completeness checked and cleaned up manually before being entered into the software. Then, data entered into the software Epidata version 3.1 and exported to univariate and multivariate binary logistic regressions analyses for further analysis. Descriptive statistics presented like texts and tables. The proportion of MCV2 vaccination uptake among children aged 15–23 months was determined by categorical variables. A binary logistic regression was fitted to determine the association between dependent and independent variables. Variables with a p-value of <0.2 during univariate analysis were included in multivariable regression to assess the effect of independent variables on dependent variables. Finally, in the multivariable analysis, variables with a p-value less than 0.05 were considered statistically significant.

Results

Socio-demographic variables revealed that 633 children participated in the study, with a response rate of 100%. The mean age of participants was 20.69 months ± 1.70(SD). More than half (52.4%) of the children were male. Among the study participants, almost two-thirds (75.67%) were orthodox. Most of the children (75.51%) had parents as primary guardians, and most of their mothers (80.25%) were married. About 43.13% of their mothers were employed and 36.02% of the study participants attended primary school (Table 1).

Access to health facility

Among all study participants, 81.99% of them had an ANC contact, 81.36% had a travel distance between 30 and 90 minutes from a nearby health institution, and 70.77% had delivered their children in a health facility (Table 2).

Proportion of MCV2 coverage

The proportion of MCV2 vaccination uptake among children aged 15–23 months was found to be 53.08 % (95% CI: 49.3%–57.2%). Among (633) study participants, 58.93% of them had information about MCV2, and 63.28% of study participants had vaccinated their children below the age of 18 months. About 57.19% of the study participants believed that immunization was safe for children.

Factors associated with the proportion of MCV2

Variables were computed in univariate and multivariable logistic regression analysis to identify association. In univariate analysis, maternal age, primary guardians, prenatal care visit (PNC) visit, information about the second dose of measles vaccine, place of child delivery, fear of side effects of the vaccine, lack of awareness about contraindications, vaccine availability, child illness during previous vaccination, and waiting time were associated with a proportion of MCV2 coverage.

Table 1. Frequency distribution of socio-demographic variables among 15–23-month old children in Bahir Dar City, Ethiopia, 2022 (N = 633)

Category	Frequency (%)
Sex	
Female	301 (47.55)
Male	332 (52.45)
Age	
Mean = 20.69036 SD= 1.702247	
Marital status	
Single	82 (12.95)
Married	508 (80.25)
Divorced	29 (4.58)
Widowed	14 (2.21)
Religion	
Orthodox	479 (75.67)
Muslim	134 (21.17)
Protestant	11 (1.74)
Others	9 (1.42)
Mother's educational level	
Unable to read and write	92 (14.53)
Able to read and write	219 (34.60)
Primary school	228 (36.02)
Secondary school	83 (13.11)
Higher education	11 (1.74)
Mother's occupation	
Housewife/unemployed	253 (39.97)
Employed	273 (43.13)
Trader	61 (9.64)
Others	46 (7.27)
Father's educational level	
Unable to read and write	124 (19.59)
Able to read and write	210 (33.18)
Primary school	91 (14.38)
Secondary school	197 (31.12)
Higher education	11 (1.74)
Father's occupation	
Unemployed	127 (20.06)
Gov't employed	239 (37.76)
Merchant	154 (24.33)
Farmer	107 (16.90)
Others	6 (0.95)
Average monthly income	
≤1500 Ethiopian Birr	41 (6.48)
>1500 Ethiopian Birr	592 (93.52)
Family size	
2-3	320 (50.55)
>3	313 (49.45)

Table 2. Frequency distribution of access to health facility related factors among 15-23-year-old children in Bahir Dar City, Ethiopia, 2022 (n = 633)

Category	Frequency (%)
Delivery place	
Home	185 (29.23)
Health facility	448 (70.77)
Travelling time to a health facility	
<30 minutes	515 (81.36)
≥30 minutes	118 (18.64)
ANC contact	
No	114 (18.01)
Yes	519 (81.99)
PNC visit	
Yes	479 (75.67)
No	154 (24.33)

Table 3. Frequency distribution of measles vaccination coverage-related factors of the mother or guardian of children aged 15–23 in Bahir Dar City, Ethiopia, 2022 (n = 633)

Category	Frequency (%)
Information about 2nd dose measles vaccine	
Yes	373 (58.93)
No	260 (41.07)
MCV2 vaccination time	
Below 18 months	212 (63.28)
Between 18- 23 months	124 (35.22)
MCV2 vaccination place	
Home	242 (38.23)
Social gathering	391 (61.77)
Unaware of need to return for 2nd dose	
Yes	318 (50.24)
No	315 (49.76)
Fear of side effects	
Yes	251 (39.65)
No	382 (60.35)
Mother too busy	
Yes	309 (48.820
No	324 (51.18)
Family problem(illness of mother)	
Yes	290 (45.81)
No	343 (54.19)
Child ill–not brought	
Yes	337 (53.240
No	296 (46.76)
Long waiting time	
Yes	398 (62.88)
No	235 (37.12)
Believing vaccine safe for children	
Yes	362 (57.19)
No	271 (42.81)

After controlling the confounding effect of the variables in the multivariable analysis guardians of the child, ANC contacts, delivery place of the index child, illness during previous vaccination, and waiting time for vaccine were significantly

associated with MCV2 with a p- value of less than 0.05. According to this, children who had parents as primary guardians were 1.54 times more likely to have MCV2 coverage as compared to children who had grandparents as primary guardians (AOR=1.54, 95% (1.05, 2.27). Children who had antenatal care follow-up were 1.97 times more likely to have MCV2 vaccine uptake (AOR = 1.97, 95 %(1.26, 3.07)). Similarly, children who had a history of child delivery at health facility were 1.66 times more likely to have MCV2 vaccine uptake (AOR = 1.66, 95% CI; 1.14,2.42), children who had not been ill during previous vaccination were 1.53 times more likely to have MCV2 vaccine uptake (AOR = 1.53, 95% CI; 1.07,2.18), and children who had no long waiting time were 2.54 times more likely to have it (AOR = 2.54, 95%1.05,2.21) (Table 4).

Table 4. Univariate and multivariate regression analysis of determinants among children aged 15–23 months in Bahir Dar city, Ethiopia, 2022 (n = 633)

Variables	MCV2 vaccinated		COR(95%CI)	AOR(95%CI)	P-value
	Yes	No			
Maternal age					
35- 43 year	147	98	1.57 (1.14, 2.18)	1.69 (0.98, 1.39)	0.123
<35 year	189	199	1.00	1.00	
Primary guardians					
Parent	270	209	1.72 (1.19, 2.48)	1.54 (1.05, 2.27)	0.027
Grandparent	66	88	1.00	1.00	
Antenatal care contact					
Yes	293	226	2.14 (1.41, 3.24)	1.97 (1.26, 3.07)	0.003
No	43	71	1.00	1.00	
Delivery place					
Health facility	261	187	2.04 (1.44, 2.90)	1.66 (1.14, 2.42)	0.008
Home	75	110	1.00	1.00	
Postnatal care visit (<6 hrs)					
Yes	301	169	3.03(2.08,5.42)	1.75 (0.97,1.21	0.059
No	57	97	1.00	1.00	
Child illness during previous vaccination					
No	183	113	1.94 (1.41, 2.67)	1.53 (1.07, 2.18)	0.017
Yes	153	184	1.00	1.00	
Side effect fear					
No	202	180	1.00	1.00	
Yes	198	53	3.3(3.02,5.03	1.9 (0.89,2.20)	0.056
Long waiting time			1.00	1.00	
No	150	85	2.01 (1.26, 2.45)	2.54 (1.05, 2.21)	0.020
Yes	186	212	1.00	1.00	

1.00= reference, significant at p-value -<0.05

Discussion

This study aimed to determine the proportion of MCV2 vaccine uptake and its predictors among children aged 18–23 months in Bahir Dar, Northwest Ethiopia. The findings showed that the proportion of MCV2 vaccine uptake among children aged 18–23 months was 53.08%. This study is in line with the studies conducted in Kenya (56.2%) (26), Ethiopia (58.5%) (27) and Tanzania (55.8%) (28). However, the finding of this study was higher than other studies conducted in Kenya (22.1% to 45%) (29-30) . This discrepancy might be due to the difference in sampling technique (multistage cluster sampling), the difference in study setting (community-based study), difference in sociocultural issues and differences in the health care system. Also, this improvement is likely a result of implementing routine vaccination practice and may result from carrying out outreach vaccination activities in coordination with the local community in areas with topography difficulties and long distance (take > 30 minutes to the health facilities.

This result is also lower than the studies done in Algeria (95%) (17), Malawi (81% (29), China (68.2%) (31), and from the WHO recommendation for MCV2 (>95%) coverage to eliminate measles. These discrepancies might be due to the difference in study setting (community-based), caregiver negligence, logistical problems, and a low level of mothers' knowledge towards important of vaccination.

This study showed that a child who had a parent as a primary guardian was 1.54 times more likely to have MCV2 coverage as compared to a child who had grandparents as a primary guardian. This association is supported with the study conducted in Kenya (32). This might be due to grandparents being less likely to make informed decisions regarding the vaccination of their children due to the fear of side effects. The finding of this study revealed that children who had ANC contact were 1.97 times more likely to have high MCV2 vaccine uptake coverage as compared to children who had no ANC contact. This association is complemented with the study conducted in Afar, Ethiopia (33). It might be when study participants have ANC contact; they got more information about the importance of vaccination during care. It might also represent health- seeking behavior, and women who seek to see a healthcare professional for follow-up might be more likely to seek care for their child later. Children who had a maternal health facility delivery history were 1.66 times more likely to have high MCV2 vaccine coverage as compared to who had history of home. This association in line with the study conducted in the Somali National Regional State, Ethiopia (34) and Abobo District, South West Ethiopia(35) . A possible explanation for this finding might be that mothers who gave birth in health facilities would have communication with health professionals and contacts to know about next immunization schedule at postnatal periods.

According to illness status, children who had not been ill during previous vaccination coverage were 1.53 times more likely to have MCV2 uptake as compared to children who had been ill during previous vaccination. This is in line with the study done in Abobo District, Southwest, Ethiopia (35) and Minjar-Shenkora District, Ethiopia (36). This might be the viral containing vaccine like measles has more side effects and they considered as child illness. For this reason, mothers were postponed on the schedule of their last immunization date by the service provider and were more likely to drop out.

Finally, finding of this study revealed that mothers who had not long waiting time at health facility were 2.54 times more likely to have high MCV2 vaccine coverage as compared to mothers who had a long waiting time during vaccination This is in line with the study done in Abobo District, Southwest Ethiopia (35). This might be because if mothers wait for a short time, it motivates the accumulation of the last immunization schedule next time and healthcare providers may not postpone the immunization schedule and decrease the MCV2 dropout rate.

The study included a report on vaccination status based on the presence of the maternal and child healthcare booklet or vaccination card and a verbal report by the caregiver, which may have introduced recall bias.

Conclusion

MCV2 vaccine uptake among children aged 18–23 months was low. Parents being primary guardians, having ANC contact, health facility delivery of the index child, absence of a child illness during previous vaccination, and no long waiting time were positively associated with the proportion of MCV2 vaccine uptake. The finding suggests increasing maternal ANC contact and encouraging women to give birth in a health institution would increase MCV2 vaccine uptake.

Declarations

Acknowledgments

We acknowledge participants, data collectors, supervisors, and health facility manager of health centers.

Conflicts of interest

The authors declared no conflicts of interest.

Ethical Considerations

Ethical clearance was obtained from the ethical review committee University of Gondar (IPH/2275/2014). In order to obtain a permission letter, we contacted the head of Bahir Dar city health office administration. Then

the health office staff were informed about the purpose of the study, the importance of their participation, and that they could withdraw at any time. Written consent was obtained from study subjects prior to data collection.

Code of Ethics

The privacy and confidentiality of the information given by each respondent were maintained properly, and names were not recorded.

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Authors' contribution

AMZ and YAF contributed substantially in the conception and design of the study. YAG and GWA carried out the data collection. AMZ, YAF AND YAF analyzed and interpreted the data. AMZ drafted the manuscript. WCT reviewed the manuscript critically for important intellectual content. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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