

CONTRIBUTING TOWARDS POLIO ERADICATION IN ETHIOPIA

PAPER I



Newborn Tracking for Polio birth dose vaccination in Pastoralist and Semi-pastoralist CORE Group Polio Project Implementation Districts (Woredas) in Ethiopia

CCRDA/CORE Group Ethiopia

Addis Ababa

June 2012

Contents

ACRONYMS.....	iv
EXECUTIVE SUMMARY.....	v
INTRODUCTION.....	1
Health status of Ethiopian under five children.....	1
Childhood immunization in Ethiopia.....	1
Polio Eradication in Ethiopia.....	1
CORE Group Polio Project.....	2
RATIONALE.....	4
OBJECTIVES.....	6
General Objective.....	6
Specific objectives.....	6
METHODS.....	6
Study design.....	6
Study area.....	6
Study populations.....	7
Women with recent deliveries.....	7
<i>Sample size determination</i>	7
<i>Sampling Procedures</i>	8
<i>Data Collection</i>	9
Health Extension Workers (HEWs).....	11
Community Volunteer Surveillance Focal Persons (CVSFPs).....	11
Woreda and Health Center EPI Coordinators.....	11
Traditional Birth Attendants (TBAs).....	11
Community and Religious Leaders.....	11
Data Entry and Analysis.....	12
Ethical Considerations.....	12
RESULTS.....	13
Socio-demographic characteristics women who delivered in the previous one year.....	13
Pregnancy and child birth.....	16
Maternal Health Service Utilization.....	17

Knowledge of vaccine preventable diseases and vaccination status of children.....	25
Reasons for not having polio birth dose vaccination.....	28
Knowledge on prevention, transmission and vaccination against polio	29
Findings of interviews with HEWs, CSFP, TBAs and EPI coordinators.....	29
Findings from FGD with community leaders.....	31
DISCUSSION	32
Strengths and limitations of the study	38
CONCLUSION	39
RECOMMENDATIONS.....	40
REFERENCES.....	42

ACRONYMS

AFP	Acute Flaccid Paralysis
CCRDA	Consortium of Christian Relief and Development Associations
CGPP	CORE Group Polio Project
CORE Group	Child Survival Collaborations and Resources Group
CV	Community Volunteers
CHW	Community Health Workers
CVSFP	Community Volunteers Surveillance Focal Persons
DPT	Diphtheria Poliomyelitis Tetanus
EDHS	Ethiopian Demographic and Health Survey
EPI	Expanded Program on Immunization
FGD	Focus Group Discussion
IDSR	Integrated Disease Surveillance and Response
IEC	Information, Education & Communication
IIP	Immunization in Practice
IRC	International Red Cross
MLM	Midlevel Managers Training
NID	National Immunization Days
OPV	Oral Polio Vaccine
PEI	Polio Eradication Initiative
PPS	Probability Proportionate to Size
PVO	Private Voluntary Organization
SNIDs	Sub-national Immunization Days
SIAs	Supplementary Immunization Activities
SNNPR	Southern Nations Nationalities and Peoples Region
WPV	Wild Polio Virus

EXECUTIVE SUMMARY

The CORE Group Polio Project (CGPP) was formed in 1999 and has been active participant in the global Polio Eradication Initiative (PEI). It has been working in high risk areas of Angola, Bangladesh, Ethiopia, India, Nepal and Uganda. Bangladesh, Uganda and Nepal have “graduated”. Currently the project is functioning in Angola, Ethiopia and India with fund made available by USAID. The current CORE Group Polio Project (CGPP) which extends from October, 2007 – September 2012 has a goal of contributing to polio eradication by increasing population immunity and enhancing the sensitivity of surveillance for AFP. CORE Group Ethiopia started to function in November 2001 and has been supporting and coordinating efforts of PVOs/NGOs involved in polio eradication activities.

Estimates of immunization coverage rates in Ethiopia varied widely, but were consistent in that polio birth dose (Polio 0) coverage is much lower than other antigens. A major reason for the low OPV 0 coverage is the low coverage of institutional delivery in the country in general, estimated at about 10% , and in pastoralist and semi-pastoralist areas, in particular. This low coverage deprives newborns the best opportunity of getting the newborn Polio 0 dose. Other factors or chain of factors that contribute to low polio 0 coverage have not been studied in Ethiopia.

This research is one of the three studies that have been identified as essential research areas to fill gaps towards efforts of GORE Group Ethiopia in contributing to polio eradication in Ethiopia.

The main objective of this study was to examine pregnancy and child delivery practices and identify mechanisms for improving polio birth dose coverage in CGPP implementation districts/ *woredas*.

The study used quantitative and qualitative methods and included community based cross sectional study design involving interviews of women who delivered during the previous one year, key informant interviews with Health Extension Workers (HEWs), program coordinators, Community Volunteer Surveillance Focal Persons (CVSFPs) and Traditional Birth Attendants (TBAs), and focus group discussions (FGDs) with community elders and religious leaders.

The study was conducted in 9 districts (*woredas*) selected using criteria that included representativeness and feasibility. A team consisting of enumerators, supervisors, coordinators core research team members and community guides was involved in data collection and ensuring quality after appropriate training and pretest was done. Quantitative data were entered and analyzed using SPSS version 17. Descriptive analysis included data presentation using tables, graphs and appropriate summary figures. Appropriate statistical tests (Chi squared test) and measures (OR, 95%CI) were used to asses significance and strength of associations respectively. Multiple regression analysis was used to measure the effect of different factors adjusted for possible confounders.

The records from the FGDs were transcribed in the language of the interview and then translated into English for analysis. Data analysis was done using thematic approach on the “ Open Code” software program.

A total of 600 of women who delivered in the previous one year were included in the study. The mean age of the respondents was $26.3 \pm SD 5.7$, median 25 and range 15-49 years. Four hundred ninety (81.7%) women could not read or write and 56 (9.3%) responded that they can read and write with difficulty. The great majority of the women (98.2%) were currently married and about 79% had monogamous marriage. 85 (14.2%) were said to have been registered between birth and 14 days.

Three hundred twelve women (52.0%) had attended antenatal care at least once during the last pregnancy. Five hundred forty nine women (91.5%) delivered their last baby at home and the reasons for home delivery include familiar birth attendants (46.4%), distance to health facility (24.4%), unavailability of transport (16.0%), delivery in health facility not culturally encouraged (10.7%) and non-friendly health services (8.9%).

When adjusted for other factors, religion, having live stock, and income generating activities were significantly associated with ANC attendance at $P < 0.05$. After adjusting for other factors, religion and no other income generating activities were statistically significantly associated with home delivery when ANC was not included in the model. When ANC is included, none of the variables retained statistical significant.

Polio 0 coverage was 29.7%, 19.7%, and 32.7% by history, by card and by history or card respectively. Penta 3 coverage was 33.8%, 27.3% and 39% by history, by card and by history or card respectively. Eighty three (28.8%) mothers answered that their children did not have polio birth dose vaccination because they did not know the importance of vaccination while 57 (19.8%) mothers said services were not available and 43 (14.9%) mothers responded that they did not know vaccination starts at birth. Other responses included health facility was far (13.2%), service time was not convenient (12.8%), and did not know place of vaccination (9.3%).

A total of 70 HEWs were interviewed in the nine study *woredas*. Forty one (58.6%) were female and 29 (41.4%) were male. Thirteen (18.6%), 4(5.7%), 5(7.1%) and 22 (31.4%) reported to have been trained in Immunization in Practice (IIP), Integrated Refresher Training, Social Mobilization, and Newborn Tracking respectively. Sixty (85.7%) HEWs reported to have received supervision of whom 39(63.9%) got feedback.

Forty four (62.9%) HEWs reported that they conduct ANC while 27(38.6%) provide delivery services. Thirty eight (54.3%) claimed to be registering births. A total of 71 CVSFPs were interviewed from the nine study districts (*woredas*). Thirty five (49.3%) were female while 36 (50.7%) were male. Thirty nine (54.9%) respondents reported that they could easily read and write, others 11(15.5%) could read and write with difficulty and 21(29.6%) could not read or write at all. Thirty eight (53.5%), 21 (29.6%) and 16(22.5%) were trained in community based surveillance, newborn tracking and social mobilization respectively. Seventeen (23.9%) volunteers did not have any of the above training. Thirty four seven (66.2%) respondents reported that they know the number of pregnant women in the catchment areas and 36 (50.7%) registered births.

Forty seven TBAs were interviewed. The number of reported deliveries conducted by a TBA ranged from 2 to 40 during the previous 3-6 months. About one-fourth the TBAs said that they participate in mobilization of the community during polio campaign whereas the rest did not participate in vaccination

activities. None of the health center EPI coordinators knew Polio 0 coverage of their catchment area and only 2 *woreda* EPI coordinators could provide figures on polio 0 coverage. Several participants in all groups of FGDs mentioned that polio causes paralysis of legs and inability to walk. On the other hand, they also mentioned symptoms that may not be indicative of polio. It was mentioned that there are rumors that may discourage women and families from having their children vaccinated, although the influence of these rumors was said to have decreased much nowadays.

Considering the findings from the different components of the study the following recommendations were made: improving awareness of women, families and communities through targeted IEC interventions; training and strengthening of supportive supervision; developing and strengthening mechanisms for identification and follow up of pregnant women, use of ANC and institutional delivery, birth registration and subsequent polio birth dose vaccination; designing and strengthening strategies for improvement of accessibility and quality of maternal and newborn health services.

INTRODUCTION

Health status of Ethiopian under five children

The most recent demographic and health survey (1) reported that the infant mortality rate is about 59 deaths per 1,000 live births. The estimate of child mortality is 31 deaths per 1,000 children surviving to 12 months of age, while the overall under-5 mortality rate for the same period is 88 deaths per 1,000 live births. Although these figures show a major decline compared to the results of EDHS 2005 (2), the country's infant and under-five mortality rates remain very high. Moreover, there was no visible change in neonatal mortality rates between EDHS 2005 (39/1000 live births) (2) and EDHS 2011 (37/1000 live births) (1) reports.

Childhood immunization in Ethiopia

The Expanded Program on Immunization (EPI) was launched in Ethiopia in 1980 with the goal to increase immunization coverage by 10% annually and achieve 100% DPT3 coverage by 1990 using three service delivery strategies: fixed health units, outreach services and mobile team. The goal was not achieved due to a combination of factors including; inadequate technical and managerial capacity, lack of regular supervision and high staff turnover. During the last ten years a lot of effort has gone into building the operational capacity of the immunization program in Ethiopia and according to the 2010/11 annual report of the Federal Ministry of Health (3), Penta3 coverage reached 85%. However, in Afar and Somali regions the reported coverage for the year was much lower (about 35%). A study conducted in September, 2009 by CORE Group Ethiopia (4) in its operational areas found Penta 3 coverage was about 68.4% with wide variation between 32% in Afder -Somali, 45% in Gambella, and 53% in Afar by history or card. Similarly, Polio3 coverage was estimated at 68.6% coverage. Polio 0 coverage was lower (about 45%) than the other antigens. Of note is the sharp contrast with the EDHS 2011 report of 37% national DPT3 coverage. Polio 0 coverage was reported at 20% in the EDHS 2011 (1). The reasons for the discrepancies might need to be explored further.

Polio Eradication in Ethiopia

Polio eradication initiative in Ethiopia was started in 1996 based on the guideline provided by the World Health Organization (WHO). Ethiopia has adapted the four strategies to eradicate polio. These are achieving high routine immunization coverage, national supplemental immunization activities (SIAs), acute flaccid paralysis surveillance and mop-up campaign. Since then the country has been conducting a number of rounds of National Immunization Days (NIDs) and sub-National Immunization Days (NIDs) to interrupt circulation of wild polio virus (WPV).

CORE Group Polio Project

The CORE Group is a voluntary network of 50 citizen supported private non-governmental organization based in the USA. CORE was formed in 1997 and to date works in over 140 countries to promote and improve primary health care. The main focus of the CORE Group is women and children in the context of multi-sectoral development.

The CORE Group Polio Project (CGPP) was formed in 1999 and has been active participant in the global Polio Eradication Initiative (PEI). It has been working in high risk areas of Angola, Bangladesh, Ethiopia, India, Nepal and Uganda. Bangladesh, Uganda and Nepal have “graduated”. Currently the project is functioning in Angola, Ethiopia and India with fund made available by USAID.

CORE Group Ethiopia started to function in November 2001 and has been supporting and coordinating efforts of PVOs/NGOs involved in polio eradication activities. The CGPP National Secretariat staff coordinates and ensures the quality of the social mobilization and community based surveillance activities conducted by cadres of community-based volunteers. It closely collaborates with eight international NGOs (CARE Ethiopia, Child Fund Ethiopia, Catholic Relief Service, Plan Ethiopia, Save the Children USA, World Vision Ethiopia, International Rescue Committee and African Medical Research Foundation) and four local NGOs (Pastoralist Concern, Harrerghe Catholic Secretariat, Alemtena Catholic Church and Ethiopian Evangelical Church Mekane Yesus). In addition to these, CCRDA, WHO, MOH and UNICEF are close allies of CORE Group Ethiopia.

Currently, CGPP Ethiopia works in 55 *woreda*¹s in Somali (11 *woredas*), Amhara (4 *woredas*), Benshangul-Gumuz (7 *woredas*), SNNP (8 *woredas*), Afar (6 *woredas*), Gambella (10 *woredas*) and Oromia (9 *woredas*) regions of Ethiopia. In these regions, CGPP reaches a total of 4690972 of which 179795 are under one and 680042 are under five years old. In these *woredas* community Volunteers Surveillance Focal Persons (CVSFPs) were trained and deployed at the village level to conduct house-house case detection and reporting of AFP, Measles and NNT; mobilize community for polio SIAs and routine immunization activities.

The current CORE Group Polio Project (CGPP) which extends from October, 2007 – September 2012 has a goal of contributing to polio eradication by increasing population immunity and enhancing the sensitivity of surveillance for AFP.

¹ Woreda means district and is the most common term used in the Ethiopian literature and official documents

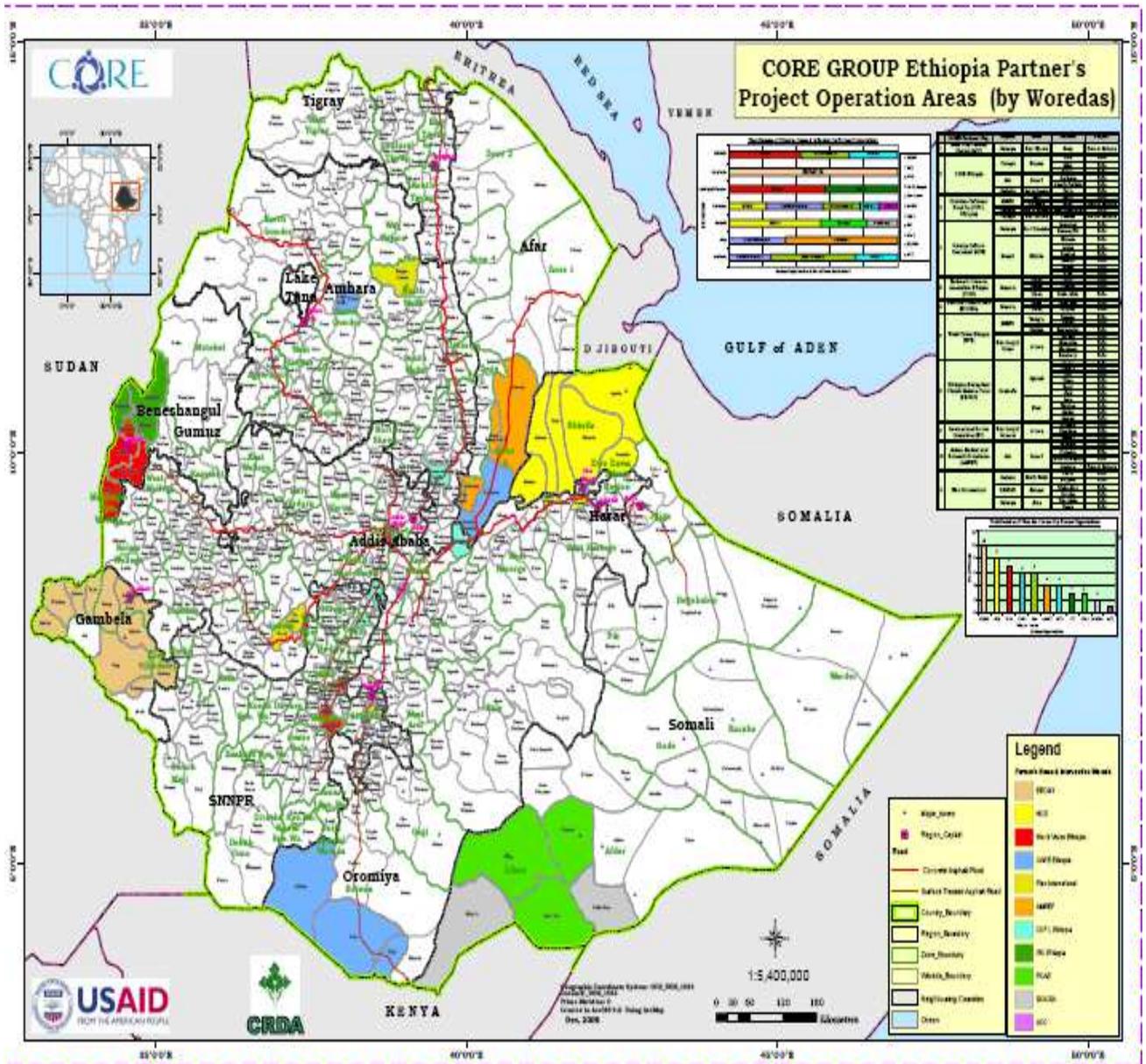


Figure 1: CORE Group Ethiopia's project operations areas by woredas, 2012.

RATIONALE

CORE Group Ethiopia's periodic reports, midterm assessment of CGPP and immunization surveys and other studies have identified certain gaps in achieving CGPP objectives (4-6).

One such a gap is the very low coverage of OPV 0 (polio birth dose)² in some CORE Group operational areas. A major reason for the low OPV 0 coverage is the low coverage of institutional delivery in the country in general, estimated at about 10% (1), and in pastoralist and semi-pastoralist areas in particular. This low coverage deprives newborns the best opportunity of getting the newborn Polio 0 dose. Thus, there is a need to devise mechanisms to identify newborns and be able to deliver Polio 0 (polio birth dose) vaccination. A great potential lies in the combined activities of the CVSFPs and HEWs at the grass roots level. CVSFPs, other community volunteers (CVs) and HEWs can create awareness among the community about the importance of ANC, promoting facility delivery, newborn tracking and vaccination of birth doses. This and other mechanisms have to be explored to identify newborns and vaccinate them with Polio 0. This is also in line with recommendations of the Midterm CORE Group evaluation conducted in Angola, Ethiopia and Uttar Pradesh India to be able to play most effective role in polio eradication (5)

This research is one of the three studies that have been identified as operations research areas for effective implementation of CORE Group Ethiopia's major activities. The other two are:-

- AFP case detection and status of surveillance in pastoralist and semi-pastoralist communities of CORE Group Polio Project implementation districts (*woredas*) in Ethiopia (7).
- Cross Border Transmission of Wild Polio Virus (WPV) and Immunization Service Delivery in CGPP Project Implementation International Border Areas in Ethiopia (8).

Figure 1 shows a conceptual frame work of the factors that affect Polio 0 (polio birth dose) vaccination in pastoralist and semi-pastoralist areas of Ethiopia.

² In this document Polio 0 and Polio birth dose are used interchangeably.

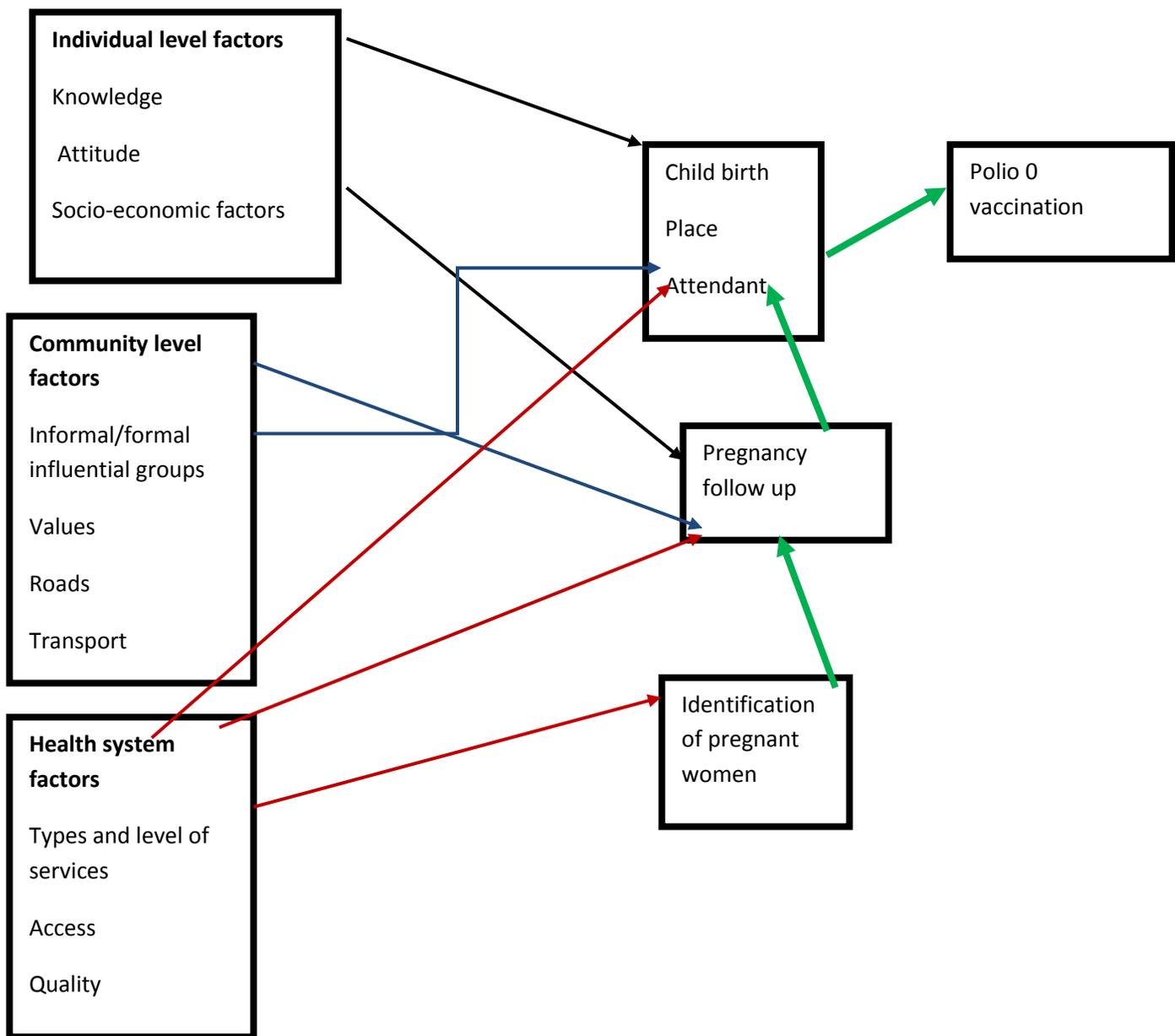


Figure 2: Conceptual Framework of Factors that Affect Polio 0 Vaccination in Pastoralist and Semi-pastoralist Areas of Ethiopia

OBJECTIVES

General Objective

To examine pregnancy and child delivery practices and identify mechanisms for improving polio birth dose coverage in CGPP implementation districts/ *woredas*.

Specific objectives

1. Assess identification, registration and follow up mechanisms of pregnant women in CGPP implementation *woredas*
2. Identify places of child delivery and delivery attendant of women who gave birth in the previous one year in CGPP implementation *woredas*
3. Assess the ways of OPV 0 vaccination delivery and their effectiveness in CGPP implementation *woredas*
4. Suggest mechanisms for effective newborn tracking and OPV0 vaccination in the study areas

METHODS

Study design

A community based cross sectional study involving women who delivered in the previous one year and facility based cross sectional study design involving key informant interviews of community volunteers, Traditional Birth Attendants (TBAs), HEWs, program coordinators and WHO surveillance officers were carried out. In addition, Focus Group Discussions (FGDs) were conducted with community and religious leaders.

Study area

The study was conducted in CORE Group Ethiopia implementation pastoralist and semi pastoralist project areas and included *woredas* (districts) in Afar, Benishangul, Oromia (Borena zone), Gambella and Somali regions.

The study areas have been identified through a consensus process of the CORE Group Ethiopia secretariat using the following criteria:

1. Distance from center (Regional capital town)
2. Immunization performance (Coverage)
3. Cultural/ ethnic representation
4. Relevance to the study question

In using the above criteria, representation of worst and best scenarios was considered, while keeping in mind feasibility, i.e. excluding extreme case of inaccessible and in secure areas.

Accordingly the following *woredas* (districts) were selected.

- a. Gambella region : Larie, Gog³
- b. Benishangul region : Kurmuk, Maokomo
- c. Oromia region: Teltele
- d. Afar region : Gewane
- e. Somali region: Shinele, Filtu⁴, Dolobay⁵

Study populations

Women with recent deliveries

Women of reproductive age group (15-49 years) in the selected *woredas* of CGGP pastoralist and semi pastoralist areas served as the source population. The study population was women who delivered in the one year before data collection in the selected *woredas*.

Sample size determination

The sample size for the community based survey of women who delivered in the last one year was calculated based on the single population proportion formula. The proportion used for the sample size calculation was 45% which was the estimate for polio 0 coverage by CORE Group study in 2010 (6). The margin of error was put at 6% and confidence level at 95%. A design effect of 2 was employed to account for variability due to cluster sampling. To account for non-response 10 % was added.

$$n = \frac{2 (Z_{\alpha/2})^2 P (1-P)}{d^2} = \frac{2 (1.96)^2 * (0.45) * (0.55)}{(.06)^2} = 528$$

$$\text{Total sample size} = 528 + 53 = 581$$

³ Replaced by Abol because of unforeseen security situations during the time of data collection

⁴ Replaced by Error because of unforeseen security situations during the time of data collection

⁵ Replaced by Moyale because of unforeseen security situations during the time of data collection

Sampling Procedures

A multistage cluster sampling method with probability proportionate to the size (PPS) of the population were employed to conduct the community based survey of women who delivered during the previous one year.

Using the PPS technique 30 clusters were distributed among the nine selected *woredas*. The total number of women who have delivered during the last one year per cluster (cluster size) is about 20 (581/30). Studies have shown that a sample of 20 in a cluster of 30 clusters give a fairly adequate sample (9,10). First the number of clusters to be included in a *woreda* were identified proportionate to the size of the population and the corresponding number of women to be studied in a *woreda* were identified by multiplying number of clusters per *woreda* by cluster size (twenty). The PPS technique is shown in Anex1. The number of women who were interviewed by *woreda* is shown in the following table (Table 1). The actual number of respondents was 600 due to rounding.

Table 1: Number of Clusters and Total Number of Women with Under one Children Required for the Study in the Selected *Woredas*

Region/ <i>Woreda</i>	Population	Eligibles	Cumulative Eligible	Sampling Fraction 18282/30 =609 Random number 49	Clusters per <i>woreda</i>	Samples Per Cluster	Total samples per <i>woreda</i>
Gambella							
Larie	35538	1174	1174		2	20	40
Gog (Abol)	18569	613	1787		1	20	20
Benshangul							
Kurmuk	14989	555	2342		1	20	20
Maokomo	46415	1717	4059		3	20	60
Oromia							
Teltele	76935	2924	6983		5	20	100
Afar							
Gewane	34564	1071	8054		2	20	40
Somali							
Shinele	113158	3847	11901		6	20	120
Filtu (Errer)	94847	3224	15125		5	20	100
Dolobay (Moyale)	92860	3157	18282		5	20	100
Total	576736	18282					600

Data Collection

Questionnaire on attendance of antenatal care, place of delivery, delivery attendant, vaccination status of the index child and other relevant variables were prepared in English. It was translated to Amharic and Somali and back translated to ensure consistency. The questionnaire was pretested and administered by trained interviewers.

Women who gave birth during the previous one year in the selected *woredas* were also a study population for one of the other research topics mentioned above: *AFP case detection and status of surveillance in pastoralist and semi-pastoralist communities*. In order to efficiently and effectively use resources, data collection for the two studies was planned together, while separate proposals were developed for each.

Based on the sample size of women to be interviewed, 2- 10 interviewers each were selected to collect data in each *woreda* for both studies (Table 2).

Partners at field level and health offices were contacted beforehand to make the necessary preparation for data collection like selecting interviewers and providing technical, logistics and transportation support.

The interviewers had a minimum of diploma education, (experience in data collection preferable), spoke fluently the local language, and were residents in the local area or vicinity. Data collection was supervised by 2 supervisors in each study *woreda*. The supervisors had a minimum of a diploma education and a previous experience in supervising community based data collection. They responded to questions and queries of interviewers and corresponded with a coordinator and researchers whenever necessary. The supervisors checked all filled questionnaires for completeness and consistency each day before turning them to the coordinator. Job descriptions for the interviewers, supervisors and coordinators were clearly spelt out and given to them in writing (Annex 2). A field guide manual was developed for use by the interviewers and supervisors (Annex 3). Each interviewer was accompanied by a community guide to help identify households and eligible respondents and facilitate communication with the study population.

Table 2: Number of Interviewers, Supervisors, Field Guides by Woreda; and Coordinators by Region

Region/ Woreda	Clusters per woreda	Total number of women to be interviewed	Interviewers	Field Guides	Supervisors*	Coordinators
Gambella						1
Larie	2	40	4	4	2	
Gog(Abol)	1	20	2	2	2	
Benshangul						1
Kurmuk	1	20	2	2	2	
Maokomo	3	60	6	6	2	
Oromia						1
Teltele	5	100	9	9	2	
Afar						1
Gewane	2	40	4	4	2	
Somali						2
Shinele	6	120	10	10	2	
Errer	5	100	9	9	2	
Moyale	5	100	9	9	2	
Total	30	600	55	55	18	6

The interviewers, supervisors and coordinators were trained for four days on general techniques of interviewing and supervision and administration of each item in the questionnaire. Moreover, a pretest was conducted in a selected pastoralist *woreda* before the final study began to assess the performance of the study tools. Some revisions were made on the study instruments based on the feedback obtained from the pretest.

In the selected *woredas*, a kebele⁶ was selected by simple random sampling among those that fulfilled the inclusion criteria mentioned above. Some kebeles are divided into “gots” or villages. In such cases, one of the villages was selected by simple random sampling procedure. Then, in the selected kebele/village a central place was identified and a direction randomly identified (eg by spinning a bottle) to locate the first household to start data collection. Data were collected in subsequent households until the end of the selected direction is reached. If the selected household didn’t have eligible member then the nearest household was included. If the allocated sample were not achieved, another direction was randomly

⁶ Kebele is the smallest administrative unit in Ethiopia

selected and data collection continued in a similar fashion until the required number of respondents was obtained. In case eligible respondents were not available at the time of the survey a revisit (of no more than 2 times) was arranged. If the required number of respondents were not obtained in one kebele/village, another kebele/village was selected by using the simple random sampling method and the procedure continued until the required sample size for the *woreda* was achieved.

Health Extension Workers (HEWs)

Key Informant Interviews were conducted with all HEWs in the selected for women's interviews kebeles. Interview guide questions including activities and services provided by the HEWs with special emphasis to identifications of pregnant women, follow up, delivery attendance, vaccination status of children including OPV0 and other relevant variables were prepared. The interviews were moderated by the study supervisors, coordinators or research team members.

Community Volunteer Surveillance Focal Persons (CVSFPS)

All CVSFPS in the selected kebeles were included in the study. Interview guide questions including activities undertaken by the CVSFPS, respondents' knowledge and practice with regards to immunization, OPV0 vaccination and surveillance were prepared. The interviews were moderated by the study supervisors, coordinators or research team members.

Woreda and Health Center EPI Coordinators

A health center and a *woreda* health office that serves the catchment population of the selected *woreda* were identified. In the selected health center and *woreda* office a staff member (usually known as EPI coordinator) who is responsible for the immunization services was identified. Key informant interviews were conducted according to a field guide which included birth identifications, antenatal care attendance, delivery attendance, vaccination status of the index child and other relevant variables, possible suggestions on how to identify pregnant women who had just given birth and mechanisms to deliver OPV0.

Traditional Birth Attendants (TBAs)

TBAs who rendered pregnancy and delivery services were interviewed in the selected kebeles. They were interviewed on pregnancy, child birth, postpartum care of women, and immunization status of children and the mechanisms to reach children with OPV0 vaccination in their catchment area

Community and Religious Leaders

Focus Group Discussions (FGD) were conducted among community and religious leaders consisting of 6-8 men in each study kebele/*woreda*.

Guide questions were prepared to explore in-depth the knowledge, attitude, believes of group members and the people they represent on newborn health and vaccination (OPV0), and maternal health service utilization. FGD participants were people who were knowledgeable and able to express the opinions of the community on the topic of discussion and were selected with the help of kebele, health staff and partner organizations. The discussion took place in a “neutral” setting. The FGDs were conducted by skilled/experienced moderators who had good knowledge of the subject of the study. This included research team members and the study coordinators. The discussions were tape-recorded with the consent of the participants and notes were taken by an assistant to the moderator.

Data Entry and Analysis

Quantitative data were entered and analyzed using SPSS version 17. Descriptive analysis included data presentation using tables, graphs and appropriate summary figures.

Appropriate statistical tests (Chi squared test) and measures (OR, 95%CI) was used to asses significance and strength of associations, respectively. Multiple regression analysis was used to measure the effect different factors adjusted for possible confounders.

The records from these FGDs were transcribed in the language of the interview and then translated into English for analysis. Data analysis was done using thematic approach.

The translated transcripts text files were copied into the “Open Code” computer program (*ICT Services, Umea University, 2006*) for the study site under the same *Project Title*. After reading the transcripts statement by statement and paragraph by paragraph, open coding of the texts was performed producing substantive codes. As a number of substantive codes repeatedly came out across and between sites, selective coding was performed where relevant codes were summarized to answer the thematic questions

Ethical Considerations

This is a cross sectional study mainly done to inform a program planning process and as such did not need to go through a national IRB process. However, it was important to consult with the RHB and get permission to undertake the survey from regional, *woreda* and kebele administrative authorities. Official letters from the Regional Health Bureaus were written to the study sites as needed. Informed consent was obtained from the study participants after explaining the purpose of the study. Participation of all respondents in the study was strictly voluntary. During the training of interviewers, supervisors and site coordinators emphasis was placed on the importance of obtaining informed consent. The interviewer was made to sign on the consent form thereby verifying and taking responsibility of getting informed consent.

RESULTS

Socio-demographic characteristics women who delivered in the previous one year

A total of 600 of women who delivered in the previous one year were included in the study. The socio-demographic characteristics of the study population are shown in Table 3.

The mean age of the respondents was $26.3 \pm SD 5.7$, median 25 and range 15-49 years. Four hundred ninety (81.7%) women could not read or write and 56 (9.3%) responded that they can read and write with difficulty. The great majority of the women (98.2%) were currently married and about 79% had monogamous marriage. Four hundred seven (78%) were Muslims. This was followed by different sects of the Christian religion (16.8%) and Wakefeta (8.8%). Waketa is a religion observed in Oromia Administrative Region. The majority (45.5%) of the respondent belonged to the Somali ethnic group followed by Oromos. Four hundred ninety (81.7%) had different types of live stocks including camels, cows, oxen, goat and sheep and 343 (57.2%) owned some farm land. About 30% of the women responded that they carry out income generating activities other than their main occupation, which is mainly cattle rearing.

Table 3: Socio-demographic Characteristics of Women who Delivered a Baby in the Previous One Year in Pastoralist and Semi-pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Characteristics		Number	Percent
Region	<i>Woreda</i>		
Somali		320	53.3
	Shinele	120	20.0
	Moyale	100	16.7
	Errer	100	16.7
Oromia	Teltele	100	16.7
		80	13.3
Benishagul	Maokomo	60	10.0
	Kurmuk	20	3.3
		60	10
Gambella	Lare	40	6.7
	Abol	20	3.3
		40	6.7
Afar	Gewani	40	6.7
		40	6.7
Age			
15-19		44	7.3
20-24		164	27.4
25-29		198	33.1
30-34		121	20.2
35-39		57	9.5
40-49		15	2.5
Don't know		1	0.2
Literacy status			
Can read and write easily		54	9.0
Can read and write with difficulty		56	9.3
Cannot read and write		490	81.7

Characteristics		Number	Percent
Grade Completed			
None		493	82.2
1-6		71	11.8
7-13*		36	6.0
Marital status			
Currently married		589	98.2
Divorced		8	1.3
Widowed		3	0.5
Type of marriage			
Monogamous		464	78.8
Polygamous		123	20.9
I don't know		2	0.3
Religion			
Muslim		407	72.8
Protestant		78	13.0
Orthodox Christian		15	3.0
Catholic		5	0.8
Wakefeta		53	8.8
Others		9	1.5
Availability of livestock			
Yes		490	81.7
No		110	18.3
Own farm land			
Yes		343	57.2
No		257	42.8
Other income generating			
Yes		181	30.2
No		412	68.8
I don't know/missing		7	1.2

* Grade 13 means studied for one year after completing senior high school (ie Grade 12)

Pregnancy and child birth

Table 4 depicts reported number of pregnancies, deliveries and registered births.

The number of reported pregnancies ranged from 1-11. The mean number of pregnancies was 3.9±2.5 and median 3.0. Ninety six women (16%) were pregnant for the first time while the majority (60.5%) were pregnant 2-5 times. One hundred seven (17.8%) had delivered one child and 305(50.8%) delivered 2-4 times. The mean number of deliveries was 3.7 ±SD2.2 and median 3.0. Of the last births 183(30.5%) were said to have been registered. One hundred (55%) were reported to be registered by HEWs. However, only 85 (14.2%) were said to have been registered between birth and 14 days; 44 (52%) by HEWs, 11(13%) by other CHWs and the rest by other health workers. Twenty two births (25.9%)who were registered between birth and 14 days were registered at home, while 25 (29.4%) births registered at the health post and 35 (41.2%) at health centers and hospitals.

Table 4: Pregnancy, Delivery and Birth Registration among Women who Delivered in the Previous One Year in Pastoralist and Semi-pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Pregnancy and child birth	Frequency	Percent
Number of Pregnancies		
1	96	16.0
2-5	363	60.5
6- 11	141	23.5
Number of Deliveries		
1	107	17.8
2-4	305	50.8
5-10	183	31.5
Last birth registered		
Yes	183	30.5
No	383	63.8
Don't know	34	5.7
Last birth registered within 14 days		
Yes	85	14.2
No/don't know	515	85.8
Place last birth was registered within 14 days		
Home	22	25.9
Health post	25	29.4
Health center	20	23.5
Hospital	15	17.6
Other/unspecified	3	3.5

Maternal Health Service Utilization

Tables 5-7 show maternal health service utilization by the study population during the last pregnancy and delivery. Three hundred twelve women (52.0%) had attended antenatal care at least once during the last pregnancy. The mean number of months at start of ANC was 4.5± SD1.5 and median was 5.0 months. The majority (51% of those who attended ANC) started attending during the second trimester (4-6 months). The mean number of ANC visits was 3.1± SD 1.5 and median 3.0. One hundred fifteen women (19.2%) had four or more ANC visits. Of the 312 women who had ANC 180 (57.7%) attended ANC for check up while 121 (38.8%) attended ANC because of a health problem. About 48% of the women who had attended ANC attended in health centers and 34% in health posts. It was reported that the decision to attend ANC was mainly made by the respondent (67.2%) or both (15.3%) the respondent and the husband.

Table 5: Antenatal Care Attendance during the pregnancy of the index child in pastoralist and semi-pastoralist areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Antenatal Care	Number	Percent
Had Antenatal care		
Yes	312	52.0
No	288	48.0
Time when antenatal care started		
First trimester (1-3 months)	94	15.7(30.1)*
Second trimester (4-6 months)	158	26.3(50.6)
Third trimester (7-9 months)	47	7.8 (15.1)
Does not remember time	13	2.2(4.2)
Did not attend ANC	288	48.0
Number of ANC visits		
None	288	48.0
1-3 visits	197	32.8
4 and above	115	19.2
Reason for ANC (n=312)		
ANC check up	180	57.7
Health problems	121	38.8
Other/unspecified	11	3.5
Place of ANC attendance (n=312)		
Health post	106	34.0
Health center	149	47.8
Government hospital	24	7.7
Private clinic	21	6.7
Private hospital	5	1.6
Decision maker on ANC (n=312)		
Women	209	67.2
Husband	39	12.4
Both	48	15.3
Others/unspecified	16	5.1

* Percent in bracket indicates proportion of those who attended ANC

Five hundred forty nine women (91.5%) delivered their last baby at home, while 45(5.5%) delivered in health centers and hospitals and the majority (80.0%) of the attendants at home were untrained or trained traditional birth attendants. The HEWs attended only 9(1.6%) births and five (0.8%) women delivered in health posts (Table 6).

In the majority of the cases (79.5%) the respondents decided on the place of delivery, where as husbands alone were reported to have decided in only 7% of the cases.

Table 6: Delivery Care During the Last Birth in Pastoralist and Semi-pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Place of delivery		
Home	549	91.5
Health post	5	0.8
Health center	18	3.0
Hospital	27	4.5
Other	4	0.7
Decision on place of delivery		
Women	477	79.5
Husband	42	7.0
Both	39	6.5
Mother-in-law	11	1.8
TBA	12	2.0
Others	16	2.7
Delivery attendant (n=549)		
TBA	337	61.4
TTBA	102	18.6
HEW	9	1.6
CVSFP	5	0.9
Neighbor	93	16.9
Others	3	0.5

Figure 3 shows the reasons for home delivery. These reasons include familiar birth attendants (46.4%), distance to health facility (24.4%), unavailability of transport (16.0%), delivery in health facility not culturally encouraged (10.8%) and non-friendly health services (8.9%). Twenty four women (4.4%) answered that the health facility was not functioning at the time they had labor.

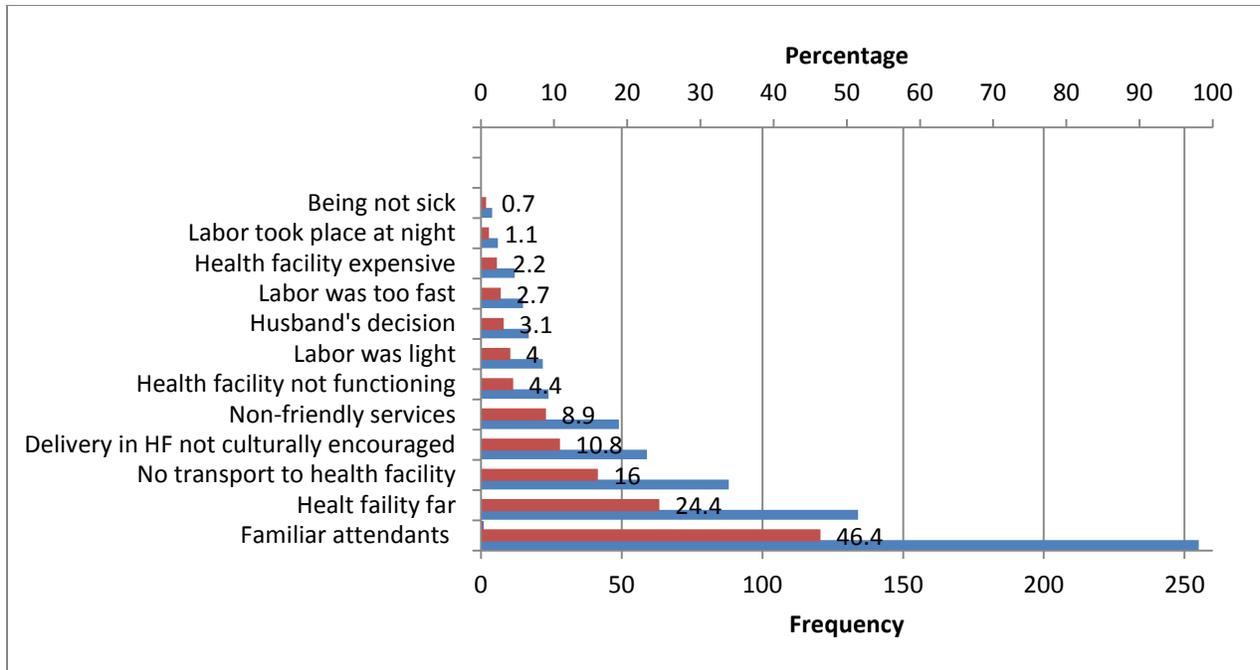


Figure 3: Reasons for home delivery of the last child in pastoralist and semi-pastoralist areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Two hundred seventy nine (46.5%) women reported to have attended postnatal care (PNC). Seventeen (2.8%) attended PNC within the first 24 hours, while 38(6.3%) visited health facilities between 24 hours and seven days. A relatively high number of the respondents, 198(33%) visited health facilities at the 45th day after delivery. Twenty one women (3.5%) reported to have postnatal care after 45 days of delivery. The main reason of post natal care visit was immunization of children (84.6% of those who had PNC) followed by maternal sickness (13.9 %). Maternal health check up was aimed at only 5.4% of the cases (Table 7)

Table 7: Postnatal Care after Last Delivery in Pastoralist and Semi-pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Attended post natal care		
Yes	279	46.5
No	321	53.5
Time of first PNC attendance (n=279)		
Within 24 hours	17	6.1
Between 24 hours and 7 days	38	13.6
PNC at 45 days	198	71.0
PNC after 45 days	21	7.5
Unspecified	5	1.8
Place of first PNC attendance (n=279)		
Health post	141	50.5
Health center	99	35.5
Government hospital	19	6.8
Private clinic	17	6.1
Private hospital	3	1.1
Purpose of PNC attendance*(n=279)		
Maternal check up	15	5.4
Child immunization	236	84.6
Mother's sickness	39	14.0
Child check up	12	4.3
Child sickness	20	7.2

* Multiple answers may be given

Association of different factors with Antenatal Care Utilization

In bivariate analysis, literacy status, religion, availability of live stock, carrying out other income generating activities were significantly associated with ANC attendance, whereas age group, owning farm land and number of pregnancies were not. When adjusted for other factors, religion having live stock, and income generating activities were significantly associated with ANC attendance at $P < 0.05$. Those who had live stocks had a 60% as much less chance to attend ANC, compared to those who do not have, while those who had other income generating activities had about twice the chance of attending ANC compared to those who had not. Regarding religion, those who follow the Wakefeta religion had a very low ANC attendance rate (7.5%) and the odds of attending ANC was 6% that of the Muslims. Those who could read and write easily had about twice the chance of attending ANC in bivariate analysis, but the association turned to be non-significant when adjusting for other factors (Table 8).

Table 8: Association of Socio-demographic Characteristics with Antenatal Care Attendance in Pastoralist and Semi pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Characteristics	Had ANC		OR 95%CI	Adjusted OR 95%CI
	Yes	No		
Age group				
15-19	29(65.9)	15(34.1)	1.00	
20-34	246(50.9)	237(49.1)	0.54(0.27,1.07)	
35-49	37(51.4)	35(48.6)	0.55(0.23,1.27)	
Literacy status				
Can read and write easily	37(68.5%)	17(31.5%)	2.1(1.2, 4.1)*	1.9 (0.97, 3.63)
Reads and writes with difficulty or unable to read and write	275(50.4%)	271(46.9%)	1.00	
Religion				
Muslim	255(58.4)	182(41.6)	1.00	0.65(0.41,1.02) 0.06(0.02,0.17)
Christian	49(47.5)	52(51.5)	0.67(0.43,1.06)	
Wakefeta	4(7.5)	49(92.5)	0.06(0.02,0.17)	
Any livestock				
Yes	239(48.8)	251(51.2)	0.48(0.3, 0.7)*	0.63(0.40,1.00)*
No	73(66.4)	37(33.6)	1.00	
Own farm land				
Yes	175(51.0)	168(49.0)	0.92(0.66,1.26)	
No	137(53.3)	120(46.7)	1.00	
Other income generating activities				
Yes	113(62.4)	68(37.6)	1.8(1.3, 2.7)*	1.89(1.28,2.79)*
No	195(47.3)	217(52.7)	1.00	
Number of pregnancies				
1	53(55.2)	43(44.8)	1.16(0.67,2.01)	
2-5	185(51.0)	178(49.0)	0.94(0.63,1.42)	
6 and above	74(52.5)	67(47.5)	1.00	

* P<0.05

Factors Associated with Home Delivery

As mentioned earlier, a large majority of the deliveries took place at home. Table 9 shows the relationship of socio demographic factors with home delivery. Inability to read and write, , religion, availability of livestock, unavailability of other income generating activities, higher number of pregnancies, and lack of ANC attendance were statistically significantly associated with home delivery. The binary logistic regression analysis results presented in Table 5 show adjusted values without (normal Font) and with inclusion of ANC (*Italic Font*). After adjusting for other factors, Wakefeta Religion and no other income generating activities were statistically significantly associated with home delivery when ANC was not included in the model. When ANC is included, none of the variables retained statistical significant. The odds of attending ANC by those who delivered at home was 19% of those who did not attend ANC.

Table 9: Association of Different Factors with Home Delivery of the Last Child in Pastoralist and Semi pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Characteristics	Delivery home Yes	No	OR 95%CI	Adjusted OR 95%CI
Age group				
15-19	38(86.4)	6(13.6)	1.0	
20-34	442(91.5)	41(8.5)	1.70(0.61,4.53)	
35-49	68(94.4)	4(5.6)	2.68(0.62,12.23)	
Literacy status				
Can read and write easily	45(83.3)	9(16.7)	0.42(0.19,0.91)*	
Reads and writes with difficulty or unable to read and write	504 (92.3)	42(7.7)	1.00	0.71(0.29, 1.73) <i>0.86(0.35,2.14)⁷</i>
Religion				
Muslim	408(93.4)	29(6.6)	1.00	
Christian	81(80.2)	20(19.8)	0.29(0.15,0.56)*	3.64(0.48,27.74)
Wakefeta	52(98.1)	1(1.9)	3.70(0.59,74.4)	11.74(1.51,91.61) <i>1.43(0.18,11.66) 5.71(0.70, 46.83)</i>
Any livestock				
Yes	454(92.7)	36(7.3)	2.0(1.00, 3.90)*	1.7(0.88,3.56) <i>1.70(0.84,3.46)</i>
No	95(86.4)	15(13.6)	1.00	
Other income generating activities				
Yes	156(86.2)	25(13.8)	0.42(0.24,0.75)*	0.53 (0.29,0.98)*
No	386(93.7)	26(6.3)	1.00	<i>0.62(0.33,1.17)</i>

⁷ Italic font ANC included in the model

Characteristics	Delivery home Yes	No	OR 95%CI	Adjusted OR 95%CI
Number of pregnancies				
1	82(85.4)	14(14.6)	0.26(0.09,0.76)*	0.77(0.37, 1.64)
2-5	332(91.5)	31(8.5)	0.48(0.17,1.19)	0.41(0.14,1.17)
6 and above	135(95.7)	6(4.3)	1.00	<i>0.77(0.36,1.66)</i> <i>0.40(0.13, 1.18)</i>
Had ANC				
Yes	270(86.5)	42(13.5)	0.21(0.10,0.43)	<i>0.19(0.09,0.44)*</i>
No	279(96.9)	9(3.1)	1.00	

*P<0.05

Factors Associated with Registration of the Last Birth within 14 days after delivery

Table 10 presents the association of socio-demographic factors with registration of last birth. In bivariate analysis, followers of Christian Religion and Wakefeta Religion were highly likely and less likely respectively, to be associated with birth registration compared to Muslims (P<0.05). Families with additional income generating activities had a higher chance of last birth registered (OR 1.8(1.1, 2.9) in bivariate analysis and adjusted for other factors, when ANC is not included in the model (OR 1.75(1.07,2.86). Those who had 2-5 number of pregnancies had statistically significant association with registration of births within the first 14 days, but number of pregnancies did not have significant association when adjusted for other factors. As in the case of deliveries none of the other factors had significant association with birth registration when ANC is included in the model (Italic Font).

As expected, home delivery was significantly and inversely associated with lower chance of association with birth registration (Adj OR 0.76 (0.4, .14), not shown in the table)

Table 10: Relationship Between Socio-demographic Factors and Registration of Births within 14 Days After Delivery in Pastoralist and Semi pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Characteristics	Last birth registered within 14 days of delivery		OR 95%CI	Adjusted OR 95%CI
	Yes	No		
Age group				
15-19	5(11.4)	39(88.6)	1.0	
20-34	67(13.9)	416(86.1)	1.26(0.47,4.23)	
35-49	12(16.7)	60(83.3)	1.56(0.46,5.56)	
Literacy status				
Can read and write easily	12(22.2)	42(77.8)	1.8(0.95,3.7)	
Reads and writes with difficulty or unable to read and write	72(13.2)	474(86.8)	1.00	<i>1.54(0.73,3.25)⁸</i> <i>0.59(0.28,1.24)</i>
Religion				
Muslim	59(13.5)	378(86.5)	1.00	
Christian	22(21.8)	79(78.2)	1.78(1.00,3.18*)	<i>0.47(0.11, 2.06)</i>
Wakefeta	2(3.8)	51(96.2)	0.25(0.03, 1.00)*	<i>0.23(0.50,1.07)</i> <i>1.79(1.02,3.16)*</i> <i>0.28(0.07,1.17)*</i>
Any livestock				
Yes	69(14.1)	421(85.9)	1.04(0.55,1.98)	
No	15(13.6)	95(86.4)	1.00	
Own farm land				
Yes	49(14.3)	294 (85.7)	1.06(0.65,1.73)	
No	35 (13.6)	222(86.4)	1.00	
Other income generating activities				
Yes	35(19.3)	146(80.7)	1.8(1.1, 2.9)*	<i>1.54(0.93,2.54)</i>
No	48(11.7)	364(88.3)	1.00	<i>1.75(1.07,2.86)</i>
Number of pregnancies				
1	23(8.0)	265(92.0)	0.28(0.15,0.54)*	<i>0.98(0.49,1.96)</i>
2-5	34(17.3)	163(82.7)	0.68 (0.37,1.25)	<i>0.62(0.28,1.34)</i>
6 and above	27(23.5)	88(76.5)	1.00	<i>0.64(0.30,1.38)</i> <i>0.65(0.37,1.34)</i>

⁸ Blue font and italics ANC included in the model

Characteristics	Last birth registered within 14 days of delivery		OR 95%CI	Adjusted OR 95%CI
	Yes	No		
Had ANC				
Yes	61(19.6)	251(80.4)	2.54(1.47-4.38)*	2.59(1.49, 4.47)*
No	23(8.0)	265(92.0)	1.00	

*P<0.05

Knowledge of vaccine preventable diseases and vaccination status of children

As shown in figure 4, three hundred five (50.8%) women said they know polio. This is followed by measles, 268(44.7%) tuberculosis 147(37.0%) and Tetanus 119(24.8%).

Regarding the time when childhood vaccination starts 174 (29.0%) women answered that it starts at birth, while 156 (26.1%) said it starts at six weeks after birth and 330(55%) said they don't know when vaccination starts.

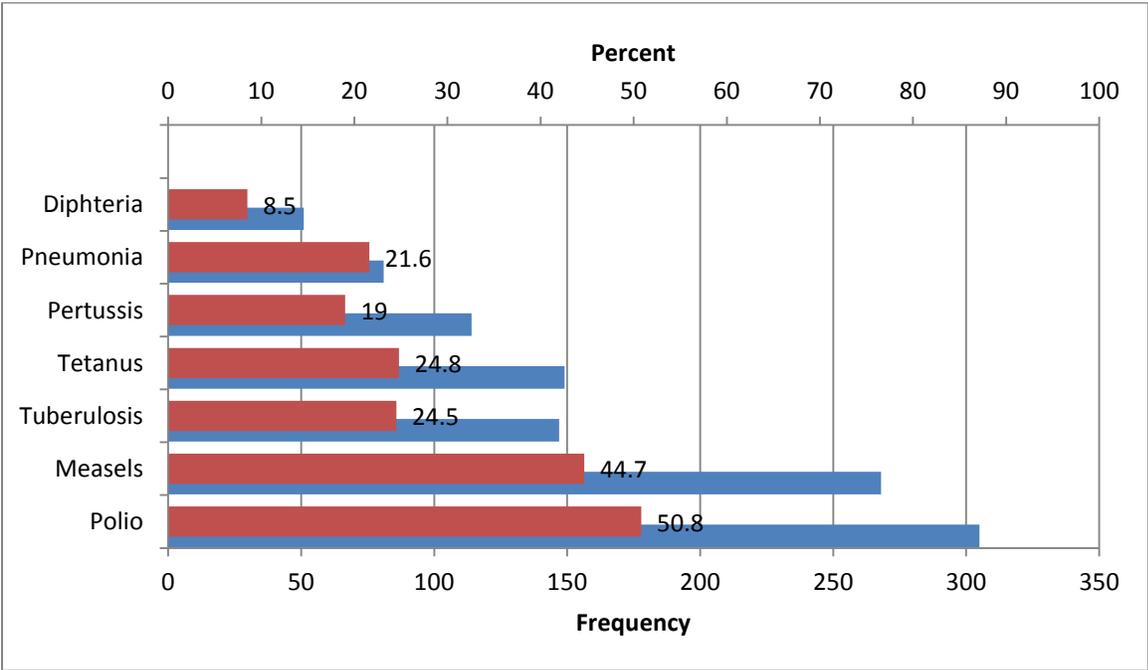


Figure 4: Reported knowledge of vaccine preventable diseases by women who gave birth in the previous one year in pastoralist and semi pastoralist areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Vaccination status of children born in the previous one year

Table 11 shows vaccination status of children born in the last one year by history, card and both history and card. BCG coverage was 53.7%, 40.8%, 57.2% by history, by card and by history or card respectively. Polio 0 coverage was 29.7%, 19.7%, and 32.7% by history, by card and by history or card respectively. Penta 3 coverage was 33.8%, 27.3% and 39% by history, by card and by history or card respectively.

Table 11: Vaccination Status of Children Born in the Previous One Year in Pastoralist and Semi pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Antigens/vaccines	Vaccinated by history No (%)	Vaccinated by card No (%)	Vaccinated by history or card No (%)
BCG	322(53.7)	240(40.8)	343(57.2)
Polio 0	178(29.7)	118(19.7)	196(32.7)
Polio 1	324 (54.0)	258(43.0)	357(59.5)
Polio 2	269(44.8)	212(35.3)	325(54.2)
Polio 3	196 (32.7)	152(25.3)	222(37.0)
Penta 1	349(58.2)	274 (45.7)	379(63.2)
Penta 2	273 (45.5)	224(37.3)	304 (50.7)
Penta3	203(33.8)	164(27.3)	234 (39.0)
Measles	102 (17.0)	86(14.3)	126(21.0)
PCV1	155 (25.8)	141(23.5)	178(29.7)
PCV 2	72(12.0)	65(10.8)	80(13.3)
PCV3	55(9.2)	51(8.5)	59(9.8)

As shown in Table 12, religion and attending ANC or birth registration within 14 days of delivery (*Italic Font*) were statistically significantly associated with polio birth dose vaccination. ANC (Black Font) and birth dose registration (*Italic Font*) were alternatively included in the model.

Table 12: Factors Associated with Polio Birth Dose Vaccination in Pastoralist and Semi pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Characteristics	Polio birth dose vaccinated		OR 95%CI	Adjusted OR 95%CI
	Yes	No		
Age group				
15-19	11(25.0)	33(75.0)		
20-34	163(33.7)	320(66.3)	1.53(0.72,3.30)	
35-49	22(30.6)	50(69.4)	1.32(0.52,3.36)	
Literacy status				
Can read and write easily	22(40.7)	32(59.3)	1.47(0.83,2.60)	
Reads and writes with difficulty or unable to read and write	174(31.9)	373(68.1)		
Religion				
Muslim	144(33.0)	293(67.0)		
Christian	46(45.5)	55(54.5)	1.70(1.07,2.70)*	1.81(1.16,2.84)*
Wakefeta	4(7.5)	49(92.5)	0.17(0.05,0.49)*	0.20(0.07,0.58)* <i>1.57(0.98,2.53)</i> <i>0.19(0.65,0.54)*</i>
Any livestock				
Yes	157(32.0)	333(68.0)	0.85(0.56,1.33)	
No	39(35.5)	71(64.5)		
Own farm land				
Yes	112(32.7)	231(67.3)	1.00(0.70,1.43)	
No	84(32.7)	173(67.3)		
Other income generating activities				
Yes	68(37.6)	113(62.4)	1.37(0.95,1.97)	1.27(0.86,1.87)
No	126(30.6)	286(69.4)		<i>1.21(0.81,1.81)</i>
Number of pregnancies				
1				
2-5	28(29.2)	68(70.8)	0.94(0.51,1.72)	
6 and above	123(34.6)	233(65.4)	1.07(0.69,1.65)	
	43(30.5)	98(69.5)		
Attended ANC				
Yes	120(38.5)	192(61.5)	1.74(1.23,2.47)*	1.48(1.02,2.14)*
No	76(26.4)	212(73.6)		
Birth registered within 14 days				
Yes	61(72.6)	23(27.4)	7.5(4.5, 12.6)*	<i>6.35(3.74,10.77)*</i>
No	135(26.2)	381(73.8)		

Reasons for not having polio birth dose vaccination

As shown in figure 5, 83 (28.8%) mothers answered that their children did not have polio birth dose vaccination because they did not know the importance of vaccination. Fifty seven (19.8%) mothers said services were not available and 43 (14.9%) mothers responded that they did not know vaccination starts at birth. Other responses included health facility was far (13.2%), service time was not convenient (12.8%), did not know place of vaccination (9.3%), mother was too busy, delivery took place not in the normal (current residence area), fear of side effects, bad health workers approach, and mother can't go out of home soon after delivery.

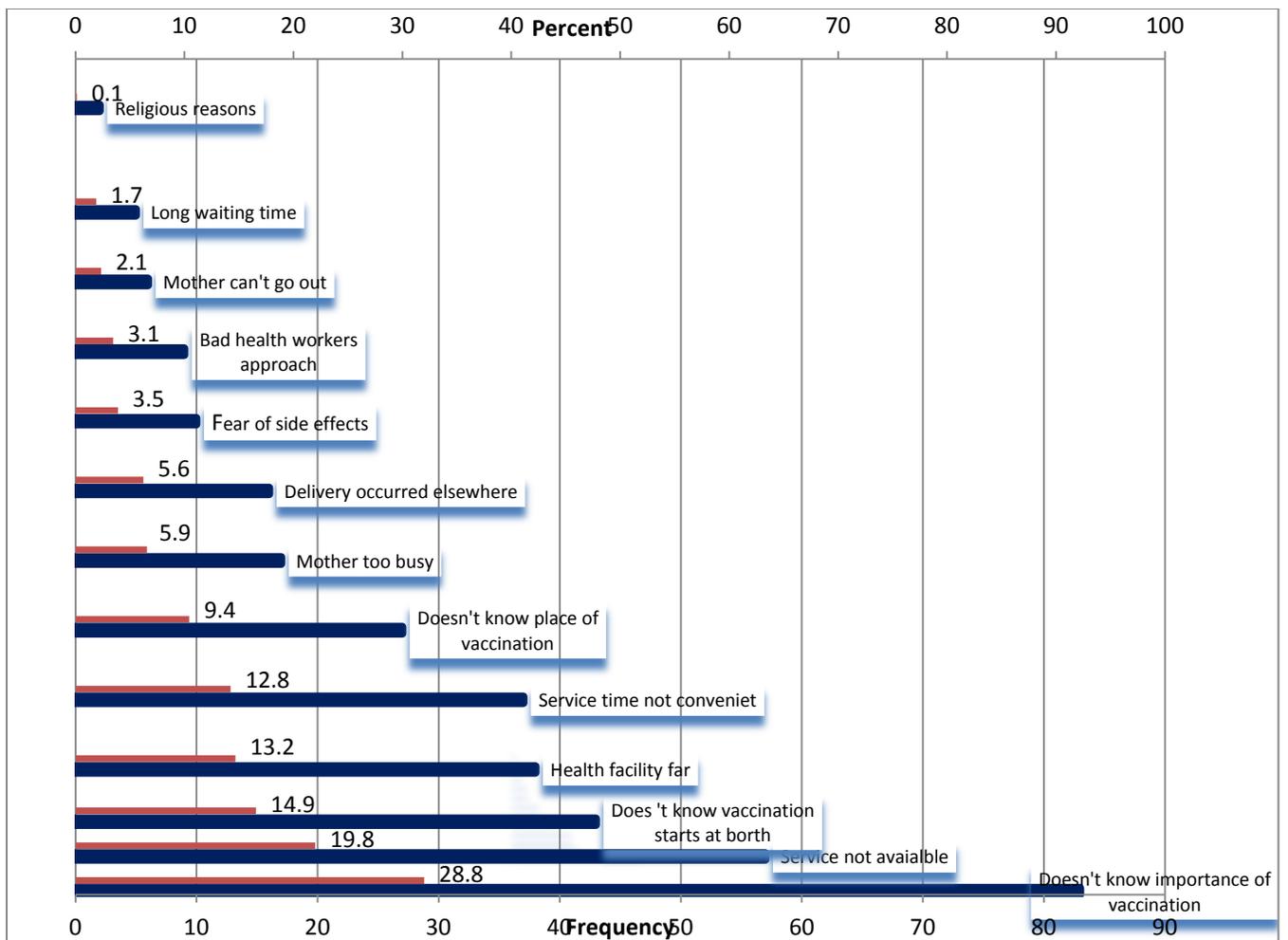


Figure 5: Reasons for not vaccinating children born in the previous one year is pastoralist and semi-pastoralist areas

Knowledge on prevention, transmission and vaccination against polio

Three hundred seventeen(52.8%) respondents answered that polio is prevented by vaccination and 118(19.7%) said it is prevented by personal and environmental hygiene, while 245(40.8%) said they don't know. Polio was said to be transmitted by sneezing/cough by 68 (13.1%), open defecation 58(9.7%), contaminated water 51(8.5%) respondents while 445(74.2%) said they don't know how it is transmitted. The time when polio vaccination starts was indicated to be birth or within 2 weeks by 220 (37.4%) women and 281(46.7%) answered that they don't know or did not tell the time when polio vaccination starts (Table 13).

Table 13 : Knowledge on Prevention, Transmission and Polio Vaccination in Pastoralist and Semi pastoralist Areas of CORE Group Polio Project Implementation Districts, Ethiopia. 2012

Knowledge on polio prevention and transmission and time vaccination starts	Frequency	Percent
Polio prevention *		
Vaccination	317	52.8
Personal environmental Hygiene	118	19.7
Others**	16	2.7
Don't know	245	40.8
Polio Transmission		
Sneezing/ cough	68	13.1
Open defecation	58	9.7
Contaminated water	51	8.5
Body fluids	30	5.0
Others	16	2.7
Don't know	445	74.2
Time to start polio vaccination		
At birth	163	27.2
At two weeks	61	10.2
At one month	95	15.8
Don't know/ not specified	281	46.7

* - Multiple answers possible

** - Others include use of bed nets, not using the same eating utensils, clothes, not playing with patient,

Findings of interviews with HEWs, CSFP, TBAs and EPI coordinators

A total of 70 HEWs were interviewed in the nine study *woredas*. The median age of the respondents was 24.0 years. It ranged from 18-45 years. Forty one (58.6%) were female and 29 (41.4%) were male. The mean (and median) duration of work of the respondents was 3.0 years and ranged from 3 months to 6 years. In the majority of the cases 59(84.3%) the health posts were located in rural areas. Thirteen (18.6%),

4(5.7%), 5(7.1%) and 22 (31.4%) reported to have been trained in IIP, Integrated Refresher Training, Social Mobilization, and Newborn Tracking respectively. Sixty (85.7%) HEWs reported to have received supervision of whom 39(63.9%) got feedback.

Fifty one (72.9%) HEWs claimed to know the number of pregnant women in their kebeles, using several means including house to house visit , estimating from the kebele population proportion (usually 3.4%) and getting numbers from the *woreda* health office. Forty four (62.9%) HEWs reported that they conduct ANC while 27(38.6%) provide delivery services. Thirty eight (54.3%) claimed to be registering births. Regarding actions to improve Polio 0 coverage, the HEWs recommended to give health education so that women bring their children to the health facility for vaccination 23(32.9%); delivering Polio 0 house to house 20(28.6%); mother to deliver in health institutions ; and equip health posts with fridge, vaccines and supplies 8(11.4%) each. Others suggested a combination of the measures mentioned above.

A total of 71 CVSFPs were interviewed from the nine study districts (*woredas*). The mean age of the respondents was 33.9 ± 9 and median 30 years. Thirty five (49.3%) were female and while 36 (50.7%) were male. Thirty nine (54.9%) respondents reported that they can easily read and write, others 11(15.5%) could read and write with difficulty and 21(29.6%) could not read or write at all. The mean duration of work was $3.4 \text{ years} \pm 2.4$, and median was 3.0 years.

Thirty eight (53.5%), 21 (29.6%) and 16(22.5%) were trained in community based surveillance, newborn tracking and social mobilization respectively. Seventeen (23.9%) did not have any of the above training. Thirty nine (54.9%) of the CVSFPs reported to have received supervision during the last six months, of whom 22(59.5%) got feedback. On the other hand, forty seven (66.2%) respondents reported that they know the number of pregnant women in the catchment areas and 36 (50.7%) registered births.

Regarding actions to improve vaccination of polio birth dose, 32 (45.1%) CVSFPs suggested educating women to give birth at health facilities and/or bring the newborn for Polio 0 vaccination. Fifteen (21.1%) recommended house to house Polio 0 vaccination, and 8 (11.3%) to assign personnel and equip the health posts with the necessary facilities and supplies.

Interview was conducted with 47 TBAs in the 9 districts. The number of reported deliveries conducted by the TBAs ranged 2-40 during the previous 3-6 months. Concerning how they identify pregnant women and conduct deliveries, most reported that it is easy because the abdomen shows up, the presence of symptoms like loss of appetite and tiredness in the absence of menstruation indicates pregnancy and many are contacted by women for advice and reassurance about the position of the fetus. A few were only called when labor starts. Two TBAs mentioned that they were no more allowed to follow pregnant women or conduct deliveries on their own. Only four TBAs knew that the first dose of polio is given at

birth or within 14 days after birth. About one-fourth of the TBAs said that they participated in mobilization of the community during polio campaign whereas the rest did not participate in vaccination activities. Concerning improvement of polio birth dose vaccination, their suggestions included house to house vaccination, since women cannot go out of home during the first 15 days, particularly according to Somali culture; ANC and advice on Polio birth dose vaccination; opening and staffing a health post in the village; house to house visit to identify and follow pregnant women, educate women, families and elders about the first (birth) polio dose; delivery in health facilities; closer ties between TBAs and health workers; and informing HEWs/health workers about deliveries as soon as they occurred.

Eleven health center and 9 *Woreda* (district) EPI coordinators were also interviewed. None of the health center EPI coordinators knew Polio 0 coverage of their catchment area. They also did not know ANC and Institutional delivery coverage. Concerning improving polio birth dose coverage, their suggestions included increase institutional delivery, educate the community on polio birth dose, house to house vaccine delivery by HEWs, and provision of polio birth doses at outreach sites, in that order. Only 2 *woreda* EPI coordinators could provide figures on polio 0 coverage. Regarding suggestions to improve Polio 0 coverage, they mentioned house to house search and vaccination by HEWs, institutional delivery, HEWs identify pregnant women through house to house assessment and link to health facility, avail refrigerators, supplies and vaccines at all health facilities, provide outreach services and networking with TBAs and volunteers .

Findings from FGD with community leaders

Participants mentioned that polio is known by different names and indicated symptoms and signs of the disease. One such sign related name can be translated as “death of legs”. Several participants in all groups mentioned that polio causes paralysis of legs and inability to walk. On the other hand, they also mentioned symptoms that may not be indicative of polio such as leg swelling and fainting. Some participants attributed curse as a cause of polio while several answered that they don’t know the cause of polio. Concerning transmission of polio, some FGD participants mentioned a number of ways including airborne from infected person, close contact with a polio patient, body contact with a polio patient and the like. A few mentioned that polio is transmitted by movement of people and migration from neighboring countries. Several participants said that they do not know the ways of polio transmission. Regarding prevention, many participants mentioned vaccination. However, in some cases correct specific knowledge may be lacking on polio vaccination. An example of such a response is that polio is prevented by vaccination of pregnant women and children. Other responses include not eating together, not sharing clothes, exclusive breast feeding, feeding children with a lot of milk and protecting children from dirt and keeping them clean.

Concerning reasons that encourage or discourage immunization, almost all participants agreed that there is no reason related to religion that discourages immunization in the study areas. It was mentioned that there are rumors that may discourage women and families from having their children vaccinated, although the influence of these rumors has decreased much nowadays. Some participants said that they may still exist to a greater extent in remote areas. The rumors include sterility of women following vaccination, children may be disabled after vaccination and vaccination causes a lot of suffering and pain in children. An instance was mentioned where a health care provider had to sign an agreement with women declaring that vaccination would not cause sterility. Actual and perceived side effects were another reason for avoiding vaccination. These include fever, excessive crying, swelling at the site of vaccination, diarrhea and vomiting. Side effects are said to particularly influence subsequent rounds of vaccinations if they occur during the first round.

The measures cited by the participants to improve polio birth dose were teaching about and promoting institutional delivery, registering pregnant women and newborns by HEWs, house to house polio birth dose vaccination by HEWs, and involving elders and religious leaders in promoting newborn vaccination. The importance of creating mechanisms for kebele administration to take responsibility for birth dose vaccination, using all available venues such as mosques, churches and market places to inform about polio birth dose was emphasized by some participants.

DISCUSSION

Six hundred women were included in the study making the response rate 100%, although non-response to few questions was noted and that the variables had to be discarded from analysis. A 100% overall response was possible because in case of absence or non-response, data collection continued until the allocated sample size was obtained. Absence or non-response that needed to be replaced was noted in only 12 (2%) cases. Data not included in the results were related to economic status assessment such as number and type of cattle and land size since they were found not to be meaningful and or the majority did not respond to them. This could be because of lack of information by the women (only the husband knows) or fear of implications of telling the truth, although the purpose of the study was well explained at each study site.

The socio-demographic characteristics of the study population generally represented the distribution of pastoralist and semi-pastoralist population in CORE Group Ethiopia Project Areas. The majority of the respondents (91%) were either unable to read and write or did so with difficulty. While this is expected in such relatively disadvantage places, it has important implications for planning, organizing and provision of proper IEC (Information, Education & Communication). Health education messages and methods should be geared accordingly. The great majority of the respondents (98.2%) were married reflecting the

expectation that child bearing generally takes place in the context of marriage in the study area. On the other hand about one fifth of the current marriages were polygamous. No difference was however noted in maternal health service utilization or polio birth vaccination in this study between polygamous and monogamous marriages.

Only 85 (14.2%) of the births in the previous one year were said to have been registered between birth and 14 days, 44 (52% by HEWs). Interview with HEWs also indicated that 38 (54.3%) claimed to be registering births. Thus, a substantial number of births go unregistered between birth and 14 days making the likelihood of receiving polio birth dose highly unlikely.

Three hundred twelve women (52.0%) had attended antenatal care at least once during the last pregnancy. The most recent demographic and health survey (1) reported a relatively lower attendance rate for some of the regions the study population is located in; Afar (35.3%), Somali (25.3%), Gambella (57.7%) , Benishangul Gumuz (40.8%) and Oromia (39.5%). Differences in coverage were also noted from the annual report of the Federal Ministry of Health (11) ; Afar (26.4%), Somali 30.9%, Gambella (39.1%), Benishagul Gumuz (52.6%). The differences may be explained by the fact that the study *woredas* may not be a typical representative of the administrative region in which it is located. It may also be the case that the activities of CGPP and partners' projects may have improved coverage in some instances.

Five hundred forty nine women (91.5%) delivered their last baby at home, while 45(5.5%) delivered in health centers and hospitals. And the majority (80.0%) of the attendants at home were untrained or trained traditional birth attendants. The HEWs attended only 9(1.6%) births. The very high proportion of home delivery and unskilled delivery attendant even by Sub-Saharan African standard is similar to the reports of the recent results of the Ethiopian Demographic Health Survey (1), although there may be some variations among and between the administrative regions of the country. The report of the FMOH gave a relatively higher result for the country and some regions (11). As indicated earlier, this persistently low institutional delivery coverage becomes a major constraint to deliver the polio birth dose. The reasons for delivering at home include familiar birth attendants (46.4%), distance to health facility (24.4%), unavailability of transport (16.0%), delivery in health facility not culturally encouraged (10.7%) and non-friendly health services (8.9%). Twenty four women (4.4%) answered that the health facility was not functioning at the time they were in labor. Thus the decision to deliver at home and not health facilities appear to mainly be related to health service delivery factors while cultural or community related reasons seem to contribute to a lesser extent.

Decision making about place of delivery and ANC attendance was made by the women in more than 65% of the cases in this study population. This is different from the general finding of the Ethiopian

Demographic and Health Survey which reported that health care of women is mainly decided jointly 61 % or by the husband 25% and to a lesser extent by the wife alone (13.4%) (1).

About 46% of the respondents reported to have attended postnatal care. However, a relatively high number of the respondents, 198(33%) visited health facilities at the 45th day after delivery. Twenty one women reported to have postnatal care after 45 days of delivery. Thus, for most of the women the chance of their babies receiving polio birth dose during post natal care is rare. It is also worth noting that the main reason of post natal care visit was immunization of children. While this shows the relative importance given to childhood immunization and has the potential for improving coverage, it shows that post natal maternal health is not getting due priority.

When adjusted for other factors, religion, having live stock, and income generating activities were significantly associated with ANC attendance ($P<0.05$) in both bivariate and multiple logistic regression analyses. Regarding religion, those who follow the Wakefeta religion had a very low ANC attendance rate (7.5%) which entails that a lot has to be done concerning the followers of the religion to improve ANC coverage as ANC is found to be the most important determinant of institutional delivery, birth registration and polio birth dose immunization (*Please see below*). Having live stock was inversely associated with ANC care. It is possible that this is related to the pastoralist nature of the population with livestock, where people travel with cattle in search of grazing land and water, and would not have access to ANC services.

The odds of engaging in other income generating activities were 1.8 times higher among the ANC attendees compared to non-attendees. A possible explanation is that other income generating activities may enable the family to stay around towns and hence improves the chance of ANC attendance.

Being able to read and write easily did not maintain significant association with ANC attendance when adjusted for other factors. It is possible that the level of literacy that was defined as being able to read and write easily and its effects on other determinants of health care is not good enough to make the required changes or differences in the study setting. The population appears fairly homogeneous in this respect.

After adjusting for other factors, Wakefeta Religion and no other income generating activities were statistically significantly associated with home delivery when ANC was not included in the model. When ANC was included, none of the variables retained statistical significance. The odds of attending ANC by those who delivered at home was 19% of that did not attend ANC. Regarding religion and other income generation activities, the association with home delivery can be explained in a similar manner as that of ANC attendance, but in the reverse order or direction. That is belonging to Wakefeta Religion and not having other income generating activities do not enable visiting health facilities for services.

Birth registration within 14 days is expected to enhance polio birth dose vaccination, as it helps identify newborns and/ or vaccinate them with birth doses as they are identified. As in the case of deliveries none of the other factors had significant association with birth registration when ANC is included in the model showing the lofty importance of ANC attendance.

Polio was the most frequently known vaccine preventable disease, but about half of the respondents did not mention it. Second comes measles but only 44% of the respondents had mentioned it. Moreover, only 29% of the women said that vaccination starts at birth. These indicate the gap that prevails in comprehensive and necessary knowledge about vaccine preventable diseases and vaccination schedule.

Vaccination status of children is difficult to measure because of difficulties in acquiring information about whether the child had received each antigen included in the national immunization program. Community based data collection employs two approaches; interviewing mothers or care takers about whether the child has gotten the required antigen for his/her age and referring to the vaccination card of the child. The methods have their advantages and disadvantages. Referring to the card is a more objective way of assessing immunization status because interviewing the mother is dependent on her memory and understanding the schedule and the routes of vaccine administration. On the other hand, vaccination cards are often lost. In this study we employed both methods and a combination of the methods (and/or) so that data would be analyzed using any of the sources. Use of interview had a higher coverage rate compared to cards. A combination of the two yields the highest coverage, but perhaps exaggerates it. Accordingly, this study revealed that BCG coverage was 53.7%, 40.8%, 57.2% by history, by card and by history or card respectively. Polio 0 coverage was 29.7%, 19.7%, and 32.7% by history, by card and by history or card respectively. Penta 3 coverage was 33.8%, 27.3% and 39% by history, by card and by history or card respectively. This finding is similar to a study in disadvantaged (slum) areas in Nairobi, Kenya that reported a much lower coverage of Polio 0 was reported compared to other antigens (12)

According to the 2010/2011 FMOH report, Penta 3 coverage in Afar was 37.4%, Oromiya 86%, Somali 34%, Ben gumuz, 98%, Gambella 70.4%, which generally indicates a higher coverage than the study districts. At this juncture it is worth noting that the FMOH annual report does not include polio 0 coverage reports, which is an impediment in follow up of progress in Polio 0 status and trend. On the other hand the 2011 Ethiopian Demographic Health Survey indicates generally lower coverage rates. Coverage rates for Polio 0 by mother's report or card for Afar, Somali, Benishagul Gumuz, Gambella and Ormiya regions were 10.6%, 18.9%, 36.4%, and 15.5 polio respectively. Penta 3/DPT3 coverage reported by the Demographic and Health survey were 10.3%, 25.3%, 27.8%, and 26.8% for Afar, Somali, Benshangul-Gumuz, Gambella and Oromiya regions respectively. While differences in coverage rates between FMOH reports that are based on health service data and the community based demographic and health survey are not unexpected, the observed wide gap cannot be explained and might warrant further

studies. Nonetheless, the wide gap renders it difficult understanding the status of immunization in the study districts (*woredas*) compared to national or local coverage. As also mentioned above, it should be noted that the study districts (*woredas*) may not be representative of the administrative region in which they are located because of selection criteria, interventions and other reasons and this also applies to vaccination coverage.

Religion and attending ANC, non-home delivery (health facility delivery) birth registration within 14 days of delivery were statistically significantly associated with polio birth dose vaccination. This finding, although may be already expected, has an important implications of the chain of actions that need to be undertaken for improving polio birth dose coverage.

The reasons that mothers gave for no polio birth dose of the newborn indicate lack of knowledge such as not knowing the importance of polio vaccination, not knowing when polio vaccination starts and does not know the site of vaccination. It also indicates issues related to inaccessibility of services as shown by responses such as unavailability of services during their visit, distance from the health facility inconvenient service time and poor health workers' approach. Other reasons although mentioned less frequently refer to societal or personal situation of the mother that may not be directly related to the provision of services. These include mother was too busy, delivery took place not in the normal (current residence area), fear of side effects, and mother can't go out of home soon after delivery. The implication of these findings is that interventions need to be undertaken from different perspectives; informing and educating women and improving accessibility and quality of services. A pilot birth dose project in India showed some similarity in reasons for refusal of polio birth dose such as fear of side effects (sterility) and misunderstanding about when and how many doses of polio vaccine are needed (13).

Similar conclusions can be made about the need for educating women on polio transmission and prevention because of the following and related findings. Forty to seventy percent of the respondents answered that they did not know how polio is transmitted and prevented. Not a small number of respondents also gave incorrect answers about polio transmission such as sneezing and cough and polio vaccination starts at one month of age.

Forty one (58.6%) of the HEWs were female and 29 (41.4%) were male. This is different from agrarian parts of the country where all HEWs are female. Having female HEWs, among other things was justified by issues related to acceptance, since many of their activities deal with women and families. The implications of having male HEWs in the study areas from performance, acceptance, and feasibility points of view need to be explored further.

Interviews with HEWs showed that less than one third (31.4%) of them were trained in Newborn Tracking and 5(7.1 %) in social mobilization indicating the need for training in order to improve polio birth dose coverage. Sixty (85.7%) HEWs reported to have received supervision during the previous six months. However, only 39(63.9%) got feedback, indicating another area that needs to be strengthened. Similar experiences were reported by the CVSFPs.

The role of TBAs, trained or untrained, in conducting deliveries in developing countries has been controversial and it seems that nowadays there is a consensus that they should not handle child deliveries on their own. That also appears to be the stand of the Ministry of Health of Ethiopia, where institutional delivery is being highly promoted recently. However, the number of reported deliveries conducted by the TBAs ranged from 2 to 40 during the previous 3-6 months, corroborating with the finding from the women's interview that a large majority of deliveries are conducted by TBAs. Thus, it becomes impossible to exclude the participation of TBAs if improving mother and newborn health is to take place in such settings. However, only 4 of the 47 TBAs knew that the first dose of Polio (birth dose) is given at birth or within 14 days after birth indicating a huge missed opportunity for informing and motivating mothers for polio birth dose immunization.

Concerning polio birth dose vaccination, TBAs' suggestions coincide with those of HEWS and CVSFPs. The TBAs have also recommended closer ties between TBAs and health workers, and informing HEWs or other health workers about deliveries that have high implications for improving polio birth dose coverage. However, a constraint in implementing the latter may be that TBAs may not be officially allowed to conduct deliveries and hence would be unable to report about the deliveries. Thus the approach to be used and the roles of TBAs should be defined in the specific context.

None of the health center EPI coordinators knew Polio 0 coverage of their catchment area. They also did not know ANC and Institutional delivery coverage. Only 2 *woreda* EPI coordinators could provide figures on Polio 0 coverage. This indicates the large gap that needs to be filled in improving awareness of the program owners (EPI coordinators) on the importance of polio birth dose, its documentation and interpretation, by having a system of documentation of polio birth dose, training and supportive supervision. Concerning improving Polio birth dose coverage, they shared the suggestions mentioned by other respondents viz increase institutional delivery, educate the community on Polio birth dose, house to house search and vaccination by HEWs, provision of polio birth doses at outreach sites, avail refrigerators, supplies and vaccines at all health facilities, and networking with TBAs and volunteers. This implies that there is a consensus on what should be done to improve polio birth dose coverage.

Several participants in the FGDs mentioned that polio causes paralysis of legs and inability to walk. On the other hand there are indications about possible misconceptions on the causes and transmission of

polio virus that need to be curbed by IEC. These misconceptions include leg swelling and fainting as symptoms of polio, polio caused by curse, polio transmitted airborne from patients, body contact with a polio patient and rumors such as vaccination may cause sterility. Almost all participants agreed that there are no reasons related to religious beliefs that discourage immunization in the study areas. This finding has a very important implication for increasing polio birth dose vaccination, since religious institutions and leaders can inform and motivate mothers and families for vaccination if they are informed and their commitment is secured. On the other hand, it was found that among women who delivered babies during the previous one year followers of the Wakefeta religion had a lower rate of immunization compared to other religions. The reasons for such a low rate when all religions were said to encourage immunization should be explored and special attention needs be given to the followers of the Wakefeta religion.

Once again the measures cited by the FGD participants to improve polio birth dose were similar to those of other study populations. More or less new additions that have important implication are involving elders and religious leaders in promoting newborn vaccination and creating mechanisms for kebele administration to take responsibility for birth dose vaccination, using all available venues such as mosques, churches and market places to inform about Polio birth dose.

Strengths and limitations of the study

This study used several study populations and a combination of qualitative and quantitative methods and presented a comprehensive answer for the study questions from different perspectives.

However, it cannot claim to be representative of all pastoralist and semi-pastoralist areas of the country, as the different areas may have unique characteristics related to health seeking and related issues. Similarly, each study district may have certain unique features that may not have been well covered in the study. Moreover, some extremely hard to reach areas and those with security problems during the time of data collection were excluded from the study and hence the findings may not reflect the realities in these areas. In addition, as mentioned above, certain variables, especially those related to assessment of economic status were not included in the results of the study.

CONCLUSION

This study took place in a sample of CORE Group Polio Project pastoralist and semi-pastoralist areas characterized by high illiteracy rate, almost universal marriage where monogamy and polygamy are practiced, gender mix of HEWs , highly influential community and religious leaders, low ANC and institutional delivery , low birth registration and low polio birth dose rates.

Religion and attending ANC, non-home delivery (health facility delivery) birth registration within 14 days of delivery were statistically significantly associated with polio birth dose vaccination. This finding has an important implication of the chain of actions that need to be undertaken for improving polio birth dose coverage.

A further analysis on determinants of ANC showed the following. Religion, having live stock, and income generating activities were significantly associated with ANC attendance. Nonetheless, being able to read and write easily did not maintain significant association with ANC attendance when adjusted for other factors. After adjusting for other factors, Wakefeta Religion and no other income generating activities were statistically significantly associated with home delivery when ANC was not included in the model. When ANC was included, none of the variables retained statistical significance. Birth registration within 14 days is expected to enhance polio birth dose vaccination, as it helps identify newborns and/ or vaccinate them with birth doses as they are identified. Similar, but inverse associations as that of home delivery were found. As in the case of deliveries none of the other factors had statistically significant association with birth registration when ANC is included in the model showing the lofty importance of ANC attendance. Thus improving ANC attendance and by extension; identification, registration and follow up pregnant women should be given high priority to improve polio birth dose coverage.

Based on the responses of women who delivered in the previous one year, the factors that lead to low birth dose coverage can be summarized as lack of knowledge on prevention, transmission of polio and schedule for vaccination, inaccessibility and poor quality of services and societal or individual related factors. The implication of having such diverse findings is that interventions need to be undertaken from different perspectives; health services and community level.

Interviews with HEWs and CVSFPs showed that less than one third of them were trained in Newborn Tracking and social mobilization and supervision was not always followed by feedback and follow up indicating the need for training and strengthening supportive supervision.

The majority of the deliveries were conducted by TBAs as shown by the women who delivered in the previous one year and TBAs' interviews. Thus, although the role of TBAs has been controversial nowadays, it becomes impossible to ignore the participation of TBAs in improving mother and newborn health in the study area.

None of the health center EPI coordinators knew Polio 0 coverage of their catchment area. They also did not know ANC and institutional delivery coverage. Only 2 *woreda* EPI coordinators could provide figures on Polio 0 coverage. It is thus necessary to train these "program owners" (*Woreda* and Health center EPI coordinators) on the importance of polio birth dose documentation and interpretation, and have an improved system of documentation of polio birth dose and supportive supervision.

Almost all FGD participants stated all religions encourage immunization in the study areas. This opportunity can and must be used to improve polio birth dose vaccination because religious leaders and institutions are highly respected and their advice and instructions firmly followed in the study areas.

A strikingly similar set of suggestions was made by the different study population groups related to improving awareness, service provision and participation of stakeholders in improving polio birth dose coverage. These have been incorporated in the recommendations section that follows.

RECOMMENDATIONS

1. Improving awareness of women, families and communities through targeted IEC interventions

- Raise awareness of women, family and community leaders on causes, transmission, prevention of polio and vaccination schedule emphasizing on polio birth dose
- Prepare messages and materials based on identified gaps, misconceptions or incorrect responses on the issues mentioned above i.e. causes, transmission, prevention of polio and vaccination schedule emphasizing on polio birth dose
- Use appropriate mechanisms to reach women, families and communities with messages. This may include house to house HEW and CV visits, using TBAs contacts with pregnant and delivering women, community meetings, local media, religious and other institutions.

2. Training and strengthening of supportive supervision

- Train or retrain HEWs, CVs, TBAs on newborn tracking and social mobilization
- Develop mechanisms for effective implementation of planning, conducting and monitoring of supportive supervision and feedback of HEWs and CVs within the existing health and administration systems

- Train *Woreda* and Health Center EPI coordinators with particular emphasis on the importance of polio birth dose documentation, interpretation and utilization of results and developing such a system at different levels, as appropriate and feasible.
3. **Develop and strengthen mechanisms for identification and follow up of pregnant women, use of ANC and institutional delivery, birth registration and subsequent polio birth dose vaccination**
- House to house identification of pregnant women by HEWs, CVs
 - Link with TBAs for identification and reporting of pregnant women and women who have just delivered
 - Involve religious leaders and community elders and their institutions on each of the steps mentioned above.
 - Involve kebele or other formal leaders to take responsibility on improving polio birth dose coverage
4. **Develop and strengthen strategies to improve accessibility and quality of maternal and newborn health services**
- Improve provision of essential equipment and supplies, with particular emphasis to health posts.
 - Expansion of immunization service delivery such as outreaches.
 - Training on management of resources as appropriate
 - Support advocacy activities that target decision makers

REFERENCES

1. Central Statistical Agency (Ethiopia) and ORC Macro. Ethiopia Demographic and Health Survey 20010/11, Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro, 2012
2. Central Statistical Agency (Ethiopia) and ORC Macro. Ethiopia Demographic and Health Survey 2005, Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro, 2006 .
3. Federal Democratic Republic of Ethiopia. Ministry of Health. HSDP IV. Annual Performance Report EFY 2003 (2010/2011).
4. CORE Group Ethiopia. Survey of Immunization of children and women in CORE Group partners' implementation areas. March 2010.
5. CORE Group Polio Project in Angola, Ethiopia, and Uttar Pradesh, India: Midterm Evaluation. June 30. 2011.
6. CORE Group Polio Project Midterm Evaluation in Ethiopia. December 2010.
7. CORE Group Ethiopia. AFP case detection and status of surveillance in pastoralist and semi-pastoralist communities of CORE Group Polio Project implementation districts (*woredas*) in Ethiopia. June 2012.
8. CORE Group Ethiopia. Cross Border Transmission of Wild Polio Virus (WPV) and Immunization Service Delivery in CGPP Project Implementation International Border Areas in Ethiopia. June 2012.
9. Lemeshow S, Taber S Lot quality assurance sampling: single- and double-sampling plans. World Health Stat Q. 1991;44(3):115-32.
10. Singh J, Jain DC, Sharma RS, Verghese T. Evaluation of immunization coverage by lot quality assurance sampling compared with 30-cluster sampling in a primary health centre in India. Bull World Health Organ. 1996;74(3):269-74.
11. Federal Democratic Republic of Ethiopia. Ministry of Health. Health and Health Related Indicators. For 2003 Ethiopian Fiscal Year (2010/2011 GC). 2012.
12. Mutua M, Kimani-Murage E, Ettarrh R. Childhood vaccination in informal urban settlements in Nairobi, Kenya: Who gets vaccinated? BMC Public Health 2011, 11:6.
13. Rainey J, Bhatnagar P, Estivariz CF et al. Providing monovalent oral polio vaccine type 1 to newborns: findings from a pilot birth-dose project in Moradabad district, India. Bull World Health Organ. 2009; 87:955-959. doi: 10.2471/BLT.08.061556