

# Determinants of incomplete immunization among children age 12-23 months in Southwest Ethiopia

**Meseret G/Mariam**

mizan aman collage

**Gistane Ayele**

Arba Minch University

**Mulugeta Shegaze**

Arba Minch University

**biressaw Wassihun** (✉ [biresswas@gmail.com](mailto:biresswas@gmail.com))

Arba Minch University

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## Research article

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# Abstract

Background Vaccination is recognized as an important immunization tool which is used in preventing and eradicating communicable diseases. Even though increase in global vaccination coverage, many children in the world particularly in low resource countries still are left unvaccinated and it remains to be a public health problem.

Objective To identify determinants of incomplete vaccination among children 12-23 months of age in Semen Bench district, Bench Maji Zone, Southwest Ethiopia, 2018.

Methods Community based case-control study design was employed. By using simple random sampling a total 312 children aged between 12-23 months from households were selected from 7 kebeles in Semen Bench district, Bench Maji Zone southern regional state. Data was entered into Epi Inof version 7 and was exported into SPSS version 21.0 for analysis. . Both bivariate and multivariate logistic regression analysis were performed to identify associated factors. P values <0.05 with 95% confidence level were used to declare statistical significance.

Results A total of 312 respondents participated in the study with a response rate of 100%. The multivariable analysis indicated that respondents having no antenatal visit [AOR=8.3(95%CI; 1.87-36.91], giving birth in home delivery AOR=4.5(95%CI; 1.411-14.27], and respondents having no postnatal visit AOR=4.2(95%CI; 1.67-10.41], were some of the variables continued to have statistically significant predictors of incomplete vaccination.

Conclusion This study was identified some of the factors associated with incomplete vaccination. In order to decrease neonatal mortality resulted from communicable diseases Strengthen antenatal care visit and prompting postnatal service and institutional delivery is very important in addition to this it is crucial that, local programmatic intervention should be strengthened to promote awareness of the community on the importance of Vaccination.

## Background

Immunization is one of the most worthwhile public health interventions to prevent child mortality and morbidity (1). Immunization can also protect children from illness and disability(2). it can averts an estimated 2–3 million child deaths each year(3).

Majority of child mortality in low resource country was due to the communicable diseases (4, 5). Nearly 70% of under 5 deaths are vaccine-preventable(6). This death was found mainly in Africa (7). Expanded vaccination coverage was largely responsible for a 55% reduction in child deaths (8). Recent studies showed that scaling up the use of existing vaccines could save 6.4 million life of children (9). Measles continues to kill about 430 children each day, mainly in Africa and Asia (10,11,12).

Worldwide, 12.9 million infants did not get any vaccinations (13). In resource-poor settings the prevention of child mortality through vaccination is one of the most cost-effective public interventions in use (14). On the other hand, inadequate levels of vaccine preventable diseases stay a major public health problem in globe (15 16).

Even though vaccines are efficient and cost-effective interventions for increasing child survival, children in many parts of the world, particularly in Sub-Saharan Africa, are either vaccinating their child late or unvaccinated all together (17–19).

Based on the Ethiopian demographic health survey (EDHS 2016 report) around 39% of children aged between 12 to 23 months receive all basic vaccination and 22 % of children aged between 12–23 months have not received all basic vaccinations and also in our study area 24.4% of children aged between 12–23 months have not received all basic vaccinations (11,20).

In Ethiopia Measles is one of the five major causes of childhood illnesses, which together contribute to 70% of under-five morbidity and mortality (21). According to the WHO measles burden estimator, Ethiopia contributes to 46% of the cases and 51% of the deaths from measles among eight eastern African countries (22–24). Previous studies done in Ethiopia indicated that the main factors affecting to incomplete vaccination are multiple such as mother age, educational status of father and mothers knowledge on vaccination. But our study focused on remote area where child morbidity and mortality was high.

## **Methods**

### **Study Area**

The study was conducted in Semen Bench district, Bench Majii Zone, southwest Ethiopia. The total population of the district is 138,556. In the district currently there are 31 Kebeles. There are four health centers, thirty one health posts and 11 privet clinics

### **Study design and period**

**Community-based case control study design was conducted from February 1-march 28/2018**

### **Population**

### **Source population**

**All household with mothers/care givers who had children in the age group 12–23 months of age residing in semen Bench district for both cases and controls.**

### ***Study population***

***Study population for cases:* Selected eligible households with mothers/care givers who had children in the age group of 12 to 23 months who did not complete the recommended vaccination.**

***Study population for controls:* Selected eligible households with mothers/care givers who had children in the age group of 12 to 23 months who completed the recommended vaccination.**

### **Sample Size Determination**

Sample size was determined by using Stat Calc program of the Epi Info version 7; Used to calculate the sample size with exposure among controls is 84.4% from previous study in Tigray region(27), and 5% marginal error, 95% confidence interval, power of 80%, case to control ratio of 1:2 and 10% of non-response rate was considered. Calculated sample size in all Independent (exposure) variables are considered and place of residence is chosen as an independent variable since it gave maximum sample size as compared to other exposure variables. The larger sample size was 282+30 (10% non-response rate) = 312 (104 cases and 208 controls).

### **Sampling Technique and Procedures**

Simple Random sampling technique was used to reach household level. The seven districts were selected by simple random sampling (lottery method). And the calculated sample size was allocated proportionally according to their population. From the two years family folder list of cases and controls were selected then by Computer Generated Simple Random Sampling Techniques the required number of cases and controls were selected. From Serty distract 38 sample case 13 control 25: Muya distract 47 sample case 16 control 31:Yikir Demoze distract 58 sample case 19 control 39: Kasha distract 50 sample case 17 control 33: Boseka distract 30 sample case 10 control 20: Endekal distract 53 sample case 17 control 36: Genga distract 36 sample case 12 control 24

### **Operational Definition**

*Complete (full) vaccination:* The childhood vaccination status once a child has received all recommended vaccines, including BCG, three doses of pentavalent, three doses of PCV, two doses of Rota vaccine, three doses of polio and measles vaccines by the age of 12 months(28).

*Incomplete (partial) vaccination/Defaulter:* The childhood vaccination status if the child missed at least one of the recommended vaccines (the recommended vaccines include BCG, three doses of pentavalent, three doses of PCV, two doses of Rota vaccine, three doses of polio and measles vaccines by the age of 12 months) (28).

## Data collection tool

The data was collected using structured questionnaire which is adapted and modified from related previous study. The data was collected from the household that a mother/caregiver with 12 - 23 months children who retained the vaccination card or registered in the family folder registration book, hence vaccination histories of children, information on socio-demographic & economic characteristics, knowledge of mothers or immediate caretakers on vaccination, Residence, monthly income, sex of the child, accessibility and features of vaccination service and family size was captured into the questionnaire. Seven data collectors and three supervisors was recruited and training was given on the objective of the study and techniques of data collection for two days

## Data quality control

Data collectors & supervisors were adequately trained for two days & also to make data collectors familiar with the questionnaire and field practice was commenced. The data collection processes was closely monitored by the supervisors and the Principal Investigator. The Interview questionnaire was translated to Amharic by the Investigator and then back to English by another person and checked for the consistency between the two translations. Questionnaires were pretested for completeness and appropriateness to the local context on 17 households in Weshkin kebele which is out of the actual study area. Based on the results of the pre-test some questions were modified. During data collection, supervisors were check how the data collection process was going on. At the end of each data collection day, the principal investigator and supervisors checked the completeness of the filled questionnaires. Every questionnaire was checked before commencing a data entry by principal investigator.

## Data Processing and Analysis

Data entry were done using EPI- Info version 7 and analysis has done using SPSS version 21.0 statistical software. During analysis the variables defined, categorized and recoded then frequencies of the different variables and cross- tabulations determined. Odds ratio used to show statistical significant level of association between independent variables with incomplete vaccination at P-value < 0.25 for Binary and

< 0.05 Multivariate Logistic Regression. Independent variables having P-value < 0.25 in binary logistic regression were a potential candidate for multivariable logistic regression analysis to control confounders in regression model and also multicollinearity were checked using tolerance and variance inflation factor (VIF). Additionally model fitness was checked by Hosmer and Lemeshow goodness of fit test and backward stepwise regression method were applied to assess the independent variables in multivariable logistic regression. Finally association between dependent variable and independent variable < 0.05 in multivariable logistic regression model were determined as a predictor for incomplete vaccination

## **Ethical consideration**

Ethical clearance was obtained from Arbaminch University, college of medicine and health science, Institutional Ethical Review Board. Support letter obtained from department of public health to Semen Bench District Health Bureau. Verbal Consent was obtained from the study respondents after giving information and thoroughly explaining on the aim of the study, benefits, significance and as it has no harm. Respondents were interviewed in their homes individually. Information obtained from respondents was not used in connection with their identification and confidentiality was assured.

## **Results**

### **Socio-Demographic Characteristics of respondent**

A total of 208 controls and 104 cases (with 100% response rate) were included in the study. Majority of respondents for controls 198(95.2%) and for cases 85 (81.7%) were mothers. With regard to religion most care takers/mothers for cases and controls were protestant which accounts 85(81.7%) and 169(81.3%) respectively. Regarding to maternal educational status 82.7% of cases and 61.1% of controls were no formal education (*Table 1*)

### **Respondents characteristics of health related service utilization**

All cases and controls of respondents reported that there is vaccination site in their district. Of the mothers/ care takers 50(48.1%) of cases and 33(15.9%) of controls were turned home without getting vaccination for their child. Majority of respondents were two to four birth orders which comprises 67.3% of cases and 63.9% of controls. Regarding ANC visits 75(72.1%) and 208(98.6%) of cases and controls have ANC visits respectively (*Table 2*). Regarding to source of information 190(91.2%) of controls get information about vaccination from Television followed by 179 (86.1%) of controls receive information about vaccination from radio (*figure 1*).

### **Mothers or care takers Knowledge about vaccination**

**Majority of mothers/ care takers was knowledgeable about vaccination which accounts 88 (84.6%) for cases and 202 (97.1%) for controls (*Table 3*).**

## **Predictors of incomplete vaccination**

Multiple logistic regression analyses identified that relationship of mother/care taker with child, father education, PNC service, place of birth, ANC visit, and turned home without vaccinating child were independent predictors that had statistically significant predictors with incomplete vaccination.

This study shows that ANC visit is predictor of incomplete vaccination, those who had no ANC follow up were more than eight times likely to default vaccination. [AOR (95%CI) = 8.3 (1.869–36.907)]. And place of child birth is strong predictor of incomplete vaccination those who gave birth at home were more than four times likely to incomplete vaccination than those who gave birth at health institutions. [AOR (95%CI) = 4.5(1.411–14.27)].

Those children who get care by care takers (other than their mother) were 5.3 times more likely to default to complete vaccination than those who get care from their mother. [AOR (95% CI) = 5.3(1.988–14.094)]. Returned home without vaccination is a predictor of incomplete vaccination, those respondents who turned home without vaccinating their child were 3.4 times more likely to default to complete vaccination than those who vaccinating their child at the time [AOR (95% CI) = 3.443(1.654–7.165)]. Respondents who do not have PNC visit were 4.2 times more likely to default to complete vaccination than those who have PNC visit [AOR (95% CI) = 4.2(1.67–10.41)] (*Table 4*).

## **Discussion**

The finding of this study showed that having anti natal care visit was statistically significant predictors on multivariate analysis. The finding of this study is consistent with the same study Conducted in Mozambique, wonago district and other part of Ethiopia respectively (29, 25, 30).

Similarly giving birth at home was found to be an independent factor that leads to incomplete vaccination status of the child. The finding of this study is consistent with the same study conducted other parts of Ethiopia (31) and Nepal(32). The explanation related to this may be due to those mothers who give birth at health institution are more like to use the health service than those mothers who gave birth in the home.

In this study father's educational status was an independent predictor for incomplete vaccination. This may be due to as educational level increase, health seeking behavior of family may possibly increase and this in turn may have positive impact on child vaccination. The finding of this study showed that mother's educational status is not significant predictor for incomplete vaccination. This is contrary to the study

conducted in Jamaica which revealed that having maternal education level collage and above were more likely vaccinate child than others (33).

Mothers returned home without vaccinating a child due to lack of maternal satisfaction on the service were significant predictors of incomplete vaccination. This is also consistent with other study conducted in Ethiopia(27).

In this study children and mothers/ care takers relationship was significant predictor of incomplete vaccination. This may be due to a mother being able to give a good care for her own child including vaccinating her child timely and completely. In contrast to this study, study conducted in Jamaica revealed that there is no association between mothers/care taker and child Vaccination (33).

## **Conclusions**

The finding of this study showed that absence of antenatal care follow up, absence of postnatal care follow up, having home delivery, low level of father educational status and mothers returned home without vaccinating their child was significant predictor of incomplete vaccination status. Based on the finding of the study we recommend that governmental and non-governmental organization working in neonatal and child health improvement should intervene and strengthened to promote awareness of the community on the importance of post natal care, anti natal care and institutional delivery is the way to optimize children's complete vaccination status.

## **Declarations**

## **Acknowledgements**

**The authors are grateful for the data collectors and study participants**

## **Availability of data and material**

**The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.**

## **Consent for publication**

## **Not applicable**

## **Author's contribution**

BW, MG, GA and MS conceived the study and undertook statistical analysis. BW, MG and MZ supervised the study design and statistical analysis. BW, MG and MS contributed to the writing of the manuscript and all authors approved the submitted version of the manuscript.

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## Competing interests

**The authors declare that they have no competing interests.**

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## Tables

Table 1 Socio demographic characteristics of mothers/care takers living in Semen Bench district in Bench Majii zone, Southern Ethiopia, 2018.

Variables		Case(104)	Control(208)
		No (%)	No (%)
Residence of respondent	Urban	13(12.5)	27(13.0)
	Rural	91(87.5)	181(87.0)
Relationship to child	Mother	85(81.7)	198(95.2)
	Caretaker	19(18.3)	10(4.8)
Age of mother/care taker	20-24	11(5.3)	39(13.9)
	25-29	45(22.1)	98(47.1)
	30-34	28(26.9)	56(26.9)
	35-45	20(19.2)	15(7.2)
Marital status	Single	3(2.9)	14(6.7)
	Married	101(97.1)	190(91.3)
	Divorced	0(.0)	2(1.0)
	Widowed	0(.0)	2(1.0)
Religion	Protestant	85(81.7)	169(81.3)
	Orthodox	18(17.3)	35(16.8)
	Other	1(1.0)	4(1.9)
Ethnic group	Bench	78(75.0)	152(73.1)
	Kefa	23(22.1)	48(23.1)
	Other	3(2.9)	8(3.8)
Educational status of mother	No formal education	86(82.7)	127(61.1)
	Able to write and read	4(3.8)	17(8.2)
	Elementary	12(11.5)	55(26.4)
	Secondary & above	2(1.9)	9(4.3)
Educational level of father	No formal education	47(45.2)	59(28.4)
	able to write and read	44(42.3)	70(33.7)
	Elementary	9(8.7)	70(33.7)
	Secondary & above	4(3.8)	9(4.3)
Monthly family income	< 500	32(30.8)	18(8.7)
	500-1000	46(44.2)	25(12.0)
	>1000	26(25.0)	165(79.3)

Table 2 Information of the Index Child and Mother/Care Taker in Semen Bench district, Bench Majii zone, Southern Ethiopia, 2018.

<b>Variables</b>		<b>Cases (104)</b>	<b>Controls(208)</b>
		<b>N<sub>0</sub> (%)</b>	<b>N<sub>0</sub> (%)</b>
<b>Sex of child</b>	Male	55(52.9)	117(56.3)
	Female	49(47.1)	91(43.7)
<b>Birth order</b>	1	9(8.7)	40(19.2)
	2-4	70(67.3)	133(63.9)
	≥ 5	25(24.0)	35(16.8)
<b>Receive all vaccination</b>	Yes	0(.0)	208(100.0)
	No	104(100.0)	0(.0)
<b>ANC visit</b>	Yes	75(72.1)	205(98.6)
	No	29(27.9)	3(1.4)
<b>PNC visit</b>	Yes	59(56.7)	192(92.3)
	No	45(43.3)	16(7.7)
<b>Turned home without getting vaccination</b>	Yes	50(48.1)	33(15.9)
	No	54(51.9)	175(84.1)
<b>Reason for not getting vaccination</b>	Vaccine not available	22(21.2)	19(9.1)
	Vaccinators were absent	28(27)	14(6.7)

Table 3. Mothers/care takers knoweldge about vaccination in Semen Bench district, Bench Majii zone, southern Ethiopia 2018

Variables		Cases(104)	Controls(208)
		N <sub>0</sub> (%)	N <sub>0</sub> (%)
vaccination prevent communicable disease	Yes	99(95.2)	207(99.5)
	No	5(4.8)	1(0.5)
Knowledge of diseases preventable by vaccination	Yes	86(82.7)	204(98.1)
	No	18(17.3)	4(1.9)
Knowledge about type of diseases prevented by vaccine	Good	27(25.9)	124(59.6)
	Poor	77(74.0)	84(40.4)
knowledge on when BCG vaccine given	Yes	91(87.5)	208(100.0)
	No	13(12.5)	0(0.0)
knowledge on when measles vaccine given	Yes	95(91.3)	205(98.6)
	No	9(8.7)	3(1.4)
knowledge on when vaccine completed	Yes	87(83.7)	204(98.1)
	No	17(16.3)	4(1.9)
Knowledge about vaccination	Less	16(15.4)	6(2.9)
	Knowledgeable		
	Knowledgeable	88(84.6)	202(97.1)

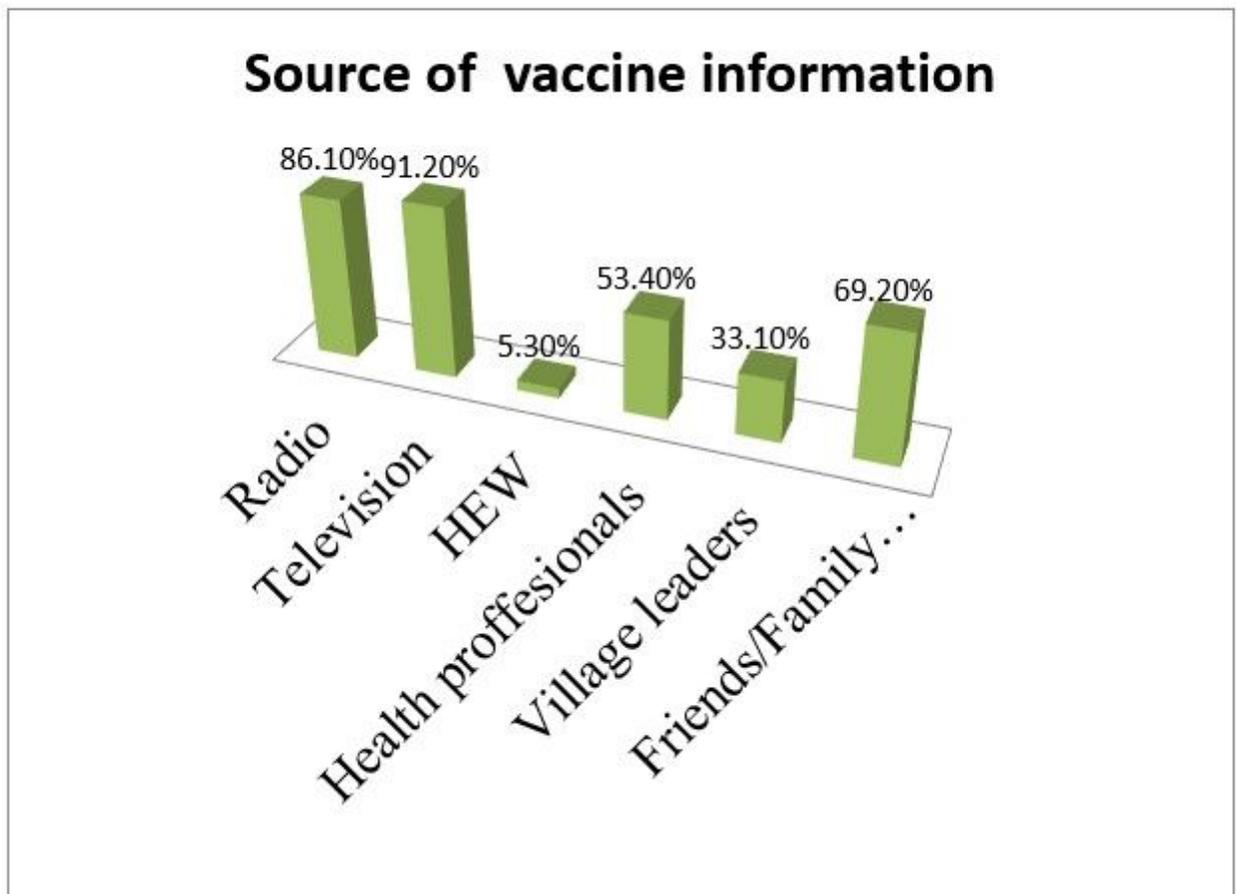
Table 4 Bivariate and Multivariate logistic regression results for Determinants of incomplete vaccination in Semen Bench district, Bench Majii zone, Southern Ethiopia 2018.

Variables		Cases 104	Controls 208	COR(95% C.I	AOR(95% C.I)
PNC service	No	45(43.3)	16(7.7)	9.15(4.82,17.37)	<b>4.2(1.67-10.41)*</b>
	Yes	59(56.7)	192(92.3)	1	1
Relation of respondent to child	Care taker	19(18.3)	10(4.8)	4.43(1.97-9.92)	<b>5.3(1.98-14.09) *</b>
	Mother	85(81.7)	198(95.2)	1	1
Mother/Care taker educational status	No formal education	86(82.7)	127(61.1)	0.35(.11,1.07)	0.45(0.11-1.83)
	Able to write and read	4(3.8)	17(8.2)	0.32(0.16-.66)	0.38(0.145-1.04)
	Elementary	12(11.5)	55(26.4)	0.33(0.07,1.56)	0.63(0.05-8.07)
	Secondary & above	2(1.9)	9(4.3)	1	1
Father educational stratus	Able to write and read	44(42.3)	70(33.7)	0.79(.46, 1.35)	0.29(0.36-2.461)
	Elementary	9(8.7)	70(33.7)	0.16(0.73, .36)	0.97(0.12-.79)
	Secondary & above	4(3.8)	9(4.3)	0.56(0.16, 1.93)	.030(.12-1.540)
	No formal education	47(45.2)	59(28.4)	1	1
Family size	≥ 5	68(65.4)	98(47.1)	2.12(1.30, 3.45)	1.58(0.77-3.23)
	<5	36(34.6)	110(52.9)	1	1
Place of birth	Home	16(15.4)	9(4.3)	4.02(1.71, 9.45)	<b>4.5(1.41-14.27) *</b>
	Health facility	88(84.6)	199(95.7)	1	1
Birth order of children	2-4	70(67.3)	133(63.9)	2.34(1.07, 5.09)	1.67(0.60-4.63)
	≥5	25(24.0)	35(16.8)	3.17(1.31, 7.70)	1.37(0.39-4.85)
	1	9(8.7)	40(19.2)	1	1
ANC service	No	29(27.9)	3(1.4)	26.4(7.82, 89.3)	<b>8.3(1.87-</b>

					36.91) *
	Yes	75(72.1)	205(98.6)	1	1
<b>Turned home without vaccination</b>	Yes	50(48.1)	33(15.9)	4.9(2.87, 8.38)	3.44(1.65-7.16) *
	No	54(51.9)	175(84.1)	1	1

\*Statistically significant at  $p < 0.05$

## Figures



**Figure 1**

Respondents source vaccine of information in Semen Bench district, Bench Majii zone, Southern Ethiopia 2018