Expanded Program on Immunization Dropout rate and associated factors among children age 12-23 months in harar town, Eastern Ethiopia

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Abstract

Introduction: Immunization dropout is a child who has received at least one dose of trivalent vaccine against diphtheria, pertussis and tetanus (DPT) Penta1-Measles/Penta3 but failed to receive his or her third dose to complete the schedule before the five years of age as WHO. Immunization dropout rate was also comparing the number of infants who started the antigen of immunization schedule with the number who received all immunization antigens completely.

Objective: To assess magnitude of immunization dropout rate and associated factors among children aged 12-23 months in Harar town Eastern Ethiopia 2021.

Methodology: Institution-based study was conducted among children aged of 12-23 months from December to January 2021. in Arategna, Abukar, Jenela and Amir nure health centers Eastern Ethiopia. Data was collected by using a structured questionnaire. And also analyzed using Statistical Package for Social Sciences 16.0 version. The dropout rate was presented in percentage with 95% Confidence Interval. Bivariate and multivariate analysis was computed to identify associated factors with immunization. The finding was presented in Crude Odds Ratio (COR) and Adjusted Odds Ratio (AOR) with 95% Confidence Interval.

Result: total of four hundred nine (409) children's data were collected from our study area. Out of 409, about 220 (53.78%) were females and 189 (46.22%) of them were males. The coverage of immunization dropout, and fully vaccination was 9.0%, and 91.0% of children respectively. In this study four major factors like covid 19, lack of community awareness, cultural or religious barriers, and forgotten family for dropout and fully vaccination were identified. Out of all factors, community awareness was more affected immunization dropout followed by culture or religious barriers.

Conclusion: The magnitude of immunization dropout in this study was 9.0%., lack of community awareness, cultural and religious barriers, COVID 19 and family forgotten independently associated for immunization dropout rate.

Introduction

Immunization is considered as one of the most powerful and cost-effective of all health intervention. It also believed to prevent debilitating illness and disability and saves millions of lives every year. Vaccination is one of the prevention strategies for common childhood illness. It prevents morbidities and mortalities from diphtheria, hepatitis B, measles, mumps, pertussis, polio, rotavirus diarrhea, rubella and tetanus (1).

Immunization schedule for the ten EPI vaccines for the children and tetanus vaccination for women of reproductive age strictly follows WHO recommendations for developing countries and given free of charge in the public sectors and NGO coordinating health facilities. So, national immunization policy recommends for BCG vaccine given at birth, three doses of DPT-HepB-Hib and PCV vaccine given at6, 10 and 14 weeks of age, four doses of oral polio vaccine given at 0, 6, 10, and 14 weeks of age, two doses of Rota vaccine given at 6 and 10 weeks and measles vaccine given at 9 months of age. Recently, inject able polio vaccines have been started and functional now a day at national level. Vaccination service delivery strategies include fixed (static), outreach and mobile sites at government and some of private health facilities. Even though various initiatives and campaigns were used over the years, the coverage of fully immunized children in Ethiopia remains low with high partially immunized children. (4)

Immunization dropout rate is one of the impact target indicators across global, regional and country and designed to track progress toward achieving the goals 2030. Progress in impact goal indicators will be evaluated pre determinant global target and will be defined by WHA in 2021. A detailed description of each impact goal indicators for monitoring, evaluation and action. Immunization is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine (23).

Immunization currently averts an estimated 2-3 million deaths of children every year from Diphtheria, Tetanus, Pertussis (Whooping Cough) and Measles throughout the world

Although Africa has made remarkable progress in immunization services, large numbers of children remain unvaccinated and under-has stalled vaccinated. The performance of routine immunizations in the African region during the last decade for the majority of vaccine delivered antigens. According to a 2013 immunization data report, vaccine coverage was 75 % and Ethiopia has second largest number of incompletely vaccinated children from the region next to Nigeria (2).

Mini EDHS 2019 reveals the coverage of all basic vaccines and/or any vaccination coverage has been strongly associated with better wealth status, better education of care givers, and living in urban areas. Fifty-seven percent of children living in urban areas have received all basic vaccinations compared with only 37% of children in rural areas. Children in the highest wealth quintile (65%) are more than twice as likely to have received all basic vaccinations as children in the lowest quintile (25%). Sixty-five percent of children whose mothers have more than secondary education were received all basic vaccinations compared with 34% of children whose mothers have no education. Coverage of all basic vaccinations is highest in Addis Ababa (83%) and lowest in Afar (20%). (5)

WHO immunization coverage in July 2019 indicated that14 million infants did not receive an initial dose of DTP vaccine pointing to lack of access to an immunization and other health services and an additional 5.7 million are partially vaccinated. Of the 19.7 million more than 60% these children live in 10 countries: Angola, Brazil, the Democratic Republic of the Congo, Ethiopia, India, Indonesia, Mexico, Nigeria, Pakistan and the Philippines. (7)

According to study done in Northwest Ethiopia, showed that full-vaccination coverage for the children aged 12-23 months was 58.4%, while 17% and 24.6% were partially vaccinated and not vaccinated at all respectively and child full vaccination status has a positive association with urban residence, having antenatal care visit, institutional delivery for the study child, vaccination site at health institutions, mothers who knows vaccination schedule of a catchment

area, and mothers taking a child for vaccination even if the child is sick. However, mothers who ever-married and their travel time to the nearest vaccination site ≤ 30 minutes were negatively associated with child full-vaccination status.(8)

Globally, about 22.4 million infants failed to receive 3 doses of DTP, leaving large numbers of children susceptible to vaccine-preventable diseases and death. Nearly 8.4 million received at least 1DTP dose, but dropped out before completing the 3-dose series (15)

In study area there was shortage of data which reveals dropout rate and associated factors. Thus, this study was important to fill for the existing information gap and help Aretegna Health Center, Abuker, Jenela and Amir Nure health centers for program planning, policy makers like Harar regional health bureau, woreda health office, health extension workers or health worker and other health related stake holders, especially for future community health life. it also helps as a baseline for future studies.

EDHS 2016 revealed that 69% of children had received the BCG vaccine and 54% had received the measles vaccine. A relatively high percentage of children received the first DPT dose (73%). However, only 37% went on to receive the third dose of DPT. More than eight children of every ten (82%) received the first dose of polio, but only about four in ten (44%) received the third dose. Even though DPT and polio vaccines are often routinely administered at the same time, polio coverage is higher than DPT coverage. According to 2013 health and health related indicators of Ethiopia, the coverage of penta-3 and PCV-3 was 87.6% and 80.4% respectively while that of measles and fully immunized was 83.2%and77.7% respectively (11).

In 2011, nearly 107 million infants (83%) worldwide received at least 3 doses of DTP vaccine; however, approximately 22.4 million failed to receive 3 doses, leaving large numbers of children susceptible to vaccine-preventable diseases and death(15).

Estimated global DTP3 coverage among children aged <12 months in 2014 was 86%, ranging from 77% in African region to 96% in the Western Pacific Region. Approximately, 18.7 million eligible children did not complete the 3-dose series, of which 22%, 12%, 6%, 5% and 4% live in India, Nigeria, Pakistan, Indonesia and Ethiopia respectively. Among them 7.1million (39%) started but did not complete. The report also shows estimated global coverage of BCG(91%), PCV3(86%) and MCV1(85%) (22)

In Ethiopia, it was found that 73.2% of children were fully immunized, 20.3% were partially immunized, and 6.5% received no vaccine .in another study conducted, 76% of the children were fully immunized. Dropout rate was 6.5% for BCG to measles, 2.7% for penta 1 to penta 3, and 4.5% for pneumonia 1 to pneumonia 3 (30).

Other study in Ethiopia in northwest on east Gojam in 2016 result that the overall statuses of children vaccination, 58.4% were fully vaccinated, 17% partially vaccinated and 24.6% not vaccinated. Nearly three-fourths of the children were vaccinated for BCG 72.9% with about three-fourths BCG scar, OPV3 73.4%, penta3 68.7%, PCV1-3 66.6%, rota-2 66.5%, measles (31)67.5% by card. The dropout rate between the first and the third pentavalent vaccine coverage was 3.73%. While dropout rate between BCG and measles was 7.44% (31).

The proportion of partially vaccinated children in Zimbabwe ranged from 13.4% to 56.1% in Rwanda, while the proportion of non-vaccinated children ranged from 0.4% in Burundi to 16% in Ethiopia. The highest vaccine-specific coverage for BCG was in Rwanda 99.1%, measles was in Burundi 93.2%, polio3 was in Rwanda 97.1% and pentavalent3 was in Rwanda 98% while the lowest vaccine-specific coverage for BCG was in Ethiopia 70.5%, measles was in Rwanda 43.6%, polio3 was in Ethiopia 57.7% and pentavalent3 was in Ethiopia 54.4% (32).

The reviewed literatures reported that, research done in Ambo district revealed that mothers' educational and occupational status were the factors that showed significant association with complete vaccination history. Children's mother who was illiterate less likely to be vaccinated than those attended primary school. Regarding the mother’s occupation, housewife or farmers were less likely vaccinate their children as compared to government employed mothers (8).

study done in Ethiopia on risk factors for childhood immunization dropout rate revealed that children from lower wealth quintiles family had lower rates of vaccination completion than the highest quintile family and Children whose mothers had no formal education more likely dropout rate vaccinated as compared to Children whose mothers had higher education (17).

However, another study conducted in Wonago district of Southern Ethiopia contradicts the above study findings. It showed that only family income status was found to be predictor of defaulting from immunization. The other socio-demographic variables such as family size, age of the mother or immediate caretaker, occupational status, ethnicity, religion, parity and educational status were not associated with defaulting (19).

Children's immunization rates have been associated with certain demographic factors, such as parental knowledge regarding immunization and practice, as well as parents’ age, educational level, and employment status. Many studies have indicated that factors such as lack of parents' awareness, misconceptions, and fear of side-effects of vaccines were the most reported reasons for low immunization coverage in countries which allow EPI opting-out. Moreover, a study (29) conducted in Tikrit, Iraq by Abdulrahman and colleagues (2008) found a significant association between immunization completeness and mother's educational level, residence, child sex, mother's age and job respectively. Similar results were reported in Lebanon as vaccination of female children less than 2 years and high parental education were found significantly associated with vaccination compliance (29).

Method And Materials

Study area and period

The study was in Harari Regional State, which is located at the Eastern parts of Ethiopia. It found 526kms away from Addis Ababa, which is the capital city of Ethiopia. According to the Harari Regional State Health Bureau Annual Report 2021, there are 3 governmental and 2 private Hospitals, 9 Health Center, 27 Community Health Posts and 1 Regional laboratory found in the town (35).

This study was conducted at health centers of Harar town from September to 25 November E.C, 2021, eastern Ethiopia. Urban health centers of Harar town include Arategna, Abukar, Jenela and Amir nure and Jenella Health Centers in Harar Harar Town Eastern of Ethiopia.

Study design

A quantitative cross-sectional institution based study was conducted

Variables of the study

Dependent variable

Dropout rate of immunization status.

Independent Variable

Socio-economic and demographic characteristics

Birth order and sex of the child

Immunization service.

Time of travel to reach the nearest health facility

Place of delivery

The Source and study population

Source population

All children aged 12-23 months who were recorded on immunization registers at Harar town Urban Health Centers.

Study population

The children's 12-23 months Randomly Selected from urban health center were living in Harar Town.

Inclusion and Exclusion Criteria

Inclusion criteria

Children age between 12 to 23 months.

Exclusion criteria

The children less than 12 of months and the children greater than 23 months both not included in this study.

Sample size determination and sampling technique

The sample size was estimated using sample size determination formula for a single population proportion formula. The previous studies done reported that the prevalence p = 41.2 % (Tadesse's, 2009) Therefore, the total sample size was calculated with the marginal error of 0.05, with 95% confidence interval. Based on these assumptions, a total sample size was calculated using the formula as indicated below.

$$N = \frac{Z^2 ceP(1-P)}{E^2}$$

$$\text{Hence } N = \frac{(1.96)^2\, 0.412\, (1 - 0.412)}{(0.05)^2}$$

$$= \frac{(3.84 \times 0.412 \times 0.588)}{(0.0025)}$$

$$= \underline{\underline{372}}$$

Therefore, final sample size for the first objective after considering 10% non-response rate is 409 eligible children dropout rate for the study.

As clearly shown in the above calculation, final sample size of 409 issued for this study because it is the largest sample size estimated and is sufficient to address the objective targeted. (20)

Sampling techniques

By using the flow of the Sampling frame would be prepared by data collectors. In health, center 409 study subjects selected by using proportion equal allocation formula. Then, our study participants were selected according to the using Systematic random sampling method until required sample size is reached from registered data.

n is sample size of each Health center

N is total data size of in each Health center

n = n1 + n2 +n3+ n4 + nk is the total sample size

Aretegna HC =409/2878*1047 =149

Abukar HC =409/2878*579 =82

Jelena HC = 409/2878*770 =109

Amir Nure HC =409/2878*482 =68

The list of governmental health centers is indicated in **Fig 1**, who fulfill the eligibility criteria during the study period

Data collection procedure and Instrument

The data was collected on the questionnaires were prepared in English and then trans-late to Amharic, Afan Oromo communication and translated back to English for accuracy and consistency. It was collected by five trained BSc Health Informatics. Data on vaccination history were collected from the available immunization register care takers of the child were asked for presence of the register. Then the information found on the immunization register were recorded accordingly.

Data was collected by five 4th year BSc Health informatics students who are studying in Harar Health Science college by using semi structured questionnaire used to assess magnitude of immunization dropout rate and associated factors among children aged 12-23 month in Harar town. After identifying the study participants, verbal consent obtained after explaining the participants about the aim of the study. Then face to face interview started using pre-tested questionnaires which have both open and close ended questions. Five enumerators who are 4thyear BSC students conducted the interviews and they supervised by the principal investigators.

The Questionnaires were prepared in English and translated in to Amharic by ourselves and then translated back to English by another translator to compare the consistency. A two-day training was given for 5 BSc Health Informatics professionals who had a training certificate before and experience with the immunization services. Before data collection, the questionnaire was pretested on EPI register in Aretegna health center and the findings were excluded from the main study.

Data quality assurance

Prior to actual data collection two days Training is given for data collectors and supervisor by principal investigators. The training focused on the objective of the study and clarification of each question to keep the consistency, neutrality of data collectors and quality of the collected data. One weeks before the data collection, the data collection instrument is pre-tested by taking 5% of the total sample in Harar town Health center for checking its clarity and easily understandable of the response. Based on the results of pre testing the necessary amendment is made on the data collection tools prior to the actual data collection period. Finally, completeness, accuracy and clarity of collected data checked by the principal investigator and supervisor on daily based.

Data processing and analysis

The collected data was carefully checked for completeness as well as consistency. Any confusion on the data collection procedure and/or response. Data was entered, coded and analyzed using SPSS, version 20. Descriptive statistics like frequencies and percentages was used to present the categorical independent variables, and mean/standard deviation was used to describe a continuous variable. Frequency tables were used to present descriptive results. For this study, bivariate logistic regression model was fitted as a primary method of analysis. Odds ratios (OR) was computed with the 95% confidence interval (CI) to see the Reasons for vaccination failure among partial and non-vaccination in relation to the considered associated factors in this research. Independent factors, with a P-value < 0.2 obtained in the bivariate logistic regression was entered into the multiple logistic regression models. Then an adjusted odd ratio (AOR) with 95% confidence interval was calculated for the significant predictive variables, and statistical significance was accepted at (P< 0.05). Logistic regression was also used to present the results

Operational definition of terms

Fully vaccinated: - children is considered as fully vaccinated when they have received a vaccination against tuberculosis (BCG), three doses each of the Penta, PCV and polio vaccines with to doses of Rota vaccine and measles vaccination.

Partially vaccinated: - children is considered as partially vaccinated when they miss at least one doses of vaccines on fully vaccinated.

Unvaccinated: - Children they did not receive any dose antigens.

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 and a child who misses at least one dose of the recommended vaccines.

Result

Socio-demographic characteristics of the respondents

In our study total of Four hundred nine (409) children where their data was collected. 220 (54%) were females and 189 (46%) of them are males. In addition, 37(9.0%) of Childs are dropout, and 372(91.0%) was fully vaccinated respectively. This eligible data observed from immunizations registers in the study and we had a hundred percent (100%) data rate. There are major identified factors associated with dropout in the community.

Table 1. Shows that sociodemographic characteristics of the children who received immunization service at Harar Town in 2021(n=409)

Variables		Frequency	Percent
Sex	Male	189	46.2
	Female	220	53.8
Total		**409**	**100.0**
	12-15 months	193.0	47.2
	16-19 months	179.0	43.8
Age	20-23 months	37.0	9.0
Total		**409**	**100**

Children Vaccination Status

According to blow table the total of 409 children's data was collected from immunization register or secondary data in our studies 356 (87.04%) BCG, 348 (85.15%) OPV 0,409(100%) OPV 1, 407 (99.5%) OPV 2, 375 (91.7%) OPV 3, 409(100%) Penta 1, 407 (99.5%) Penta 2, 375 (91.7%) Penta 3, PCV 1, 407 (99.5%) PCV 2, 375 (91.7%) PCV 3, Rota 1, 407 (99.5%) Rota 2, 372(91.0%) Measles, 37(9.0%) immunization dropout vaccination. (Table 2).

Table 2. Shows that immunization service taken for children among 12 to 23 months at Harar Town Eastern Ethiopia 2021.

Variable		Frequency	Percent
BCG	No	53	13.0
	Yes	356	87.0
OPV 0	No	61	14.9
	Yes	348	85.1
OPV 1	Yes/No	409	100.0
OPV 2	No	2	.5
	Yes	407	99.5
OPV 3	No	34	8.3
	Yes	375	91.7
Penta 1	Yes/No	409	100.0
Penta 2	No	2	.5
	Yes	407	99.5
Penta 3	No	34	8.3
	Yes	375	91.7
IPV	No	34	8.3
	Yes	375	91.7
PCV 1	Yes/No	409	100.0
PCV 2	No	2	.5
	Yes	407	99.5
PCV	No	34	8.3
	Yes	375	91.7
Rota 1	Yes/No	409	100.0
Rota 2	No	2	.5
	Yes	407	99.5
Measles	No	37	9.0
	Yes	372	91.0

Vaccination coverages Status

According to above the table shows that from the total of 409 children collected secondary data in our studies 372(91.0%) fully vaccination, and 37 (9.0%) immunization dropout vaccination. So that when we are, compare this study with the Ethiopia Ministry of Health national standard Immunization program. This study results was high dropout rate.

Figure 1 shows that compare immunization service status like dropout vaccination, and fully vaccinated among child 12 to 23 months at Harar Town, Ethiopia 2021(n=409)

Health Workers Related Factors Respondents

According to the below table a total of 238 (58.2%) children has had fear of COVID 19, 365 (89.2%) had lack of community awareness, 282 (68.9%) had cultural or religious barriers, and 270 (66.0%) had forgotten families. (Table 4).

Table 3. Shows Factors associated with immunization dropout Among Children 12 to 23 at Harar Town, Ethiopia, 2021(n=409)

Variables	Frequency		Percentage
COVID 19	Yes	238	58.2%
	No	171	41.8%
Lack of Community Awareness	Yes	365	89.2%
	No	44	10.8%
Culture or Religious Barriers	Yes	282	68.9%
	No	127	31.1%
Forgotten Family	Yes	270	66.0%
	No	139	34.0%

Association of factors with Immunization Dropout

The result of bivariate analysis, variable eligible with p-value of less than 0.05, were COVID 19, lack of community awareness, cultural barriers or religious barriers and forgotten family were associated with immunization dropout at a p-value less than 0.25. In bivariate model, COVID 19, lack of community awareness, cultural barriers or religious barriers, fear of vaccination side effect and forgotten family were associated with immunization dropout rate. In this study five major factors like covid 19, lack of community awareness, cultural or religious barriers, and forgotten family for (table 4 shows factors affect drop n=409)

Table 4. Bivariate and Multivariate Analysis Association of factors with immunization dropout children age 12 to 23 at selected health centers of Harar, 2021

Variables	*Drop Vaccination*						
	Yes n (%)		No n (%)		Crude OR (95%) CI	P - value	Adjusted OR (95%) CI
COVID 19	238	58.2%	171	41.8%	5.136	0.001	6.91 [1.11 - 10.18]
Lack of Community Awareness	365	89.2%	44	10.8%	4.177	0.042	5.61 [3.46 - 7.44]
Culture or Religious Barriers	282	68.9%	127	31.1%	1.056	0.048	17.98 [1.005 –7.578
Forgotten Family	270	66.0%	139	34.0%	2.037	0.000	3.17 [14.43, 51.34]

Discussion

In this study, the magnitude of immunization dropout rate was 9 .0% and fully vaccinated 91.0% respectively. This study assessed magnitude immunization dropout rate factors associated with immunization dropout, and fully vaccination status children aged between 12 to 23 months in Harar Town.in my group study, a total of 409 children immunized data were collected from immunization register. Based on this finding of this research the coverage of immunization dropout was 37 (9.0%). This finding was high where compare with the Ethiopian Ministry of Health scale of immunization dropout rate standard must below the five percent. Therefore, our study shows that was high 9.0%. All observed and data from immunizations registers in the study were found Eligible (100%). In this study, we identified five major factors like that covid 19, lack of community awareness, cultural or religious barriers, fear of vaccination side effect and forgotten family for dropout and partial vaccination were identified. Out of all factors, lack of community awareness was more affected fully vaccinated and immunization dropout followed culture and religious barrier Covid 19 and forgotten family.

Conclusion

Generally, in this study the magnitude of immunization dropout rate was 9.0%. Major Factors for immunization dropout rate were 238 (58.2%) children has had fear of COVID 19, 365 (89.2%) had lack of community awareness, 282(68.9%) had cultural or religious barriers, and 270 (66.0%) had forgotten families. were predictors of immunization dropout rate. Then from all factors lack of community awareness more main resin was affect immunization drop vaccination identified in this study can be prevented and managed by providing appropriate care during immunization service and timely on immunization schedules.

Recommendation

In this study health experts, health workers and we discussed must all persons strictly works by commitment on immunization drop. Integrate with community health workers. Federal Ministry of health, regional health bureau and other public health facilities should work together to establish smooth expanded program on immunization services system. depending on this study some of the health care providers, health experts working on immunization program recommended strictly provide counseling during immunization service and immunization schedules visits about immunization to reduce risks of child morbidity and mortality. Further prospective researches should be conducted incorporating factors like causes of immunization dropout rate, etc. considering larger sample size with longer follow up period of study to address issues related with information incompleteness.

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35. Harar Town Administration health office, 2021.

Figures

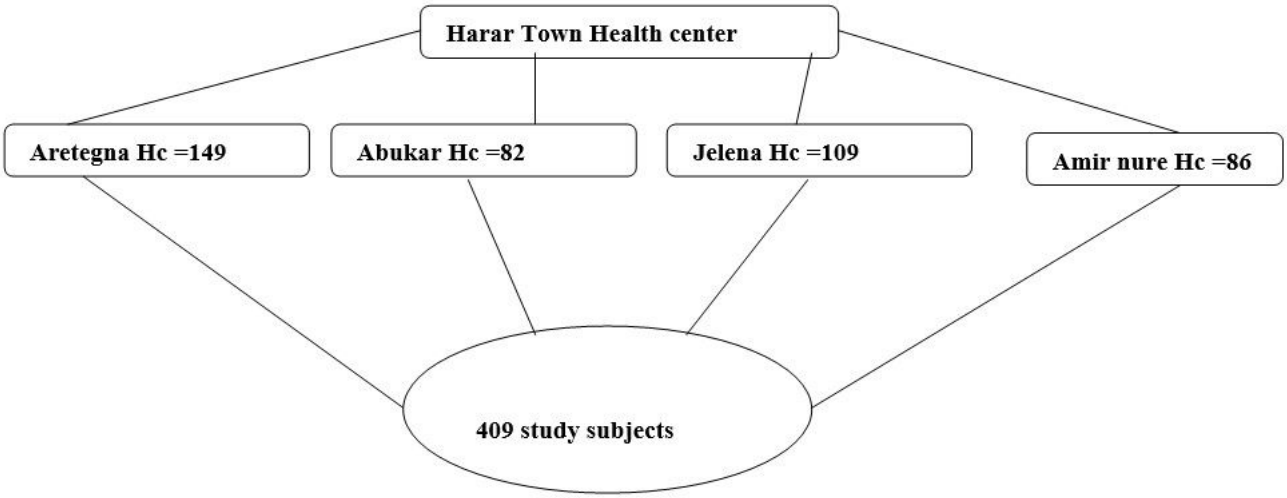

Figure 1

Schematic representation for sampling of immunization dropout rate and associated factors among children aged 12-23 months in Harar town Eastern Ethiopia 2021.

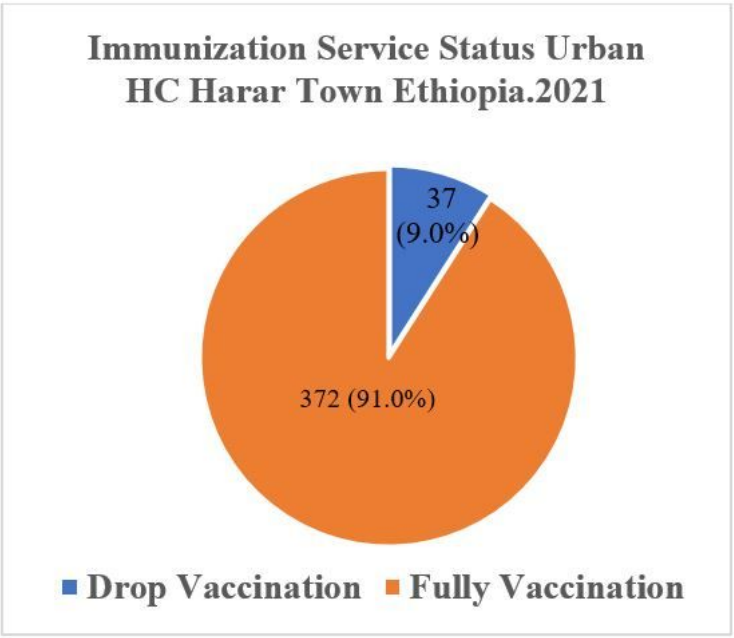

Figure 2

Legend not included with this version.