E-ISSN: 2378-654X

Recent Advances in Biology and Medicine

# Original Research Article

## Vaccination Coverage and Associated Factors among Children in Debre Berhan Town, Ethiopia

HATASO, USA

# Vaccination Coverage and Associated Factors among Children in Debre Berhan Town, Ethiopia

**Tadesse Desalegn[1], Melashu B. Shiferaw[2]*, Esubalew Tesfahun[3], Amtatachew Moges[4], Tsedale Semunigus[1]**

[1]North Showa Zone Health Department, Debre Berhan, Ethiopia.
[2]Amhara Public Health Institute, Bahir Dar, Ethiopia.
[3]Medicine and Health Sciences College, Debre Berhan University, Debre Berhan, Ethiopia.
[4]Amhara National Regional Health Bureau, Bahir Dar, Ethiopia.

***Correspondence:** bmelashu@gmail.com

**Received: Nov 1, 2019; Accepted: Dec 14, 2019**



**Citation:** Desalegn T, Shiferaw MB, Tesfahun E, Moges A, Semunigus T. Vaccination coverage and associated factors among children in Debre Berhan town, Ethiopia. Recent Adv Biol Med. 2019; Vol. 5, Article ID 961845, 5 pages. https://doi.org/10.18639/RABM.2019.961845

**Abstract**

Vaccination is a proven tool to prevent and eradicate communicable diseases. It can prevent more than 2.5 million child deaths each year. However, many children are still left unvaccinated and still die from communicable diseases in developing countries. Hence, this study was conducted to assess the vaccination status in children at Debre Berhan town, Ethiopia. A community-based cross-sectional study was carried out from June 2017 to September 2017 in Debre Berhan town. A total of five kebeles were included in the study to collect data from 621 study participants. The data were entered into EPI-Info version 7 and analyzed using SPSS version 20 statistical software. Only 73% of children were fully vaccinated. Vaccination for oral polio 0, pentavalent3, and measles was done in 47.3%, 79.7%, and 72.6% of the children, respectively. About 19% of the children did not receive any vaccination. The dropout rate for Bacillus Calmette Guerin to measles, pentavalent1 to pentavalent3, and pneumococcus vaccine (PCV) 1 to PCV3 was 10.7%, 1.8%, and 0.6%, respectively. In multivariable analysis, mother's educational status (adjusted odds ratio [AOR]: 0.102; 95% confidence interval [CI]: 0.022-0.487), distance from the vaccination site (AOR: 4.669; 95% CI: 1.498-14.547), number of antenatal care (ANC) visits (AOR: 4.472; 95% CI: 1.209-16.543), and income of mother per month (AOR: 2.192; 95% CI: 1.112-4.323) were associated factors for unsuccessful vaccination. The vaccination of children was still low in Debre Berhan town. Distance, family income, education, and number of mothers' ANC visit were associated factors for the low coverage of vaccination. Health intervention programs including encouraging awareness of the community is important to achieve the recommended vaccines among children.

**Keywords:** Children; Vaccination; Debre Berhan; Ethiopia.

## 1. INTRODUCTION

Vaccination is the most effective means to combat infectious diseases. In developing countries, children under 5 years old are immunized against 10 diseases: tuberculosis, diphtheria, tetanus (including neonatal tetanus through immunization of mothers), pertussis, polio, measles, hepatitis B (HepB), and homophiles influenza (Hib), rotavirus, and pneumococcus vaccine (PCV). These vaccines prevent more than 2.5 million child deaths each year [1, 2].

In developing countries, millions of children are not fully immunized for their first year of life. About 24 million children were not administered vaccines and over 10% of children under 1 year old did not receive even one dose of diphtheria, pertussis, and tetanus (DPT) vaccine. Hence, they are prone to vaccine-preventable diseases. For instance, the reported annual incidence of tetanus and pertussis is closer to 1 million and 151,586 cases per year, respectively [1, 3].

In Ethiopia, the expanded program on immunization (EPI) was launched in 1980 aiming to reduce morbidity and mortality in children from vaccine-preventable diseases. The program had been planned to create immunization services available to 10% of the population in 1980 and to increase immunization access by 10% each year and reach 100% coverage [4].

According to the 2016 Ethiopia demographic and health survey (EDHS), only 39% of Ethiopian children received all the recommended vaccines [5]. Studies carried out in Ambo and Jigjiga District also showed only 35.6% and 27.5% of the children took full vaccines, respectively [6, 7]. Moreover, there was a measles epidemic in 2015 in Debre Berhan town [7] that questions the vaccination coverage among children in Ethiopia including our setting. Hence, this study was carried out to assess the vaccination status of the children and identify problems that affected the immunization coverage in Debre Berhan town. This could generate data to be used for better planning and strengthening of immunization services in the town.

## 2. METHOD(S)

A cross-sectional study was carried out to assess the vaccination coverage and associated factors among children aged between 12 and 23 months old in Debre Berhan town from June 2017 to September 2017. The town has 97,969 total populations, 6,900 under-five children, and 1,187 children between 12 and 23 months old. There are three health centers, five health posts, and one referral hospital that could routinely provide immunization service to children in the town [8].

The study population comprised all children aged between 12 and 23 months in Debre Berhan town. Mothers/caretakers with one or more children were included from randomly selected five kebeles (01, 03, 04, 05, and 08) households of the total of nine kebeles in the town. In the case of two or more children, the youngest child per household was selected. Households with sick mothers/caretakers (unable to respond) at the time of data collection were excluded.

The final sample size was 629 as calculated using EPI info 7 with an expected frequency of 45.8% of full immunization coverage in the Amhara region [4], 95% level of confidence, 5% margin of error, 1.5 design effects, and 10% nonresponse rate.

Sociodemographic and vaccination-related data were collected using a questionnaire. The questionnaire was pretested on 24 participants. The data were collected after 1-day training of a supervisor and five trained data collectors who had diploma nursing. The daily data collection process was strictly supervised, and the completeness of questionnaires was checked by the investigators. Immunization status was identified from the immunization card of the child. In the absence of the immunization cards, mothers were asked to recall whether the child had received different vaccines. To avoid recall bias, the investigators and data collectors used sample of cards for immunization so that the mothers could remember. Then, fully vaccinated was defined as when a child took three doses of pentavalent/OPV, and one dose of BCG and measles vaccine; partially immunized when a child took at least one of the vaccine types but not all the EPI vaccines; and unimmunized when a child did not take the EPI vaccines during the first year of life [9]. These statuses of vaccination were checked either from the immunization card or from the mother's recall.

The collected data were entered and cleaned using EPI info version 7 and analyzed using Statistical Package of Social Sciences (SPSS) version 20. The dependent variable was dichotomized into fully vaccinated and not fully vaccinated (unvaccinated and partially vaccinated). The full immunization status of the children assessed from the vaccination cards as well as the mother's/caregiver's response was used in the analysis of both bivariate and multivariable logistic regression. To identify the factors associated with the immunization status of children, bivariate and multivariate logistic regression analyses were performed to test associations. Crude and adjusted odds ratios with 95% CI were calculated to determine the presence of an association. Variables having value ≤0.2 based on the WHO standard cut of a point in the bivariate analysis were entered into a multiple regression model to control the confounding effect. *p*-Value <0.05 in the logistic regression model was considered as a significantly associated factor for vaccination coverage among children.

Ethical clearance was obtained from the College of Health Science, Debre Berhan University. Support letter was obtained from North Shoa Health Department, Debre Berhan Woreda Health Office and kebele administrations. Written consent was taken from each mother/caregiver in addition to the provision of information about confidentiality.

## 3. RESULTS

### 3.1. Sociodemographic Characteristics of Children and Mothers

From a total of 629 households invited, 621 pairs of mothers of children were interviewed with a response rate of 98.7%. The mean age of the mothers was 29 with a standard deviation of 5.5 years. Mothers with secondary school education level were 239 (38.5%). The majority of the respondents, 576 (92.8%), were married. A total of 266 (42.8%) respondents had more than five family members. About 79% of the respondents walked 15-30 minutes and 3.5% of the respondents walked 30-60 minutes to reach the nearest health facility. Three hundred twenty (51.5%) children were females (Table 1).

### 3.2. Maternal and Children Characteristics

More than fifty percent, 333 (50.8%), of the mothers had four and more antenatal care (ANC) visits during their last pregnancy. About forty-nine percent, 288 (49.3%), of the mothers attended antenatal care from first to the third visit during their pregnancy of children. Besides, 620 (99.8%) of mothers took one or more doses of the tetanus toxoid vaccine. About 98% of the study participants were heard about the vaccination program. From the total respondents, more than sixty-nine percent (69.6%) of them heard from Nabors and 15.3% from mass media. Almost all, 99.7%, of the children were delivered in the health facility.

### 3.3. Immunization Coverage

Among the total 621 participants, 72.6% (95% CI: 67.9-77.3%) of children were fully vaccinated, 8.6% partially vaccinated, and 18.8% did not take any vaccination. More than eighty-one percent (81.3%) of children took OPV1 and BCG vaccine as per the schedule. Vaccination status for OPV0, pentavalent1, pentavalent3, and measles was 47.3%, 81.2%, 79.7%, and 72.6%, respectively (Table 2). The dropout rate, the proportion of children who started a certain vaccine but did not complete the next intended vaccine, was 10.7% for BCG to measles, 1.8% for pentavalent1 to pentavalent3, and 0.6% for PCV1 to PCV3.

**Table 1: Sociodemographic characteristics of children and their mothers in Debre Berhan town, North Shoa Zone, Ethiopia, 2017.**

| Variables | Response | Frequency | Percent |
|---|---|---|---|
| Gender of the child | Male | 301 | 48.5 |
| | Female | 320 | 51.5 |
| Marital status of the mothers | Single | 17 | 2.7 |
| | Married | 576 | 92.8 |
| | Widowed | 20 | 3.2 |
| | Divorced | 8 | 1.3 |
| Occupational status of the mothers | House wife | 334 | 53.8 |
| | Government employ | 110 | 17.7 |
| | Merchant | 124 | 20 |
| | Daily laborer | 33 | 5.3 |
| | Others | 20 | 3.2 |
| Mothers age in years | <20 | 17 | 2.7 |
| | 20-34 | 491 | 79.1 |
| | 35-49 | 113 | 18.2 |
| Family size | ≤5 | 355 | 57.2 |
| | >5 | 266 | 42.8 |
| Educational status of the mothers | Illiterate | 8 | 1.3 |
| | Read and write | 64 | 10.3 |
| | Primary school(1-8) | 176 | 28.3 |
| | Secondary (9-12) | 239 | 38.5 |
| | Ternary (TVET/University) | 134 | 21.6 |
| Income of the mothers | <2250 | 185 | 29.8 |
| | 2250-3818 | 254 | 40.9 |
| | ≥3819 | 182 | 29.3 |
| Time to reach to nearest health facility | <15 minutes | 108 | 17.4 |
| | 15-30 minutes | 491 | 79.1 |
| | 30-60 minutes | 22 | 3.5 |

**Table 2: Vaccination coverage of children in Debre Berhan town, North Shoa Zone, Ethiopia, 2017.**

| Vaccines | Coverage by card | | Coverage by recall | | Total | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| BCG | 498 | 80.2 | 7 | 1.1 | 505 | 81.3 |
| OPV0 | 290 | 46.7 | 3 | 0.5 | 293 | 47.2 |
| OPV1 | 460 | 74.1 | 45 | 7.2 | 505 | 81.3 |
| OPV2 | 498 | 80.2 | 7 | 1.1 | 505 | 81.3 |
| OPV3 | 494 | 79.5 | 5 | 0.8 | 499 | 80.4 |
| Pentavalent1 | 497 | 80.0 | 7 | 1.1% | 504 | 81.2 |
| Pentavalent2 | 493 | 79.4 | 6 | 1.0 | 499 | 80.4 |
| Pentavalent3 | 490 | 78.9 | 5 | 0.8 | 495 | 79.7 |
| PCV1 | 492 | 79.2 | 7 | 1.1 | 499 | 80.4 |
| PCV2 | 494 | 79.5 | 7 | 1.1 | 501 | 80.7 |
| PCV3 | 491 | 79.1 | 5 | 0.8 | 496 | 79.9 |
| Rota1 | 496 | 79.9 | 7 | 1.1 | 503 | 81.0 |
| Rota2 | 497 | 80.0 | 7 | 1.1 | 504 | 81.2 |
| Measles | 447 | 72.0 | 4 | 0.6 | 451 | 72.6 |

BCG, bacillus calmette guirin; OPV, oral polio vaccine; PCV, pneumococcus vaccine.

 https://doi.org/10.18639/RABM.2019.961845

**Table 3: Bivariate and multivariable analysis of factors associated with full immunization status of children in Debre Berhan town, 2017.**

| Variables | Category | Child fully vaccinated | | COD (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Mothers educational status | Illiterate | 4 | 4 | 0.136 (0.031-0.596) | 0.102 (0.022-0.487)* |
| | Read and write | 50 | 14 | 0.484 (0.220-1.067) | 0.519 (0.226-1.193) |
| | Primary school (1-8) | 158 | 18 | 1.190 (0.583-2.432) | 0.781 (0.364-1.673) |
| | Secondary school (9-12) | 215 | 24 | 1.215 (0.621-2.377) | 0.832 (0.406-1.702) |
| | Tertiary/TVT/University | 118 | 16 | 1 | 1 |
| Income of mother per month | ≤2249 | 144 | 17 | 2.353 (1.265-4.375) | 2.192 (1.112-4.323)* |
| | 2250-3818 | 254 | 24 | 2.282 (1.304-3.991) | 2.324 (1.247-4.331)* |
| | ≥3819 | 147 | 35 | 1 | 1 |
| Numbers of ANC visit | One time | 105 | 3 | 6.741 (1.877-24.213) | 4.472 (1.209-16.543)* |
| | Two times | 70 | 9 | 1.344 (.549-3.295) | 1.007 (0.393-2.581) |
| | Three times | 94 | 25 | .615 (.299-1.264) | 0.488 (0.229-1.042) |
| | Four times | 194 | 25 | 1.300 (.643-.2.628) | 1.129 (0.533-2.392) |
| | More than five times | 82 | 14 | 1 | 1 |
| Distance in minutes from health facility | <15 minutes | 97 | 11 | 5.039 (1.730-14.680) | 4.669 (1.498-14.547)* |
| | 15-30 minutes | 434 | 57 | 4.351 (1.749-10.825 | 4.089 (1.543-10.836)* |
| | 30-60 minutes | 14 | 8 | 1 | 1 |

ANC, antenatal care; AOR, adjusted odds ratio; COR, crude odds ratio.

### 3.4. Factors Associated with the Immunization Status of Children

In multivariable analysis, the educational status of mothers, health facilities near to vaccination site, number of antenatal care visits, and income of mother per month were found to be significantly associated. Mothers with tertiary levels were 10% more likely to fully vaccinate their children than those at the illiterate level (AOR: 0.102, 95% CI: 0.022-0.487). Mothers who had health facilities near to vaccination sites were about five times (AOR: 4.669, 95% CI: 1.498-14.547) more likely to fully immunize their children, compared to counterparts. Mothers who had greater than two ANC visits during their pregnancy had about four times (AOR: 4.472; 95% CI: 1.209-16.543) more likely to fully immunize their children compared to those who had first ANC visit. Mothers who had less than 3,818 Ethiopian Birr (ETB) income per month were about two times (AOR: 2.324; 95% CI: 1.247-4.331) more likely able to fully immunize their children compared to those mothers who had 3,819 and more ETB income per month (Table 3).

## 4. DISCUSSION

This study aimed to assess the vaccination status of children and factors that could affect its implementation in Debre Berhan town, Ethiopia. More than one-third of the children were fully vaccinated. Specifically, vaccination coverage for oral polio (OPV) 0, pentavalent3, and measles was 47.3%, 79.7%, and 72.6%, respectively. The dropout rate was 10.7% for BCG to measles, 1.8% for pentavalent, and 0.6% for PCV.

It is recommended to provide OPV, pentavalent, and PCV vaccines with a similar schedule [5]. In this study, the overall full vaccination coverage was about 73%. It is lower than the national 90% target [4]. The probable cause may be due to the skill gap and professional negligence to give the vaccine for the children in the setting. However, the finding is similar to a study done in Nigeria that reported 77% full immunization coverage among children [10].

In this study, high (10.7%) BCG to measles dropout rate was found. The probable cause may be due to the longer time interval to provide vaccination of BCG and measles. Besides, a caregiver may forget the measles appointment date. However, the dropout rate found in our study is lower than the 2016 national estimate in addition to a documented study in central Ethiopia [5, 6]. The reason for the low-performance dropout rate might be due to improved respondent's awareness increase from time to time by health extension workers, health development army (HAD), and other health professionals.

In this study, illiterate mothers/caregivers had significantly more fully vaccinated children than educated mothers. In line with this finding, studies in Arba Minch Zuriya Woreda, Lay Armachiho Ethiopia, and Kenya [11-13] also showed similar findings. The possible cause might be because illiterate mothers had less understanding of the side effect of the vaccines. Our data in the focus group discussion also indicated that educated mothers fear vaccine side effects. Heads of the health centers also explained gaps of health professionals about informing mothers for vaccine side effects and the schedule of vaccines and inconvenient service of the health professionals, like poor communication with clients.

The average distance of health facilities showed significant association. Mothers or caregivers who traveled less than 30 minutes were more likely to get their children fully vaccinated. This study had a similar result with a study done in Sinana District, Ethiopia [14]. This enables to easily access the vaccine program compared to those who are far from the service site. Another reason for some defaulters and unvaccinated children were because of forgetting vaccination dates. As a result, they may postpone or not come back for the next scheduled vaccination when they see common vaccine reactions. The discussants also stated that some mothers migrate from one place to another within the district and this favors a default on their child's immunization. The participants stressed that when this occurs, it is difficult to trace these mothers and they may not complete their child's immunization in their new residence. The participants stressed that when this occurs, it is difficult to trace these mothers and they may not complete their child's immunization in their new residence. As a limitation, when the mother asked about the immunization status of the child using interview method, they may had recalled bias even if we showed them sample cards to remember especially mothers at illiterate level as the age of the child increases.

In general, the overall vaccination coverage was low in children at Debre Berhan town. Mother's educational status, distance from the vaccination site, number of ANC visits, and income of mother per month were associated factors. Health intervention programs including encouraging awareness of the community on the importance of the recommended immunization may have considerable importance on children's health. Therefore, zonal and district health offices should mobilize the community of the town and provide sufficient information to the migrated people, which will encourage them to seek immunization at the appropriate age of the child.

**Acknowledgments**
The authors would like to thank Debre Berhan kebele administrative staffs, Woreda Health Office, town administration, and North Showa Zone Health Department for their support and for providing us the necessary information to carry out this study. All the research participants who took part in the study are gratefully acknowledged.

**Author Contributions**
TD designed the study. TD, MBS, ET, AM, and TS analyzed and interpreted the data. MBS drafted the manuscript. All authors read and approved the submission of this manuscript.

**Conflict of Interest**
There is no conflict of interest.

**References**

1. WHO, UNICEF, World Bank. States of the World's Vaccines and Immunization. 3rd edn. Geneva (2009). Available at: https://www.unicef.org/immunization/files/SOWVI_full_report_english_LR1.pdf
2. Feikin DR, Flannery B, Hamel MJ, Stack M, Hansen PM. Reproductive, Maternal, Newborn, and Child Health. Disease Control Priorities. 3rd edn., Vol. 2. Washington, DC: World Bank (2016). doi:10.1596/978-1-4648-0348-2
3. Gentile A, Bhutta Z, Bravo L, Samy AG, Garcia RD, *et al*. Pediatric disease burden and vaccination recommendations: understanding local differences. Int J Infect Dis. 2010; 14(8):e649. doi:10.1016/j.ijid.2009.11.006
4. Ministry of Health. Ethiopia National Expanded Program on Immunization. 2015. Available at: http://www.nationalplanningcycles.org/sites/default/files/country_docs/Ethiopia/ethiop_cmyp_latest_revised_may_12_2015.pdf
5. Ministry of Health. Demographic and Health Survey in Ethiopia. 2016. Available at: https://dhsprogram.com/pubs/pdf/FR328/FR328.pdf
6. Etana B, Deressa W. Factors associated with complete immunization coverage in children aged 12-23 months in Ambo Woreda, central Ethiopia. BMC Public Health. 2012; 12:566. doi:10.1186/1471-2458-12-566
7. Mohamud AN, Feleke A, Worku W, Kifle M, Sharma HR. Immunization coverage of 12-23 months old child and associated factors in Jigjiga District, Somali National Regional State, Ethiopia. BMC Public Health. 2014; 14:865. doi:10.1186/1471-2458-14-865
8. North Showa Health Department. Health Management Information System Immunization Report. 2015. Debre Berhan, Ethiopia.
9. WHO. Reported Measles Cases and Incidence Rates. 2015. Available at: http://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measlesreportedcasesbycountry.pdf
10. Tagbo BN, Eke CB, Omotowo BI, Onwuasigwe CN, Onyeka EB, *et al*. Vaccination coverage and its determinants in children aged 11-23 months in an urban District of Nigeria. World J Vaccines. 2014; 4:175-183. doi:10.4236/wjv.2014.44020
11. Facha W. Fully vaccination coverage and associated factors among children aged 12 to 23 months in Arba Minch Zuriya Woreda, Southern Ethiopia. J Pharm Altern Med. 2015; 7:19-25. Available at: https://www.iiste.org/Journals/index.php/JPAM/article/view/26445/27089
12. Kassahun M, Biks G, Teferra A. Level of immunization coverage and associated factors among children aged 12–23 months in Lay Armachiho District, North Gondar Zone, North west Ethiopia: a community based cross sectional study. BMC Res Notes. 2015; 8:239. doi:10.1186/s13104-015-1192-y
13. Kiptoo E, Esilaba M, Kobia G, Ngure R. Factors influencing low immunization coverage among children between 12-23 months in East Pokot, Baringo Country, Kenya. Int J Vaccines Vaccin. 2015; 1(2):00012; 1(2):1-6. doi:10.15406/ijvv.2015.01.00012
14. Legesse E, Dechasa W. Assessment of child immunization coverage and its determinants in Sinana District, Southeast Ethiopia. BMC Pediatr. 2015; 15:31. doi:10.1186/s12887-015-0345-4