

# Factors Influencing Fully Vaccination Coverage among Children Aged 12 to 23 Months in Debre Markos Town, Amhara Region, Ethiopia, 2018

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## Abstract

**Introduction:** One of the most important and cost-effective public health interventions to reduce child mortality and morbidity is vaccination. Despite a continued global effort in providing vaccinations, there are still cases of inadequate vaccination coverage especially in low-income countries. With the high under-five mortality in Ethiopia (67 deaths per 1,000 live births), only 38.5% of the children (12 to 23 months) had received all the recommended vaccines. Hence, the purpose of this study was to assess factors influencing fully vaccination coverage among children aged 12 to 23 months in Debre Markos town.

**Methods:** A community based cross-sectional study was employed among 389 children aged 12-23 months in Debre Markos town from January 1, 2018 to February 1, 2018. Systematic random sampling technique was used to select the study participants. Data was collected using face to face interviewer administered structured questionnaires. Then, the collected data was entered, coded and cleaned into EPI Data version 3.1 and exported to SPSS version 20.0 for data analysis. Bivariate and multivariate logistic regression was done to assess the association of factors with full vaccination coverage. Adjusted odds ratios with 95% confidence intervals were calculated, and p-values<0.05 were considered to indicate statistical significance.

**Results:** This study revealed that fully vaccination coverage among children aged 12 to 23 months was 76.9%. Fully vaccination coverage was significantly associated with women's level of education (AOR=1.2, 95%CI (1.41-2.42)), place of delivery of the index child (AOR=3.28, 95%CI (1.38-3.67)), maternal knowledge on vaccine and vaccine preventable disease (AOR=4.12, 95%CI (3.0-10.6)) and ANC service utilization (AOR=5.04, 95%CI (1.35-12.06)).

**Conclusion:** Fully vaccination coverage among children aged 12 to 23 months in the studied area was low. Therefore, health extension workers should work on improvements in women's educational status, encourage mothers to have ANC follow-up and institutional delivery and they should discuss vaccination with mothers in order to improve their knowledge on vaccine preventable disease and the advantage of complete vaccination services.

**Keywords:** Vaccination • Full vaccination • Children aged 12 to 23 months

## Introduction

One of the most important and cost-effective public health interventions to reduce child mortality and morbidity is vaccination [1]. Existing evidences showed that children who receive all appropriate vaccinations in each immunization schedules are less likely to die than those who do not [2]. Globally, it is estimated that as many as 2.5 million deaths among under 5 children are averted annually by vaccination against diphtheria, tetanus, pertussis, and measles. For the prevention and control of this Vaccine Preventable Diseases (VPD), improving access to and utilization of routine vaccination services as a best option is unquestionable. However, one-fifth of the world's children about 22.4 million infants are not immunized against these fatal diseases. As a result, an estimated 1.5 million children died each year from vaccine-preventable diseases [3]. Most of these preventable deaths in children occur in low and middle-income countries [4].

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Despite a continued global effort in providing vaccinations, there are still cases of inadequate vaccination coverage especially in reaching those at high risk: the poorest, most disadvantaged and remote communities. In addition, the coverage in low-income countries remains significantly below the levels in middle and high-income countries [5]. Globally, in 2016, an estimated 19.5 million infants were not reached with routine vaccination services such as DTP3 vaccine. Around 60% of these children live in 10 countries [6]. In Africa, only 71% of African infants receive the full series of three doses of the Diphtheria-Tetanus-Pertussis vaccine (DTP3). Among sub-Saharan countries surveyed, full childhood vaccination coverage varies widely from only 23% in Chad to 99% in Mauritius [7]. Although estimated global routine measles vaccination coverage reached 86% in 2016, nearly 23.2 million children were unvaccinated, of which 15.3 million (65%) resides in eight countries mainly in Africa [6].

In low-income countries, increasing access to complete vaccination service has been a primary concern of public health importance both at global and national contexts. However, meeting high and equitable coverage remains questionable in low-income countries. Despite the availability of vaccines and the efforts of governments and their partners' in Sub-Saharan Africa, mortality rate of children under the age of five years remains the highest [8].

Ethiopia is not different for this scenario in that, a substantial number of deaths and morbidities among fewer than five years of age children in the country are due to vaccine-preventable diseases.

Among others; diarrhea (18%), pneumonia (18%), measles (1%), and meningitis are the leading causes of child mortality in the country [9,10]. The under 5 years age mortality stands at 67 per 1,000 live births with a plan to reduce to 30 per 1,000 up to the year 2020 to meet sustainable development goal. In this regard, vaccination coverage will be one of the indicators to monitor the progress [10,11].

According to CDC global vaccination strategic plan, all countries should achieve at least 90% fully vaccination coverage in every district at the end of 2015 [12]. However, a nationwide Ethiopian Demographic and Health Survey (EDHS) in Ethiopia conducted in 2016 showed that only 38.5% of the children (12 to 23 months) had received all the recommended vaccines. Across regional states, fully vaccination coverage ranges from a lowest of 15.2% in Afar region to a highest of 89.2% in Addis Ababa [13]. A study conducted in Lay Armachiho District, North Gondar Zone, 2014 showed that vaccination Coverage of children aged 12-23 months based on child vaccination card was 24.9% [14]. Another study conducted in in Jigjiga district, 2014 showed that vaccination coverage of 12-23 months children based on vaccination card were 35% [15].

Many studies have shown that the factors related to full vaccination are the presence of maternal or paternal education, good economic status, less number of children within the family, presence of knowledge on vaccination, delivery at health facility, presence of post natal visits of mothers, and living in urban area. Also studies have shown that children with younger mothers, children of mothers with no formal education, children whose mothers were unemployed, children of mothers with no health seeking behavior, and those who lived in rural areas were more likely to be not fully vaccinated [16-23].

The actual routine vaccination coverage in the study area was unknown because there was no an organized health recording system and no previous study to documented it. On the other hand, the factors associated with failure to realize full immunization were not well investigated. Therefore, this study was undertaken to fill this gap by providing insights into vaccination coverage level and factors associated with childhood vaccination in the district. The study will inform the district health management team, policy makers, funding agencies and other stakeholders on the management tools to employ for future increase in EPI services utilization and to reduce defaulter rates, increase coverage levels and finally reduce the incidence of vaccine preventable diseases in our societies. The research will set the platform for which further studies can be conducted for the purposes of improving EPI service utilization.

## Materials and Methods

### Study setting, population and design

A community based cross-sectional study was conducted in Debre Markos town from January 1, 2018 to February 1, 2018. Debre Markos is located 299 km far away from Addis Ababa, the capital city of Ethiopia and 260 km from Bahir Dar, the capital city of Amhara National Regional State. According to the town administration health office, the town has 7 kebeles with the total population of the city is estimated nearly 62,497 populations from these 11,203 of them are under two years old children. The source population comprised of all mothers/caretakers to children aged 12-23 months pair in Debre Markos town. At the household level, the mother/caretakers

were selected as the respondent. Caretaker in this study refers the most responsible person that provides care for the child that has no mother due to different reasons (death, separated from husband, and others).

### Sample size and sampling procedure

The sample size was calculated using the single population proportion formula  $n = (Z \alpha/2)^2 P(1-P)/(d^2)$ , considering the 2016 EDHS, Amhara regional vaccination coverage which was 45% [13]. The use of a 95% Confidence Interval (CI) and a 5% margin of error (d). After adding a 5% non-response, the total sample size was calculated to be 399. A systematic sampling technique was used to select participants in the study area. Of the total 7 kebeles in the town, three kebeles were selected with simple random sampling or lottery method. The list of mothers had children aged 12-23 months in each selected kebele was obtained from registration of the health post in the kebeles and served as a sampling frame. The total calculated sample size was proportionally distributed to each selected kebele based on the number of women who had children aged 12-23 months in each selected kebele. Finally, proportionally allocated respondents to each selected study kebele was selected through systematic sampling technique.

### Data collection

A structured and pre-tested questionnaire was prepared first in English and translated to the local language (Amharic), and translated back to English in order to assess its consistency. Data were collected by four medical doctor (Intern) students and one BSc nurse for supervision. Face-to-face interviews were conducted to collect the data. Mothers or caretakers were asked to show vaccination cards. For those mothers/caretakers who had no vaccination card, different appropriate questions were asked in order to determine the vaccination status of the child for each specific vaccine. In case of pentavalent and polio vaccine, the mothers were asked to report the number of pentavalent/polio vaccines that the child had received. In order to reduce recall bias for mothers/caretakers history, remainder such as site of administration (whether it is taken as injection or orally, presence of scar, and also at what age they vaccinate) was included in instruments. Data quality was checked during questionnaire designing, data collection, and data entry. The collection questionnaire was pre-tested among 5% of study subjects to the non-selected kebele of in Debre Markos town. The data collectors and supervisors were trained at district town (Debre Markos) for one day on the objectives of the study and data quality.

### Measurements

The main outcome variable of interest in this study was fully vaccination coverage. Presentation of immunization cards was one of the criteria used to justify whether the respondents had immunized their children. A child 12-23 months old was labeled as fully vaccinated if she or he had received ten basic vaccines (one dose of BCG, three doses each of the DPT-HepB-Hib (Pentavalent), three doses of polio vaccines, three doses of PCV, two doses of Rota vaccine, and one dose of measles vaccine before first birth date.

### Data processing and analysis

All returned questionnaires were checked manually for the

completeness and consistency of responses. The collected data were coded and entered in to in EPI Data version.3.1 and exported to SPSS version 20.0 for analysis. Descriptive statistics were computed for each study variables. Both bivariate and multivariate logistic regressions were used to identify factors associated with postpartum modern contraceptive use. Variables with a p-value<0.2 in the bivariate analysis were fitted into a multivariate logistic regression model to control for confounding effects. Adjusted Odds Ratios (AORs) with 95% CIs were used to identify factors associated with full vaccination coverage. The p-values less<0.05 were considered to indicate statistically significant of the associations with postpartum modern contraceptive use.

### Ethical considerations

Ethical clearance was obtained from Debre Markos University Ethical Review Committee and Permission letter was obtained from Debre Markos town administration health Office. Written informed consent from each participant was obtained. Confidentiality of the results was maintained. Name of the respondents were not written on the questionnaire. The respondents were told that study has no risk and it offers an opportunity for parents of children to get more information on vaccination. Confidentiality was kept at each step of data collection and processing. The participants were assured that they have full right to participate or withdraw from the study.

## Results

### Socio demographic characteristics of the study population

Among the total study participants (399), 389 mothers/caretakers of children aged 12-23 months were interviewed (97.3%). The median age of the respondents was 28 years, which ranges from 24 to 29 years. Most (87.9%) of the mothers/caretakers were followers of Orthodox Christian religion. Majority (91.3%) of the mothers/caretakers were married. From the total respondents, 196 (50.4%) of mothers/caretakers can read and write (Table 1).

### Socio demographic characteristics of the index child

A total of 389 children of aged 12-23 months/caretakers were included. The numbers of male and female participants were 184 (47.3%) and 205 (52.7%), respectively. The mean and median ages of children's were 18 and 18.3 months, respectively. Majority (90%) of children were born at health institution, while 39 (10%) of them at home (Table 2).

**Maternal health care utilization:** Regarding ANC follow-up, majority (57.4%) of the mothers/caretakers had at least one Ante Natal Care (ANC) follow-up during their pregnancy. The remaining 243(64.3%) had four visits and 109 (28.8%), and 27 (7.0%) of them had three and two visits, respectively. From the total respondents, 186 (49.2%) of them had Post Natal Care (PNC) follow-up.

**Availability and accessibility of vaccination service:** More than half (56.2%) of mothers/caretakers responded that they could reach the vaccination site within 30 minutes on foot. All of the respondents were reported that they had access to the health facility that provides vaccination services.

**Knowledge of mothers/caretakers on vaccine and vaccine:** According to this study, all (100%) of mothers/caretaker had heard

Variable	Category	Frequency	Percent
Age of the mother/caretaker	18-23 yrs	75	19.3
	24-29 yrs	181	46.5
	30-35 yrs	97	24.9
	>36 yrs	36	9.3
Educational level of mother/caretaker	Illiterate	49	12.6
	Can read and write	197	50.6
	>diploma	143	36.8
Religion	Orthodox	342	87.9
	Muslim	29	7.5
	Protestant	16	4.1
	Others	2	0.5
Marital status	Married	355	91.3
	Unmarried	5	1.3
	Divorced	21	5.4
	Widowed	8	2.1
Occupation of mother/caretaker	Housewife	52	13.4
	Employee	293	75.3
	Merchant	44	11.3
Educational level of father	illiterate	56	14.5
	Read and write	113	29
	>diploma	220	56.6
Occupation of the father	Daily laborer	1	0.3
	Employee	216	55.5
	Merchant	125	32.1
	Unemployed	47	12.1
Household monthly income in Ethiopian birr	1100-3000	113	29
	3100-5000	199	51.2
	5100-7000	77	19.8

**Table 1.** Socio demographic characteristics of the respondents at Debre Markos town, East Gojjam zone, northwest Ethiopia, 2018 (N=389).

Variable	Category	Frequency	Percent
Sex	Male	184	47.3
	Female	205	52.7
Age (months)	15-Dec	123	31.6
	16-19	156	40.1
	20-23	110	28.3
Place of delivery	Home	39	10
	Health institution	350	90

**Table 2.** Socio demographic characteristics of children aged 12-23 months at Debre Markos town, East Gojjam zone, northwest Ethiopia, 2018 (N=389).

about vaccination as a specific program. Major sources of information for it includes; television (51.9%), health workers (27.2%), friends (10.5%) and radio (8.5%). Majority (69.4%) of the participants knew that the objective of vaccinating children was to prevent disease, while 3(0.8%) of them said that they had no idea about the objectives of vaccination. Concerning the age at which vaccination begins, two hundred thirty five (60.4%) and one hundred thirty five (34.7%) of them reported that it should be started just after birth and after six weeks, respectively. But, sixteen (4.1%) of them reported that vaccination could be started at any time and three (0.8%) of them reported that they did not know. Also regarding the question of how many sessions needed to get full vaccination, majority (74.6%) of them answered four sessions and 61 (15.7%) of them responded

Variable	Category	Frequency	Percent
Source of information	Friend	41	10.5
	Television	203	52.2
	Radio	33	8.5
	Health worker	105	27
	Other	7	1.8
Objectives of vaccination	To prevent disease	207	69.4
	For healthy child	113	29
	It has no benefit	3	0.8
	Do not know	3	0.8
Number of vaccine-preventable diseases	Know one	5	1.3
	Know two	6	1.5
	Know three	56	14.4
	Know four	105	27
	>Know five	206	53
	I do not know	11	2.8
The age at which child start vaccination	Just after birth	234	60.2
	6 weeks after	135	34.7
	Any time	16	4.1
	After one year	4	1
Number of sessions required to complete vaccination	One	1	0.3
	Two	60	15.4
	Three	290	74.6
	Four	38	9.8
The age at which child completes vaccination	9 month	320	82.3
	>9 month	69	17.7

**Table 3.** Respondents' knowledge on vaccination and vaccine-preventable diseases at Debre Markos town, East Gojjam zone, northwest Ethiopia, 2018.

Variable	Category	Fully immunized		COR (95% CI)	AOR (95% CI)
		Yes	No		
Educational level of mother/caretaker	Illiterate	32	17	1	1
	Read write	106	91	1.6( 1.91-5.20)	1.32(1.2-3.40)
	>diploma	111	32	1.3(1.33-2.29)	1.2(1.41-2.42)
Place of child birth	Home	32	7	1	1
	Health institution	201	149	3.38(1.46-3.63)	3.28(1.38-3.67)
Knowledge on vaccine and vaccine preventable disease	Poor knowledge	131	13	1	1
	Good knowledge	140	105	7.55(4.73-12.06)	4.12(3.0-10.6)
ANC service utilization	No	46	10	1	1
	Yes	149	174	5.37(1.32-10.19)	5.04(1.35-12.06)

**Table 4.** Factors associated with complete vaccination of children aged 12-23 months in Debre Markos town, East Gojjam zone, Northwest Ethiopia, 2018 (N=389).

that less than four sessions are needed. Regarding the age at which children's vaccination is completed, 320(82.3%) of them responded that it ends at nine months (**Table 3**).

### Vaccination coverage of children aged 12-23 months

In this study, 365 (93.8%) of mothers/caretakers showed the child vaccination card during the survey. According to a finding from card plus history, all of them have taken one or more of the recommended vaccines. Of total vaccinated child, 299(76.9%) of them had finished all the recommended doses and 90(23.1%) did not complete the entire doses.

Out of the total surveyed children aged 12-23 months, vaccination card was only seen and confirmed for 365 (93.8%) children. From 365 vaccinated children by card only, 90.4% received OPV1, followed by OPV2 (89.6%) and BCG (88.2%). Penta 3 was taken by 88.5% and measles vaccine was taken by 86.1% and based on the

available vaccination card, only 287(78.6%) children completed all the recommended vaccines.

Based on the vaccination card and the mother's/caretakers recall, from the total study participants, 299(76.9%) were claimed fully immunized while 90(23.1%) were partially vaccinated.

The respondents who were not completing their children's vaccination were asked for reasons of failure. Accordingly, the majority (35.7%) of them replied that forgetting the appointment date was the root cause for not completing vaccination. Also 14.9% of them provided lack of vaccine on the day of appointment as a main reason for vaccine dropout.

Concerning the reason for not ever vaccinating their child, the majority (41.3%) of them replied fear of the side effects of vaccination as a cause while 36.2%, 15.5% and 6.9% of respondents replied that many injections at one visit, child sickness and lack of awareness are major causes for not ever vaccinating their child, respectively.

## Factors associated with child vaccination status

In the multivariate logistic regression analysis, the following four variables were identified as independently associated with postpartum modern contraceptive use. These were maternal educational status, ANC follow-up during pregnancy, place of index child delivery and maternal knowledge on vaccine and vaccine preventable disease.

Women who attended diploma level education were 1.2 times more likely to fully vaccinate their children than those who are illiterate (AOR=1.2, 95%CI (1.41-2.42)). Women who gave birth at health institution were 3.28 times more likely to fully vaccinate their children than those who deliver at home (AOR=3.28, 95%CI (1.38-3.67)). The odds of fully vaccinating children was 5 times higher among women who attend ANC service compared to those who did not (AOR=5.04, 95%CI (1.35-12.06)). Women who had knowledge on vaccine and vaccine preventable disease were 4.12 times more likely to fully vaccinate their children than those who didn't (AOR=4.12, 95%CI (3.0-10.6)) (Table 4).

## Discussion

This study tried to assess vaccination coverage and factors associated with it among children aged 12 to 23 months in Debre markos town. Based on the finding of this study, out of total children surveyed by card plus history, the coverage of fully vaccination observed was 299 (76.9%). This figure was relatively higher compared with different studies conducted in various regions including North Eastern India and Uganda where the proportion of fully immunized children aged 12-23 months was 62.2% and 52%, respectively. It was also much higher than a survey done in Oromia regional state where vaccination coverage was 35.4% [22,24,25]. These differences may be attributed to maternal satisfaction about vaccination that helps to complete the schedule which depends mainly on maternal knowledge about vaccination. Another way used to get information about vaccination status of children in this method was asking mothers to show infant vaccination card.

According to the findings obtained from this study, maternal education had significant association with fully vaccination coverage. This may be explained as increasing in educational level helps a woman to have better awareness on vaccine and vaccine-preventable diseases so that they can make decision to vaccinate their children for all schedules. In addition, it is a fact that as educational status of a woman increased, health seeking behavior could be increased which might lead them to vaccinate their children. Studies elsewhere have revealed a similar pattern of relationship between educational level and fully vaccination coverage [14,15].

This study had revealed that place of delivery of the index child showed a significant association; with fully vaccination coverage. This finding was coherent with a result obtained from Kenya where being born in hospital increased the probability of the child being immunized [26,27]. This is likely because if delivery occurs in health care facility, some vaccines such as BCG is normally administered which increases the likelihood of the child being immunized which in turn amplifies the vaccination coverage. Additionally mother who delivers in a hospital is more likely to receive training on benefits of vaccination from health service providers.

The result of this study showed that receiving antenatal care visit was an important determinant factor for fully vaccination status. This finding is consistent with that of a finding obtained from Kenya and Ambo district [22,26,27]. This could have happened due to mother's health seeking behavior and mothers may discuss with health professional about vaccine and vaccine-preventable diseases, importance of vaccination, time of vaccine initiation and when vaccine is completed, and possible side effects associated with a vaccine.

Furthermore, knowledge of mothers on vaccination and vaccine preventable disease showed a significant association with full vaccination of children. This might be explained in that knowledge acquired can change mothers' health seeking behavior as well as they can understand as there is no best way to fight such disease except vaccination services. A study conducted in in Oromia region Ambo district and Jijiga supports this finding. In this study, forgetting the appointment date was mentioned as the commonest reason for not completing vaccination while fear of the side effects of vaccination was cited as a common reason for never vaccinating their child at all. This finding was supported with a finding obtained from Nigeria [15,21,22].

## Conclusion

The finding from this study revealed that child vaccination coverage in the studied area was low. Educational level of the mother, knowledge on vaccine and Vaccine Preventable Disease (VPD), antenatal care follow-up and place of delivery of the index child were statistically significant factors of full vaccination coverage of children. The main reasons described for not completing vaccination by respondents was forgetting the appointment date. In addition, the common reason for never vaccinating their child was fear of vaccine side effects. Therefore, health extension workers should work on improvements in women's educational status, encourage mothers to have ANC follow-up and institutional delivery and they should discuss vaccination with mothers in order to improve their knowledge on vaccine preventable disease and the advantage of complete vaccination services.

## Conflicts of Interest

The authors did not receive payments, funding, or salary from any organization in relation to the work and publication of this paper in the past five years and there will also be no financial support to be received in the future. There is not any organization affected positively or negatively by the publication of this paper. There are not any competing interests related with patents of the content of the paper. The authors also declare that there are not any other financial or nonfinancial competing interests.

## Authors' Contribution

All authors, Wassachew Ashebir and Yimenu Belachew conceptualized the research question, monitored and managed fieldwork, analyzed and interpreted the findings and written the paper.

## Availability of Data and Materials

Data will be available up on request of the corresponding author.

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