Fully Vaccination Coverage and Associated Factors among Children Aged 12 to 23 Months in Arba Minch Zuriya Woreda, Southern Ethiopia

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Abstract

Despite efforts to improve Expanded Program on Immunization (EPI) services, outbreaks related to vaccine preventable diseases are still major problems in developing countries including Ethiopia. The objective of this study was to assess fully vaccination coverage and associated factors among children aged between 12 to 23 months. A community-based cross-sectional study using thirty-by-seven cluster sampling technique developed by WHO in 1978 was employed in Arba Minch zuriya district, Southern Ethiopia in March, 2014. The district was divided in to thirty clusters based on geographic boundary and a total of 210 mothers/care givers whose children aged between 12-23 months old during study period were included in the study. Interviewer administered pre-tested structured questionnaire was used to collect quantitative data from mothers/care givers and in- depth interviews with Arba Minch Woreda health office, respective health centers EPI coordinators and health extension workers using interview guide were conducted. Bivariate and multivariate analysis was used to assess factors associated with fully vaccination coverage. Fully vaccination coverage among children aged 12–23 months in the study area was 53.3%. Those mothers/care givers who attended formal education [AOR = 3.73, (95% CI = 1.66, 8.42)]; received antenatal care in their last pregnancy [AOR = 4.05, (95% CI = 1.7, 9.63)]; delivered their last child at health facility [AOR = 3.24, (95% CI = 1.23, 8.42)] and informed the date of subsequent vaccine during EPI session by health workers [AOR = 6.72, (95% CI = 2.83, 15.94)] were more likely to get their child fully vaccinated than their counter parts. In conclusion fully vaccination coverage among children aged 12–23 months remains low. Maternal education on the benefits of vaccination and health care utilization (especially antenatal care and institutional delivery) should be strengthened.

Keywords: Fully vaccination, Vaccination coverage, Children aged 12-23 months, Arba Minch

Introduction

Vaccination has been shown to be one of the most cost effective health interventions worldwide, through which a number of serious childhood diseases have been successfully prevented (WHO, 2009). In 1974, the World Health Organization (WHO) launched the Expanded Program of Immunization (EPI) to make vaccines available to all children (WHO, 2010). Ethiopia launched the program in 1980, which aimed to achieve 100 percent vaccination coverage of children under two years of age by 1990 (WHO, 2010 and Federal Ministry of Health, 2005). However, the policy updated in 2007 to reach children younger than one year of age with the following vaccines: one dose of Bacillus Calmettee-Guerin (BCG) vaccine at birth (or as soon as possible); three doses of diphtheria, pertussis and tetanus (DPT) with hepatitis B (HepB) and Haemophilus influenza type b (Hib) (DPT-HepB-Hib) at 6th , 10th and 14th weeks of age; at least three doses of oral polio vaccine (OPV) at birth , 6th , 10th and 14th weeks of age; and one dose of measles vaccine at 9 months of age (Federal Ministry of Health, 2005). Therefore, children are expected to be fully immunized by 12 months of age. The program also aims to reach women of reproductive age (15 to 49 years old) with the tetanus toxoid (TT) vaccine (Federal Ministry of Health, 2005; Unicef, 2009 and WHO, 2011). The vaccine-preventable diseases currently included in the National Expanded Program on Immunization (EPI) in Ethiopia are tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus, measles, hepatitis, pneumonia and meningitis due to Haemophilus influenza type b (Federal Ministry of Health, 2005 and Global Immunization Vision and Strategy 2006-2015).

Despite efforts to promote child health by controlling vaccine preventable childhood diseases, there are still millions of children who were not benefited from the protection that vaccination provides (Global Immunization Vision and Strategy 2006-2015). In 2012 WHO revealed that around 1.5 million children under five years of age worldwide died from vaccine preventable disease (WHO and UNICEF, 2012). Yet vaccine availability, accessible EPI service, suitable delivery strategy and government commitment to vaccinate all eligible children vaccination coverage is still low and mortality rate of children under the age of five years remains highest in Ethiopia (88 per 1,000 births) (WHO, 2010; EDHS, 2011 and UN, 2000).

According to Ethiopia Demographic and Health Survey (EDHS), vaccination coverage increased from 14% in the 2000 to 20% in 2005 and fully vaccination coverage for the country was 24.3% and for Southern Nations and Nationality People Region (SNNPR) was 24.1%. However, about 15% of children at the age group of 12-23 months in the country and 12% of them in the region did not receive the recommended vaccines at all

(EDHS, 2011). According to annual report, fully vaccination coverage was 98% for Gamo Gofa zone and 84% for Arba Minch zuriya woreda by the year 2012/13. In spite of relative high vaccination coverage as to that of national and regional coverage, there has been recurrent occurrence of epidemics on EPI target diseases like measles and meningitis in the study area. The reason was not clearly understood. However, it may be due to false report at lower health facility level (health post or health center) or invalid and/or non-potent dose of vaccines given for children. Therefore, the aim of this study was to assess fully vaccination coverage and associated factors among children aged between 12 to 23 months in Arba Minch zuriya woreda, Gamo Gofa zone, Southern Ethiopia.

Methods and Materials

Study setting and design

This community based cross sectional study was conducted in Arba Minch zuriya woreda, Southern Ethiopia in March, 2014. The district has 6 health centers and 37 health posts, all were providing EPI service at static and outreach activity. For the study the author divided the district into thirty clusters based on geographic boundary assuming that all clusters have nearly equal number of eligible children.

Sample size and sampling technique

The sample size for quantitative study was calculated by using thirty-by-seven cluster sampling technique which was developed by WHO in 1978 such that seven children were selected from each cluster which results in the final sample size of 210. For qualitative study (in depth interview) seventeen key informants (ten health extention workers, six EPI coordinators from each health center and one EPI focal person from Arba Minch zuriya woreda health office) were selected purposely.

Data collection

The researcher used both quantitative and qualitative data collection methods. Interviewers administered pre-tested structured questionnaire was used for data collection from mothers/care givers of children aged between 12-23 months old. The questionnaire addressed socio-demographic variables of children and their mothers/care givers, vaccination status of the children, mothers/care givers knowledge, attitude and practice on their children's vaccination, and health service utilization related factors of mothers/care givers. Fifteen data collectors and five supervisors were participated during quantitative data collection after two days training. All mothers/care givers were asked by interviewer to show their children's EPI cards (if available) so as to record the type and date of each vaccine their children received. If a child did not have EPI card, or if the mother/care giver unable to show the card to the interviewer, the child's vaccination status was recorded based on mother's/care giver's verbal report which later corrected by already existing EPI registration book from health posts/health centers. In depth interview with ten health extension workers (HEWs) who were randomly selected from ten kebeles (one HEW from each kebele); EPI coordinators of six health centers and Arba Minch zuriya woreda health office were conducted based on interview guide. Note taking and tape record was used during in-depth interview not to miss important points.

Data analysis

Data was edited, coded and entered into Epi data version 3.1 and then transported to SPSS 16.0 statistical software for analysis. Pre-test and double entry was performed to assure quality of data. Bivariate analysis was done and all explanatory variables which have association with the outcome variable (fully vaccination status) at p value of 0.2 were selected as candidate for multivariate analysis. Then multivariate analysis using backward stepwise selection method was conducted to determine presence of statistical association at P value < 0.05 and OR with 95% CI was used to measure the degree of association between explanatory variables and the outcome variable. Finally qualitative findings were categorized by key thematic areas to supplement quantitative findings.

Ethical consideration

Ethical clearance was obtained from the ethical review committee of Arba Minch College of Health Science and Southern Nations and Nationality People Regional Health Bureau. Verbal consent was obtained from the study participants and confidentiality was assured for all the information provided.

Operational definitions

- Coverage by card only - coverage calculated with numerator based only on documented dose among total children in the study.
- Coverage by card plus history - coverage calculated with numerator based on card and mother's verbal report among total children in the study.
- Fully vaccinated - a child of 12-23 months old who received one dose of BCG, one dose of measles, three doses of Pentavalent, Polio and PCV before her/his first birthday.
- Invalid dose – a vaccine given to children earlier than minimum recommended time gap.

- Unvaccinated - a child who does not receive any dose of the nine vaccines.

Results

A total of 210 mothers/care givers of children aged between 12 to 23 months old were interviewed. Of total 210 children, 112(53.3%) were males, 116(55.2%) had EPI card and 63(30%) were delivered at health facility. The mean age of mothers/care givers was 28.3(SD=6.28) years, which ranged from 17 to 43 years. Majority of the mothers/care givers did not attend formal education 118(56.2%), protestant by religion 135(64.3%), Gamo by ethnicity 179(85.2%) and house wives by occupation 176(83.8%). (Table 1)

Vaccination coverage

Vaccination coverage was assessed based on mothers' recall, EPI card and registration book from health post or health center. Based on this, fully vaccination coverage in the study was 112 (53.3%). Among all vaccines $Polio_1$ and $Penta_1$ has highest coverage 192(91.4%); while $Polio_0$ has lowest coverage 71(33.8%). Concerning dropout rate that of BCG to measles was 11.7%, PCV_1 to PCV_3 was 7.4% and $Pentavalent_1$ to $Pentavalent_3$ was 7.3%. (Table 2)

Those vaccines recommended to be given together at the same time schedule (eg. Polio, pentavalent and PCV) were not administered as per the national EPI guidelines. Moreover, the number of children who received the subsequent doses of these vaccines decreased. A qualitative study also showed that there was inadequate supply of some vaccines to target groups. *"……there was shortage on supply, and sometimes absence, of certain vaccines like polio, pentavalent and PCV with the number of eligible children last year (the time in which our study participants expected to take the vaccines)".* (23 years old, Male, EPI coordinator, Shelle health center)

Invalid and missed vaccine dose

The study showed that 90(42.9%) of children did not take, even, one of the nine recommended vaccines and/or took invalid doses. The most frequently given invalid dose (given below the minimum recommended time gap) of vaccine was measles 16(7.6%), followed by $Polio_2$ 11(5.2%) and $Penta_2$ 11(5.2%). On the other hand, among the recommended vaccines the most common one that was not given at all was $Polio_0$ 128(61%), followed by measles 43(20.5%) and BCG 39(18.6%). (Table 3)

There was challenge on timely supply of vaccine to eligible children due to lack of transportation access to health facilities. Therefore, volunteers from community members were obliged to bring vaccines from nearby health center via vaccine carrier. *"……we had difficulty to get vaccines from woreda health office. Vaccine were brought from Arba Minch woreda health office to Zigiti Bakole health center by car and then carried with the help of volunteers to our health center which spent about four hours for a single trip on foot".* (25 years old, Male, EPI coordinator, Mazo Doysa health center)

Mother's/care giver's knowledge on child's vaccination

Almost all mothers/care givers 208(99%) ever heard of vaccine and more than half of them, 109(51.9%) possess radio and/or television at their home. About 188(89.5%) mothers/care givers mentioned at least one of EPI targeted child hood diseases but only 52 (24.8%) knew all of them. The most commonly vaccine preventable child hood diseases as mentioned by mothers/care givers were measles 187(89%) followed by polio 176(83.8%) and pneumonia 155(73.8%). One hundred eighteen (56.2%) mothers/care givers knew that their child should start vaccination at birth and 109(51.9%) complete vaccination before the age of one year. A great effort was done in the study area to increase maternal awareness on children vaccination. *Though not as expected, women health development army (each women health development army was responsible for thirty households) were mobilizing mothers/care givers at the time of vaccination and health extension workers inform the subsequent date of vaccination session. (A 28 years old, Male, EPI coordinator, Lante health center)*

Mather's/care giver's attitude and practice on child's vaccination

About 204(97.1%) of mothers/care givers believe the importance of vaccinating their children, 199(94.7%) support providing vaccine to all eligible children and 154(73.3%) advice others to vaccinate their children. The average time of trip to reach EPI site was 28 minute (SD±17.5) and waiting time to get the vaccine was 21 minute (SD±18.5). However, some of the mothers were uncomfortable due to long waiting time and service providers' absenteeism on scheduled vaccination session. A qualitative study revealed that some of mothers have negative attitude towards vaccination. *"……some mothers were not voluntary to bring their children for vaccination due to fear of side effects related to vaccine".* (26 years old, Female, EPI coordinator, Gatse health center)

Health service utilization

Seventy seven (36.7%) mothers/care givers were not informed for the date of next EPI session and thus 81(38.6%) ever missed their next appointment. More than half of households in which our study participants reside were

visited by health extension workers in the past six months prior to data collection and 126(60%) of children ever visited health facility in their first year of life for health services other than vaccination. About 135(64.3%) of mothers got antenatal service at least once in their last pregnancy and 145(69%) of them got TT vaccine.

EPI related activity

Great efforts were done to vaccinate children at study area. There was health center health post linkage in which technical support has been given for health extension workers by health center staff. Thus every health center assigned one health workers for each kebele to support the activities of health extension workers and they visit health post once per week. Health development agents and one to five linkages among women were strongly involved to mobilize mothers to vaccinate their children. However, there was complaint on commitment and defaulter tracing practice by health workers. *"……there was resistance and lack of commitment by some health extension workers to address eligible children in all pockets of the kebele and poor defaulter tracing habits by health center staffs due to working load and topographic problem of woreda".* (*42 years old, Male, official from Arba Minch zuriya woreda health office*)

Multivariate analysis

Sixteen variables with P value less than 0.2 were selected in bivariate analysis. Multivariate analysis using stepwise selection (backward LR) method was done to identify independent predictors to complete child's vaccination. Finally place of delivery [AOR = 3.24 (95% CI = 1.23, 8.42)], maternal education [AOR = 3.73 (95% CI = 1.66, 8.42)], reminding the date of next EPI session [AOR = 6.72 (95% CI = 2.83, 15.94)] and antenatal care utilization [AOR = 4.05 (95% CI = 1.7, 9.63)] were found to be independent predictors to complete child's immunization. (Table 4)

Discussion

Immunization is a major health intervention for child survival throughout the world and believed as a key strategy for the accomplishment of the Millennium Development Goal 4 (MDG 4) of reducing child mortality by two-thirds within 2015.

Based on mothers' recall, EPI card and registration book, fully vaccination coverage among children aged 12-23 months was 53.3%. This finding is higher than several studies conducted in rural district of Ethiopia by Teklay et al, 2003 and central part of Ethiopia in Ambo by Belachew et al, 2012 which ranged from 36% to 51%. It was also much higher than the national and regional vaccine coverage which was 24.3% and 24.1% respectively (EDHS, 2011). However, the coverage is lowest when compared to most African countries like Tanzania, Kenya, and Rwanda in which fully immunized children age 12-23 months was 75%, 77% and 90% respectively (WHO, 2010 and Lilian et al, 2013). This may be due to lack of transportation access to some kebele and lack of commitment by some health workers to trace defaulters. Fifteen percent of children in Ethiopia did not receive any of the recommended vaccines (EDHS, 2011), however, this study showed that only 3.8% of children did not receive any vaccine at all which was much lower than the national coverage. The dropout rate in this study for BCG to measles was 11.7% and that of Pentavalent was 6.3%. This was low when compared to a study conducted in Ambo Woreda, central Ethiopia in which BCG to measles dropout rate was 22.2% and Pentavalent dropout rate was 12.9% (Belachew et al, 2012).

Among socio demographic variables mothers/care givers educational status has shown statistical association on multivariate analysis. Those mothers/care givers who attended formal education were more likely fully vaccinate their children than those who did not attend formal education [AOR = 3.73, (95% CI = 1.66, 8.42)]. Health extension workers who provide vaccines to children said that those who attended formal education have high awareness on the importance of vaccinating their children than those who did not. The finding was in line with the study conducted in rural district of Ethiopia in which mother's education were significant predictors of immunization status of children (Teklay et al, 2003); however, it did not much with the study conducted in Ambo district of central Ethiopia in which maternal education was not significantly associated with child hood vaccination (Belachew et al, 2012).

This study also showed that those children who were delivered at health facility were more likely fully vaccinated than those who were delivered at home [AOR = 3.24, (95% CI = 1.23, 8.42)]. This finding is in line with study conducted in Ambo district of central Ethiopia and Kenya in which children delivered at health facility were in favor to complete their vaccination that those who delivered at home (Belachew et al, 2012 and Lilian et al , 2013). This might be due to that those who delivered at health facility started their vaccination as early as possible and their mothers/care givers got adequate information on importance of vaccination more likely than those who delivered at home.

Those children whose mothers/care givers were informed for subsequent date of vaccine were more likely fully vaccinated than those who were not informed for next vaccination date [AOR = 6.72, (95% CI = 2.83, 15.94)]. This finding was in line with studies conducted by Teklay et al, 2003 and Tadesse et al, 2008 in our country and

other African countries like Kenya (Lilian et al , 2013), Burkina Faso (Aboubakary et al, 2009) and Mozambique (Jagrati et al, 2008) in which advice on date of next vaccination and good communication about immunization positively affect children's fully vaccination status. *A 23 years old health extension workers said that when mothers were reminded for next vaccination date during each session and mobilized for vaccination over night by community health development agents, they avail their children on time for vaccination.* This indicates that community mobilization and efforts to raise mothers/care givers awareness were important strategies to fully vaccinate children in study area.

This study also revealed that those children whose mothers received antenatal care in last pregnancy were more likely fully vaccinated than those who did not get antenatal care [AOR = 4.05, (95% CI = 1.7, 9.63)]. The finding was consistent with the study conducted in Ambo district of central Ethiopia (Belachew et al, 2012) in which ANC follow up is related with fully vaccination coverage. This may be due to that antenatal follow up give opportunity to educate mothers/care givers on benefit of vaccination.

As limitation, though the study used qualitative data to supplement quantitative findings and registration book from health post and health center for children who lack EPI card, it did not address cold chain system to assure potency of vaccine and immunological aspects whether the child has developed immunity for administered vaccines or not.

Conclusion and recommendation
Fully vaccination coverage among children aged 12-23 months in the study area remains low. Maternal education and health care utilization by mothers/care givers (especially antenatal care utilization and institutional delivery) were independent predictors for fully vaccination status. It is necessary that local interventions should be strengthened to raise mothers'/care givers' awareness on the importance of immunization, utilization of antenatal care and institutional delivery at all levels.

Competing interests
The author declares that there is no competing interest.

Author's contributions
WF: Study conception and design, drafting of manuscript, in-depth interview and data analysis.

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Table 1. Socio-demographic characteristics of mothers/care givers and their children in Arba Minch zuriya district, Southern Ethiopia, March 2014

Variables (n=210)	Nº (%)	COR (95%CI)	P value
Sex of child			
Male	112(53.3)	1	0.631
Female	98(46.7)	1.14(0.66,1.97)	
Availability of EPI card			
No	94(44.8)	1	0 .001
Yes	116 (55.2)	4.31(2.41, 7.69)	
Place of delivery			
Home	147(70)	1	0.001
Health facility	63(30)	7.91(3.73, 16.77)	
Age mothers/care givers			
15-24	50(23.8)	1	0.037
25-34	122(58.1)	1.08(0.55,2.13)	
≥ 35	38(18.1)	0.41(0.17,0.98)	
Educational status of mother/care givers			
Not attended formal education	118(56.2)	1	0.001
Attended formal education	92(43.8)	9.04(4.7, 17.39)	
Religion of mothers/care givers			
Protestant	135(64.3)	1	0.45
Orthodox	71(33.8)	0.82(0.46,1.47)	
Others	4(1.9)	0.27(0.03,2.63)	
Ethnicity of mothers/care givers			
Others	31(14.8)	1	0.012
Gamo	179(85.2)	0.32(0.13,0.77)	
Occupation of mothers/care givers			
Others	34(16.2)	1	0.01
House wife	176(83.8)	0.33(0.14,0.77)	

Table 2. Vaccination coverage by card, mothers recall and registration book in Arba Minch zuriya district, Southern Ethiopia, March 2014

Vaccine Given	Cards only (n=116)	Mother's recall plus registration book (n=94)	Card plus mother's recall plus registration book (n=210)
BCG	106 (50.5)	65(30.9)	171(81.4)
Polio 0	49(23.3)	22(10.5)	71(33.8)
Polio1 & Penta1	114(54.3)	78(37.2)	192(91.4)
Polio 2 & Penta2	109(51.9)	72(34.3)	181(86.2)
Polio3 & Penta3	107(50.9)	71(33.8)	178(84.7)
PCV1	113(53.8)	75(35.7)	188(89.5)
PCV2	108(51.4)	69(32.9)	177(84.3)
PCV3	106(50.5)	68(32.4)	174(82.9)
Measles	95(45.2)	56(26.7)	151(71.9)
Fully vaccinated	80(38.1)	32(15.2)	112(53.3)

Table 3. Vaccine dose and its validity among children aged between 12 to 23 months in Arba Minch zuriya district, Southern Ethiopia, March 2014

Vaccine	Valid dose Frequency (%)	Invalid dose Frequency (%)	Not given at all Frequency (%)
BCG	171(81.4)	0(0)	39(18.6)
$Polio_0$	71(33.8)	11(5.2)	128(61)
$Polio_1$ & $Penta_1$	192(91.4)	7(3.3)	11(5.2)
$Polio_2$ & $Penta_2$	181(86.2)	11(5.2)	18(8.6)
$Polio_3$ & $Penta_3$	178(84.7)	9(4.3)	23(11)
PCV_1	188(89.6)	6(2.8)	16(7.6)
PCV_2	177(84.3)	10(4.7)	23(11)
PCV_3	174(82.9)	10(4.7)	26(12.4)
Measles	151(71.9)	16(7.6)	43(20.5)
Total	112(53.3)	90(42.9%)	8(3.8%)

Table 4. Independent predictors to fully vaccination among children aged 12 to 23 months in Arba Minch zuriya district, Southern Ethiopia, March 2014

Variable	N° (%)	COR (95%CI)	AOR (95% CI)
Maternal Educational			
Attended formal education	92	9.04(4.7 - 17.39)*	3.73 (1.66 - 8.42)*
Not attended formal education	118	1	1
Place of delivery			
Health facility	63	7.91(3.73-16.77)*	3.24 (1.23 - 8.42)*
Home	147	1	
Be informed for next EPI session			
Yes	133	8.82(4.56-17.02)*	6.72 (2.83 - 15.94)*
No	77	1	1
Got ANC at last pregnancy			
Yes	135	10.21(5.18-20.13)*	4.05 (1.7 - 9.63)*
No	75	1	1

Statistically significant at P value less than 0.05