PLOS ONE

RESEARCH ARTICLE

Full immunization coverage and associated factors among children aged 12–23 months in Somali Region, Eastern Ethiopia

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Citation: Yadita ZS, Ayehubizu LM (2021) Full immunization coverage and associated factors among children aged 12–23 months in Somali Region, Eastern Ethiopia. PLoS ONE 16(12): e0260258. https://doi.org/10.1371/journal.pone.0260258

Editor: Comfort Z. Olorunsaiye, Arcadia University, UNITED STATES

Received: January 15, 2021

Accepted: November 7, 2021

Published: December 7, 2021

Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: https://doi.org/10.1371/journal.pone.0260258

Data Availability Statement: All data supporting the findings is submitted with the manuscript. The data set for this article is Openly accessible without restriction (S2 File).

Abstract

Objective

Despite those efforts in expanded programs of immunization, nearly one fifth of children in developing countries miss out basic vaccines. Moreover, many children who started vaccination fail to complete immunization.Identifying associated factorswhich is scarce in the study area, is crucial for interventions. This study assessed full-immunization and associated factors among children aged 12–23 months in Somali region, Eastern Ethiopia.

Methods

A community-based cross-sectional study design was conducted from October 1–30, 2018, in selected rural and urban kebeles in Somali regionamong 612 children. Cluster sampling was employed and data was collected using structured questionnaire. Full-immunization was measured by maternal recall and vaccination card.Data entry and analysis was done by EpiData3.1 and SPSSversion.20 respectively. Binary logistic regression with Bivariate and Multivariable model was usedto identify predictors of full-immunization. Odd ratios were computed and P-value <0.05 was considered as statistically significant.

Results

Based on maternal recall plus vaccination card 249(41.4%) of children were completed immunization, while vaccination only by card was 87(29.7%). Only 238(39.5%) of participants had good knowledge about vaccination. Not knowing to come back for next visits 197(55.8%) were the major reason for dropout. Residing in urban (AOR = 2.0, 95%CI: 1.0, 3.9),primary educated mothers(AOR = 2.2, 95%CI: 1.0, 5.0), married mothers (AOR = 4.2, 95%CI:1.0, 18), higher average monthly income (AOR = 2.5, 95%CI 1.1, 5.2)and delivered at health facilities (AOR = 3.8, 95%CI 1.9, 7.3)were significantly associated with full-immunization.

Conclusion

Coverage of full immunization was found to be low compared to the targets set in the Global Vaccine Action Plan(2011–2020).Two-third of the participants has poor knowledge about

Funding: The authors received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

Abbreviations: DPT, Diphtheria, Pertussis, Tetanus; EDHS, Ethiopia demographic and health survey; EPI, Expanded program on immunization; GVAP, Global Vaccine Action Plan; HSDP, Health sector development program.

vaccination. Urban residence, mother education, higher family income, male child and institutional delivery were factors. This study suggests that awareness creation, behaviour change on vaccination and enhancing utilization of maternal health service including delivery service, should be stressed.

Introduction

Childhood immunization is the most effective and efficient intervention area of public health. It is currently high on both national and international policy and aid agendas [1–3]. To ensure maximum protection of children, the World Health Organization(WHO) launched the Expanded Program on Immunization(EPI) in 1974. In developing countries, the annual death of children has fallen below 10 million. Of this, immunization averted an estimated 2.5 million deaths [1,4,5]. Nevertheless, vaccine-preventable diseases (VPDs) are by far responsible for about 29% of under-five deaths each year globally. In 2018, more than thirty million children under five suffer from VPDs every year in Africa [3–6].

In 2015, an estimated 19.4 million infants worldwide were not reached with routine immunization; where 60% of them reside in ten developing countries [7,8]. In 2018, an estimated 86% of infants worldwide were vaccinated with three doses of the vaccine against diphtheria, tetanus, and pertussis(DTP3) up from 20% in 1980. While global coverage with the third dose of Haemophilus influenza-B and the hepatitis-B vaccine was estimated at 72% and 84%, respectively. Only 86% of children had received one dose of measles vaccine worldwide [9–11].

In Africa, significant progress has been achieved. Nevertheless, overall coverage rates remain low compared to the Global Vaccine action plan (GVAP: 2011–2020) targets. In 2018, coverage with DPT-3 and measles vaccine was 76% and 74% respectively. While 76% of the children were vaccinated for Haemophilus influenza-B (Hib) and hepatitis B. Nearly one-third of African countries did not achieve 80% infant PCV3 coverage [4,6,12].

In Ethiopian, according to the Ethiopian demographic and health survey (EDHS)-2016 and 2011, 39% and 24% of children were fully immunized, respectively. However, it remains below the goal of 66% set in the HSDP-IV [13–16]. In EDHS-2016, 73% and 53% of children received the first and third DPT-HepB-Hib(pentavalent) dose, respectively. 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 [12,14,15].

In the Somali regional state, full-immunization coverage increased from 2.8% in EDHS-2005 to 22% in EDHS-2016. However, these numbers were very low compared to the other regions [14–17]. Nevertheless, studies on factors for low full immunization and reasons for discontinuation are scarce in the region. Hence, this study was intended to assess the coverage and factors affecting the full immunization status among children 12–23 months of age in the Somali region and enable to generate data that could be used for better planning and strengthening of immunization services.

Methods

Study design, setting and period

Community based cross-sectional study design was employed to assess coverage and associated factors of full immunization among children 12–23 month of age in Somali Region, from October 1–30, 2018.Somali region is pastoralist and an agro-pastoralist region in Eastern Ethiopia.

Population, sample size determination and sampling procedure

All children aged 12–23 months with their mothers/caregivers were the source population. Study populations were children aged 12–23 months with their mothers/caregivers residing in randomly selected Kebele's of Somali region.

Inclusion criteria. Mothers with at least one child aged between 12–23 months who did take at least one dose of any vaccine were included.

Exclusion criteria. Those mothers who were unable to respond or very sick were excluded.

The sample size was determined by using single population proportion formula by considering the assumptions of 95% CI, 5% margin of error, design effect of 1.5, non-response rate (10%)and national coverage of full immunization (39%) [15] giving a final sample of 612. A cluster random sampling method was employed and the number of clusters was decided before data collection. Deghabur district was selected by lottery method. The lists of thirty Kebele's were taken from the administrative bodies of district and town. Then, elevenurban and rural Kebele's were selected by simple random sampling (a lottery method) and a total of 1876 households were found in these Kebele's. Each Kebele's were considered as one cluster and 60 households were selected from each of five rural Kebele's and the rest of the households were selected from the six urban Kebele's. The lists and number of households for each Kebele's was found for all selected Kebele's. in each Kebele the first household was selected randomly. The subsequent households were selected by systematic random sampling. For those households with more than one eligible child, one child was taken by lottery method.

Data collection

A structured questionnaire was developed from DHS and other literatures in English and was translated to the local language (Somali language) (S1 File) [15,17]. The questionnaire includes; information on socio-demographic and economic status, child characteristics, reproductive/obstetric history, accessibility of vaccination service (travel time), immunization histories of children, maternal knowledge on immunization, and reasons for defaulting. Thirteen closed ended questions were developed to assess maternal knowledge towards child immunization. The content validity of the questionnaire was achieved by reviewing the previous similar studies. Pretest was carried out on 5% of respondents of the total sample in Kebridahir town. The data was collected based on the availability of immunization card and mothers/caretakers verbal report. In the selected households, mothers/caretakers of the child were asked for the presence of child's immunization card. For the child with immunization card, the information on the doses and types vaccine received by the child was copied from the card. If immunization card was unavailable for the child, the mothers/caretakers were asked for immunization history.

Measurement

Immunization status: being fully vaccinated or not fully-immunized.

Full immunization: a child who received all basic vaccinations: One dose of BCG vaccine, three doses of Pentavalent, three doses of Polio vaccine, two doses Rota vaccine, three doses of Pneumococcus vaccine, one dose of Measles vaccine [18].

Coverage by card only: Coverage calculated with numerator and denominator based only on documented dose, excluding from the numerator those vaccinated by history.

Coverage by card plus history: Coverage calculated with numerator based on card and mother's report.

Full Immunization coverage: Proportion of children took all the recommended basic vaccination.

Kebele: is the smallest administrative unit in Ethiopia.

Dropout rate (DoR): is the rate difference between the initial vaccines (BCG or pentavalent one) and the final vaccines (Pentavalent three or Measles).

Good Knowledge: If a mother scored above the mean score for those questions related to vaccination and vaccine preventable diseases, considered to be good knowledgeable.

Poor Knowledge: If a mother scored below the mean score for those questions related to vaccination and vaccine preventable diseases, considered to be good knowledgeable.

Data processing and analysis

The data was cleaned, edited and entered into Epi data version 4.1. Then, the data was exported to SPSS window version 20 for analysis. Descriptive statistics was done by computing proportions and summary statistics. Chi-square testing were used and normality were checked. Binary logistic regression model was employed to identify associated factors. Initially, bivariate logistic regression analysis was done and crude odd ratio (COR) with 95% CI was computed. In the Bivariate analysis, variables with a p-value of below 0.2 were included in the multi-variable logistic regression analysis. Adjusted odd ratios with 95% CI were calculated and factors with a p-value less than 0.05 were declared as independent predictors. Model goodness of fit was checked by Hosmer-Leme show goodness-of-fit test.

Ethical approval and consent to participate

Written ethical approval letter was taken from Jigjiga University Research Ethics Review Committee (S1 Fig). Permission letter was also sought from Somali Region Health Office. Written consent (S1 File) was asked from each study participants (mothers/caregivers of children's aged 12–23 months before data collection. They were informed about the objective of the study, confidentiality of their data and the right to refuse participation (S1 File). Mothers with incompletely vaccinated child were counseled to complete the immunization as per the schedule.

Results

Socio-demographic characteristics of the mothers/caregivers

Six hundred two mothers of children aged 12–23 months of age were successfully interviewed, yielding a response rate of 98.4%. Nearly half 298 (49.5%) of participants were rural dwellers. More than half 312 (51.8%) of the respondents were in the range of 20 to 29 years with the median of 28.5 (SD ±5.2). The majority of respondents 517 (85.9%), 537 (89.2%) and 485 (80.6%) are Somalis in Ethnicity, Muslims in religion and married in marital status, respectively.

Only 74 (12.3%) of the respondents achieved secondary education and above 12.Two third 399 (66.3%) of the respondents were housewives. Regarding the average monthly family income, nearly three fourth of 447 (74.9%) of the households get 5000 Ethiopian birr and below.

Reproductive history and child characteristics

Two hundred ninety two (48.5%) of children in the study are males. More than half of children were found between the range of 12–15 months of age with median age of 15. The average family size was 6.6 per household. Regarding antenatal care, only 205 (34.1%) of respondents had four antenatal care visits. One third of the respondents gave their last birth in the health institutions (Table 1).

Table 1. Reproductive history and child characteristics of mothers/caregivers of children aged 12–23 months in Somali region, Eastern Ethiopia, 2018.

Variables		Frequency(n = 602)	Percentage
Child sex	Male	292	48.5
	Female	310	51.5
Child alive	≤ 3	192	31.9
	4–6	295	49.0
	>6	115	19.1
Family size	1–3	63	10.5
	4–6	140	23.3
	≥ 7	399	66.3
Child age	12–15	349	58.0
	16–19	163	27.1
	20–23	90	15.0
ANC	Yes	464	77.1
	No	138	22.9
Number of ANC visits (n = 464)	1–2	109	23.5
	3–4	355	76.5
TT Vaccine	Yes	477	79.2
	No	125	20.8
Number of TT vaccine (n = 477)	1–2	277	58.0
	3–5	200	42.0
Place of delivery	Home	252	41.9
	Health institution	350	58.1
Birth Order	First	63	10.5
	Second	27	4.5
	Third	96	15.9
	Fourth and above	416	69.1

https://doi.org/10.1371/journal.pone.0260258.t001

Vaccination service availability and access

More than two third 424 (70.4%) of the respondents reported that there is a nearby heath facility which render vaccination service. For more than half 234(55.2%) and nearly half 201 (47.4%) of respondents an average travel time to reach the nearby health facility and an average waiting time was 15 to 30 minutes, respectively (Table 2).

Knowledge on vaccination/Vaccine preventable diseases

The majority 528 (87.7%) of study participants ever heard about vaccination and, health personnel were the most frequent source of information for 349 (66.1%) of the respondents. Only 214 (35.5%) of the respondents know correct number of sessions to complete immunization; while 318 (52.8%) and 277 (46.0%) of mothers/caregivers Know correct age to begin immunization and correct age to complete immunization, respectively.

Immunization status of children

Of all mothers/caregivers of children who ever took one or more dose of vaccine, nearly half 293 (48.7%) of them retained vaccination card. Of all children who were involved in the study, 256(42.5%) of them have completed all of the recommended vaccination by history (maternal recall) and plus Card. While from the total of two hundred thirty nine mother who retained vaccination cards, 87 (29.7%) of them completed the recommended vaccination.

Table 2. Vaccination service availability and accessibility in Somali region, Eastern Ethiopia, 2018.

Variables		Frequency(n = 602)	Percentage
Presence of nearby health facility for vaccination service	Yes	424	70.4
	No	178	29.6
Type of Health facility (n = 424)	Health center	104	24.5
	Hospital	143	33.7
	Health post	169	39.9
	Private clinic	8	1.9
Travel time to the nearby health facility (n = 424)	<15min	71	16.7
	15-30min	234	55.2
	31 to 60 min	81	19.1
	above 60min	38	9.0
Waiting time (n = 424)	<15min	166	39.2
	15-30min	201	47.4
	31-60min	57	13.4
Functional refrigerator (n = 424)	Yes	244	57.5
	No	180	42.5
Defaulter tracing (424)	Yes	74	17.4
	No	350	82.6

https://doi.org/10.1371/journal.pone.0260258.t002

Immunization coverage by card only. Of all respondents who retained vaccination card, 194 (66.2%) of children took BCG vaccine. Two hundred thirty-six (80.5%) of children took OPV1, while only 125 (42.7%) took OPV3. More than three fourth (79.9%) of respondents took pentavalent one and Rota vaccine one. While two hundred thirty-two (79.2%) of respondents took PCV one, only 118 (40.8%) of them took the third dose. Eighty-seven (29.7%) of them children were completed the recommended Vaccination (Fig 1).

Immunization coverage by history/recall plus card. According to vaccination card and maternal recall, from the total of 602 children, 249 (41.4%) of them were completed their immunization (fully vaccinated). The majority (77.7%) of children were vaccinated for BCG. More than nine out of ten children took OPV1, while only 269 (44.7%) took OPV3, where 50.9% dropout rate from OPV1 to OPV3. Similar trends were found with pentavalent and PCV; decrement was seen from the first dose to the last dose. Five hundred thirty-nine (89.5%) took pentavalent one, while 267 (44.3%) of the respondents took Pentavalent 3, with 50.4%

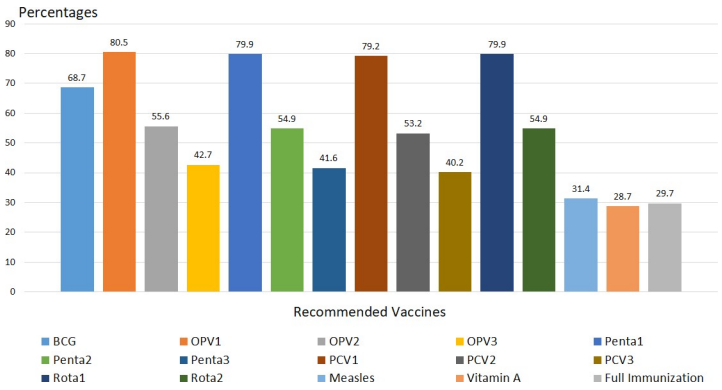

Fig 1. Full immunization coverage by card only, among children 12–23 month of age, in Somali region, Eastern Ethiopia 2018. *(Note*: (BCG- Bacillus calmette-guerin, OPV- Oral polio vaccine, Penta-pentavalent, Rota- Rota vaccine, PCV-Pneumococcal conjugate vaccine).

https://doi.org/10.1371/journal.pone.0260258.g001

dropout rate. Nearly half (46.3%) of children took measles vaccine; where 40.4% BCG to measles dropout rate were seen (Fig 2).

Reasons for not fully vaccinated

Mothers/care givers with incompletely vaccinated child were asked for reasons for drop out. Of the total children, 353 (58.6%) of were not fully vaccinated. Not knowing to come back for next visits were the most frequently mentioned reason for 197 (55.8%) mothers/care givers, followed by vaccination site far away 112 (31.7%) (Fig 3).

Factors associated with full immunization

In the bivariate logistic regression twelve variables were found to be candidates for multivariable logistic regression. Nevertheless, in the multiple logistic regression: residence, maternal marital status, maternal education, average family income, sex of the child, place of delivery and travel time to the nearby facility were significantly associated with full immunization.

Children of mothers/care takers who reside in the urban were two times AOR: 2.0, 95%CI [(1.0, 3.9)] more likely to fully vaccinate their child compared to children of mothers/care takers in the rural. Children's of mothers who are primary educated were two times AOR: 2.2, 95% CI [(1.0, 5.0)] more likely to be vaccinated compared to children's of mothers who were illiterate. Children's of mothers who are married were four times AOR: 4.2, 95%CI [(1.0, 18)]more likely to be fully vaccinated compared to children's of mothers who are single. Children's who are from a family with an average monthly income of 5000 birr and above were more than two times AOR: 2.5, 95% CI [(1.1, 5.2)] more likely to be vaccinated than children's of a family with a monthly of 1000 and below. Male children were nearly two times AOR: 1.7, 95%CI [(1.0, 2.7)] more likely to be fully vaccinated than their counter parts. Children's of mothers who delivered at health facilities were nearly four times AOR: 3.8, 95%CI [(1.9, 7.3)] more likely to complete their vaccination. Mothers/caregivers who traveled to the nearby health facility in less than 30 minutes were more than two times AOR: 2.6, 95%CI [(0.8, 8.3)] more likely to fully vaccinate their child than mothers/caregiver who travel for above an hour (Table 3).

Discussion

This study determined the prevalence of full immunization and associated factors among children aged 12–23 months. The prevalence of full immunization was 29.7% by card only and

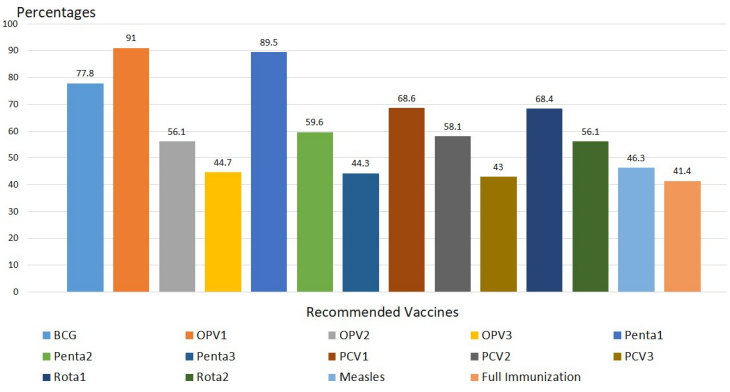

Fig 2. Full immunization coverage by maternal recall plus vaccination card, among children 12–23 month of age, in Somali region, Eastern Ethiopia 2018. *(Note*: (BCG- Bacillus calmette-guerin, OPV- Oral polio vaccine, Penta- pentavalent, Rota- Rota vaccine, PCV-Pneumococcal conjugate vaccine).

https://doi.org/10.1371/journal.pone.0260258.g002

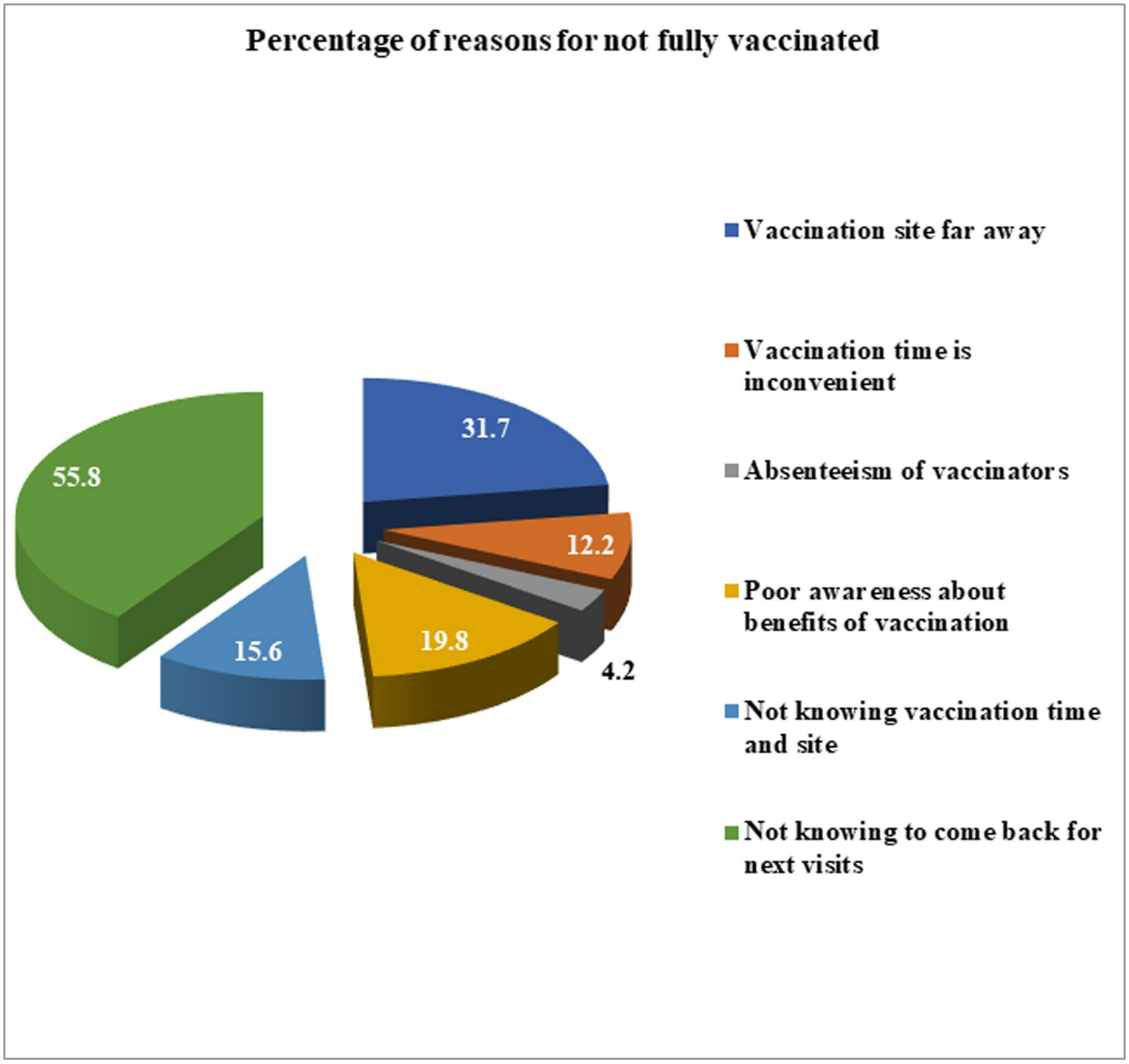

Fig 3. Reason for not fully immunized among children 12–23 month of age, in Somali Region Eastern Ethiopia 2018.

https://doi.org/10.1371/journal.pone.0260258.g003

41.4% by history/recall plus card. It was higher compared to EDHS-2016 Somali region prevalence (22%), and Jijiga district (36%). This difference is expected as progress has been made since EPI initiated and intensive vaccination campaigns before the study [15,19]. Nevertheless, it was low compared to the goal of 66% coverage set in the HSDP-IV and other district level studies in Ethiopia [11,20,21]. It was also low compared to low-and middle-income countries reported coverage ranges from 63%-90%, and 80% targets set in the GVAP(2011–2020) and UNICEF Strategic Plan(2018–2021).The difference is expected as our study place is a pastoralist and agro-pastoralistarea. Improvements in program performance in the aforementioned countries were reported [3,22–24].

Table 3. Determinants of full immunization among children 12–23 months of age, in Eastern Ethiopia 2018.

Variable		Full immunization (n = 602)		COD (95% CI)	AOR 95% CI
		Yes	No		
Residence	Urban	180	124	4.8(3.4, 6.8)	2.0 (1.0, 3.9) *
	Rural	69	229	1	
Maternal marital status	Single	4	17	1	
	Divorced	14	20	2.9(0.8, 10.7)	8.9(1.5, 54.2) *
	Married	217	268	3.4(1.1, 1.3)	4.2(1.0, 18) *
	Widowed	14	48	1.2(0.3, 4.3)	11.3(1.5, 83.2)
Educational status	Illiterate	133	266	1	
	Read and write	39	40	1.9(1.1, 3.1)	1.1 (0.5, 2.2)
	Primary	32	18	3.5(1.9, 6.5)	2.2 (1.0, 5.0) *
	Secondary	27	21	2.5(1.4, 4.7)	1.2 (0.4, 3.6)
	Above 12	18	8	4.5(1.9, 10.6)	1.3 (0.3, 5.1)
Average monthly family income	≤1000	22	85	1	
	1001–2500	58	83	2.7(1.5, 4.8)	1.5(0.6, 3.5)
	2501–4999	73	112	2.5(1.4, 4.4)	2.0(0.9, 4.4) *
	≥5000	96	73	5(2.9, 8.9)	2.5(1.1, 5.2) *
Sex of the child	Male	141	151	1.7(1.2, 2.4)	1.7(1.0, 2.7) *
	Female	108	202	1	
Place of delivery	Home	55	197	1	
	Health institution	194	156	4.4(3.1, 6.4)	3.8(1.9, 7.3) *
Knowledge about Vaccination and VPD	Good knowledge	141	97	3.4(2.4, 4.8)	1.5(0.9, 2.6)
	Poor knowledge	108	256	1	
Travel time to the nearby health facility(n = 424)	<15min	39	32	5.4(2.1, 13.8)	2.9(0.8, 9.4)*
	15-30min	138	96	6.3(2.7, 15.0)	2.6(0.8, 8.3)
	31–60 min	25	56	1.9(0.7, 5.0)	0.9(0.3, 3.3)
	Above 1hr	7	31	1	

* significant (P-value <0.05).

https://doi.org/10.1371/journal.pone.0260258.t003

This study found that a dropout rate ranging from 40% to 50.9%. This rate was higher than the reported National dropout rate (20% to 25%), and other findings in Ethiopia [15,16,25]. This was possibly due to the mothers/care-takers lack of access for maternal health service.

Children of mothers who reside in urban were found to be a positive predictor of full immunization. It is supported by evidences from Ethiopia, Nigeria, Pakistan and Myanmar [15,26–28]. Children's of mothers who weremarried were four times more likely to be fully vaccinated. This is supported by others evidences [26,29]. This is may be due to married women get husband support in decision making. This study also showed higher full immunization coverage for those who delivered at health institution compared to home delivery. It is comparable with findings in Ethiopia, Kenya, Philippines and Pakistan. This shows increased contact with the healthcare facility would improve full immunization [21–23,30]. Male children were more likely to be fully immunized than females. This could be due topriority is given to males, in most low and middle-income countries including Ethiopia [15,20,31].

This study and others have found that household economic status was predictor of full-immunization [15,20,32]. This can be justified that children born to economically better households have more chance of being fully vaccinated.

Conclusions

Both Fullimmunization by card only (29.7%) and by maternal recall plus card (41.4%) is low compared to the targets set in the Global Vaccine Action Plan, 2011–2020, the UNICEF Strategic Plan, 2018–2021 and other district level studies [9]. Only 39.5% of the study participants have good knowledge about immunization session correct age to start and finish vaccination. Urban residence, marital status of the mother, primary educational status of the mother, average family income, sex of the child, below 30 minute travel time to nearby facility and institutional delivery were the significantly associated with full immunization status of children age 12–23 months. On the other hand, not knowing to come back for next visits (55.8%), vaccination site far away (31.7%) and poor awareness about benefit of vaccination (19.8%) were frequently mentioned reasons for incomplete vaccination. This study suggests governmental and non-governmental organizations working on immunization locally and nationally, need to promote knowledge on proper immunization session, correct age to start and finish vaccination. National and regional programs should strive to increase accesses and utilization of maternal health service like delivery service, which have direct impact on child full immunization.

Limitations

Assessing vaccination status based on maternal recall is liable for recall bias. Since cross-sectional study design was employed, it doesn't show temporal relationships between factors. The data was collected by interviewers that can potentially introduces social desirability bias.

Supporting information

S1 Fig. Ethical approval letter.
(TIF)

S1 File. Annex.
(PDF)

S2 File. Data set in SPSS version-23.
(SAV)

Acknowledgments

We would like to thank Jigjiga University and Somali region health office for their close support. We are grateful for study participants, supervisors and data collectors for their willingness and cooperation during data collection and field work.

Author Contributions

Conceptualization: Zemenu Shiferaw Yadita.

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Investigation: Zemenu Shiferaw Yadita, Liyew Mekonen Ayehubizu.

Methodology: Zemenu Shiferaw Yadita, Liyew Mekonen Ayehubizu.

Project administration: Zemenu Shiferaw Yadita.

Software: Zemenu Shiferaw Yadita.

Validation: Zemenu Shiferaw Yadita.

Writing – original draft: Zemenu Shiferaw Yadita.

Writing – review & editing: Liyew Mekonen Ayehubizu.

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