Vaccine Dropout Rate and Associated Factors Among Children Age 12-23 Month in Shewa Robit Town, North Shewa Zone, Amahra Region, Ethiopia, A community Based Cross-sectional Study Design

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Abstract

Background: Immunization against disease is one of the most important public health interventions with cost effective means of preventing childhood morbidity, mortality, and disability. However, children in Africa was not fully immunized with in the recommended vaccines thus, many children are still susceptible to the expanded program on immunization target disease. The objective of this study was to assess the magnitude of vaccine dropout rate and associated factors among children age 12-23 month in Shewa Robit town in 2019.

Methods: Community based cross sectional study was conducted from April 5 to April 10, 2019 with a total of 432 mothers/caregivers who have children 12-23 month of age were include in the study. Template was prepared and the data was entered, categorized, coded, and summarized using Epi data version 3.1 and analysis by using SSPSS version 21 for further analysis. Bivariate and multivariate logistic regression analysis was done to see the association of each categories of variable with the outcome variable. Significance was checked at 95% CI with p-value <0.05.

Result: From the total 432 children 392(90.7%) were fully vaccinated and the BCG- Measle dropout rate were 9.3%. Occupation of mothers/caregiver's being student (AOR: 0.075(0.006,0.971)), distance of time to reach health facility <15 minute (OR:15.617(2.06, 118.4) and ANC follow-up of mothers/caregivers(AOR:4.87(1.39,16.98)) were significantly associated to vaccine dropout rate.

Conclusion: The overall immunization dropout rate in Shewa Robit town was 9.3% in 2019. Time to reach health facility, ANC follow-up of mothers and occupation of mother were statistically significant predictors of vaccine dropout rate of children.

Background

Vaccination is the administration of a vaccine, that is, a biological substance intended to stimulate a recipient's immune system to produce antibodies or undergo other changes that provide future protection against specific infectious diseases. Immunization is the stimulation of changes in the immune system through which that protection occurs[1] Immunization is considered as one of the most powerful and cost-effective health interventions. It also believed to prevent debilitating illness and disability and saves millions of lives every year[2, 3].

Routine immunization programs protect most of the world's children from a number of infectious diseases that previously claimed millions of lives each year [4].

The Expanded Program on Immunization (EPI) was established by the World Health Organization in 1974 to control vaccine preventable diseases. In Ethiopian, EPI program was launched in 1980 [5]. It was launched with the aim of reducing mortality and morbidity of children and mothers from vaccine preventable diseases. The target group when the program started was children under two years of age until it changed to under one year in 1986 to be in line with the global immunization target [6].

With the introduction of new approaches known as Reaching Every Districts (RED) and Sustainable Outreach Services for immunization in 2003, improvement has been documented. However, system-wide barriers related to geographic coverage remain as gaps, requiring bridging approaches such as the Enhanced Outreach Strategy even as the country moves towards a more equitable geographical coverage with construction and staffing of additional peripheral health facilities[7].

The World Health Assembly in May 2012 endorsed the Global Vaccine Action Plan (GVAP) as a roadmap to prevent millions of deaths through vaccine preventable disease. Under this plan countries hope to achieve vaccination coverage of at least 90% nationally and at least 80% in each district by 2020 [7]. In Ethiopia, number of deaths of children under five years of age is due to vaccine-preventable diseases. Under five age mortality stands at 123 per 1,000 with a plan to reduce to 54 per 1,000 up to the year 2015 to meet Millennium Development Goal-4 (MDG-4)[8]. Ethiopia strictly follows WHO recommendations for developing countries immunization schedule for the ten EPI vaccines for children and tetanus immunization for women of reproductive age[6]. As per the updated Ethiopian immunization policy of 2007, children under the age of one and women of 15–49 years are the targets for the EPI vaccines. Immunization services in Ethiopia are provided free of charge in most of the health facilities as well as in the outreach services for communities residing beyond 5 km from the health facilities[5].

Based on 2011 Ethiopia Demographic and Health Survey (EDHS), vaccination coverage increased from 14% in the 2000 to 20% in 2005. The 2011 EDHS revealed that 24% of Ethiopian children in the age group of 12–23 months received all the recommended vaccines [9]. In Ethiopia still has not reached the target figures and realized the planned objectives[10].

Dropout rate is used to measure program continuity and follow up of immunization. Dropout rate between the first and third dose of DPT -HepB -Hib is the best indicator for vaccine is not given in the campaigns[11]. Approximately 29% of death in children under five age is vaccine preventable [12].

According to 2014 Ghana Demographic and Health Survey (GDHS), infant and under five mortality rates were reported as 64 and 111 deaths per 1000 live births in 2003, 50 and 80 deaths per 1000 live births in 2008, 41 and 60 deaths per 1000 live births in 2014 and respectively with vaccine preventable disease[13].

In 2011 alone 1.5million children die from disease prevented by currently recommended vaccine. It has been also recognized that vaccine preventable diseases are responsible for 16% of under-five mortality in Ethiopia [14].WHO recommends that both pentavalent-1 to pentavalent -3 and pentavalent-1 to- measles dropout rate should remain below 10% in order to decrease vaccine dropout rate and to reduce under five morbidity and mortality In NewYork North district [15]. Both the pentavalent 1-to-pentavalent 3 and the pentavalent 1-to-measles dropout rates have remained persistently above 10% over the last ten years. These children who fail to complete the immunization schedule in time was vulnerable to infection with vaccine-preventable diseases as result child morbidity and mortality was increase[15].

During the March 2012 measles outbreak, a total of 278 suspected measles cases had been reported. Out of these, 27 cases been confirmed to be measles at the Kenya Medical Research Institute reference

laboratory while most of the others were epidemiologically linked to these confirmed cases. A total of 12 measles-related deaths had been documented since the onset of the outbreak [16].

Similarly, due to the persistent immunization dropout problem, the children in the district were also at a high risk of getting infected with polio since the re-emergence of polio in Kenya in February 2009 [17].

In 2011, about 107 million infants (83%) worldwide received the third dose of diphtheria pertussis-tetanus vaccine (DPT3) [17]. Approximately 22.4% million children failed (dropout) to receive the DPT3 vaccine and 2–3 million children became ill and susceptible to vaccine preventable diseases and death annually [18]. The dropout rate or defaulter rates for the years 2004, 2005, 2006, and 2007 in Ethiopia were 13.9%, 21.9%, 33.3% and 29.9% respectively [19].

In Ethiopia, vaccine preventable diseases contribute substantially to under-five mortality as well as morbidity. Diarrhea (18%), pneumonia (18%), measles (1%), and meningitis are the leading causes of child mortality in the country [6]. Child immunization is the key to achieving the millennium development goals (MDGs) specially to reduce child morbidity and mortality. The proportion of children immunized against measles is one of the indicators of millennium development goals [20]. However, in Ethiopia, the incidence of measles has increased from 3.19 per 100,000 in 2009 and 7.35 per 100,000 in 2010 with a total of confirmed 1,964 and 3,121 measles cases respectively, in 2012 measles incidence was 146 per 100,000 populations with a total of 125 confirmed measles outbreaks, in 2013, measles incidence was 7.2 cases per 100,000 populations with a total of 243 measles outbreaks and confirmed cases were 192 [7, 21].

The aim of this study was assessing magnitude of vaccine dropout rate and associated factors in Shewa Robit town. The findings of this study were showed immunization dropout rate in the study area, and the study was contributing to address issues related to vaccine dropout rate. The result get from this study is used to know the vaccination status of children and used for identifying associated factors that leads to dropout rate. This study was conducted to identify the current gaps, supplement the past studies and this study can be used as a reference for health care providers, health care workers, program managers and future researchers in this or other related fields.

Methods And Materials

Study area and study period

The study was conducted in Shewa Robit town, North Shewa zone, Amhara region, Ethiopia Which is Located 220 km from Addis Ababa the capital city of Ethiopia and 90 km from Debre Birhan town the capital city of North Shewa Zone. The town has a longitude and latitude of 10° 00'N 39° 54' E with elevation of 1280 meter above sea level. Based on figures from the central statistical agency in 2015, the town has an estimated total population of 24,886 of whom 13,021 were men and 11,865 were woman. According to woreda health sector annual plan of 2019 Shewa robit has a total population of 54,306 of whom 26,176 are man and 28,130 women. The data was collected from April 5 to April 10, 2019

Study design

A community based cross sectional study design was conducted.

Source population

The source population were all mothers/care givers living in Shewa Robit town and who have at least one 12–23 months of child.

Study population

Study population were sampled mothers who have at least one 12–23 months of child and resident in Shewa Robit town at least for six month prior to the day of the study at selected kebele of Shewa robit.

Sample size determination and sampling procedure

The sample size was calculated by single population proportion formula, the following assumptions was taken. Assumptions: A 95% confidence interval, margin of error (5%), considering design effect 1.5 and the proportion of vaccine dropout rate for all source was (21.7%) in Southern nation ,nationalities and peoples region of Ethiopia in 2015[25]. Sample size were 392 individuals and add 10% of non-response rate. Then the study were conducted on 432 mothers/caregivers who have children 12-23 months of age.

Sampling procedures

multi- stage sampling method was used, three kebeles from 9 kebeles were selected using simple random sampling methods (lottery method). The sampling was considered probability proportion to population size in each kebeles. Systematic sampling technique was employed for household selection.

Data collection tools and procedures

The data was collected through face to face interview using structured questionnaires and through a review of the vaccination cards and mothers/caregiver's history, questionnaires were adopted from different reviewed literature [25, 36, 37]. Four graduating nursing students were involved in data collection. During data collection when the house was find locked next time the house was revisited three times then if locked the next house was interviewed. Systematic sampling technique was employed for household selection. The first household was selected randomly from the first household list 1st to 3rd list by using lottery method then the next household was selected every 3rd households by using the household record used by health extension worker as reference until total sample needed in the kebele was achieved. Within each selected household only one mother with index child age between 12-23 months was selected. Whenever there was more than one mother with 12-23 months of age children in a household only one was selected using lottery method and in case of the twins, one child was selected by lottery method. Mothers or caregivers were asked to show immunization cards, and for those mothers/caregivers who had no vaccination card, different questions were asked to know the vaccination status of the child for each specific vaccine and Vaccination histories of children.

Inclusion and Exclusion Criteria

Inclusion Criteria

Mothers/caregivers who have at least one 12–23 months child and living in Shewa robit town for at least six months prior to the day of the study period.

Exclusion criteria

Mothers/ caregivers who are in serious illness and unable to communicate during data collection time.

Dependent Variable

Vaccine dropout rate of children aged between 12-23 months.

Operational Definitions

Fully vaccinated- children are considered as fully vaccinated when they have received a vaccination against tuberculosis (BCG), three doses each of the Penta, PCV and polio vaccines and measles vaccination by the age of 12 months

Partially vaccinated- children are considered as partially vaccinated when they miss at least one doses of the above-mentioned vaccines on fully vaccinated definition

Unvaccinated- children are considered as unvaccinated when they did not receive any dose of the above-mentioned vaccines on fully vaccinated definition

Vaccine dropout rate - children that received the first dose of Penta, polio, PCV but have failed to receive the remaining doses of those vaccine and measles vaccine or types of vaccines to complete the recommended schedule

Data Processing and Analysis

Data were checked for completeness and inconsistencies, then data processing, master sheet or template was prepared and the data was entered, categorized, coded, and summarized using Epi-data version 3.1 and transformed to SPSS version 21 for further analysis.

Frequency and proportion were computed for description of study population in relation to socio demographic and other relevant variable. Both bivariate and multivariate logistic regression analysis were done to see the association of each categories of each variable with the outcome variable. variable that had $p\text{-value} < (0.25)$ from binary logistic regression variable were analyzed for multiple logistic regression. Finally, statistical significance was disclosed at $P < 0.05$ at 95% CI to identify determinant factors of vaccine dropout rate. The results were presented in the form of tables, figures, charts and summary statistics.

Data Quality Control

The questionnaire was prepared in English and translated from English to Amharic and re-translated back to English to check consistence. One day training was given for data collectors on methods of data

collection. Questionnaire was checked on daily basis for completeness during data collection and data were cleaned and coded before data entry. Data analysis was started by sorting and performing quality control checkup on field. Data was checked in the field to ensure that all the information was properly collected and recorded. Before and during data processing the information was checked for completeness. Before the actual data collection, the tool was pretested on 5% of the sample size at kebele 01 of Shewa Robit town to check the reliability and no modification was done on the tools. The pre-tested data was not including in the main data.

Ethical Consideration

The letter was obtained from research ethical committee and the formal permission letters was written from Debre Birhan University, collage of medicine and health science, department of nursing to Shewa Robit town health office. After obtaining the permission from concerned bodies the informed verbal consent was obtained from each respondent and the purpose of the study is clearly explained to him/ her about the objective, the contents of the study, as well as their right to refuse and discontinue the data collection. Anonymity and confidentiality of the information was assured and privacy of each respondents was maintained throughout data collection and data was used for the research purpose only.

Result

Socio-Demographic Characteristics of study population

A total of 432 mothers/ caregivers who have children aged between 12-23 months were interviewed and the response rate was 100%. More than half of the respondents 256(62.7%) were between the age of 18 -28 years and the mean age of study participants was 28.21 with SD 5.77. Regarding to marital status 316(73.1%) of the mothers/caregivers were currently married. From the total respondents 234 (54.2%) of them were orthodox Christians followers. Based on occupational status of the respondents 268 (62%) were housewives followed by 70 (16.2%) were government employees. literacy status showed that 161(37.3%) had no formal education and 48(11.1%) had higher education. Approximately 162 (37.5%) respondents were earning less than 300-birr per month. Majority of respondent's index child 185(42.8%) were between 16-19 months and 100(23.2%) were between 20-23 months with a mean age of 17.02 and (SD 3.14) months. (Table:1).

Information on Immunization

Majority of the respondents 418(96.8%) were heard about immunization program from different sources of information 253(60.7%) were heard from health professional working in health facility, 186(43.1%) were heard from the community, 242(58%) were heard from health extension workers, 65(15.6%) were heard from radio, and 55(13.2%) were heard from other mothers and 32(7.4%) were heard from religious leader. Regarding to information heard, 271(65%) mothers/ caregivers were heard about the important of routine vaccination and 185(44.4%) heard about where to get routine vaccine, 125(30%) were heard about campaigns, 121(29%) were heard age of vaccination. Regarding to the time when begin vaccination

316(73.1%) were responded just after birth, 114(26.4%) after six weeks of birth, the rest 2 respondents were didn't know the age to begin vaccination.

Vaccination coverage

Regarding Vaccination coverage 392 (90.7%) children were fully vaccinated for recommended vaccine of the country. All 432 children were immunized for BCG vaccine and 392 (90.7%) children were immunized for measles vaccine.

Most respondents 333(77.1%) have immunization card and 99(22.1%) had no immunization card. From those who have vaccination card 24 children had drop out their vaccine and 16 children didn't have immunization card. Vaccination coverage by card 71.5% and coverage by mother history 19.2%.

Vaccination dropout rate

The study showed that BCG -Measles drop out rate were 9.3%, OPV1 to OPV3 dropout rate were 3.5%, penta1-penta3 dropout rate were 3.2%, PCV1-PCV3 dropout rate were 3% (figure:1).

Mother's/caregiver's reason for vaccination dropout

Regarding to the reason for vaccination drop out 16(40%) were due to forget appointment, 12(30%) were due to mothers were busy for other activity, 7(17.5%) were due to mother was sick, 3(7.5%) were due to fear of side effect, the rest 2 participants were due to child was sick during the time of vaccination date.

Access to immunization service

The study showed that 400(92.6%) were live near to the health facility, the rest 32(7.4%) were lived far from the health facility. Based on means of transport used during vaccination time. 218(50.5%) respondents means of transportation were on foot, 211(48.8%) were used taxi, 2 were used motor cycle and 1 were used public bus. More than half of 281(65%) mothers/caregivers traveled less than 15min to attained vaccination site.

Majority of respondents 408(94.4%) were got health information from health worker during vaccination service, among those who got health information about vaccination 152(37.1%) were informed when to finish vaccination, 102(24.9%) were informed about the important of routine vaccination, 79(19.3%) were informed about next vaccination date, 68(16.6%) were informed about important of completing vaccination, 8(2%) were informed about side effect related to vaccine.

Maternal health care utilization

from 432 mothers/care givers 350(81%) were attended ANC, from those who attended ANC service 187(53.4%) were attend 4 times followed by 100(28.6%) were attended 3 times. According to this study majority of the respondents 356(81.4%) were deliver their last child in health facility and the reaming 76(17.6%) were deliver at home.

Results of multiple logistic regression analysis

On multivariate logistic regression ANC follow-up of mothers, time to reach health facility and occupation of mothers/caregivers variables were predictors of vaccine dropout rate. Regarding to occupation of mothers/caregivers students had less likely dropout rate than government employee (AOR: 0.075 (95% C.I (0.006, 0.971)), Regarding to time to reach health facility with in less than 15 minute were 15.62 times more dropout rate than mothers/caregivers who reach health facility within 30-60 minute (AOR: 15.62 (95% C.I (2.06, 118.4)) and mothers/caregivers who didn't attend ANC follow-up were 4.87 times more likely dropout rate than who attend ANC follow-up (AOR: 4.87 (95% C.I (1.39, 16.98)) (table :5).

Discussion

The study was conducted to assess vaccine dropout rate and associated factors among children age between 12-23 month. From the total children include the study 40 (9.3%) children didn't complete the recommended vaccine, whereas study done in Yirgalem town, Sidama Zone from 478 participants 95 (20%) of children was dropout rate their vaccine. This difference was may be due to socio demographic characteristics of respondents [25].

According to this study the dropout rate of penta-1 to penta-3 was 3.2% and BCG to measles dropout rate was 9.3% whereas other study conducted Ambo, Easter Ethiopia penta-1 to penta-3 dropout rate was 55.2% and BCG to measles dropout rate was 38.1% this difference was may be due to study time and sample size [26]. Similar study conducted in Debre markos show that the Dropout rate of BCG to measles was 6.5%, the dropout rate of Penta-1 to Penta-3 was 2.7% and PCV 1 to PCV 3 dropout rate was 4.5% this is almost similar to this study [29]. This study reveals that out of the total 432 children between 12-23 months' age group, Majority of respondent's index child 185 (42.8%) were between 16-19 months. On this study from the total 432 children 392 (90.7%) children were fully immunized.

from the total interviewed mother 333 (77.1%) could show immunization card whereas study conducted in yirgalem town, south Ethiopia 243 (52.5%) could show immunization card. This is may be related to awareness about immunization was increase in our study [25].

According to this study maternal occupation students was significantly associated to vaccine dropout rate (AOR: 0.075 (C.I. 0.006, 0.971)) other study conducted in Mizzen Aman showed that maternal occupation Civil servant was significantly associated with vaccine dropout rate (AOR: 3.14 (1.34, 3.55)) [30], similar study conducted in Yirgalem town maternal occupation government employee were significantly associated to vaccine dropout rate (AOR: 0.35 (0.17, 0.7)) [25].

mother who didn't attend ANC follow-up during pregnancy were more dropout rate for child vaccination than mother who were attend ANC follow-up (AOR: 4.87 (1.39, 16.98)) and a study conducted in Yirgalem town, Sidama Zone showed that Mothers who didn't attend ANC are more likely to incomplete vaccination than those who attend ANC (AOR: 5.10 (C.I. 3.8, 52)) [25].

According to this study mothers/care givers who were took less than 15 minute to reach health facility had 15.617 times more likely dropout rate than took with 30-60 minute (AOR:15.617(2.06, 118.4).

Conclusion

The overall immunization dropout rate in Shewa robit town was 9.3%. Distance of time to reach health facility, ANC follow-up of mothers/caregivers and occupation of mothers/caregivers were statistically significant predictors of vaccine dropout rate of children in Shewa robit town. The main reasons described for dropout rate by respondents were forgetting the appointment date and mother was busy by other activity. Also as a reason for not vaccinating their child, most respondents replied that mother and child was sick at the time of vaccination date and fear of side effect which led to partially vaccinated. Based on the result of the study, the following recommendations are suggested to Shewa robit town health office, and mothers/caregivers.

Abbreviations

ANC: Ante Natal Care; BCG -Bacillus Chalmette Guerin; DPT –Diphtheria, Tetanus and Pertussis ; EDHS Ethiopia Demographic and Health Survey ; EPI -Expanded Program of Immunization; GDHS-Ghana Demographic and Health Survey; GVAP -Global Vaccine Action Plan; HepB -Hepatitis B Vaccine; HIB- Homophiles Influenza Type B; MDG-Millennium Development Goal; OPV-Oral Polio Vaccine; PCV- Pneumococcal Polysaccharide Vaccine; RED -Reaching Every Districts; SOS -Sustainable Outreach Services ; SSPSS -Statistical Package of Social Science; WHO -World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from review committee of Debre Berhan University. Oral consent was obtained from each study participants. All the information obtained from the study participants were kept confidential throughout the study, the name of the participant did not write rather replaced by code. Participants can withdraw from the study at any time.

Consent to publish

Not applicable

Availability of data and materials

All data generated or analyzed during this study are included in this published article including raw datasets is available from the corresponding author for reasonable request.

Competing interest

All authors declare that they have no competing interests

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Author's contributions

SS, YD, TD, ST, YT were prepared the proposal, Developed the methodology, Supervised data collection, check completeness of data, analyzed and interpret data and wrote the manuscript. All authors critically edited the manuscript, and approved the final manuscript.

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Additional Files

Additional files 1: English version of consent form and questionnaire.

Tables

Due to technical limitations, tables are only available as a download in the supplemental files section.

Figures

Figure 1: Vaccination status of children by card and mother recall among children age 12-23 month in Shewa robit town, North Shewa Zone, Amhara Region, Ethiopia, April ,2019.

Figure 1

Vaccination status of children by card and mother recall among children age 12-23 month in Shewa Robit town, April ,2019

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table2.jpg](#)
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