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International Journal of Current Research
Vol. 7, Issue, 09, pp.20234-20240, September, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

CHILDHOOD IMMUNIZATION COVERAGE IN TEHULEDERIE DISTRICT, NORTHEAST OF ETHIOPIA: A COMMUNITY BASED CROSS SECTIONAL STUDY

[1]Toyeb Yasine Ebrahim and [2,]*Waju Beyene Salgedo

[1]Wollo University, College of Health Sciences, Department of Health Services Management
[2]Department of Health Economics, Management and Policy, College of Health Sciences, Jimma University

ARTICLE INFO

Article History:
Received 16th June, 2015
Received in revised form
24th July, 2015
Accepted 23rd August, 2015
Published online 16th September, 2015

Key words:

Immunization coverage,
Geographical access,
Availability,
Acceptability and Tehulederie.

ABSTRACT

Background: Immunization remains one of the most important public health interventions and cost effective strategy to reduce both morbidity and mortality in children. World health organization estimated that if global immunization coverage rises to 90%, vaccines would prevent an additional two million deaths a year among children under five years. Nevertheless, global immunization coverage is still low, leading to two million deaths annually from vaccine preventable diseases. Assessment of immunization coverage provides evidences to evaluate progress in achieving programme objectives and in improving service delivery.

Methods: A community based Cross sectional study was conducted in Tehulederie district North East Ethiopia from February 1 to 15, 2012. Multistage sampling technique was used to select study participants. Seven villages were selected by simple random sampling method. The sample size was allocated to the selected villages proportionally to population size. Logistic regression model was used to identify factors associated with full immunization coverage of children. Ethical clearance was obtained from college of Health sciences' Ethical clearance committee, Jimma University.

Results: All the villages were staffed with two Health Extension workers with ratio of 1:2591and 1:5180 population in rural and urban residences respectively. Five hundred fifty seven (87.2%) of the respondents were geographically accessible to the service and 96.8% of them accepted the service. 83.1% of children were fully immunized whereas 14.7% and 2.2% of the children were partially immunized and never vaccinated respectively. In the multivariate logistic regression analysis, children in rural areas were 8 times more likely to be fully immunized than children in urban residence (AOR= 8.01 95% CI: 3.78- 16.99) and children who had access for the service were 8 times more likely to be fully immunized than children who had no access for the service [AOR= 8.24 95% CI: 4.66- 14.59).

Conclusions: Physical access to immunization was nearer to the national standards. The trend showed that the immunization coverage was tending to lower in later doses. Thus, it was recommended that attention should be given to awareness of mothers to complete doses in order to achieve full protection for their children.

Citation: Toyeb Yasine Ebrahim and Waju Beyene Salgedo, 2015. "Childhood immunization coverage in Tehulederie district, Northeast of Ethiopia: A community based cross sectional study", *International Journal of Current Research*, 7, (9), 20234-20240.

INTRODUCTION

Expanded Program on Immunization (EPI) has been one of the world's most cost effective public health strategies to reduce morbidity and mortality associated with infectious diseases in children. It forms a key building block for health systems through which, over two million deaths are delayed each year worldwide (Waisbord and Larson, 2005).

***Corresponding author: Waju Beyene Salgedo,** Department of Health Economics, Management and Policy, College of Health Sciences, Jimma University*

World health organization estimated that if all the vaccines currently available against childhood diseases are widely adopted, and if immunization programs can raise vaccine coverage to a global average of 90%, vaccines would prevent an additional two million deaths a year among children under five years (United Nations, 2006). Increasing immunization coverage is an important step towards reducing under five mortality by two thirds by 2015 and immunization coverage is one of the indicators used to monitor progress towards the achievement of MDG4 (United Nations, 2006). The EPI recommends that all countries immunize against poliomyelitis, diphtheria, pertussis, tetanus and measles while those countries

with a high incidence of tuberculosis (TB) infection should immunize against TB, Hepatitis B (HepB) and Haemophilus influenza type b (Hib) vaccines should be integrated into national immunization programs in all countries (WHO 2006). The immunization schedule calls for all children to receive one dose of BCG vaccine, 3 doses of DPT vaccines, 3 doses of HipB and Hib vaccines, 4 doses of OPV, and one dose of measles and yellow fever vaccine before the first birthday (World Health Organization, 2011). Nevertheless, Global immunization coverage is still low, leading to two million unnecessary deaths annually from vaccine preventable diseases. Particularly in sub Saharan Africa, immunization coverage level is under 50 % in 2010 (Mitchell *et al*., 2008).

There are different Challenges contributing to this including: infrastructural problems of health delivery systems, funding pressures that divert resources away from routine immunization, non-acceptance against immunization programs, under utilization of vaccines, the introduction of new often more expensive vaccines, inadequate long term sustainable financing and competition for funding with other health interventions and immunization services disproportionately miss the poorest and most excluded populations (World Health Organization, 2011). Infant and under five mortality rates in Ethiopia are among the highest in the world according to EDHS 2011 report, child mortality rate is estimated to be 88 deaths per 1,000 live births (Central Statistical Agency, 2011). Diarrheal diseases, vaccine preventable diseases (VPDs) and malnutrition are responsible for a majority of childhood deaths in Ethiopia (Federal Ministry of Health of Ethiopia, 2006). In Ethiopia the Expanded Program on Immunization (EPI) was initiated in 1980 by the Ministry of Health (MOH) in close cooperation with WHO, UNICEF and other partners and implemented in each region by the Regional Health Bureaus with the objective of reaching 90% coverage among children under one year of age by the year 1990 which targeted against six diseases recommended by world health organization (Kidane and Tekie, 2005).

Since 2007, three doses of pentavalent vaccine (DPT-HepB-Hib) are given in place of the three doses of DPT vaccine in the country. BCG vaccine should be given at birth, and pentavalent and polio vaccines should be given at approximately 6, 10, and 14 weeks of age. Measles vaccine should be given at or soon after the child reaches nine months of age. It is also recommended that children receive the complete schedule of vaccinations before their first birthday, and that the vaccinations be recorded on a vaccination card that is given to the parents or guardians (Central Statistical Agency, 2011). In addition to these, Ethiopia launched the pneumococcal vaccine (PCV10) on 16 October 2011 with support from GAVI that should be given with similar schedule recommended for pentavalent vaccines (World Health Organization, 2011). Routine immunization is the basis of the EPI activities in Ethiopia in which, Vaccinations are given in static and outreach program on a regular basis all over the country. Additionally, Supplementary immunization activities are carried out to improve the coverage of a certain vaccines, for instance, Measles vaccination, Vitamin A supplementation and polio eradication campaigns are conducted throughout the country (Federal Ministry of Health of Ethiopia, 2006).

Evidences show that Ethiopia has made progress in routine immunization coverage compared to previous performances (Central Statistical Agency, 2011; Kidane and Tekie, 2005; Kidane *et al*., 2009). However, there were big disparities in regional DPT3 coverage, which ranges from less than 10% in Somali region to over 80% in Tigray and SNNPR regions and our national health objectives for the year 2010 of eliminating most childhood vaccine preventable diseases and of attaining 90% immunization coverage of two years old children were not achieved (Kidane *et al*., 2009).

The major obstacles in achieving national immunization coverage were low access to immunization services, inadequate awareness of caregivers, and low density of health workers, availability of safe needles and syringes and high dropout rates have been recognized since the early years of EPI efforts (Federal Democratic Republic of Ethiopia Ministry of Health, 2007). A number of measures were undertaken to strengthen immunization coverage in Ethiopia. These included, expansion of primary health care, implementation of an integrated health extension package to increase accessibility, training of front line health extension workers for implementing the extension package, high priority has been given to it at national level and the service has been provided as exempted for all eligible target groups (Federal Democratic Republic of Ethiopia Ministry of Health, 2010). Ethiopia has implemented the RED approach in 2004 to address common obstacles of increasing immunization coverage (WHO and UNICEF, 2005).

However, immunization coverage in many parts of Ethiopia is less than desired to prevent the spread of target diseases (Central Statistical Agency, 2011; Federal Democratic Republic of Ethiopia Ministry of Health, 2007; World Health Organization, 2010). For example according to WHO immunization summary annual report in 2010, immunization coverage in Ethiopia were 69%, 90%, 86% and 81% for BCG, pentavalent 1, pentavalent 3 and MCV, respectively (Anand S, Barnighausen, 2007). According to EDHS 2011 report the immunization coverage in Amhara region were 67.7%, 38.4%, 62% and 26.3% for BCG, pentavalent 3, measles and full immunization, respectively (Central Statistical Agency, 2011). Studies have been conducted to assess immunization coverage in Ethiopia but most of the findings were at national and regional levels in which district coverage figures and information about district level service characteristics are not reflected (10,12). District coverage figures and information about district level service characteristics which provide important inputs for program managers at national, regional, zonal and district levels were not addressed to further increase and sustain coverage.

MATERIALS AND METHODS

Both community and facility based cross sectional study was conducted in Tehulederie district from February 1 to 15, 2012. The study populations were children of 12-23 months aged from selected villages. Mothers or caregivers the study participants who lived in the district for at least one year provided the information on behalf of the children. Multi stage sampling technique was used to select seven (one urban and six

from rural) villages by random sampling method. The Sample size was determined by single population proportion formula with assumption of p=26.3% (EDHS 2011) (Central Statistical Agency, 2011), 95% confidence interval, 5% marginal error and 10% of non-response rate with calculate size of 655. The sample size was allocated to each village based on the proportion of households those have children 12-23 months of age as identified by preliminary census. When the selected household is locked, didn't have child or the mother/caregiver was not volunteer, the nearest household with children 12-23 months of age was included in the study.

Adapted structured questionnaires consisting of Socio demographic characteristics of mothers/caregivers, history of vaccines received by the child, geographical accessibility and acceptability of immunization services were used for household survey (World Health Organization, 2007) and checklist was used to assess availability of the services and health workers (Federal Democratic Republic of Ethiopia Ministry of Health, 2007). The instruments were prepared in English and translated from English in to local language (Amharic) and re-translated back in to English to check the consistency of the instrument. Moreover, the instruments were pre-tested in village 08 of the district. The Dependant Variable of measurement was full immunization coverage while Independent Variables were Socio Demographic characteristics (Age, Marital status, Religion, Educational status, sex of the child and Residence), Accessibility, Acceptability and Availability of services and respective resources.

Seven trained diploma graduate data collectors and two supervisors collected the data through face to face interview. When there was no vaccination card for the child or if a vaccine had not been recorded on the card, the respondent was asked to recall the vaccines given. The data collectors and supervisors were trained for one day. Data were entered onto computer using Epi Data version 3.14 and transported into SPSS version 16.0 software for analysis. Association of the dependent and independents variables was assessed using bivariate and multivariate logistic regression model. Variables which showed significant association by bivariate regression model at $P < 0.05$ and 95% confidence interval) were entered into multivariate regression model to identify independent predictors. The findings were described by frequencies, proportions and summary statistics and presented in tables and figures.

Ethical clearance was obtained from Jimma University, College of Public Health and Medical Sciences Ethics Review Committee. Letter of cooperation was written to Norht Wollo Zonal Health Department and the study district. Informed oral consent was obtained from each respondent during data collection.

RESULTS

Six hundred and thirty nine children were included in the study with response rate of 97.6%. The mean age mothers/caregivers of the children was 31.3 ± 5.3 years. The majority of respondents 583 (91.2%) were married and 551 (86.2%) were Muslims by religion. Two hundred thirty nine (37.4%) of mothers were not able to read or write and most of them 595 (93.1%) live in rural areas. Of the 639 surveyed children, 321 (50.2%) were males and 318 (49.8%) were females (Table 1).

Table 1. Socio-Demographic Characteristics of Mothers and Children in Tehulederie district Northeast of Ethiopia February 2012

Variables	Frequency (n= 639)	Percent (%)
Residence		
rural	595	93.1
urban	44	6.9
Age of Mothers/caregivers		
15-24 years	86	13.5
25-35 years	399	62.4
>35 years	154	24.1
Marital Status		
Married	583	91.2
Single	14	2.2
Divorced	26	4.1
Widowed	16	2.5
Religion		
Muslim	551	86.2
Orthodox	88	13.8
Educational Status		
Unable to read and write	239	37.4
Read and write but not formal education	190	29.7
Primary school (1-8)	185	29
Secondary school (9-12)	19	3
Above grade 12	6	0.9
Occupation of Mothers/caregivers		
Farmer	538	84.2
Housewife	51	8
Merchant	28	4.4
Daily laborer	15	2.3
Employee	7	1.1
Sex of Child		
Male	321	50.2
Female	318	49.8

Availability of the Service

In all rural health posts the services were provided two days per month (one fixed day on static and one fixed day on outreach basis). The same is true for urban health posts but they didn't have outreach. On the other hand, the four health centers provided the service on all government working days as static program by one health personnel.

Geographical Accessibility

557 (87.2%) the study subjects were living within one hour walking distance from the nearest health facility. The walking time to reach to the nearest health facility was significantly higher in urban than in rural areas (86.2% versus 100 %, $p<0.001$). Immunization completion (card plus history) was significantly higher in areas where the walking time to the nearest health facility is less than or equal to one hour greater than those who came from more than one hour distance ($p<0.001$).

Acceptability

In this study most mothers had positive attitude and reported that they accepted the immunization services to children. The

mean score was 19.8 ± 1.4 points with 619 (96.8 %) of the mothers/caregivers scoring above 16 points and were classified as having positive attitudes for accepting the service. acceptability of the service was not significantly different in urban and rural areas (p =0.314), but immunization completion (card plus history) was significantly higher in children whose mothers/caregivers accepted than not accepted the service (p<0.001).

Vaccination Status of Children

531 (83.1%) of children had taken all the recommended immunization whereas 94 (14.7%) and 14 (2.2%) of the children were partially immunized (had received at least one vaccine) and never vaccinated respectively. The card retention rate was 45.2% in urban and 53.0% in rural areas. The BCG, pentavalent 1, pentavalent3, measles and FIC coverage before the age of one year by card plus history was 97.5 %, 97.8%, 90.3 %, 84.2 % and 83.1 % respectively. On the other hand, immunization coverage before the age of 1 year by card was 51.2 %, 51.5 %, 48.0 %, 47.6 % and 47.7 % for BCG, pentavalent 1, pentavalent3, measles and FIC respectively (Table 2).

status, walking time and positive attitude of mothers/caregivers were independent predictors of full immunization of children.

Accordingly, Children in rural areas were 8 times more likely to be fully immunized than children in urban residence (OR= 8.01 95% CI: 3.78- 16.99). Children born from illiterate mothers/caregivers were 60% less likely to be fully immunized than children born from literate mothers/caregivers (OR= 0.40 95% CI: 0.21-0.78). Children born from married mothers were 3 times more likely to be fully immunized than children from widowed mothers [OR=2.6 95% CI: 0.72-9.45), children from single mothers were 1.33 times more likely to be fully immunized than children from widowed mothers [OR=1.33 95% CI: 0.20- 8.82)] and children from divorced mothers/caregivers were 39 % less likely to be fully immunized than children from widowed mothers (OR=0.61 95% CI: 0.13-2.94). On the other hand, children who had access for the service (within one hour walking distance) were 8 times more likely to be fully immunized than children who had no access for the service (> one hour walking distance) [OR= 8.24 95% CI: 4.66- 14.59). Children from mothers/caregivers who accepted the service were 15 times more likely to be fully immunized than children from mothers/caregivers who didn't accept the service [OR= 14.88 95% CI: 3.01-73.49) (Table 3).

Table 2. Immunization Coverage rates of vaccines among surveyed children aged 12-23 months in Tehulederie district Northeast of Ethiopia February, 2012 (n= 639)

Type of vaccine	Coverage by card only (%)	Coverage by card plus history (%)
BCG	51.2	97.5
Pentavalent 1	51.5	97.8
Pentavalent 2	49.6	95.5
Pentavalent 3	48	90.3
OPV 1	51.3	97.6
OPV 2	49.6	95.5
OPV 3	48.2	90.8
Measles	47.6	84.2
Fully immunized	47.6	83.1

Table 3. Independent predictors of full immunization coverage of children in Tehulederie district, Northeast of Ethiopia, February 2012

Variables	Child immunization completion		Crude OR(95%CI)	p- value	Adjusted OR(95%CI)	p- value
	Yes (%)	No (%)				
Residence						
rural	84.8	15.2	3.88(2.04,7.38)	0	8.01(3.78,16.99)	0
urban	59.1	40.9	1		1	
Educational status						
illiterate	79.5	20.5	0.41(0.24,0.68)	0.001	0.40(0.21,0.78)	0.007
literate	90.5	9.5	1		1	
Marital status						
married	85.9	14.1	7.85(2.85,21.670	0	2.60(0.72,9.45)	0.018
single	71.4	29.6	3.21(0.70,14.74)		1.33(0.20,8.82)	
divorced	50	50	1.28(0.37,4.49)		0.61(0.13,2.94)	
widowed	43.8	57.2	1		1	
Accessibility						
<= 1hour	88.5	11.5	8.92(5.34, 14.79)	0	8.24(4.66,14.59)	0
>1 hour	46.3	53.7	1		1	
Acceptability						
accepted	85.5	14.5	52.90(12.06,61.89)	0	14.88(3.01,73.49)	0.001
Not accepted	10.5	89.5	1		1	
Religion						
Muslim	86.8	13.2	4.32(2.64,7.07)	0	1.02(0.18, 2.01)	0.065
Orthodox	60.2	39.8	1		1	

Independent Predictors of Full Immunization coverage

Our multivariate logistic regression model showed that residence, educational status of mothers/caregivers, marital

DISCUSSION

Our study revealed that all the rural villages had two Health extension workers (HEWs) and urban villages had one only.

This matches with the plan of the government in rural villages but one minus for urban villages (World Health Organization, 2009). However, the availability of HEWs in the district is higher than the national coverage of 50% in 2009 (Kidane *et al*., 2009). Recent international research suggests that the size of countries' health workforces and short training courses are important for increasing immunization coverage (Anand and Barnighausen, 2007) but all of the HEWs in the study area didn't take refresher training about immunization. This might affect the sustainability as well as coverage of the service in the district.

Majority (87.2%) of the respondents were within one hour walking distance to the nearest health facility which is higher than the study done in Ethiopia in 2009 which was 82.9% (Kidane *et al*., 2009). But the finding is lower compared to the 97.4% coverage reported from a study in Bangladesh (Perry, 2007). The walking distance to reach to the nearest health facility was significantly higher in rural than urban areas; 100 % of urban respondents were geographically accessible to the service but only 86.2 % of rural respondents were geographically accessible to the service. Similar finding was obtained from other studies in Tigray in 2008 and the Ethiopian national study in 2009 10).

Information about acceptability coverage is very important for policy-makers in order to better understand some of the predisposing and enabling factors that affect the use of services; even if resources are available and accessible, they may not be used if they are not acceptable to the population (World Health Organization, 2009). The result of the study showed that 96.8 % of mothers/caregivers had a positive attitude towards the service which is higher than the Wonago district south Ethiopia in 2008 (Tadesse *et al*., 2009) and 90% compared to the study result from Roma in 2010 (Idzerda *et al*., 2011) but lower than that of study done in Nigeria in 2008 to assess determinants of immunization coverage which was 99% (World Health Organization, 2010).

In the study, the immunization coverage for BCG, pentavalent, and OPV was above 90% but due to the long interval between the third doses of pentavalent and measles, a number of children do not return for measles vaccine and this makes the coverage rate for this antigen to be lower than others (84.2%). This didn't achieve the national immunization coverage of measles to at least 90% by 2010 and to sustain such levels of immunization coverage through 2015 (Central Statistical Agency, 2011) but, it accomplished the goal of RED approach of achieving at least 80% immunization coverage in every district (World Health Organization, 2005).

The coverage rates from this study (BCG 97.5 %, pentavalent3 90.3 %, measles 84.2 % and fully immunized (83.1 %) are higher than the EDHS 2011 coverage of Ethiopia (BCG 66%, pentavalent3 37%, measles 56% and fully immunized 24%) (World health organization, 2011). It is also higher than that of EDHS 2011 for Amhara region (BCG 67.7%, pentavalent3 38.4%, measles 62% and fully immunized 26.3%) (World health organization, 2011). However, these results are comparable with the WHO-UNICEF estimates for Ghana (BCG 99%, pentavalent3 84%, measles 85% and fully immunized 68%) in 2010 (Brown *et al*., 2011). The result of from this study tended to suggest that, there was a decline in coverage rates from BCG (97.5%), to measles (84.2%) and that of fully vaccinated (83.1 %) indicating that many of the children are lost to follow up in later months and some (who take the later antigens) skip some of the vaccines. The pentavalent1 to measles dropout rate in our study (14.6%) was higher as compared to a study conducted in Kenya in 2008 in which dropout rate was 12% (Kamau, 2008). However, it is lower than that of the national EPI cluster survey result (35.6%) in 2009 (Kidane *et al*., 2009) and EDHS 2011 dropout report of 43% (Central Statistical Agency, 2011). Factors that affect full immunization coverage are complex and interwoven. The result of this study identified several socio behavioral factors which affect full immunization coverage of children. Studies conducted in Ethiopia in 2009, southern Ethiopia in 2008 and India district in 2010 have reported that residence was an associated factor for immunization completion; full immunization coverage was higher in urban than rural areas (10, 20, 25). But the finding from the study was different from these studies although it is similar to that of the study done in Tigray (Kidane and Tekie, 2005) in which the coverage was higher in rural than urban areas. This might be due to the implementation of health extension program in rural communities prior to urban areas that creates community awareness and also accessed on immunization services in rural areas.

Similarly, studies done in Tigray 2006, in Ethiopia 2009, India in 2010 and Brazil in 2008 reported that maternal education has been a determinant factor of child immunization completion (Kidane and Tekie, 2005; Kidane *et al*., 2009; Takum *et al*., 2011; Logullo *et al*., 2008). A result from this study confirmed that, maternal education was a factor that positively influenced child immunization completion in which, full immunization coverage of children was higher in literate mothers/caregivers than illiterate mothers/caregivers. This might be due to better knowledge of vaccine preventable diseases and importance of vaccination among literate mothers. The result from this study showed that, marital status of mothers/caregivers was associated factor for immunization coverage of children. Children born from married and single mothers were more likely fully immunized as compared to children from widowed and divorced mothers. This might be due to the fact that divorced and widowed mothers/caregivers might be in disturbed due to the quarrel and death of their husbands and these leads to give less attention to their children's immunization schedule. Similar findings were obtained from other studies done in rural Bangladesh in 2008, India in 2006 and in South Ethiopia in 2008 which showed that marital status of mothers was an associated factor for immunization of children (Tadesse *et al*., 2009; Rahman, 2008; Rao, 2006).

Geographical accessibility in terms of walking time to reach to the nearest health facility was also factors that affect full immunization coverage in this study. This finding is supported by other similar studies done in Ethiopia in 2009 and Bangladesh, Dhaka city in 2008 (Kidane *et al*., 2009; Perry, 2007) in which geographical accessibility was an associated factor for immunization coverage of children. Acceptability of the immunization service by mothers/caregivers was also

identified as associated factor which affects immunization coverage of children. Similar findings were obtained from other studies done in rural Bangladesh in 2008, India in 2006 and South Ethiopia in 2008 which showed that acceptability of the service was associated factor for completion of child immunization in which the coverage was higher in those mothers/caregivers who accepted the service (Tadesse *et al*., 2009; Rahman, 2008; Rao, 2006).

The study addresses the effect of socio demographic characteristics, geographical accessibility and service acceptability on full immunization of children but it didn't address the effect of availability of health facilities and health care workers on full immunization of children. Lack of health facilities and trained health care provider might be root cause for low immunization coverage in children. On the other hand, questions about immunization history of children in the absence of vaccination card require appropriate recall of events. This might introduce recall bias in the data obtained. For instance, the mother/caregiver may forget the number of vaccine doses that her child took and reported the partially immunized child as fully immunized child. This might over estimate the coverage level of the service. However, efforts were made to reduce such biases by asking participants about one year duration of events.

Conclusion

It was revealed that the immunization services were accessible in the district as per the WHO standard with more than 87% of population to reach within one hour walking distance from the nearest health facility. The proportion of fully immunized children (by card plus history) was higher than those in previous studies and meets the RED goal in the district. There was a sharp decline in coverage rates from BCG (97.5%), to measles (84.2%) and full immunization (83.1%). interestingly, the immunization coverage was higher in rural areas when compared to urban site. Thus, it was recommended that the district health office should work to increase the immunization coverage especially in urban by increasing the number of HEWs and should conduct house to house visit in order to increase the completion of the later doses.

Acknowledgments

We thank Jimma University for funding our work. We would like to acknowledge our study participants for their volunteering during data collection. We are also grateful to north Wollo zone health department and heads of the respective health centers for their permission to conduct the study in the area.

Abbreviations

AOR- Adjusted Odds Ratio
BCG- Bacillus Camille Guerin
CDC-Communicable Disease Control
CI - Confidence Interval
CSA-Central Statistics Agency
DOR-Dropout Rate
DPT -Diphtheria, Pertussis, Tetanus
EDHS -Ethiopian Demographic and Health Survey
EPI -Expanded Program of Immunization
FMOH-Federal Ministry of Health
FIC-Fully Immunized Child
GAVI -Global Alliance for Vaccines and Immunization
GIVS-Global Immunization Vision and Strategy
HC- Health Center
HEW -Health Extension Worker
HEP-Health Extension program
HepB -Hepatitis type B
HH-House Hold
Hib -Haemophilus influenza type b
HP -Health Post
HRH- Human Resources for Health
HSDP -Health Sector Development Program
IMNCI - Integrated Management of Neonatal and Childhood Illnesses
MCV - Measles Containing Vaccine
MDG -Millennium Development Goal
MOH - Ministry Of Health
NGO-Non Governmental Organization
OPV- Oral Polio Vaccine
OR -Odds Ratio
PCV-Pneumococcal Conjugated Vaccine
PHCU - Primary Health Care Unit
RED -Reach Every District
SNNPR- Southern Nations Nationalities and Peoples Region
SRS -Simple Random Sampling
TB-Tuberculosis
TT -Tetanus Toxin
UNICEF -United Nations Children's Fund
VPD -Vaccine Preventable Diseases

Competing interests

There is no competing interest with the presented data as external data collectors collected it. There was not financial interest b/n the funder and the research area community and us. We, the researchers, have no any form of competing financial and non-financial interest between ourselves.

Authors' Contributions

We both had significant contribution in the proposal development, defending for fund obtaining, data collection and data analysis and manuscript preparation process of this work.

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