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Volume 27

Supplement 2

The Expanded Program on Immunization in Ethiopia

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Ethiopian Government, EPI partners and the World Health Organization

Supplement guest editors:
Fiona Braka, Thomas Karengera, Kathleen Gallagher

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This supplement presents data and reports that highlight some of the recent efforts and activities on the part of the Ethiopian Government, EPI partners and the World Health Organization to further the understanding and control of vaccine preventable diseases in Ethiopia. Included in this supplement are manuscripts that describe the epidemiology of measles in selected areas of the country, the impact of polio eradication efforts on routine immunization activities and community knowledge in the Somali region of Ethiopia, analysis and assessment of AFP and other surveillance data, determinants of immunization service utilization and routine immunization performance, and the utility of an accountability framework for monitoring polio eradication efforts.

TABLE OF CONTENTS

Advances in the control of vaccine preventable diseases in Ethiopia (Editorial) **1**

Behavioral determinants of immunization service utilization in Ethiopia: a cross-sectional community-based survey **3**

Health care seeking behavior of parents with acute flaccid paralysis child **9**

Effects of polio eradication activities on routine immunization: lessons from the 2013 outbreak response in Somali region of Ethiopia **15**

Factors contributing to routine immunization performance in Ethiopia, 2014 **21**

Status of surveillance and routine immunization performances in Amhara Region, Ethiopia: findings from in-depth peer review **27**

Assessment of source of information for polio supplementary immunization activities in 2014 and 2015, Somali, Ethiopia **33**

Assessment of reporting sites for acute flaccid paralysis surveillance in Ethiopia: implications for planning of active case search visits **39**

Measles outbreak investigation in Guji zone of Oromia Region, Ethiopia **45**

Analysis of acute flaccid paralysis surveillance in Ethiopia, 2005-2015: progress and challenges **51**

Measles burden in urban settings: characteristics of measles cases in Addis Ababa city administration, Ethiopia, 2004-2014 **57**

Introducing an accountability framework for polio eradication in Ethiopia: results from the first year of implementation 2014-2015 **63**

Notes **68**

Supplement article

PanAfrican Medical Journal

Editorial

Advances in the control of vaccine preventable diseases in Ethiopia

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Guest editors: Fiona Braka, Thomas Karengera, Kathleen Gallagher

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Editorial

Tremendous advances in the past decade have been made in the development and introduction of new vaccines and expansion of immunization programs to reach every child. These advances, in combination with other health care and development interventions such as improved hygiene, sanitation, and education have led to significant reductions in the number of deaths in children under 5 years of age annually. Despite increases in the annual birth cohort globally, these childhood deaths fell from an estimated 9.6million in 2000 to 7.6 million in 2010 [1]. Increased immunization coverage has helped drive this reduction in childhood mortality. However, gaps in immunization coverage still persist between and within many countries.

To address these gaps, the Global Vaccine Action Plan (GVAP) was endorsed by the 194 Member States of the World Health Assembly in May 2012 to provide a framework for the prevention of millions of deaths due to vaccine preventable diseases through 2020 by providing more equitable access to vaccines for people in all communities. The GVAP has four major goals: 1) strengthen routine immunization, 2) accelerate the control of vaccine-preventable diseases (with polio eradication as the first milestone), 3) introduce new and improved vaccines and spur research and development.

In Ethiopia, the Expanded Program on Immunization (EPI) was started in 1998 and currently ten antigens (BCG, diphtheria, pertussis, tetanus, Hib, HepB, polio, measles, rotavirus, PCV) are included in the routine childhood immunization schedule. Since 1996, Ethiopia has been implementing polio eradication initiative activities using standard World Health Organization(WHO) recommended strategies. Ethiopia adopted an accelerated measles control strategy in 2001 and the African Regional Measles elimination strategy in 2012. Since 2014, Ethiopia has been implementing a routine immunization improvement plan to further enhance its ability to reach every child with vaccine. Gradual improvements in immunization coverage have been reported with time. In 2015, the WHO-UNICEF joint estimates for DPT-3 and MCV-1 coverage nationwide were 86% and 78%, respectively [2]. Ethiopia has achieved its MDG 4 target, namely a reduction of Under-5 Mortality Rate (U5MR) from 204 in 1990 to 59 per 1,000 live births. Infant Mortality Rate Also declined significantly from 123 to 36 per 1,000 live births [3]. Immunization program contributed to the reduction of child mortality through expansion of the service and introduction of new life saving vaccines.

Despite these efforts, surveillance data shows that cases of vaccine preventable diseases such as measles and polio continue to occur in the country, especially in areas with a history of weak routine immunization services. During 2015 alone, more than 17,000 cases of measles were reported from throughout the country. Ethiopia initially achieved interruption of indigenous wild polio virus (WPV) in December 2001, just five years after launching the "Kick Polio out of Africa" campaign. However, the country has experienced numerous separate WPV importations from neighboring countries. The most recent polio outbreak, starting in 2013, was associated with the larger Horn of Africa outbreak and resulted in

10 cases in the Somali Region of the country. The last case of wild polio virus in Ethiopia occurred in January 2014 but the country remains at risk for importations due to low routine immunization coverage in some area, difficult to reach population, highly porous borders and large pastoralist populations.

This supplement presents data and reports that highlight some of the recent efforts and activities on the part of the Ethiopian Government, EPI partners and the World Health Organization to further the understanding and control of vaccine preventable diseases in Ethiopia. Included in this supplement are manuscripts that describe the epidemiology of measles in selected areas of the country, the impact of polio eradication efforts on routine immunization activities and community knowledge in the Somali region of Ethiopia, analysis and assessment of AFP and other surveillance data, determinants of immunization service utilization and routine immunization performance, and the utility of an accountability framework for monitoring polio eradication efforts. These reports represent a small fraction of the actual efforts throughout Ethiopia in support of the EPI program. Ongoing efforts, adequate resources and capacity and new innovations and strategies continue to be needed to ensure that every child throughout Ethiopia has access to life-saving vaccines.

Competing interests

Authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

All authors have read and approved the final version of the manuscript.

References

1. WHO. Global Vaccine Action Plan 2011-2020. Google Scholar
2. WHO vaccine-preventable diseases: monitoring system. 2016 global summary (Ethiopia). Accessed on December 8, 2016.
3. UN Inter-agency Group for Child Mortality Estimation. Levels and Trends in child mortality. Report 2015. Google Scholar

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Research

Behavioral determinants of immunization service utilization in Ethiopia: a cross-sectional community-based survey

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Abstract

Introduction: according to the Ethiopian Health Sector Development Plan IV annual performance report (HSDP IV), Ethiopia targeted to reach 90% coverage with DPT-Hib-HepB 3 (Pentavalent3) vaccine and 86% coverage with measles vaccine in 2010- 2011. However, the actual performance fell-short of the intended targets due to several reasons. Therefore, a nationwide comprehensive study was conducted to examine the behavioral determinants of immunization practices in the Ethiopian context. The study employed the Modified Steps of Behavioral Change (SBC) Model as a theoretical lens.
Methods: a cross-sectional study was conducted in May 2012 in all the nine regions and the two city administrations of Ethiopia. The study used a community-based quantitative survey design comprising of multistage cluster sampling to draw relevant data from a sample of 2,328 caretakers whose children were 12-23 months of age at the time of data collection.
Results: overall, the multivariate analysis findings revealed that caretakers, who had high knowledge were 2.24 times more likely to vaccinate their children than participants had low knowledge (OR= 2.24, 95%CI: 1.68-2.98). Participants who had high approval were 2.45 times more likely to vaccinate their children than participants who had unfavorable approval (OR= 2.45, 95%CI: 1.67-3.59); and participants who had high intention were 6.49 times more likely to vaccinate their children with pentavalent3 vaccines than participants who had low intention(OR= 6.49, 95%CI: 4.83-8). Also, it was clear from the regression analysis that aspects of caretakers' demographic characteristics were significant predictors of their immunization practice for the sample group.
Conclusion: we identified that caretakers' knowledge, approval, intention, parents' residence, and religious backgrounds were associated with immunization service utilization. To achieve sustainable behavioral change on immunization service utilization of the caretakers in Ethiopia, this study suggests investing in activities that enhance caretakers' knowledge, approval, intention, and practice components represented in the behavioral change model.

Introduction

Immunization is one of the most cost-effective public health interventions to curb potential health problems globally. As of 2011, the World Health Organization (WHO) estimated that immunization averted 2-3 million deaths globally. In Ethiopia, from 1960-2002, a 50% reduction in under-5 mortality was observed and the immunization program saved the lives of nearly 4 million children [1,2]. However, several studies reveal that millions of people have still not benefited from the protection that vaccination provides and remain at risk of life-threatening illnesses every day. For instance, there are large numbers of unvaccinated children in Ethiopia [3]. According to the Ethiopian Health Sector Development Plan IV (HSDP IV) annual performance report of 2011, the country aimed to reach 90% coverage with DPT-Hib-HepB 3 (Pentavalent3) vaccine and 86% coverage with measles vaccine in 2010 and 2011. However, the actual performance fell short of the target and DPT-Hib-HepB 3 and measles vaccine coverage dropped from 86.0% to 84.7% and 82.4% to 81.5% respectively from 2010 to 2011. A substantial decline in Pentavalent3 vaccine coverage was observed in Afar, Oromiya, Somali, and Harari regions. The 2010 and 2011 surveillance reports also indicated that 38,288 suspected measles cases and 182 deaths were reported from all regions; the major reasons for the outbreaks were low immunization coverage [4] We conducted a study to identify the potential determinants of immunization service utilization by caretakers from a broader perspective using the Modified Process of Steps of Behavioral Change (SBC) Model [5]. The primary purpose of the study was to investigate the potential behavioral and socio-economic determinants of immunization service utilization. We aimed to use the results of the study to suggest potential behavioral interventions that could help to improve immunization service utilization in Ethiopia.

Methods

Study area and period: the community-based cross-sectional study was conducted in May 2012 in all the nine regions and the two city administrations of Ethiopia.

Sample size and sampling method: the study population for the community survey consisted of children aged 12-23 months. We used the immunization coverage survey standard formula recommended by World Health Organization to calculate the sample size for each region; we used Epi Info statistical software (Centers for Disease Control and Prevention, Atlanta, USA) with the following formula:
$N = DE\,(Z\alpha/2)^2\,P\,(1-P)/d^2$ where:

DE=3 (design effect from the multistage sampling technique employed in this study); P= Regional pentavalent3 coverage data; Zα/2 = 1.96 (The z-score corresponding to 5% level of significance or 95% confidence interval); and d= Margin of error (10%).

The total sample size was 2,328 caretakers. We selected study participants using multi stage cluster sampling. We determined the number of clusters per region based on the total number of children to be sampled in each region using the WHO Expanded Program on Immunization (EPI) survey recommendations, previous studies and availability of sampled children per cluster in each region [6].

Survey instrument: primary data were collected using a standardized pretested questionnaire which had structured and semi-structured questions. The questionnaire covered caretakers' socio-demographic variables. It also included aspects to assess caretakers' knowledge, intention, approval, practice and advocacy on immunization service utilization, as well as availability of communication devices (such as television, mobile phone, and radio) and sources of information regarding immunization services. The English version of the questionnaire was translated to local languages, including Amharic, Somaligna, Afan Oromo, Tigrigna and Afarigna.

Measures and scoring procedures: knowledge: was measured using composite score of 11 items. We calculated participants' score out of 11 and converted the score into a percentage. If participants got a score of 60% and above, they would be classified as being knowledgeable and, classified as being not knowledgeable if they got a score less than of 60% . Approval: was measured using composite score of five items. The overall score for a respondent was summed and converted to a percentage. Accordingly, those participants who scored 60% and above were categorized as favorably approved the use of vaccination, while participants who scored less than 60% were categorized as lacking approval of vaccination. Intention: was measured using composite score of five items. We calculated participants' score out of 5 and converted the score to percentage .Those participants who scored 60% and above were categorized as having an intention to immunize their children and participants who scored below 60% were categorized as having no intention to immunize their children. Practice: was determined based on whether or not the child received the pentavalent3 vaccine from the card or history or certificate. Advocacy: was measured with six items. If a respondent responded positively, he or she received a point which was totaled out of six and converted to a percentage. Those participants who scored 60% and above on overall advocacy score were categorized as advocates of the immunization program and participants who scored less than 60% were considered as having less advocacy inclination of immunization service to others. Behavioral change process: This was determined in two ways. First, the levels of knowledge, approval, intention and advocacy were computed without restrictions to any requirements in moving from one stage of change to the next stage. Secondly, to determine the percentage of participants who had gone through the steps of change according to the recommendations of the Social Behavioral Change Model, participants who moved to the next stage of change without fulfilling the prerequisite stage (e.g., approval without knowledge, having intention without approving) were excluded at each stage. We referred this stage of change as "adjusted to the model" (Figure 1).

Figure 1
diagrammatic representation of the conceptual framework for behavioral change (SBC) model

Operational definitions: cluster: was considered as kebele (the smallest administrative unit in Ethiopia). Urban residence: An administrative town with municipality service. Rural residence: A kebele which does not fulfill urban criteria and officially registered as rural kebele. Pastoralist residence: Pastoralist refers to subsistence practice in which people care for and domesticate animals such as camels, sheep and goats. In this survey, such areas were considered as pastoralist residences when officially recognized.

Study variables: dependent variable was utilization of immunization service based on pentavalent3 (DPT-Hib-HepB) vaccination status. Independent variables were socio-demographic variables, behavioral dimensions and source of information about immunization service.

Data collection procedures The data were collected by trained data collectors, who could speak local languages and had experience in survey undertaking. The data collectors were supervised by 14 supervisors for the 11 regions. Initially, the data collectors went to the center of the village and selected the direction by lottery method to obtain a random start direction, thereafter the data collector followed the direction to search for eligible households which contained children whose ages were 12-23 months.

Data analysis: the quantitative data were cleaned and entered into computer using SPSS version 17. Univarate analysis was used to describe the findings. Bivariate and multivariate logistic regression analyses were conducted to analyze the associations that existed among constructs.

Odds ratios, confidence intervals (CI) at 0.1 alpha levels were used to adjust and identify the factors that were associated with immunization service utilization (Figure 2).

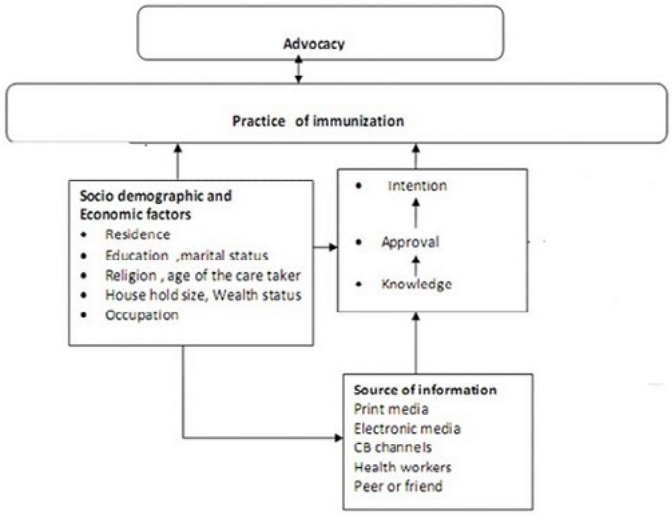

Figure 2
diagrammatic representation of the modified conceptual framework of the behavioral determinant survey

Ethical considerations: the study was approved by the Ethiopian Ministry of Science and Technology Ethical Review Board (Reference No: 310/622/04). Before the conduct of the field work, the researchers sought permission from each administrator at all levels. Each study participant was asked to participate in the study after explaining the aim of the study and after assuring confidentiality of personal information using code numbers instead of names.

Results

There was a 100% response rate, of which, the large majority of them 2,174 (96.3%) were female. A total of 1,378 (60.7%) the study participants resided in rural areas. Half of the study participants were Muslims 1,141 (50.3%), followed by Orthodox 812 (35.8%). Out of 2,268 participants, 2,093(93.2%) were married. Most participants 773 (34%) were in the 30-34 years age group, followed by the 25-29 years age group had 602 (26.5%) participants. At total of 1,119 (49.6%) participants could not read and write. Most participants were housewives and farmers who constituted 1,262 (55.9%) and 439 (19.4%) respectively. Out of 2,268 participants, 1,279 (58.0%) were middle economic income class (Table 1).

Participants who owned mobile phones, radios, and televisions (TV) were 1,299 (57.2%), 1,249 (55.0%) and 706 (31%), respectively. The proportion of study participants who owned TV was lower in rural areas 149 (10%). The percentage of mobile phones distribution varied across regions; Addis Ababa participants had the highest 28, (87.5%) while Somali region had the lowest 92 (44.2%) (Table 2).

The urban participants obtained immunization information from TVs, health workers and radio, which constituted 539 (60.6%), 514 (57.8%) and 512 (57.5%) respectively. Rural residents obtained information from health workers, radio and town criers, accounting for 766 (55.9%), 580 (42.3%) and 485 (35.4%) respectively. Religious leaders as immunization sources of information in Afar region and Addis Ababa contributed 23% and 0% respectively (Table 3).

As shown in Table 4, the results of the adjusted model revealed that the participants who have adequate knowledge about immunization constituted 76.7% of the total sample. Similarly, the percentage of participants who approved immunization service importance accounted for the 72.3%; and participants who had an intention to use immunization service was 67.6%. A total of 60.0% of the participants vaccinated their children with having adequate knowledge, approval and intention. Only 27 (8%) of the participants advocated for the immunization program by having adequate knowledge, approving the program, having intention and practice by oneself (Table 4).

In the bivariate analysis, the odd of older participants vaccinating their children was 3% less than for younger participants. The odds of Rural dwellers and Pastoralist community participants vaccinating their children were 48% and 53% less than from urban residents participants (OR= 0.52, 95% CI: 0.42-0.64) and (OR= 0.47, 95% CI: 0.42-0.64), respectively. The odds of could read and write but with no formal education and couldn't read and write participants vaccinating their children were 54% and 47% less than form formal education participants (OR= 0.46, 95% CI: 0.37-0.58) and (OR= 0.53, 95% CI: 0.40-0.71), respectively. The odd of Muslims participants vaccinating their children was 44% less than form Orthodox participants (OR= 0.56, 95% CI: 0.45-0.69).

Table 1: socio-demographic and economic characteristics of the participants for the behavioral determinants survey, 2012, Ethiopia

Characteristics		N(%)
Gender	Female	2174 (96.3)
	Male	84 (3.7)
Income	Poor	446 (20.2)
	Middle	1279 (58.0)
	High	480 (21.8)
Religion	Orthodox	812 (35.8)
	Muslim	1141 (50.3)
	Protestant	282 (12.4)
	Catholic	26 (1.1)
	Others	8 (0.4)
Marital status	Married	2093(92.3)
	Single	45 (2.0)
	Divorced	81 (3.6)
	Widowed	49 (2.2)
Age	15-19	67 (2.9)
	20-24	366 (16.1)
	25-29	602 (26.5)
	30-34	773 (34.0)
	35-39	269 (11.8)
	40-44	117 (5.1)
	45-49	38 (1.7)
	>50	40 (1.8)
Education	Cannot read and write	1119 (49.6)
	Read and write but no formal education	430 (19.1)
	Attended formal education	707 (31.3)
Occupation	Housewife	1262 (55.9)
	Farmer	439 (19.4)
	Merchant	231 (10.2)
	Government employed	188 (8.3)
	Private employed	47 (2.1)
	Daily Laborer	60 (2.7)
	Other	31 (1.4)

Table 2: ownership of communication devices among the study participants by region and residence, 2012, Ethiopia

Region	Mobile phone N (%)	Radio N (%)	TV N (%)
Addis Ababa	28(87.5)	32(100)	30(93.8)
Afar	154(58.1)	204(77.9)	103(39.0)
Amhara	174 (64.7)	133(49.3)	94(35.1)
Benishangul G.	173 (54.6)	158(49.7)	72 (22.6)
Dire Dawa	113(54.6)	109(52.9)	115(55.8)
Gambella	147 (56.3)	61(23.4)	22(8.4)
Harari	129(65.5)	124(64.2)	118(61.1)
Oromiya	135 (56.2)	145 (60.7)	44(18.6)
SNNPR	81(47.6)	97(57.4)	36(21.2)
Somali	92(44.2)	133 (67.2)	41(20.0)
Tigray	67 (69.8)	38(39.2)	25(25.8)
Residence			
Urban	687 (77.3)	549 (62.5)	551 (62.5)
Rural	606 (44.1)	685 (50.1)	149 (10.9)
Average	1299 (57.2)	1249 (55.0)	706 (31.1)

Table 3: sources of information about immunization among the study participants by region and residence, 2012, Ethiopia

Region	Radio	TV	Kebele	Peer	HWs	HEWs	Criers	Clan	Religiou
	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
Addis Ab	20 (62.5)	25 (78.1)	2 (6.2)	0(0)	12 (37.5)	0(0)	1 (3.1)	0(0)	0(0)
Afar	194(73.5)	118(44.7)	120 (45.5)	90 (34.1)	115 (43.6)	82 (31.1)	46 (17.4)	48 (18.2)	61 (23.1)
Amhara	22(45.2)	104 (38.5)	33 (12.2)	29 (10.7)	154 (57.0)	39 (14.4)	158(58.5)	26 (9.6)	7 (2.6)
BenisG	34(42.1)	85(26.7)	87 (27.4)	84 (26.4)	248 (78.0)	75 (23.6)	130(40.9)	75 (23.6)	27(8.5)
DireDawa	108(52.2)	102(49.3)	62 (30.0)	52 (25.1)	131 (63.3)	21(10.1)	106(51.2)	70 (33.8)	3 (1.4)
Gamb	73(28.2)	30 (11.6)	62(23.9)	42 (16.2)	201 (77.6)	94 (36.3)	135(52.1)	84(32.4)	51 (19.7)
Harari	127(64.5	118(59.9)	39 (19.8)	13 (6.6)	88 (44.7)	74 (37.6)	85 (43.1)	12(6.1)	3(1.5)
Oromiy	123(51.2)	44 (18.3)	41 (17.1)	29 (12.1)	81 (33.8)	144(60.0)	33 (13.8)	22 (9.2)	17 (7.1)
SNNPR	70 (41.2)	40 (23.5)	22 (12.9)	15 (8.9)	102 (60.0)	42 (24.7)	110(64.7)	29 (17.1)	22 (12.9)
Somali	96 (46.6)	19(9.2)	40 (19.4)	10 (4.9)	78 (37.9)	71 (34.5)	32 (15.6)	0 (0.00)	3 (1.5)
Tigray	25(25.5)	24 (24.7)	16 (16.5)	11 (11.3)	70 (72.2)	48 (49.5)	0(0)	8 (8.2)	4 (4.1)
Residenc									
Urban	12(57.5)	539 (60.6)	239 (26.9)	147(16.6)	514 (57.8)	205(23.0)	321(36.1)	167(18.8)	54 (6.1)
Rural	580 (2.3)	170 (12.4)	285 (20.8)	228(16.6)	766 (55.9)	485(35.4)	515(37.6)	207(15.1)	144(10.5)

Table 4: behavioral level of the stage of change process among study participants, 2012, Ethiopia

Behavioural stage Variables	*Unadjusted model (N=2328)	**Adjusted model (N=2328)
Knowledge		
Good knowledge	76.7%	76.7%
Approval		
Favourably Approved	89.8%	72.3%
Intention Positively Intended	88.7%	67.6%
Practice Penta 3 coverage	73.9%	60%
Advocacy positively Advocate	40.9%	27.8%

*unadjusted value shows that the participants levels of stage of change without restriction by the Behavioral Change Theoretical model
**Adjusted value indicates that each stages of the participants stage of change process that fit with stage of Behavioral Change Theoretical model

Table 5: distribution of bivariate and multivariate logistic regression analysis of overall variables by pent3 coverage, 2012, Ethiopia

Variables	Unadjusted		Adjusted	
	OR	CI	OR	CI
Age	0.97	(0.96-0.99)	0.99	(0.97-1.00)
Residence				
Urban*	1		1	
Rural	0.52	(0.43-.64)	0.44	(0.32-.60)
Pastoralist	0.47	(0.28-.80)	0.54	(0.25-1.13)
Education				
Formal educated*	1		1	
Can read and write	0.46	(0.37-.58)	0.64	(0.39-.77)
Can't read and write	0.53	(0.40-0.71)	0.5	(0.38-.76)
Income				
Low*	1		1	
Middle	2.09	(1.54-2.83)	1.05	(0.72-1.53)
High	1.37	(1.09-1.72)	0.95	(0.64-1.48)
Religion				
Orthodox*	1		1	
Muslim	0.56	(0.45-0.69)	0.85	(0.63-1.14)
Protestant	1.41	(0.98-2.02)	2.14	(1.28-3.59)
Catholic	0.89	(0.35-2.25)	1.07	(0.31-3.64)
Others	0.8	(0.16-4.00)	1.41	(0.15-18.94)
Knowledge				
Low*	1		1	
High	3.41	(2.71-4.28)	2.24	(1.68-2.98)
Approval				
Low*	1		1	
High	3.68	(2.76-4.89)	2.452	(1.67-3.59)
Intention				
Low*	1		1	
High	3.68	(2.83-4.02)	6.49	(4.83-8.71)

*Reference Category

The odds of high level of knowledge of immunization participants vaccinating their children was 40% higher than from lower knowledge participants (OR= 3.40, 95% CI: 2.71-4.28). The odds of high of approval for immunization participants vaccinating their children was 70 % higher than had unfavorable approval participants (OR= 3.70, 95% CI: 2.76-4.89); and the odds of had high intention for immunization participants vaccinating their children with pentavalent3 vaccines was 70% higher than had low intention participants (OR= 3.70, 95% CI: 2.83-4.02) (Table 5).

A multiple logistic regression was performed to ascertain the effects of age, residence, education income, and religion, knowledge of immunization, approval and intention of immunization, which had statistically significant relationships in the bivariate analysis on the likelihood that children received pentavalent3 vaccines.

The results of multiple regression analysis for the adjusted model revealed that rural dwellers were 0.44 times less likely to vaccinate their children as compared to urban dwellers (OR= 0.44, 95% CI: 0.32-0.60); participants who were Muslim was 0.85 times less likely to vaccinate their children than participants who were Orthodox (OR= 0.85, 95% CI: 0.63-1.14) ; participants who could read and write but had no formal education and participants who couldn't read and write were 0.64 and 0.50 times less likely to vaccinate their children as compared to people who attended formal education (OR= 0.64, 95% CI: 0.39-0.77) and (OR= 0.50, 95% CI: 0.38-0.76). Participants who had high knowledge were 2.24 times more likely to vaccinate their children than participants had low knowledge (OR= 2.24, 95% CI: 1.68-2.98). Participants who had high approval were 2.45 times more likely to vaccinate their children than participants who had unfavorable approval (OR= 2.45, 95% CI: 1.67-3.59); and participants who had high intention were 6.49 times more likely to vaccinate their children with pentavalent 3 vaccines than participants who had low intention(OR= 6.49, 95% CI: 4.83-8.71) (Table 5).

Discussion

Overall, there is a fairly good level of knowledge about immunization services demonstrated through our study (76.7%). This proportion is however lower than some previous studies conducted in Ethiopia and Nigeria [7, 8]. We also found that 72.30% of the participants had approved or had very favorable attitude towards immunization service utilization; this finding is almost consistent with studies conducted in Nigeria and Poland [7]. However, the proportion of participants who developed intention was 67.6%. This implies that some parents intended to vaccinate their children without actually approving immunization

service. This might happen due to peer influence or imitation of other parents.

Immunization practice was below the national target; pentavalent3 vaccination coverage among the children sampled in the survey was 60%. This finding is consistent with other findings of studies in rural Ethiopia and Nigeria [8, 9]. However, even though the coverage was suboptimal, our study showed relatively higher level of immunization service utilization among the community compared to figures in the last Ethiopia Demographic Health Survey (EDHS) report that revealed penvalent 3 coverage of 35% [10]. The observed difference might be attributed to difference in design of the survey. Advocacy, the final step to behavior change, is a vital part of the process because it represents a level of commitment that goes beyond the mere practice of a new behavior. Our survey revealed that only 28% of the participants were found at the stage of advocacy, (i.e., expressed commitment to support immunization program in their community). Also, the communication approach may lack appropriate strategies to boost up people's confidence and to prepare them for advocacy.

We identified that good level of knowledge was associated with positive behavior of immunization service utilization, which is consistent with studies conducted in Nigeria and Ethiopia [11,12]. Approval and intention were significantly associated with immunization practice and this finding is consistent with some earlier studies conducted in Ethiopia, Brazil and Nigeria [11,13,14]. In addition, we found out that caretakers' residence and religious backgrounds were associated with low immunization uptake which also reported in other countries particularly in Brazil, Uganda, India and Iran [14-20].

Although we revealed important findings on determinants of immunization services utilization in Ethiopia, the study did not address immunization service determinants like immunization service quality, logistic inventory, inter personal communication skills and practice of health workers. These determinants may have influences on caretakers' immunization service utilization and deserve investigation in the future.

Conclusion

In conclusion we identified that caretakers' knowledge, approval, intention, parents' residence, and religious backgrounds were significantly associated with immunization service utilization. However, age, marital status, occupation and income had no association with immunization service utilization. Also communication channels like town criers / megaphone announcements; religious, clan and Kebele leaders were the most available communication channels at community level in Ethiopian context . However, we identified that there is poor utilization of traditional channels like towncriers , religious, clan and Kebele leaders to promote immunization service utilization across the studied regions. To achieve sustainable behavioral change in immunization service utilization in Ethiopia, we recommended to all immunization partners and stakeholders to pay special attention to promote activities that enhance care takers' knowledge, approval and intention components of the behavioral change process. A mix of communication channels (traditional and modern) including locally available communication channels to address illiterate parents, should be deployed to increase knowledge on immunization, and ultimately impact practice to increase coverage rates in Ethiopia.

What is known about this topic

- Availability of immunization service and antigens determine immunization service coverage. Studies aimed to assess the knowledge and attitude of mothers attending antenatal clinic. Previous studies on immunization service utilization most often consider aspects of demographic characteristics of caretakers without including behavioral aspects and without examining how that have influenced caretakers immunization service utilization. Most studies on caretakers' immunization service utilization emphasize on inequities in coverage between and within countries;
- Social determinants have the potential to affect immunization service utilization in many parts of the world, with globalization and ease of communication leveraging the process. Research reveals different types of social determinants affecting immunization efforts in various countries;
- While it is common to link caretakers' immunization service utilization data with some demographic characteristics, there is minimal link created so far between immunization service utilization and behavioral components. Due to this, little is known about behavioral indicators and their potential influences on the caretakers' immunization practices.

What this study adds

- This study provides a new perspective and a conceptual model of studying immunization service utilization considering the behavioral aspects of caretakers and examining how that have influenced caretakers immunization service utilization in the Ethiopian context;
- Improving caretakers immunization service utilization requires much more than the results of survey on their experiences. We also need to link immunization service utilization data with some demographic characteristics and personal behaviors so that we can understand which of these demographics and behavioral indicators have significant influence on the caretakers' immunization practices. By doing so, we'll surely discover some demographic characteristics and personal behaviors that are related with immunization service utilization;
- Above all, this study provides empirical evidence testifying the application of a behavioral model and the corresponding behavioral indicators that should be considered for effective behavioral change planning used to improve caretakers' immunization service utilization and behavioral change intervention in Ethiopian context.

Competing interests

Authors declared they have no competing interests in this study. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

Yohannes Ababu: made substantial contribution in concept paper and proposal development at conception stage, research method, design, analysis and interpretation. Also finalized this article. Fiona Braka: made a support in the conceptualization of the paper and crafting the proposal, research method, design, and edit the article. Kinde Getachew: made substantial contribution in reviewing and finalizing the proposal, research design, analysis and interpretation including edited the article. Aschalew Teka: provided technical support including data interpretation, write up and editing. Tefera Tadesse: made substernal contribution in reviewing and finalizing the proposal, research design, data analysis and interpretation and edited and write up. Yohannis H/Michael: reviewed and finalized the conceptual framework and the proposal, data analysis and interpretation and edited and write up the paper. Zewdie Birhanu: is contributed in casualization of models, data analysis and interpretation including write up the paper. Tersit Assefa: is made a support this study in conception, design and instrument development. Nsubuga Peter: is supported the editorial and manuscript writing part of the study. Kathleen Gallagher: is contributed in editing and data analysis part of the study. Mpele-Kilebou Pierre: Initiated manuscript development and publication.

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References

1. Federal Democratic Republic of Ethiopia Ministry of Health. Health Sector Development Program IV 2010/11 - 2014/15. 2010.
2. WHO, UNICEF, World Bank. State of the World's Vaccines and Immunization. 3rd ed. Geneva, World Health Organization, 2009.
3. Angus K, Cairns G, Purves R, Bryce S, MacDonald L, Gordon R. Systematic literature review to examine the evidence for the effectiveness of interventions that use theories and models of behaviour change: towards the prevention and control of communicable diseases. Stockholm: ECDC; 2013.
4. Prochaska JO, Diclemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. Journal of Consulting and Clinical Psychology. 1983;51(3):390-5.
5. World Health Organization. Immunization coverage cluster survey: Reference manual . Geneva Department of Immunization, Vaccine and Biologicals, World Health Organization (WHO/IVB/04.23); 2005. p. 115.
6. Abdulraheem I, Onajole A, Jimoh A, Oladipo A. Reasons for incomplete vaccination and factors for missed opportunities among rural Nigerian children. Journal of Public Health and Epidemiology. 2011;3(4):194-203.
7. Awodele O, Oreagba I, Akinyede A, Awodele D, Dolapo D. The knowledge and attitude towards childhood immunization amongst mothers attending antenatal clinic in Lagos University Teaching Hospital. Tanzania Journal of Health Research. 2010;12(3):172-7.
8. Tadesse H, Deribew A, Woldie M. Explorative assessment of factors affecting child immunization in Wonago district, Gedeo zone, South Ethiopia. Archives of Medical Science. 2009;5(2):233.
9. Central Statistical Agency (Ethiopia), ORC Macro. Ethiopia Demographic and Health Survey 2005 . Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro; 2006.
10. Lakew Y, Bekele A, Biadgilign S. Factors influencing full immunization coverage among 12-23 months of age children in Ethiopia: evidence from the national demographic and health survey in 20 BMC Public Health. 2015;1(15):1-8.
11. Odusanya OO, Alufohai EF, Meurice FP, Ahonkhai VI. Determinants of vaccination coverage in rural Nigeria. BMC Public Health. 2008;8:381.
12. Branco FLCC, Pereira TM, Delfino BM, et al. Socioeconomic inequalities are still a barrier to full child vaccine coverage in the Brazilian Amazon: a cross-sectional study in Assis Brasil, Acre, Brazil. International journal for equity in health. 2014;13(1):118.
13. Dorell CG, Yankey D, Santibanez TA, Markowitz LE. Human Papillomavirus Vaccination Series Initiation and Completion, 2008-2009. Pediatrics. 2011;128(5):830-9.
14. Rademacher N, Albin O, Dalton V, Wafula L, Mulongoti J, Malani P. Parental attitudes towards childhood immunizations in Eastern Uganda. Rural and remote health. 2009;10(4):1620.
15. Tesfaye F, Tamiso A, Birhan Y, Tadele T. Predictors of immunization defaulting among children age 12-23 months in Hawassa Zuria District of Southern Ethiopia: community based unmatched case control study. International Journal of Public Health Science (IJPHS). 2014;3(3):185-94.
16. Hamid S, Andrabi S, Fazli A, Jabeen R. Immunization of children in a rural area of north Kashmir, India: a KAP study. Online J Health Allied Scs. 2012;11(1):10.
17. Ibnouf A, Van Den Borne H, Maarse J. Factors influencing immunisation coverage among children under five years of age in Khartoum State, Sudan. South African Family Practice. 2007;49(8):14.
18. Adam D, Mokieldin AA, Bilal A, Hussein A, Hirsi M. Socio-economic factors influence measles immunization coverage in Shendi and Almatama Localities-Sudan. International Journal of Chemical, Environmental & Biological Sciences. 2015;3(5):411-4.
19. Bosch-Capblanch X, Banerjee K, Burton A. Unvaccinated children in years of increasing coverage: how many and who are they? Evidence from 96 low-and middle-income countries. Tropical Medicine & International Health. 2012;17(6):697-710.

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Research

Health care seeking behavior of parents with acute flaccid paralysis child

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Abstract

Introduction: despite the tremendous increase in the number of modern health institutions, traditional medical practices still remain alternative places of health care service delivery and important sites for disease notification in the disease surveillance system. The objectives of this study are to describe the patterns and factors associated with health care seeking behavior of parents and care takers with acute flaccid paralysis child and see how the traditional practice affect the surveillance system.
Methods: a cross-sectional descriptive study was conducted to assess the health seeking behavior of parents with an acute flaccid paralysis child. Data were collected throughout the country as a routine surveillance program.
Results: of 1299 families analyzed, 907(69.3%) of families with AFP child first went to health institutions to seek medical care, while. 398 (30.7%) of parents took their child first to other traditional sites, including holy water sites (11.8%), traditional healers (9.1%) and prayer places (5.4%). Over half of the parents with AFP child reported practicing home measures before first seeking health service from modern health institutions. Home measures (OR, 0.1202, 95% CI 0.0804-0.1797), decision by relatives (OR, 0.5595, 95% CI 0.3665-0.8540) and More than 10km distance from health facility (OR, 0.5962, 95% CI, 0.4117-0.8634) were significantly associated to first seeking health service from health institutions ($p<0.05$).
Conclusion: program strategies must certainly be developed to expand and capture all traditional sites in the surveillance network, and intensify sensitization and active surveillance visit in these areas.

Introduction

Poliomyelitis is a serious infectious disease that primarily affects young children causing permanent disabilities and deaths. In 1988, when the World Health Assembly passed a resolution to eradicate polio by the year 2000, the annual number of paralytic polio cases was estimated at 350,000 worldwide [1]. Since then, substantial progress has been made in the eradication of poliomyelitis globally, and three WHO Regions, the regions of the Americans (1994), Western Pacific Region (2000), and European Region (2002) have already been certified free of indigenous wild polio virus [2-4]. As of October 10, 2016, the numbers of polio cases have been dramatically reduced and clustered in a few geographic areas from what has been reported in 1988 [5]. However, global eradication of poliomyelitis remains a concern for all countries.

Available evidence indicates that Ethiopia suffered a lot from poliomyelitis infection. A study conducted in 1988 in Gondar zuria in the Northwest Ethiopia among children aged 1-15 years old indicated a prevalence of residual poliomyelitis of 2.1/1000, while an estimated annual incidence of poliomyelitis was found to be 7.7/100000 [6]. Another study also demonstrated a prevalence of paralytic poliomyelitis of 7.3/1000 children in 5-9 years old [7]. Ethiopia, following the Yaoundé declaration on polio eradication in 1996, joined the global effort for the eradication of poliomyelitis and established in 1997 acute flaccid paralysis case-based surveillance system throughout the country [8]. Progress has been made for the implementation of polio eradication strategies in terms of surveillance networking, capacity building, and supplemental immunization activities (SIAs). Nonetheless, the achievements were suboptimal at the beginning according to the major indicators of quality and sensitivity of the surveillance system i.e. stool adequacy within 14 days of onset of paralysis and non-polio acute flaccid paralysis (NP-AFP rate) [9]. The trend of stool adequacy and nonpolio AFP rates were persistently suboptimal for certification in spite of the regular active case search and sensitization efforts at all level. From the start of the acute flaccid paralysis surveillance up to the year 2000, the NP-AFP rate had persistently been lower than 0.8/100,000 children < 15 years old, while stool adequacy was lower than 50 % during the same period [10].

The Ethiopian health service system is primarily focused on the preventive and promotive aspect of health service. The health service system is designed on a three-tier health service delivery system, which comprises a primary health care unit, (a network of a health center and five health posts), general hospital, and specialized hospital. The primary health service coverage is estimated at 76.9%, while health service utilization is at 33% [11]. A longitudinal community based study conducted from 1992-1994 on mothers health seeking behavior for ill babies at various levels indicated that less than 47% of ill children only got treatment for various illness [12]. Hence, the objective of this study is to investigate the health care seeking behavior and related factors inhibiting families or care takers of acute flaccid paralysis to visit first modern health facilities.

Methods

Acute flaccid paralysis cases were reported from all regions, zones, and woredas (equivalent to district) of the country. Treatment for illness is available from public, private health facilities, traditional practitioners, and holy water sites. Under the polio eradication program, all children under the age of 15 years that present with sudden onset of flaccid paralysis are investigated and reported immediately. All professionals are also required to investigate and report any suspected AFP cases without delay. As soon as cases notified arrangements are made for two stool samples collected within 24 hours apart and within 60 days but preferably within the first 14 days of onset of paralysis. Samples are transported to the National Polio laboratory at the Ethiopian Health and Nutrition Research Institute within 72 hours with appropriate cold chain system (2-8Oc). The WHO medical surveillance officer of that area is required to verify, investigate the case and fill health care seeking questionnaire. All cases investigated by medical surveillance officers from August 2004 to May 2008 throughout the country were included in the study and retrospectively analyzed.

A standardized and pretested questionnaire was used to collect information on health care seeking behavior of parents and caregivers of acute flaccid paralysis child after securing verbal consent from respondents. The questionnaire includes demographic characteristics of the parents and epidemiologic characteristics of the cases. Part of the questionnaire includes socio- demographic variables like income, religion, education, occupation, specific measures taken at home, the first site of visit, reasons for choosing the first site and awareness on AFP and polio eradication initiatives. Data were entered, summarized, and analyzed using EpiInfo 2000 version 3.2 statistical packages. Five records with incomplete information on the date of onset and first site visited were excluded from the analysis. We used simple frequencies and bivariate analysis with further analysis with multivariate logistic regression.

Results

A total of 1338 caretakers with acute flaccid paralysis child were interviewed including examination of their children with AFP and health seeking questionnaires were filled. Of these analyzed, 797(60%) are females. Nearly half (49.7%) of the respondents were the child´s mothers, while one-third were fathers, and only 10.9% of the respondents were both parents. The majorly (70.1%) of the respondents were of the Orthodox Christian faith and two-thirds of the respondents had no schooling at all. Sixty seven and a half percent (67.5%) of the respondents were farmers and the majorities (70%) were living on an income less than 200 Ethiopian Birr (ETB) per month. Ninety percent of the respondents were from South Nation's and Nationalists Region (SNNPR), Oromia, Amhara, Tigray and Addis Ababa Regions. The median number of days from the date of onset to the detection of cases at facility level was found to be 6 days, while it ranged from less a day to 60 days (Table 1, Figure 1).

Table 1: distribution of families with AFP child by selected variables 2004-2008, Ethiopia

Variables		
Sex respondent	**Frequency**	**Percent**
Male	509	40.0
Female	797	60.0
Total	1306	100
Religion of respondents		
Orthodox Christian	937	70.1
Muslims	385	28.8
Others	14	1.0
Total	1336	100
Education of respondents		
No formal education	839	67.6
Primary	249	20.0
Secondary	122	9.8
Tertiary	32	2.6
Total	1242	100
Income of respondents in ETB		
<200	854	70.0
200-400	190	15.6
401-600	86	7.0
601-800	51	4.2
>800	39	3.2
Total	1222	100
Sex (child)		
Female	573	43.3
Male	751	56.7
Total	1324	100
Child age		
<5	846	68.1
6-10	279	22.44
11-15	118	9.5
Total	1243	100
Vaccinated in routine immunization		
Yes	1032	85.1
No	180	14.9
Total	1212	100
Vaccine doses child received		
0 dose	48	4.9
1-2 doses,	127	13.1
3+ doses	762	78.6
Unknown	33	3.4
Total	957	100

The male: female ratio of AFP cases was 1.5:1. Eight hundred and forty one (68.1%) and 397(31.9%) of the AFP cases were under five years of age, and between 6-15 years of age respectively. In regard to vaccination history, 1032(85.5%) of parents indicate that their children have taken

at least one dose of OPV in routine or during vaccination campaigns. Of those children immunization status evaluated, 889(91.7%) of these have taken at least one dos OPV, 762 (78.6%) of the kids were fully immunized for OPV (>=3 doses of OPV) and 127(13.1%) have taken<=2 doses OPV. On the other hand, less than five percent (4.9%) of the kids haven´t taken any dose of OPV, while 33(3.4%) of the kids have unknown histories of vaccination (Table 1).

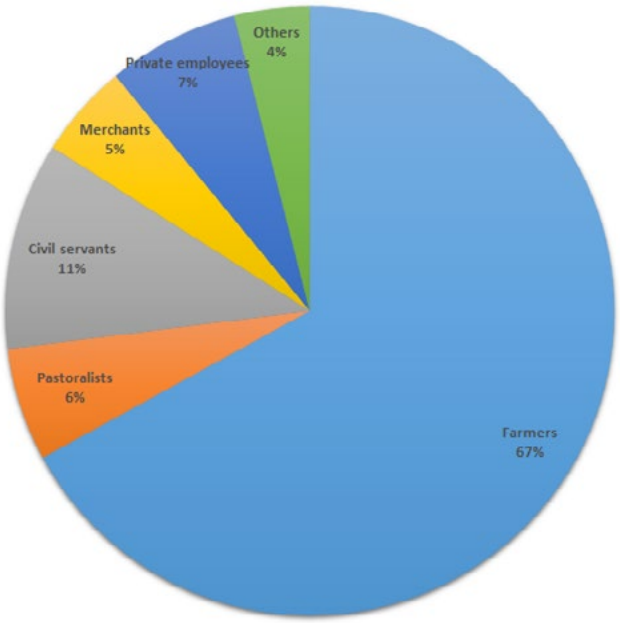

Figure 1
distribution of occupations of respondents of families with acute flaccid paralysis child, Ethiopia, 2008

Table 2: characteristics of AFP cases with health seeking questionnaire and examined by MSOs: Ethiopia, 2004-2008

Traditional measures taken at home	**Number**	**%**
Prayer	206	15.8
Holy water	127	9.8
Traditional treatment	105	8.1
Massage	207	15.9
Nothing	636	48.9
Other	19	1.50
Total		
Decision made by where to take the child first	1299	100
By both parents	271	21.7
By father	512	41.0
By mother	385	30.8
By relatives	58	4.7
By OTHERS	23	1.8
Total		
Child taken to the nearest health institution	1141	100
Yes	1045	85.2
No	182	14.8
Total	1227	100
Distance to the nearest health facility(Km)		
<10km	658	71.9
11-20km.	172	18.8
21-30km.	45	4.9
31-40km.	11	1.2
>40km	29	3.2
Total	947	100
Days child taken to health facility		
≤5.	567	49.3
6-10.	382	33.2
11-14.	63	5.5
15-20.	69	6.0
21-25.	18	1.6
26-30.	25	2.2
31+	27	2.2
Total	1151	100

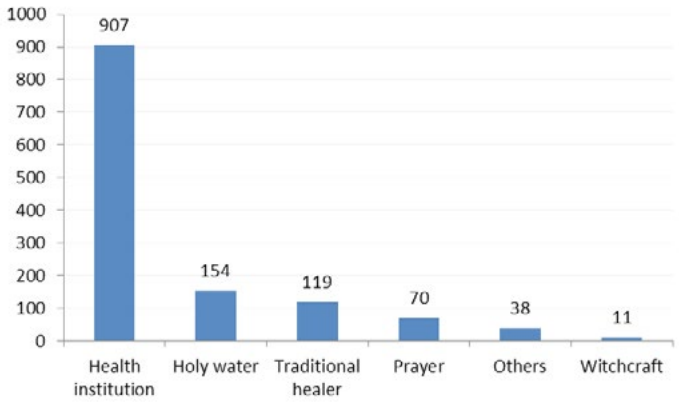

Figure 2
distribution of sites AFP child first taken by families with acute flaccid paralysis child, Ethiopia, 2008

As indicated in Table 2 and Figure 2, a significant proportion of families 907(69.5%) went first to health institutions to seek medical care, while 398(30.5%) of parents took their child first to alternative traditional sites including holy water sites (11.8%), traditional healers (9.1%), and prayer places (5.4%). On the other hand over half of the families with AFP child reported practicing various home measures. Forty percent of the parents said that the child's father decided where to take the child first for medical care, while 29% were decided by the child's mother, and only in 23% of the cases, a decision was made by both parents. The majority of the families (85.2%) reported that they took their child with AFP to the nearest health facility to seek medical care, and 564(62.1%) families reported that they travelled to 10kms to reach to the nearest health facility, while 344(37.9%) traveled more than 10kms. The median distance traveled by families was found to be 5km ranging from less than 1km to 45 km. The median km is higher in Gambella (11.8km) and Somali (11.67km) regions (Table 2). Five hundred and sixty seven (49.3%) families reported that they went first to a health facility within five days of onset of paralysis, while 38.7% went to a health facility within 6-14 days of onset of paralysis. On the other hand, 700(59%) sought any help including traditional sites within 5 days, whereas 31.2% of the families went to any site of help within 6 to 14 days of onset of paralysis. Overall, 88% of families with an AFP child went to health institution within 14 days of onset of paralysis, while families seeking any kind of help including traditional sites were found to be 1070(90.2%)). 222(29.1%) of the families took their child to the health center, while 127(16.7%) and (15.4%) to health posts and hospital respectively. Eleven percent of families first went to church and holy water (7.1%) (Table 3).

Respondents were asked whether they had been exposed to any information regarding polio eradication and acute flaccid paralysis surveillance and site the source of information. Less than 5% of the respondents had no any source of information on polio eradication and AFP surveillance, while great majority (85%) mentioned health workers and radio (25.6%) as a main source of information, while newsletter and TV were the very least source of information mentioned (Table 3).

The influences of socio-Demographic characteristics of the study population on health seeking behavior of parents' first visit to health institutions were investigated using the standard bivariate methods (Table 4) shows that Occupation, income, traditional home measure practices, decision made by relatives and distance travelled more than 10kms from the health facility showed significant associations with health care-seeking behavior of families first to health facilities with acute

Flaccid paralysis child. However, as demonstrated in Table 5 better educational status, being civil servant and higher family income were associated with health care seeking behavior to modern health facilities first than traditional sites (P<0.05). Education and religion showed no significant association in the bivariate analysis. In the multivariate logistic regression analysis, we employed all socio-demographic variable

considered in the bivariate analysis, education, income, religion and occupation were not demonstrating statistically significant association with health care seeking behavior of parents to modern health facilities first visit (p>0.05), while traditional home measures, the decision made by relatives or care takers and distance traveled more than 10kms by parents to the first place of choice were still demonstrating a significant association in multivariate logistic regression analysis (p<0.05). Religion, education, income and occupation remain insignificant in the logistic regression analysis, while , occupation and income which were significant in the bivariate analysis turned out to be insignificant (Table 5), while education and religion remain insignificant in both analysis.

Table 3: health seeking behavior of families by different characteristics Ethiopia 2004-2008

Days AFP child taken to any site of help		
≤5.	700	59.0
6-10.	312	26.3
11-14.	58	4.9
15-20.	58	4.9
21-25.	17	1.4
26-30.	19	1.6
31+	23	1.9
Total		
Name of first site visited n=762	1151	100
Health center	222	29.1
Health station/clinic/health posts	127	16.7
Hospital	117	15.4
Church	86	11.3
Holy water site	54	7.1
Private HF including drug vendor	41	5.4
Traditional healer	39	5.1
Home(Found at home)	22	2.9
Prayer	6	0.8
Others	48	6.3
Total		
Information on PEI and AFP surveillance	762	100
Yes	1112	85.5
NO	188	14.5
Total	1300	100
Sources of Health information on PEI & AFP*		
Health personnel	1123	85.1
Radio	338	25.6
Newsletter	21	1.6
TV	30	2.3
No source	55	4.2
Others	47	3.6
Total*	1614	100
Median days to any site of help by region	**To health facility**	**To any site of help**
Addis Ababa	5.0	4.0
Afar	5.0	4.5
Amhara	3.0	5.0
Benshangule. Gumuz	7.0	7.0
Dire Dawa	7.5	8.0
Gambella	11.5	4.0
Hareri	2.0	2.0
Oromia	6.0	7.0
SNNPR	4.0	5.0
Somali	7.0	7.5
Tigray	4.0	7.0
National	4.0	6.0

* One respondent may have more than one source of health information

Table 4: biavariate analysis of selected socio-Demographic characteristics and impact on health seeking behavior of families with acute flaccid paralysis child

Characteristics	**First health seeking to health facilities**		**Odds ratio**	**95% CI**	**P- Value**
	Yes	**No**			
Education					
No formal education	545	274	0.6680	0.504-0.88061	0.261230
educated	295	98			
Occupation			0.5332	0.4055-0.7011	0.000005
Farmers	539	297			
others	312	90			
Religion					
Orthodox Christian	634	281	0.9741	0.7523-1.2612	0.85213
others	271	117			
Income ETB					
<200	554	276	0.6940	0.5263-0.9150	0.00940
+200	269	93			
Traditional Home measure					
Do nothing	562	64	8.8662	6.5617-11.9689	0.00000
Home measure	326	329			
Decision made					
Both families	822	335	2.7853	1.7586-4.4114	0.00006
OTHERS	37	42			
Distance traveled Km					
<10km	473	179	1.6663	1.2286-2.2599	0.00096
+10km	157	99			

Table 5: logistic regression analysis of selected socio-Demographic characteristics impact on health seeking behavior of Families with acute flaccid paralysis child, Ethiopia

Category	**Odds Ratio**	**95% C.I.**		**P-Value**
Decision made by distant relatives	0.5595	0.3665	0.8540	0.0071
Distance more than 10 km	0.5962	0.4117	0.8634	0.0062
Education	1.0264	0.6764	1.5577	0.9024
Home measures taken	0.1202	0.0804	0.1797	0.0000
Income	1.0401	0.5615	1.9266	0.9006
Occupation	2.3435	0.9816	5.5949	0.0551
Religion	1.1766	0.8042	1.7213	0.4023

Discussion

In this study, over 90% of the respondents were from 5 regions, which may be due to the high population contribution or better surveillance sensitivity that lead for detection of many AFP cases and care seeking questionnaire were filled. On the other hand, we found that 69.8% of the families are going first to health facilities when their child developed acute flaccid paralysis, while over 30% are looking for other traditional sites. This is very worrisome as the surveillance system in this country is mainly health facility based. However, 88% of the families going to a health facility within 14 days of onset of paralysis and can meet the minimal required surveillance performance indicator for certification assuming that the surveillance system at facility level is very sensitive enough to pick all cases going to health institutions. Nevertheless, this is unlikely that in many circumstances cases are missed because of lack of awareness or misconception of the case definition of AFP.

In general, health service utilization during illness is poor in many developing countries. A study conducted by Fantahun M. and Degu G in Amhara Region of Ethiopia indicated that among reported sicknesses and deaths, only 59% and 39.1% of them visited health facility respectively [13]. In addition, the DHS 2000 Ethiopia reveled that only 44% of the families utilized some type of health service for a sick child [14]. In this study, first health facility visit by parents with AFP child was found to be 69.5% and lower for pastoralists families compared to settled families, which may be due to the nature of mobility and absence of health facilities. In general mobile pastoralist population, health service utilization is lower than the settled population as evidenced by a study done by Double T and Haile Mariam D on determinants of conventional health service utilization among pastoralists in northeast Ethiopia [15].

In this study over 51% of the families does some sort of traditional interventions at home level before seeking any medical help which is one of the reason for late detection of cases and this has been statistically significant both in bivariate and logistic regression analysis. Massage and prayer were the most practiced traditional measures at home including holy water treatment. In the multi variate logistic regression, we observed a protective factor of home measures to first going to health facilities, which may indicate that families are doing different traditional measures and taking the child first to modern health facilities considered as a final resort when families tried all sort of interventions. Many families have little awareness of the possible causes of acute flaccid paralysis and the need to take the child immediately to health institutions, and over 39% of the respondents said that the community prefers to go to other traditional sites than the health facility which raised again a concern for the program. The need for strengthening the existing active case search and sensitization activities beyond the conventional health facility is paramount important in the surveillance system and target all possible sites where a family with AFP child might go for help such as traditional healer, holy water site, prayer place, church, drug vendor and others.

Although the result shows that the majorities (80%) of the respondents said they have information regarding AFP surveillance and polio eradication, we also observed that not a small percentage of families are seeking help first to none conventional sites. The majority of respondents cited health workers as a source of information, this may be due to the fact that parents may have this information during a health facility visit after child paralyzed and may not measure the actual information at the community level.

The study disclosed that 85% of the AFP cases have taken at least one dose of Oral Polio Vaccine (OPV) according to the family's history and over 78% of the cases have taken three or more doses of OPV. However, 4.8% of the children with flaccid paralysis had no history of vaccination. In general, in African region among AFP cases < 5years investigated in 2005 only 45% had received at least three doses of Oral Polio Vaccine [16].The high vaccination coverage in this study may be explained by the in-depth interview of families about vaccination status by the medical surveillance officer filling the health seeking behavior questionnaire.

About 33.6% of the respondents take their children to seek medical help first to a wide range of traditional sites (other than health institutions) for consultation to the affected child for different reasons. This includes, among others family's perception of disease as a supernatural cause, preference of the families to stay at home and doing traditional treatment or go to a traditional healer or praying sites which delay the health seeking intention of families to modern health institutions. Apart from the perception of families in regard to the disease in favor of traditional treatment, health service availability may have contributed to the low-level utilization of health facilities first. One of the reasons is the distance to the nearest health institution. In our study, we found that 29% of the families travel more than 10km to reach to the nearest health facility, while 78% of them live within 10 km radius from the health facility. DHS findings indicated that distance as the main problem in two to three women questioned [14]. In multivariate logistic regression, we didn't observe the role of religion, income, and occupation in the process of health seeking behavior of families with AFP child. In a study conducted in Bangladesh distance to hospitals were found to be a risk factor leading to a delay notification [17].

Conclusion

In conclusion apart from modern health facilities families with an AFP child first seek health service in different traditional healing sites before going to modern health facilities. Targeting these sites in the surveillance network will greatly improve the NP-AFP rate and stool adequacy rate. In addition to traditional measures taken at home, decision by relatives, neighbors and distance traveled to the nearest health facility appears to be the main contributing factors to health seeking first in modern health facilities by families with an AFP child.

What is known about this topic

- Traditional healers are most common in Ethiopia;
- Despite the increase in modern health facilities, traditional healing sites are most common and popular, and are not in the network of disease surveillance.

What this study adds

- The study provides valuable information on factors that enable the improvement of the surveillance system;
- The study also provides information on the first sites visited by parents or care taker with an AFP child;
- The study also indicates the need to have sensitive and strong surveillance, including traditional healing sites.

Competing interests

The authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

AT generates the idea, did the analysis, and writ up the final draft of the manuscript and incorporated all comments, AM critical reviewed the manuscript and gave the final approval for submitting for publication. All authors have read and approved the final version of the manuscript.

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References

1. Assembly FWH, World TF, Assembly H. Global eradication of poliomyelitis by the year 2000. Wha4128. 2000; WHA428 (May 1988):2-4.
2. International Notes Certification of Poliomyelitis Eradication -- the Americas, 1994. MMWR Morb Mortal Wkly Rep. 1994 Oct 7;43(39):720-2.
3. Certification of poliomyelitis eradication--European Region, June 2002. MMWR Morb Mortal Wkly Rep. 2002 Jul 5;51(26):572-4.
4. Certification of Poliomyelitis Eradication --- Western Pacific Region, October 2000. MMWR Morb Mortal Wkly Rep. 2001 Jan 12;50(1):1-3.
5. Research underpins new roadmap to a polio-free world. The poliopipeline. Accessed on October 24, 2016.
6. Tahir Ahmad, Sania Arif, Nazia Chaudary, Sadia Anjum. Epidemiological Characteristics of Poliomyelitis during the 21st Century (2000-2013). Accessed on October 24, 2016.
7. Maru M, Getahun A, Hoshna S. Prevalence of paralytic poliomyelitis in rural and urban populations in Ethiopia: report of a house-to-house survey. Am J Trop Med Hyg. 1988 May; 38(3):633-635.
8. World Health Orgazanition. International/national review of Ethiopia's surveillance system for acute flaccid paralysis (AFP) and other vaccine-preventable diseases. Accessed on October 24, 2016.
9. Progress toward poliomyelitis eradication--Ethiopia, 1997-August 2000. MMWR Morb Mortal Wkly Rep. 2000 Sep 29;49(38):867-70.
10. Mentaye BB, Tomori O, Femi O, Senbet AG, Woldemichael T. Eradication of poliomyelitis int Ethiopia: Virological and Acute flaccid paralysis surveillance. Jpn J Infect Dis. 2002 Jun;55(3):95-7.
11. Federal Ministry of Health. Health and Health Related Indicators 2005 E.C (2012/2013). Accessed on October 24, 2016.
12. Tessema F, Asefa M, Ayele F. Mothers' health services utilization and health care seeking behaviour during infant rearing: a longitudinal community based study, south west Ethiopia. Ethiopian Journal of Health Development. 2002; 16: 51-58.
13. Fantahun M, Getu D. Health service utilization in Amhara Region of Ethiopia. Ethiop J Health Dev. 2003;17(2):141-147.
14. Macro CSA, ORC. Ethiopia Demographic and Health Survey 2005.
15. Dubale T, Mariam DH. Determinants of conventional health service utilization among pastoralists in northeast Ethiopia. Ethiop J Health Dev. 2007; 21(2):142-147.
16. World Helth Organization. 1st Annual Regional Conference on Immunization. Accessed on October 24, 2016.
17. Haran EGP, Claquin P, Rahman M et al. Health Seeking Behavior of Families with an AFP Child and its Implications on Strengthening the Quality of AFP Surveillance. Abstract. The 129th Annual Meeting of APHA.

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Research

Effects of polio eradication activities on routine immunization: lessons from the 2013 outbreak response in Somali region of Ethiopia

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Abstract

Introduction: Ethiopia experienced several WPV importations with a total of 10 WPV1 cases confirmed during the 2013 outbreak alone before it is closed in 2015. We evaluated supplemental immunization activities (SIAs), including lessons learned for their effect on the routine immunization program during the 2013 polio outbreak in Somali regional state.
Methods: we used descriptive study to review documents and analyse routine health information system reports from the polio outbreak affected Somali regional state.
Results: all data and technical reports of the 15 rounds of polio SIAs from June 2013 through June 2015 and routine immunization coverages for DPT-Hib-HepB 3 and measles were observed. More than 93% of the SIAs were having administrative coverage above 95%. The trend of routine immunization for the two antigens, over the five years (2011 through 2015) did not show a consistent pattern against the number of SIAs. Documentations showed qualitative positive impacts of the SIAs strengthening the routine immunization during all courses of the campaigns.
Conclusion: the quantitative impact of polio SIAs on routine immunization remained not so impressive in this study. Clear planning, data consistencies and completeness issues need to be cleared for the impact assessment in quantitative terms, in polio legacy planning as well as for the introduction of injectable polio vaccine through the routine immunization.

Introduction

The global burden of poliomyelitis has decreased by ≥ 99% since the time the World Health Assembly endorsed the initiative for global polio eradication in 1988. The burden of the wild poliovirus (WPV) has shown significant reduction in Africa with the last case confirmed in July 2014 in Nigeria. Ethiopia joined the polio eradication effort in 1996 and was able to interrupt endemic WPV transmission in 2001. However, the country experienced several WPV importations where between 2004 and 2008 a total of 44 cases were confirmed associated with six different importations. The last importation of WPV was in August 2013 following the outbreak that was declared in the Horn of Africa in April 2013. A total of 10 WPV 1 cases were confirmed with onset of paralysis of the last case on 5 January 2014.

Since the late 1980s, use of Supplemental Immunization Activities (SIAs) has been a key strategy of the Global Polio Eradication Initiative (GPEI). Polio SIAs are mass vaccination campaigns that aim to administer additional doses of Oral Poliovirus Vaccine (OPV) to each child (usually aged <5 years), regardless of their vaccination history. In doing so, SIAs attempt to remedy the limited ability of routine immunization services to reach at-risk children with the number of OPV doses required to generate immunity. Several rounds of polio SIAs were conducted in Ethiopia following each outbreak as per the recommendation of the polio Global Advisory Committee. Like the majority of polio outbreaks which were controlled within 6 months with OPV, it took about five months in the country to limit further new incidence of the WPV; however the outbreak response extended to 2 years between June 2013 and June 2015 and the country responded with 15 SIAs out of which four were National Immunization Days (NIDs) [1]. As in many other countries, the high quality responses were partly due to the appointment of staff to oversee implementation, engagement of the national government and its partners as well as participation of pastoralist community leaders [2]. Deployment of national stop transmission of polio (STOP) team members with rich experience in surveillance and routine immunization helped to sustain the gains of SIAs integrated with routine services [3]. A robust acute flaccid paralysis surveillance system, including a multi-tiered polio laboratory network, has been maintained, forming the platform for integrating measles, neonatal tetanus, and other vaccine-preventable disease surveillance and their respective control goals in the WHO Western Pacific Region [4]. Resources need to be mobilized and invested in surveillance and routine immunization systems parallel with SIAs to avert a risk for additional outbreaks of WPV and other vaccine-preventable illnesses in a region. Monitoring and evaluation of program strengthening activities are needed [5].

Prior use of routine immunization services and compliance with the routine OPV schedule has strong positive association with SIA participation [6]. On the other hand, the few studies conducted elsewhere did not find compelling evidence of widespread and significant effects of polio eradication campaigns, either positive or negative, on quantitative measures of routine immunization coverage and other maternal healthcare [7]. A study conducted on the effects of extra immunization activities on routine immunization coverage rate of the third dose of diphtheria-pertussis-tetanus (DPT3) showed the districts that implemented extra national neonatal tetanus immunization were at risk of having lower routine DPT3 coverage than those that did not [8]. The different studies conducted elsewhere have a mixed outcome of effects of the polio SIA on routine immunization; moreover, such documentations appear to be inexistent or patchy in Ethiopia. Therefore, this study will help increase knowledge of implementers to look for effects of SIAs on routine immunization in Ethiopian context and also helps in planning SIAs making the agenda of positive impact of the campaigns for sustainability and program ownership purposes from the outset. In this article, we set out as an objective to document the effects of the polio SIAs on routine immunization services (both qualitatively and quantitatively) during the 2013 polio outbreak affected regional state of the country, Somali.

Methods

Study area: administratively Ethiopia is divided into nine Regional States and two City Administrations. One of the regional states is Somali region and it comprises nine zones. The region shares porous border with Somalia and Kenya which puts it at increased risk of importation of WPV. The total population of the region was estimated to be 5,446,968 in 2015 and the <5 years of age comprised 10.1% of the total population (National census 2007 projection).

Study design: we conducted a descriptive study design using campaign and routine health management information system (HMIS) data from June 2013 to June 2015 to explore lessons from the SIAs and observe trends in the routine immunization coverage in relation with the number of polio SIAs conducted in Somali region of Ethiopia.

Method of sampling and recruitment: we purposefully selected Somali region of the country as it was epi-center for the polio outbreak during mid-2013. In addition, all rounds of the polio SIAs included the region in the subsequent campaigns until closure of the outbreak in June 2015. Except during the four NIDs conducted from 2013 through 2015, the remaining regions had intermittent polio response campaigns during the 2 years outbreak period.

Procedures: we obtained technical reports of all the SIAs conducted as part of the outbreak response in Somali region from June 2013 to June 2015 as well as quarterly program review documents. The technical reports of each of the polio SIAs rounds were reviewed for coverage of the SIAs, lessons learned and best practices out of the campaigns as to their contribution to strengthen the routine immunization were narrated and summarized in tables and graphs. We also compiled the periodic HMIS reports from the region to see the trends in uptake of the routine immunization coverage on key indicators of (i.e., DPT-Hib-HepB3, measles and dropout rates) over the same 2 years period.

Statistical analyses: after the data compilation was completed, we checked the data manually for completeness and consistency. We entered the data into an MS Excel spreadsheet and checked for major outliers, and then analysed for proportions, percentages and trends. We used frequency distribution and percentages used to describe the variables, and compiled results and presented those using tables, graphs, and narrations.

Results

Summary of the polio SIAs

As shown in Table 1, a total of 15 rounds of polio NIDs were conducted in Somali region between June 2013 and June 2015. On average, the administrative campaign coverage over the 2 years of outbreak response was 97.8% and in all of the campaign rounds, coverage was above the cut off for high coverage (which is 95%) except in July 2013 where it was 92%. On average, among children who got vaccinated in the age range of 0-11 months, 1 child in every 20 had not received any OPV vaccination prior to the campaign, that is they were labelled as zero dose children. The zero dose rate in the age range of 12-59 was 1.6%. This rate was fluctuating in both age groups but higher during the initial rounds of the response (i.e., during June and July 2013).

Table 1: administrative data of polio supplemental immunization activities, Somali region, Ethiopia, June 2013 to June 2015

Rounds of Polio SIAs	OPV coverage %	(N)	Zero dose (%) in 0-11 mo	(N)	Zero dose (%) in 12-59 months	(N)
Jun-13	95.2	883,365	14.8	26,189	5.3	35,336
Jul-13	92.0	818, 582	15.6	24537	5.2	33,767
Aug-13	95.5	805,382	3.2	5,354	5.7	3,586
Oct-13	97.1	822,662	7.3	12,472	4.2	27,618
*Dec-13	98.2	2,376,804	4.2	7,888	0.8	5,324
*Jan-14	96.5	2,476,024	2.5	4,976	0.6	4,451
*Mar-14	99.8	2,638,848	3.0	6,331	0.3	1,886
*May-14	95.5	2,571,328	2.3	4,491	0.2	1,459
Jun-14	99.3	913,676	7.1	4,492	0.5	3,403
Jul-14	97.2	894,169	2.5	4,410	0.2	1,705
Sep-14	100.5	953,892	3.4	6,721	0.4	3,000
Nov-14	98.5	936,416	1.6	5,331	0.1	1,031
Feb-15	98.9	939,461	0.4	5,331	0.1	1,014
Mar-15	103.8	969,498	2.0	6,177	0.1	659
Jun-15	99.7	970,403	3.6	6,736	0.2	1,619
Average	**97.8**		**4.9**		**1.6**	

* Under 15 years campaigns

Integrated routine immunization service delivered during the polio SIA rounds

Routine immunization service provisions were integrated with the SIAs starting from the May 2014 round with all antigens. During their house to house visits, vaccinators sought for unvaccinated or under vaccinated children based on the national schedule for all the routine immunization antigens and referred them to nearby temporary fixed stations established for vaccination. As shown in Table 1, although no targets were set for the routine immunization service tracing during the campaigns, from May 2014 to June 2015, a total of 13,284 and 15,894 children were vaccinated for DPT-Hib-HepB 3 and measles respectively. The routine immunization coverage for the antigens varied in each round, and was highest in May 2014 round and lowest in March 2015 round (Table 2).

Table 2: number of children vaccinated for ri with selected indicators during the sia rounds, Somali region, Ethiopia, June 2013 to June 2015

Rounds of Polio SIAs	DPT-Hib-HepB 3 (N)	Measles (N)
May-14	6,304	8,089
Jun-14	1,184	1,512
Jul-14	866	1,071
Sep-14	2,179	2,398
Nov-14	1,803	1,880
Mar-15	372	374
Jun-15	576	570
Total	**13,284**	**15,894**

Trends in the routine immunization coverage

The trend of routine immunization for DPT-Hib-HepB3 and measles coverage, over the five years (2011 through 2015) did not show a consistent pattern; however the trend in coverage based on the two indicators was parallel to each other (Figure 1). Throughout the 5 years report periods (2011-2015), the coverages were below the national expectation of 90% as set for DPT-Hib-HepB 3 in 2014. The dropout rates (DoR) of DPT-Hib-HepB1 (Penta 1)-DPT-Hib-HepB3 (Penta 3) were also beyond acceptable set target of 10% in all the report years. However, the DoR for Penta has shown remarkable decline in the years with levelling in later years.

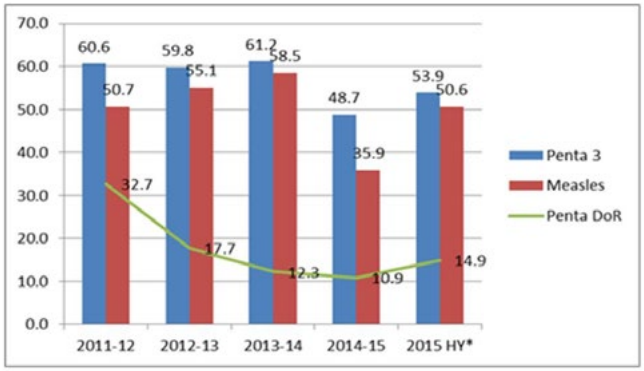

Figure 1
trend in routine immunization coverage in Somali region, Ethiopia, June 303 2011 to December 2015

Report review for lessons learned on how the SIAs supported the routine

immunization: review of the technical reports of the 15 SIA rounds and minutes of the quarterly joint program review meetings of Expanded Program on Immunization (EPI) and surveillance for contributions of the campaigns to support the routine immunization services are stated below.

Pre-implementation: the planning exercises helped to develop or update the social maps in the areas of the campaign. Intense participation of the community at the lower level during microplan development increased the community engagement and program sustainability. Bottom-up microplans were developed or updated in each of the campaigns which were claimed to have boosted the local capacity. During each of the rounds, basic and practical trainings to vaccinators was given where routine immunization and surveillance components were included. All campaign preparation trainings included the following major topics: recording and reporting techniques, vaccine management and distribution, identification of hard to reach and high risk populations, inter personal communication, monitoring and supervision which all boost the routine immunization in general. Deployment of technical assistants with skills in routine immunization and campaigns also helped in coaching and mentoring to the health workers. In majority of the reports of the SIA rounds, immunization task force committees were established up to district level with technical sub working groups. The launching ceremonies for the SIAs and advocacy visits to different level political and community leaders, nongovernmental organizations and other potential partners have helped to gain support and political commitment for immunization as a whole. On the campaign mobilization events, key immunization messages were passed. Functionality and capacity of refrigerators, inventory of cold boxes and vaccine carriers, temperature recording, pattern and placement of routine EPI vaccines were assessed at all levels. In some rural health facilities where electricity supply was not available, kerosene was distributed to start up the refrigerators and maintain the cold chain. In most places, ice pack production was initiated days before the actual implementation of the campaign date. Additionally, in places where nearby health facilities were not available, identification of vaccine distribution points were carried out. In areas where shortage of vaccine carriers was noticed, re-distribution of supplies was made from some health facilities.

Intra-campaign: inter sectoral collaboration among different sectors and partners with mix of technical capacities were increased. School involvement in the campaign helped the partnership by motivating teachers and school administrators for vaccine preventable diseases (VPD). Close supervision and monitoring of the campaigns were also done at all levels which supported monitoring of the routine immunization as well.

Post campaign: in order to evaluate quality of SIAs and take immediate action in low performing areas rapid convenience surveys were conducted where the number of children with zero dozes were monitored and shared for subsequent inclusion in the routine immunization programme. At the end of each SIAs round, regional review meetings were organized with participation of all level supervisors. Strengths and weaknesses were discussed and action points taken for the subsequent round. The routine immunization strengthening efforts were discussed during the review periods.

Discussion

We found that the administrative coverages in almost all (93.3%) of the 15 polio SIA rounds in Somali region after WPV importations met the cut off for a high quality campaign as supported by the Rapid convenience survey findings as well. Despite this fact the number of zero dose children in both age groups of 0-11 months and 12-59 months of age did not show satisfactory decrease in number along the course of subsequent campaigns. We also found from the campaign coverage trends that lessons and strategies from previous rounds of campaigns were not well documented or not implemented in subsequent campaigns which would have be reflected in an increase of campaign quality/coverage.

We also found that good number of children have got access to routine immunization services integrated with the SIAs as service providers visit the community and link eligible children to prearranged temporary fixed vaccination posts; however the proportion of children accessed and tracked back to the immunization service could not be measured as there were no targets set for vaccination with routine vaccines before the vaccinators went for the activities.

Despite the reported positive qualitative impacts of the campaigns on the political commitment and health workers' knowledge and skill on the routine immunization, the impact of the repeated number of polio SIAs on routine immunization coverages in the region could not be conclusively determined in this study as there was no clear pattern with immunization coverage for the key indicators of DPT-Hib-HepB 3 and measles vaccines. This finding is consistent with the study conducted in seven countries

of South Asia and sub-Saharan Africa that assessed impacts of polio eradication activities on key health system functions including routine immunization using mixed methods data.

Despite the major financial and technical investments on immunization in the region, the fact that the study area was already disadvantaged in terms of infrastructures and other facilities due to scattered geographic settlement, pastoralist nature, social insecurity and others could have masked the positive effects of the SIAs on routine immunization in the region with high chance of persistently missing immunization [9,10]. In addition to the fact that some of the impact of polio campaigns on RI may not immediately translate into immediate improvement in routine immunization coverage, data incompleteness or lack of periodic verification for consistency was also another concern as limitation in this study.

Conclusion

In conclusion, SIA response should have been more focused in system strengthening and polio eradication activities can provide support for the routine immunization as part of the primary health care; their quantitative impact on routine immunization remained not so impressive in this study. As it is seen in other studies, absence of periodic documentation and tracking effects of the polio SIAs on RI and health system might have contributed to conceal the anticipated positive impacts of the campaigns on the routine immunization following increased commitment to scaling up best practices could lead to significant positive impacts to the routine system [7]. Additional immunization efforts, without additional resources and planned program integration, may not have clear effect on the routine immunization. Even though one of the objectives of the polio SIAs is to strengthen routine immunization, their direct effects were not quantitatively evaluated immediately after each of the campaigns for further action. Having successfully interrupted the indigenous transmission and importation of WPV through SIAs, missing the opportunity to sustain the routine immunization coverage will leave a threat of polio outbreak importations from the remaining polio-endemic countries [11]. Poor vaccination team performance could be one of the major reasons for missing the opportunity to identify the immunization gap in the routine form and link with immunization service points [12]. We recommend that the impact of the polio SIAs on the routine immunization needs to be strongly sought for especially in the process of articulating the lessons learned from the polio eradication efforts during the polio legacy planning. Verification of SIAs data using different mechanisms in pastoralist areas like low cost, hand-held global positioning system (GPS) receivers will increase the reliance of the reported data as was done elsewhere [13]. Data consistencies and completeness issues need to be cleared for the impact assessment in quantitative terms as well as in planning for the introduction of injectable polio vaccine which is to be administered through the routine immunization. Inter-sectoral collaboration between human and animal health services as flexibility and capacity of vaccinators to vaccinate with other routine immunization services when and where nomads were available is commendable [2].

What is known about this topic

- Use of Supplemental Immunization Activities (SIAs) and strengthening of routine immunization have both been key strategies of the Polio Eradication Initiative;
- Several rounds of polio SIAs were conducted in Ethiopia following each outbreak as per the recommendation with additional intention to strengthen the routine immunization by identifying never-vaccinated children and linking to further completion of their immunization with other infant antigens as well;
- The different studies conducted elsewhere have a mixed outcome of effects of the polio SIAs on routine immunization.

What this study adds

- This study tries to summarize the qualitative impact of the rounds of polio SIAs in the outbreak focus, Somali region, during the 2013 outbreak period through review of different campaign technical reports and review meeting proceedings;
- Documentation on quantitative impact of polio SIAs appear to be inexistent or patchy in Ethiopia; this study tries to assess impact of the polio SIAs on coverages with regard to DTP3 and measles coverages in routine immunization;
- This study also triggers further statistical analysis to seek associations and statistical significant relations between the polio SIAs and on the routine immunization uptake, the dependent variable.

Competing interests

Authors declared they have no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

The corresponding author compiled available data and reviewed reports to synthesize the draft report and all co-authors extended their unreserved support by reviewing the document and providing constructive comments. All authors have read and approved the final version of the manuscript.

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References

1. Mach O, Tangermann RH, Wassilak SG, Singh S, Sutter RW. outbreaks of paralytic poliomyelitis during 1996-2012: the changing epidemiology of a disease in the final stages of eradication. j infect dis. 2014; 210(suppl 1): s275-82.
2. Ndiaye SM, Ahmed MA, Denson M, Craig AS, Kretsinger K, Cherif B et al. polio outbreak among nomads in chad: outbreak response and lessons learned. j infect dis. 2014; 210(suppl 1): s74-s84.
3. Waziri NE, Ohuabunwo CJ, Nguku PM, Ogbuanu IU, Gidado S, Biya O et al. polio eradication in nigeria and the role of the national stop transmission of polio program , 2012-2013. j infect dis. 2014; 210(suppl 1):2012-3.
4. Adams A, Boualam L, Diorditsa S, Gregory C, Jee Y, Mendoza-Aldana j. maintaining polio-free certification in the world health organization western pacific region for over a decade. j infect dis. 2014; 210(suppl 1): s259-67.
5. Walker AT, Sodha S, Warren WC, Sergon K, Kiptoon S, Ogange J et al. forewarning of poliovirus outbreaks in the horn of africa?: an assessment of acute flaccid paralysis surveillance and routine immunization systems in kenya. j infect dis. 2014;210(suppl 1): 85-90.
6. Helleringer S, Frimpong JA, Abdelwahab J, Asuming P, Touré H, Awoonor-Williams JK et al. supplementary polio immunization activities and prior use of routine immunization services in non-polio-endemic sub-saharan africa. bull world health organ. 2012;90(7):495-503.
7. Closser S, Cox K, Parris Tm, Landis Rm, Justice J, Gopinath R et al. the impact of polio eradication on routine immunization and primary health care: a mixed-methods study. j infect dis. 2014; 1-10.
8. Hong R, Banta JE. effects of extra immunization efforts on routine immunization at district level in pakistan. east mediterr heal j. 2005;11(4):745-52.

9. Gidado SO, Ohuabunwo C, Nguku PM, Ogbuanu IU, Waziri NE, Biya O et al. outreach to underserved communities in northern nigeria, 2012-2013. j infect dis. 2014; 210(suppl 1): s118-24.
10. Michael CA, Ogbuanu IU, Storms AD, Ohuabunwo CJ, Corkum M, Ashena S et al. an assessment of the reasons for oral poliovirus vaccine refusals in northern nigeria. j infect dis. 2014; 210(suppl 1): 125-30.
11. Kamadjeu R, Mahamud A, Webeck J, Baranyikwa MT, Chatterjee A, Bile YN et al. polio outbreak investigation and response in somalia, 2013. j infect dis. 2014; 210(april 2013): 181-6.
12. Michael CA, Ashena S, Ogbuanu IU, Ohuabunwo C, Sule A, Corkum M et al. an evaluation of community perspectives and contributing factors to missed children during an oral polio vaccination campaign - katsina. j infect dis. 2014; 210(suppl 1): 131-5.
13. Gammino VM, Nuhu A, Chenoweth P, Manneh F, Young RR, Sugerman DE et al. using geographic information systems to track polio vaccination team performance: pilot project report. J Infect Dis. 2014; 210(Suppl 1): S98-101.

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Research

Factors contributing to routine immunization performance in Ethiopia, 2014

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Abstract

Introduction: an increasing trend of routine immunization performance has generally been observed over the past decade in Ethiopia. However, the improvement is irregular with wide disparity among and within regions. This study analyzes health facility characteristics contribution to immunization performance in Ethiopia.
Methods: we conducted a cross-sectional study and compared characteristics of health facilities in good and poor performing zones. We used administrative coverage reports and Personal Digital Assisted (PDA) supervisory data collected by WHO EPI field officers using a standardized structured checklist. We selected 48 zones and 302 health facilities based on immunization performance data and supervisory data on potential variables.
Results: logistics regression was used to identify independent contributors to good immunization performance. On logistics regression we found that: actions by higher levels in conducting supervision (Odds Ratio (OR) =4.15. 95% Confidence Interval (CI) = 1.85, 9.32, p value <0.01] and providing written feedback (Odds Ratio (OR) =4.35. 95% Confidence Interval (CI) = 2.27, 8.33, p value <0.01) , and provision of immunization services by the health facility itself for catchment population under each health unit (Odds Ratio (OR) =20.15. 95% Confidence Interval (CI) = 2.24, 181.38, p value =0.01) and absence of stock out of vaccines (Odds Ratio (OR) =0.44. 95% Confidence Interval (CI) = 0.23, 0.83, p value =0.01) are the likely significant factors contributing to good immunization performance in Ethiopia.
Conclusion: ensuring availability of immunization services in all health facilities, regular supervision and written feedback and improved stock management are essential factors contributing to good immunization performance.

Introduction

Immunization is one of the most effective public health interventions known so far [1,2]. In 2013, an estimated 2 to 3 million deaths globally were averted through immunization [3]. The Government of Ethiopia incorporated childhood vaccination in the Health Sector Development Plan (HSDP) as one of the key interventions to improve child health outcomes [4]. Progress was measured by proportion of under 1 year old children vaccinated with a third dose of diphtheria, pertussis and tetanus containing vaccine (DPT3) coverage which is the reference indicator of coverage for Expanded Programme on Immunization (EPI) [4,5]. Ethiopia adopted the Global Vaccine Action Plan (GVAP) targets to reach 90% DPT3 coverage nationally and 80% coverage at district level by 2015 [6]. Between 2004 and 2014 improvement in immunization coverage was observed globally and in Africa [7]. The DPT3 administrative coverage in Ethiopia increased reports from 66% to 87% in 2004 and 2014 respectively [8].

Based on administrative and World Health Organization (WHO)-United Nations Children's Fund (UNICEF) joint estimates, immunization performance in Ethiopia showed improvement from 2012-2014. However, variation and discrepancies within regions and zones still remained a challenge where in 2013 and 2014 the proportion of zones that achieved DPT3 vaccination coverage of at least 80% were 50% and 73% respectively [8]. To improve and sustain routine immunization (RI) coverage, woredas (which are equivalent to districts in Ethiopia) need a supportive political and policy context, as well as essential immunization infrastructure [9]. The success factors for the improved coverage in Africa as well as Ethiopia were attributed to implementation of the "Reach Every District" (RED) approach, support of global partners, use of community health workers, and expansion of the health infrastructure and the health system [9-11]. There is little published evidence of studies conducted in Africa to identify the reasons why some jurisdictions perform well in immunization activities while others do not despite being in the same country setting of infrastructure and socio-economic contexts [12]. We performed a cross-sectional study to compare good and poor performing zones based on the characteristics of immunization programme management by health facilities to identify possible contributing factors to RI improvement in Ethiopia. We believe that the study results and recommendations could be used to sustain improvement in good performing zones and scale up good practices in poor performing zones.

Methods

Study area and study period: Ethiopia is a country with a federal government composed of nine regional states and two city administrations. Regions are further sub-divided into 103 zones and 840 woredas which are equivalent to districts. As of 2014 the total population was estimated to be 89,714,313 with more than 3 million birth cohort targeted for immunization. Oromia, Amhara, Southern Nations and Nationalities People Region (SNNPR) and Tigray regions constitute more than 85% of the total population. There are over 3200 health centers and 15000 health posts and more than 90% of them provide immunization services. We collected data in July 2014 from 426 health facilities located in 53 zones to describe factors associated with good immunization performance in Ethiopia.

Study design: we conducted a cross-sectional study and compared characteristics of health facilities in good and poor performing zones to identify potential factors that contribute to immunization performance in Ethiopia.

Study population: we included 53 good and poor performing zones and studied characteristics of 426 health facilities that had data collected on the nine explanatory variables of this study: immunization service, session interruption, supervision, written feedback, defaulter tracking system, performance monitoring, vaccine stock status, availability of trained focal person and practice of informing care takers on key immunization messages. Health facilities from Harari region and Dire Dawa and Addis Ababa city administrations were not included as there was no supervisory data from these regions (Figure 1).

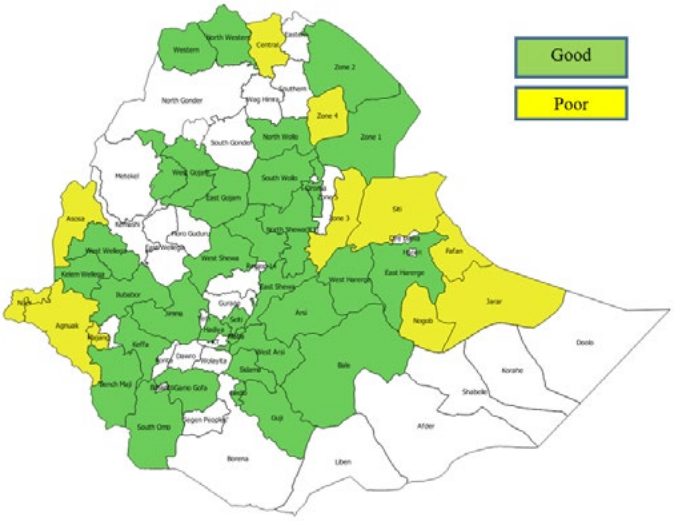

Figure 1
map of good and poor performing zones in Ethiopia, 2014

Inclusion criteria: we included zones with DPT3 coverage data for 2014 and health facilities with records on the nine independent variables.

Sample size: we selected 426 health facilities which had data on the nine explanatory variables and with available coverage data on third dose DPT3 coverage for their respective zones.

Data collection and measurement

Data source: we used the joint Federal Ministry of Health - WHO-UNICEF report for administrative (JRF 2014) and used supervision data stored in the WHO database for analysis of health facility characteristics. The supervisory data were collected during health facility visits by WHO EPI field officers using a standard checklist adapted by the central EPI team uploaded in a PDA. The checklist contained questions on surveillance and immunization activities. Data were submitted to the regional and central coordinators and cleaned by central data management team.

Study variables

Dependent variable: zone immunization coverage of third dose of diphtheria, pertussis and tetanus containing vaccines (DPT 3 coverage)

Independent variables: health facilities providing immunization service; health facilities that were supervised by higher level in the past 6 months; tracing of defaulters who missed their subsequent vaccination doses; monitoring immunization performance as evidenced by use of monitoring chart; stock out of any vaccine for any duration; presence of trained EPI focal point; written feedback given by higher levels; interruption of immunization session for any reason; are care takers informed on key immunization messages after vaccinating their children?

We obtained the data on the independent and dependent variables from the WHO databases which are maintained in MS-Excel. We also used administrative coverage reports and the WHO database for data on supervision.

Operational definitions: DPT 3 coverage: proportion of under 1-year old infants vaccinated with three doses of DPT (Diphtheria, Pertussis, Tetanus) containing vaccine. A good immunization-performing zone was defined as a zone with at least 80% DPT 3 coverage and a poor performing zone was defined as one with less than 80% DPT 3 coverage. The Global Immunization Vision and Strategy (GIVS) and the national immunization Comprehensive Multi-Year Plan (cMYP) 2011-2015 documents aim to achieve at least 80% DPT 3 coverage in 90% of districts. Therefore the cut-off for categorizing zones in to good and poor performing zones is based on the national and global targets.

Data analysis: we checked both administrative and supervisory data for cleanliness, accuracy and missing values. We used MS Excel and Epi Info 3.5.3 [13] for cleaning and further data analysis. We

performed descriptive analysis of variables and checked completeness and frequency of each variable. We recoded variables into yes/no and conducted bivariate analysis and explored the presence of association between the independent variables and zone immunization coverage. We decided to consider variable with small p-value (p<0.1) for multivariate analysis of possible prediction of immunization performance, adjusted for the presence of other variables.

Results

We analyzed data on immunization management from 426 health facilities located in eight Regions and 53 zones. Of these 38 (71%) were categorized as good performing zones while15 (29%) were categorized as poor performing zones (Table 1).

Table 1: regional distribution of supervised facilities in Ethiopia, 2014

Region	Frequency	Percent
Afar	24	5.6%
Amhara	81	19.0%
Benishangul Gumuz	8	1.9%
Gambella	18	4.2%
Oromia	163	38.3%
SNNPR	66	15.5%
Somali	45	10.6%
Tigray	21	4.9%
DPT-HIB-HepB3 performance of zones		
Good	38	79%
Poor	15	21%

Immunization sessions for catchment population were available in 396 (93%). Three hundred forty four (88%) and 166 (45.7%) facilities were supervised and given written feedback within the 6 months study period. There was no reported interruption of immunization sessions in 391 (94%) nor stock out of any vaccine in 264 (64%). Performance monitoring and defaulter tracing were observed in 207 (52%) and 217 (55%) health facilities respectively. Immunization sessions were observed in 116 (27.9%) of the facilities out of which 103 (88.8%) of vaccinators provided key EPI information to caretakers. Trained focal persons were available in-237 (56%) of the facilities (Table 2).

Table 3: association of supervisory characteristics with DPT-HIB-HepB 3 coverage, Ethiopia, 2014

Variable	Low coverage # (Col %)	High coverage # (Col %)	OR (95% CI)	P value
Are defaulters traced				
Not traced	46 (50)	130 (43.2)	1.31(0.82-2.10)	0.25
Yes traced	46	171		
Does HF provide immunization service				
No	14 (14.9)	16(4.8)	3.45(1.62-7.38)	<0.01
Yes	80	316		
HF supervised				
No	23 (25.6)	24 (8.1)	3.92(2.08-	0.001
Yes	67	274	7.37)	
HF Monitor immunization performance				
No	49 (53.8)	145(46.8)	1.33(0.83-2.12)	0.23
Yes	42	165		
Any interruption of immunization session				
No	88(97.8)	303(92.9)	3.34(0.77-	0.08
Yes	2	23	14.4)	
Stock out of any vaccine				
No	42 (46.2)	222 (69.2)	0.38(0.24-	0.001
Yes	49	99	0.61)	
Available trained focal person				
No	41(45.1)	143 (43.3)	1.07(0.67-1.71)	0.77
Yes	50	187		
Written feedback given by the higher level				
No	75(82.4)	123(45.1)	5.72(3.17-	<0.001
Yes	16	150	10.32)	
Key EPI information provided to caregivers				
No	4(11.4)	9(11.1)	1.03(0.82-2.10)	0.59
Yes	31	72		

Findings from bivariate analysis revealed strong association between DPT3 coverage and availability of immunization service in the facility [Odds Ratio (OR) =3.45. 95% Confidence Interval (CI) = 2.08,7.37, p value <0.01], written feedback [OR =5.72. 95% CI= 3.17, 10.32, p value <0.001], supervision of health facilities by woredas or zones [OR =3.92. 95% CI= 2.08 7.37, p value 0.001] and stock out of vaccine [OR =0.38. 95% CI= 0.24, 0.61, p value 0.001] (Table 3).

Logistic regression analysis revealed that, based on our categorization of good performance, DPT3 coverage was 7.16 and 4.35 times greater respectively in zones that conducted supportive supervision within the preceding 3-6 months (95%CI=1.92, 26.26, p value 0.00) and provided written feedback to their health facilities (95%CI =2.27, 8.33, p value 0.00). The DPT3 coverage was 20.15 times greater in zones where the health facilities had immunization services (95%CI=2.24, 181.38, p value 0.01) and 4.1 times greater where health facilities monitored their immunization performance (95%CI =1.2, 14.05, p value 0.02). The DPT3 coverage was 0.44 times lesser in zones where health facilities had stock out of vaccines (OR 0.44 95%CI = 0.23-0.83, p value 0.01) (Table 4).

Table 2: characteristics of supervised facilities by selected variables, Ethiopia, 2014

Characteristic	Number	Percent
Are defaulters traced?		
No	176	45%
Yes	217	55%
Is the EPI focal person trained?		
No	102	24%
within 2 years	237	56%
More than 2 years	82	19%
Does the health facility provide feedback?		
No	30	7%
Yes	396	93%
Was the health facility supervised by woreda/zone?		
Not supervised	47	12%
Supervised within 1-3 months	47	12%
Supervised within 3-6 months	294	76%
Was there interruption of immunization service?		
No	391	94%
Yes	25	6%
Does the health facility monitor immunization performance		
No monitoring chart	31	8%
Have monitoring chart but not updated	163	41%
Have monitoring chart and updated	207	52%
Was there stock out of vaccine		
No stock out	264	64%
Yes-stock out of DPT-HIB-HepB	8	2%
Yes-stock out of other vaccine	140	34%
Has the health facility given written feedback from woreda/zone?		
No	198	54,3%
Yes	166	45,7%
Are care givers informed on key EPI messages?		
No	13	11,2%
Yes	103	88,8%

Table 4: logistic regression analysis of variables with strong association as predictors for DPT-HIB-HepB3 performance, Ethiopia, 2014

Term	Odds Ratio	95% C.I.	S. E.	Z-Statistic	P-Value
Were health facilities supervised within 3-6 months(Yes /No*)	7.16	[1.92-26.6]	0.67	2.93	0.00
Were health facilities supervised within 3 months (Yes /No*)	4.15	[1.85-9.32]	0.41	3.45	0.00
Were health facilities providing immunization services (yes/No*)	20,15	[2,24-181,38]	1,12	2,68	0,01
Did health facilities monitored performance (Yes-not updated/No*)	3.80	[1.10-13.10]	0.6318	2.11	0.03
Did health facilities monitored performance (Yes-updated/No*)	4.10	[1.20-14.05]	0.63	2.25	0.02
Was there interruption of immunization session (Yes/No*)	6.38	[0.63-65.01]	1.18	1.56	0.11
Was there stock out of vaccines (Yes-Other vaccine stockout/No stockout*)	0.44	[0.23-0.83]	0.3223	-2.55	0.01
Was there stock out of vaccines (Yes-DPT-HIB-HepB stockout/No stockout*)	0.14	[0.02-0.97]	0.98	-1.99	0.04
Was there written feedback given by higher level (yes/No*)	4.35	[2.27-8.33]	0.33	4.44	0.00
CONSTANT	*	*	1.32	-3.50	0.00

Discussion

In our analysis of factors associated with good performance of RI, we found availability of immunization sessions, supervision, written feedback, performance monitoring and stock out of vaccines to be strong predictors of immunization coverage in Ethiopia [9,14-16]. Written feedback, supportive supervision, availability of immunization services in all health facilities and performance monitoring were associated with good performance. Stock out of vaccine was associated with poor performance[14,15,17]. In our logistic regression analysis, we also found that performance monitoring was associated with good immunization performance though this was not observed on bivariate analysis[18]. We also observed that stock out of vaccines other than DPT containing vaccines were associated with poor DPT3 coverage containing vaccine probably through interruption of session until all antigens are ready for immunization sessions [14,19].

To our surprise, we did not observe any association between coverage and the following characteristics: provision of key EPI messages to care

takers, availability of trained EPI focal person and interruption of session and defaulter tracking. We considered that the association between coverage and provision of key messages might have been affected due to observation of inadequate immunization sessions [18,20]. Generalization of our findings to other contexts may be limited by the following: we conducted cross-sectional study which may not be a preferred method for comparison analysis. However, we analyzed variables with p-value <0.1 and explored factors contributing to immunization performance. Data from the two city administrations (Addis Ababa and Dire Dawa) and Harari region was not available. However, data were available from the remaining regions and we included urban zones in our analysis.

Conclusion

In conclusion, though we did not include all potential predictor variables in the study, we found that the way health facilities manage immunization programme and the supportive function of higher levels are predictors of immunization performance of zones in Ethiopia. We recommend that administrative health offices should provide regular written feedback and enforce provision of immunization service in all health facilities where there are adequate immunization system inputs. We further recommend that stock management should improve at all levels and the negative impact of stock out of vaccines other than pentavalent should be noted; therefore stock management should aim at improving availability of all vaccines at all times. We also recommend regular supervision of health facilities which provides the opportunity to identify and rectify gaps as they occur. We also recommend further study incorporating other potential variables and more settings to gather more evidence in Ethiopia.

What is known about this topic

- While there is adequate information on the importance of conducting supportive supervision to health units and provision of feedback, little is documented about the contribution of such actions to improve immunization performance;
- Most studies focus on identifying challenges to immunization performance and try to forward recommendations to increase coverage by removing the identified challenges than focusing on identifying the positive factors that contribute to better performance;
- Little effort is made to understand why some areas perform well compared to the others while being under the same socio-economic and political environment.

What this study adds

- This study gives a different perspective as to looking at the factors that contribute to immunization by trying to understand the positive attributes than focusing on challenges;
- This study also gives evidence that the actions of the higher levels such as supervision and written feedback when done regularly and properly can influence performance positively;
- The study provides evidence as to the contribution of health facility characteristics to immunization performance apart from the experience and characteristics of service providers and service users.

Competing interests

The authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

Aschalew Teka: made substantial contribution in manuscript design, data compilation, analysis, write up and finalization of manuscript. Braka Fiona: made substantial contribution in manuscript design write up and finalization of manuscript. Karengera Thomas: contributed to manuscript design in write up and finalization of manuscript. Aron Kassahun: made significant contribution in data compilation and analysis. Gallagher Kathleen: made significant contribution in manuscript design, edition and finalization. Peter Nusubuga: made significant contribution in manuscript design, data analysis and editing. Yohannes Ababu: contributed in write up and data analysisAssefu Lemlem: contributed in write up and finalization. All authors have read and approved the final version of the manuscript.

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References

1. WHO, UNICEF. GIVS: Global Immunization Vision and Strategy 2006-2015. Accessed on August 04 2016.
2. Bustreo F, J-M Okwo-Bele, Kamara L. World Health Organization perspectives on the contribution of the Global Alliance for Vaccines and Immunization on reducing child mortality Arch Dis Child 2015;100(Suppl 1):s34–s37.
3. Cherian T, Okwo-Bele J-M. The decade of vaccines global vaccine action plan: shaping immunization programmes in the current decade. Expert Rev Vaccines. 2014; 13(5): 573-5.
4. UNDP. Analyzing Regional Performance and Disparities in Health Outcomes in Ethiopia. 2012. Accessed on 4 August 2016.
5. Kamara L, Lydon P, Bilous J, Vandelaer J, Eggers R, Gacic-Dobo M et al. Global immunization vision and strategy (GIVS): a mid-term analysis of progress in 50 countries. Health Policy Plan. 2013; 28(1): 11-9.
6. Brown DW, Burton A, Gacic-Dobo M, Karimov RI, Vandelaer J, Okwo-Bele J. A mid-term assessment of progress towards the immunization coverage goal of the Global Immunization Vision and Strategy (GIVS). BMC Public Health. 2011; 11: 803.
7. UNICEF W and. Ethiopia -WHO and UNICEF estimates of immunization coverage: 2014 revison. pdf. 2015. Accessed on August 04 2016.
8. LaFond AK, Sequeria J. Drivers of routine immunization system performance at the District level: Ethiopia case study. ARISE Res Br. 2009; 2: 2.
9. LaFond AK, Kanagat N, Sequeira JS, Steinglass R et al. Drivers of Routine Immunization System Performance at the District Level:Study Findings from Three Countries, Research Brief No3. 2012. Accessed on 4 August 2016.
10. FMOH-Ethiopia. Ethiopia's Health Sector: Excellent Return on Your Development Funding. 2013.
11. Lakew Y, Bekele A, Biadgilign S. Factors influencing full immunization coverage among 12-23 months of age children in Ethiopia: evidence from the national demographic and health survey in 2011. BMC Public Health. 2015 Jul 30; 15: 728.
12. CDC. Epi Info . Accessed on 4 August 2016
13. Favin M, Steinglass R, Fields R, Banerjee K, Sawhney M. Why children are not vaccinated?: a review of the grey literature. Int Health Royal Society of Tropical Medicine and Hygiene. 2012; 4(4): 229-38.
14. Community E. H ealth S ystem and Notes from the field: 2012;1-6.
15. Kahn JG, Mokdad AH, Deming MS, Roungou J, Boby AM, Excler J et al. Avoiding missed opportunities for immunization in the Central African Republic: potential impact on vaccination coverage. Bull World Health Organ. 1995; 73(1): 47-55.
16. Duclos P, Okwo-Bele J-M, Gacic-Dobo M, Cherian T. Global immunization: status, progress, challenges and future. BMC Int Health Hum Rights. 2009; 9(Suppl 1): S2.
17. Berhane Y, Masresha F, Zerfu M, Birhanu M, Kebede S, Shashikant S. Status of expanded program on immunization in a rural town--south Ethiopia. Ethiop Med J. 1995 Apr; 33(2): 83-93.
18. Bicaba A, Haddad S, Kabore M, Taminy E, Feletto M, Fournier P. BMC International Health and Monitoring the performance of the Expanded Programme on Immunization: the case of Burkina Faso.

BMC. 2009; 9: 1-9.
19. Mitchell S, Andersson N, Ansari NM, Omer K, Soberanis JL, Cockcroft A. Equity and vaccine uptake: a cross-sectional study of measles vaccination in Lasbela District, Pakistan. BMC Int Health Hum Rights. 2009 Jan; 9(Suppl 1): S7.

PanAfrican Medical Journal

Research

Status of surveillance and routine immunization performances in Amhara Region, Ethiopia: findings from in-depth peer review

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Abstract

Introduction: trend analyses of non-polio AFP and stool adequacy rates in Amhara Region showed optimal performance over the years. However, sub regional gaps continue to persist in certain zones where the reasons for low performance were not well documented. The objective of this study was to assess the performance of the disease surveillance and immunization system in Amhara Region, Ethiopia with emphasis on low performing woredas and zones.
Methods: a descriptive cross-sectional study was conducted from July 2-10, 2015 to assess the structure, core and support surveillance functions in five zones and two town administrations that were purposively sampled based on differing performances, geographic location, and history of vaccine preventable disease outbreaks among others.
Results: of the 82 sites reviewed, 71 (87%) have a designated surveillance focal person. Less than half 36(44%) of these focal persons have written terms of reference. Twenty-six (93%) of the health offices had a written surveillance work plan for the fiscal year. Only 17 (81%) of woreda health offices and town administrations had prioritized active surveillance sites into high, medium and low during the last 12 months. Only 4(17%) had independent active case search visits to these sites as per the priority. Seventy-eight (95%) and seventy-seven (94%) sites have a designated immunization focal person and updated EPI performance monitoring charts, respectively. There had been vaccine stock out in the 3 months before assessment in 28 (34%) of the sites.
Conclusion: though there is an existence of well-organized surveillance network with adoption of the integrated disease surveillance and response, gaps exist in following the standard guidelines and operation procedures. Improvements needed in reporting site priority setting and regular visiting for active case search, outbreak investigation and management, vaccine supply and overall documentations.

Introduction

Effective communicable diseases control relies on effective surveillance and response systems that promote coordination and integration of surveillance functions. Recognizing this, an initiative to strengthen the disease surveillance system by promoting integration of surveillance activities was started in 1996 in Ethiopia. Later in 1998 the World Health Organization Regional office for Africa (WHO-AFRO), following the resolution of the 48th assembly, started promoting Integrated Disease Surveillance and Response (IDSR) for all Members States to adopt as the main strategy to strengthen national disease surveillance systems [1]. Ethiopia as a Member State adopted the IDSR strategy, which is district centered and outcome-oriented. Based on the steps recommended by the strategy, the Federal Ministry of Health (FMOH) of Ethiopia and its development partners conducted an assessment of the country's surveillance systems in October 1999 and subsequently prepared a 5-year national implementation plan [2]. Vaccine Preventable Disease (VPD) surveillance, including acute flaccid paralysis (AFP) and measles surveillances, is one of the operational components of IDSR. In 2009, FMOH restructured its health programs and designed a more comprehensive approach for public health surveillance and responses including recovery from public health events named Public Health Emergency Management (PHEM). IDSR and VPD surveillance were included in PHEM. Public Health Emergency Management (PHEM) was designed to be implemented directly by the Regions [2]. Amhara, one of the nine Regions and two City Administrations of Ethiopia, implements VPD surveillance within the framework of the IDSR strategy as part of PHEM. We describe the process and the result of Amhara Regional State peer exchange integrated disease surveillance review which was conducted from 2 to 10 July 2015. The main objective was to assess the performances of disease surveillance and routine immunization in Amhara Region with particular focus on VPD surveillance and the extent of its integration into PHEM and thereby share experiences among WHO officers and their government counterparts.

Methods

Study area: Amhara Region is one of the nine administrative regions in the country. It is the second most populated region in Ethiopia with a projected total population of 20,398,999 (from 2007 Census) as per the national Central Statics Authority (CSA) with a mean annual growth rate of 1.8% [3]. The Region shares boundaries with four Regional States of the country (Oromyia, Tigray, Afar and Benishangul-Gumuz) and The Sudan. The Region has 10 zones and three town administrations which are further divided into 167 woredas (similar to districts) which further comprise a total of about 3,431 kebeles (sub-districts), of which 318 are urban.

Study design: we conducted a cross-sectional study between 2-10 July 2015 in South Gondar, North Gondar, West Gojjam, South Wollo zones and two town administrations (Bahirdar and Dessie).

Sampling: five zones and two town administrations were purposively sampled and visited for the review based on recent surveillance performances and risk of wild or vaccine derived polio virus importations .We included those areas owing to the sub-optimal AFP surveillance performances during the two years prior to the review and zone bordering Sudan with history of imported circulation of wild polio virus in the past. Zone and woreda health offices, health facilities, and a holy water site were selected for review. Three to five woreda health offices and two to three health facilities in each of the woredas were included for the review in most of the areas. One holy water site was also visited. We tried to include both good and poor performing woredas in the selected zones. Health facility selection considered representation of all types of facilities in the level of care and geography (urban-rural).

Measurements/variables: the following variables were considered for both health offices and health facilities: availability of focal persons and their training status in the last two years, terms of reference for surveillance and availability of formats and guidelines, supervisory support from higher levels, and documentation status of cases and outbreaks. The following variables were considered for woreda and zonal health offices: availability of surveillance work plan, written supervision plan, supervisory checklist that adequately addresses surveillance, records for active surveillance visits, review meetings on surveillance, availability of coordinating committees and rapid response teams, availability of line lists of reported AFP, measles and neonatal tetanus cases, and monitoring of selected AFP and measles surveillance indicators. Prioritization of sites and written schedule for active surveillance were assessed for woredas and town administrations only. Clinician sensitization during last 6 months and availability of standard case definitions or reminders were variables considered for only health facilities.

Data collection: the primary tool for data collection was a structured questionnaire adapted from the standard WHO - AFRO tool for external surveillance review. The tool consisted of two sets of questions: the first set can only be administered to zonal and woreda health offices and the second set only apply to health facilities. Generally, the questionnaire was designed to assess the organization of surveillance at each level, active surveillance system, case-based surveillance performance and documentations [4]. The tool also assessed PHEM implementation and its monitoring, outbreak detection, response and documentation, and the effects of the polio eradication initiative (PEI) resources on general surveillance and other programs, and key aspects of immunization. The review teams consisted of six WHO surveillance officers and six government surveillance counterparts who received orientations on the data collection tools and procedures. One WHO surveillance officer and a government counterpart who is from the zone to be reviewed, consists of one review team and thus, expected to review all the selected sites in one zone. Each WHO surveillance officer was assigned to a different zone to independently assess his peer's zone and also share experiences of surveillance in the zone. The tool was administered through interviews of surveillance focal persons or their subordinates, heads of health offices, health facilities and holy water site. The team also conducted reviews of surveillance related documents (e.g., meeting minutes, surveillance plans, supervisory checklists and active surveillance sites prioritization documents) at the various levels. Observations of key service delivery practices, and discussions with heads and senior members of the visited sites were made to get their general views of surveillance system and their recommendations for further strengthening of WHO's support.

Data analysis: primary and secondary data were entered, cleaned, and analyzed in MicrosoftTM Excel 2010. Proportions were calculated for selected variables and key indicators.

Results

Peer WHO Medical Surveillance Officers and regional and zonal PHEM officers reviewed a total of 82 reporting units consisting of five zones, two town administrations, 21 woredas, and 54 health facilities. One holy water was visited but excluded from the analyses because of incomplete information.

Organization status of surveillance

Written surveillance work plan was available for 26 (93%) of the 28 zonal and woreda health offices reviewed. There was a written supervision plan and supervisory checklist that covers surveillance in 23 (82%) and 26(93%) of health offices visited, respectively. Of the reviewed offices and health facilities, 71 (87%) had a designated surveillance focal person. About three-fourth (76%) of these surveillance focal persons had a refresher training in the last two years. Only 36(44%) of the offices and health facilities have written terms of reference for surveillance. Out of the reviewed health offices and facilities, 71 (87%) have operational surveillance guidelines. Standard case definitions on AFP, measles and NNT were available and posted in outpatient departments of 50 (93%) of the 54 health facilities visited (Table 1).

Surveillance network and active surveillance sites

Availability of prioritization of reporting sites was assessed in 21 woreda and two town administration levels and it was found that only 17 (81%) of them had potential reporting sites prioritized in to high, medium and low during the last one year. Private health facilities, holy water sites and traditional practitioners included in the prioritization of surveillance units by 21 (70%) of woreda and town health offices visited. Only nine (39%) of woredas and town administrations have written schedule for visiting priority reporting sites. Only four (17%) of woredas and town administration health offices have made regular active surveillance visits based on their plan during the last 6 months. There was a written

evidence of regular active case search within health facilities (e.g. in the form of weekly register review and signature by facility focal person) in more than two thirds (70%) of health facilities visited. Almost all (96%) of 23 woreda and town administration health offices had made one or more independent active surveillance visits to reporting sites during the six months prior to the visit. But, only 15 (65%) had documented records (e.g. filled management tool or integrated checklist) for the active case search visits to these reporting sites. Both health offices and health facilities were inquired if a supervisor from higher level visited them for surveillance, and it was found that 75 (91%) of the sites were visited during the past 6 months. The supervisory visit was followed by written feedback in 58 (78%) of supervised sites. About two-thirds (63%) of visited health facilities have received clinician sensitizations on surveillance during six months prior to the assessment. Surveillance review and/or monitoring meetings mostly integrated with review of other health programs were conducted in all of the 28 health offices and town administrations during the past 12 month. Of the health offices and health facilities with laboratory services, 55 (72%) of them had laboratory staff actively involved in surveillance activities. Almost all (96%) of health offices have coordinating committees for surveillance activities either in the form of health emergency taskforce or rapid response team (Table 2).

Table 1: organization of disease surveillance in Amhara Region, July 2015

Level/Variables	Number	Yes
Woreda and zonal health offices only (n=28)		
Availability of surveillance work plan	28	26(93%)
Availability of written supervision plan that covers surveillance	28	23(82%)
Availability of supervisory checklist that covers surveillance	28	26(93%)
Health offices and health facilities (n=82)		
Availability surveillance focal person	82	71(87%)
Focal persons received refresher training last 2 years	71	54(76%)
Availability of surveillance terms of reference	82	36(44%)
Availability of surveillance guide lines	82	71(87%)
Health facilities only (n=54)		
Availability of standard case definitions	54	50 (93%)

Table 2: surveillance network and active surveillance sites in Amhara Region, July 2015

Variables	Number	Yes
Have reporting facilities been prioritized into high, medium and low priority	21	17(81%)
Are there any other key community informants included in active surveillance	82	35(43%)
Knowledge of health workers in case definition of priority diseases	82	78(95%)
Prioritization of reporting units updated	30	16 (53%)
Are private health facilities included in active surveillance activities	30	21(70%)
Has a supervisor visited this site for surveillance activities in the last six months?	82	75(91%)
Are there any supervisory reports/feedbacks on surveillance available?	74	58(78%)
Are laboratories involved in surveillance activities (e.g., as member of RRT, collect and process samples, assist weekly report compilation) at this level?	79	53(67%)
Are there any coordinating structures for surveillance (PHEM/emergency task force?)	81	62(77%)
Was surveillance monitoring/review meeting conducted in the last 12 months?	81	72(89%)

Case based surveillance

Three years (2012-2014) trend analyses of AFP detection rates for the zones reviewed showed that Awi and Bahir Dar had non-polio AFP rates below 2 per 100,000 under-15 years of age population for two of the three years reviewed. Detection was also low (1.2/100,000) in 2014 for South Gondar. Stool adequacy rate was below the target 80% during two of the three years in both Awi and West Gojjam zones (Figure 1, Figure 2). Majority ,75 (91%) ,of the health workers interviewed in all of the 82 sites have knowledge of standard case definitions and case investigation procedures including sample collection for AFP and measles cases (Table 3). Of the 71 sites that have reported at least one AFP case during the last three years, only 41 (58%) of them had documented copies of those reported cases. Of the 77 sites that reported at least one measles case, only 47 (61%) have copies of case investigation forms for the reported cases during the last three years. Sixty-two (76%) sites said to have reported one or more neonatal tetanus cases but only 16 (26%) of them had copies of the reported cases during the three year period. AFP and measles surveillance indicators were regularly calculated and monitored in 12 (43%) and 13 (46%) of health offices, respectively. Readiness for AFP and measles case investigations was also reviewed. More than two-thirds (68%) and about a third (36%) of the 76 offices and health facilities other than health posts have blank AFP investigation form and standard stool collection cup, respectively. Blank measles case investigation forms were available in only 45 (59%) of similar sites reviewed (Table 3).

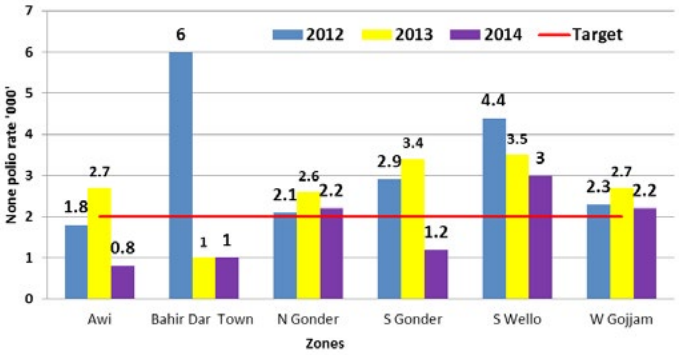

Figure 1
distribution of the non- polio AFP rate by Zone, Amhara Region, Ethiopia, 2012-2014

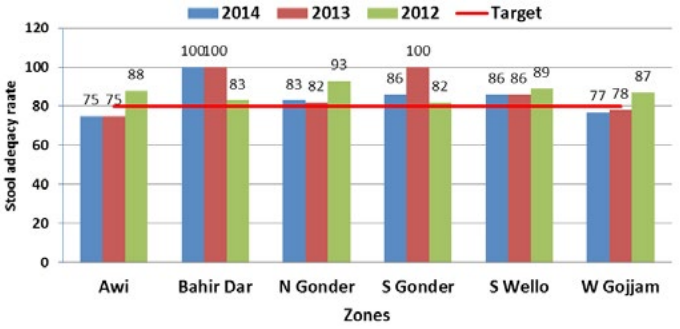

Figure 2
distribution of stool adequacy rate by zone, 2012 -2014 Amhara region, Ethiopia

Table 3: status of key activities of case-based AFP, measles and neonatal tetanus surveillance, Amhara, Jul 2015

	Number	Yes	%
Knows case definitions and sample collection procedure	82	75	91
Have AFP Case file	71	41	58
Have measles case file	77	47	61
Have neonatal tetanus case file	62	16	26
AFP surveillance indicators monitored	28	12	43
Measles surveillance indicators monitored	28	13	46
Have blank AFP report form	76	52	68
Have standard stool cup?	76	27	36
Have blank measles report form	76	45	59

Public Health Emergency Management Performances

PHEM activities are being implemented at all, 82 (100%), sites reviewed. Of all sites visited, 64(78%) have integrated case definitions of IDSR priority diseases. The national PHEM guidelines were available in 69 (84%) of the sites. A line graph was available and used for trend analysis in 55 (67%) of the 82 sites (Table 4). Of the 66 suspected diseases outbreaks reported from January to June 2015, only 45 (68%) were investigated and 23 (51%) of these investigations were done properly as per national guidelines. The proportion of laboratory confirmation of outbreaks (all of them measles) was 47 (71%) and there was proper response in 33 (50%) of the 66 reported outbreaks (Table 4).

Routine immunization

A designated Expanded Program of Immunization (EPI) focal person was available in 78 (95%) of sites and there was a trained cold chain technician in 37(48%). EPI monitoring tools (i.e., tally sheets and reporting formats) were available in 93% and EPI coverage performance monitored on a monthly basis in 77 (94%) of sites. There had been vaccine stock out in the 3 months before assessment in 28 (34%) of sites (Table 5).

Table 4: Public Health Emergency Management (PHEM) performance status, Amhara Region, Jul 2015

Key PHEM issue	Number	Yes	%
PHEM implementation started	82	82	100
Availability of National PHEM guideline	82	69	84
Availability of PHEM report format	82	78	95
IDSR diseases' definitions posted?	82	64	78
PHEM trained health worker available?	82	69	84
Line graph being used for trend monitoring?	82	55	67
Rumor log book used (health centers, health offices)?	71	52	73
No. of investigated outbreaks	66	45	68
No. properly investigated	45	23	51
No. of lab confirmed outbreaks	66	47	71
No. of outbreaks with proper response	66	33	50
Polio resources supported other programs?	28	28	100

Table 5: Assessments result of routine immunization performance Amhara Region, July 2015

Variable	Number	Yes
Designated EPI focal person available	82	78 (95%)
EPI micro plan available	82	78 (95%)
Vaccine stock out the last three month	82	28 (34%)
Availability of trained cold chain technician	77	37 (48%)
Cold storage space adequate for this level?	80	71 (89%)
Availability EPI monitoring tools	55	51 (93%)
EPI coverage performance monitored monthly bases	82	77 (94%)

Discussion

This study addresses an important peer exchange surveillance and immunization review in selected zones and woredas of Amhara regional state. The main finding from this evaluation was that there were still some challenges to the functioning of the disease surveillance and immunization systems in some of the visited woredas [5-7]

In the majority of reviewed woredas and health facilities, we found that 71 (87%) visited sites have designated surveillance focal persons. However, less than half 36 (44%) of the health offices and health facilities have clearly written and communicated surveillance terms of reference and standard operating procedures for their focal persons. Though not well-structured and not detailed with measurable indicators, almost all, 26 (93%), of the health offices reviewed have written surveillance work-plans, mostly as a section of annual integrated health plan.

Though officers were aware of the number, type and location of their reporting sites, not all surveillance focal persons have exhaustively listed reporting sites organized into high, medium, and low priorities. Conducting active case search by surveillance focal persons is one of the major activities for diseases targeted for eradication and elimination but this activity hardily seen in the reviewed sites. Woreda surveillance focal persons were key persons to ensuring of active surveillance in the reporting sites. Except irregular integrated supportive supervisions, these personnel were not performing independent active case search on regular basis due to financial limitations and multiple responsibilities they had. The results of surveillance performance analysis were not being used at all levels to stimulate activities to improve surveillance performance [8]. All levels knew the correct case definitions of AFP, measles, and to a lesser extent neonatal tetanus. The respondents at all levels demonstrated good knowledge of correct procedures for investigating AFP and measles cases. However gaps in knowledge of case definitions, national procedures for outbreak investigation and response do exist especially at health facilities. Except in few woredas, satisfactory mechanisms had been put in place to ensure case investigation forms and stool kits are available for investigation of AFP cases [9]. Documentation of the activities carried out including case files of reported cases of reportable diseases were very low and also lacking completeness.

We have found that there was measles and other priority diseases outbreaks in the visited areas but not all outbreaks were laboratory confirmed. The involvement of laboratories in surveillance activities (e.g., as member of rapid response team, collect and process samples, assist weekly report compilation) at all levels is very limited (8). The biggest concern we found from our review was that not all outbreaks specifically measles were properly investigated, lab confirmed and appropriately responded [10]. The major reason given was that there was no adequate vaccine stock for outbreak response immunization. Almost all immunization program implementing sites were found to have relatively better system performances in terms of planning, implementing and monitoring. However, high rate of vaccine stock outs and insufficient numbers of cold chain technicians are the major weaknesses for proper functioning of the program.

Finally, we found that polio related resources were used to strengthen other health programs particularly through integrated trainings, review meetings and supervisions, technical supports from polio funded WHO staff, and budgetary supports for other PHEM and routine immunization activities,

Limitations of the study: the main limitations include the selection of poor performing zones, inclusion of small number of woredas and health facilities due to financial and time constraint. Thus, the current findings cannot be generalized for the whole region. Despite these limitations, however, the study revealed challenges and successes of disease surveillance in the study areas with viable recommendations. Moreover, experiences shared among World Health Organization surveillance officers and their government counter parts. This exercise enabled WHO medical surveillance officers as well as the government surveillance focal person to independently identify strength and weakness of the system.

Conclusion

In conclusion, disease surveillance system is better organized, planned, implemented and monitored at all levels of Amhara region. However, there are major gaps in following the nationally adopted standards and guidelines both in routine surveillance and outbreak managements. Immunization program is constrained by high rates of vaccine stock outs and inadequate numbers of cold chain technicians. Furthermore, particular gaps exist in Awi, Bahir Dar Town and South Gondar Zones of the region. Hence, woreda and health facility focal persons should properly formulate operational plans for strengthening active case search with realistic prioritization of reporting sites to be visited; the planned schedules should be strictly adhered to. The regional or zonal or Woreda level should analyze data and closely monitor surveillance performance indicators, properly investigate and respond to outbreaks. Overall surveillance documentations should be improved. A system should be in place to ensure sustainable supply of vaccines for the region.

What is known about this topic

- In 1998 the World Health Organization Regional office for Africa (WHO-AFRO), following the resolution of the 48th assembly, started promoting Integrated;
- Disease Surveillance and Response (IDSR) for all Members States to adopt as the main strategy to strengthen national disease surveillance systems;
- Ethiopia as a Member State adopted the IDSR strategy, which is district centered and outcome-oriented.

What this study adds

- It builds the capacity of zonal and woreda (district) Government focal person who participated in the assessment;
- It will also be an input for surveillance planning for the study areas.

Competing interests

The authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

Gebre Asmamaw was responsible for the conception of the problem, design, collection, analysis and interpretation of data and drafting the

final article. All the authors had oversight of all the stages of the research and critically reviewed the final draft for academic content, read and approved the final manuscript. All authors have read and approved the final version of the manuscript.

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References

1. World Health Organization and Centers for Disease Control and Prevention. Technical guidelines for integrated disease surveillance and response in the African Region [Internet]. Geneva World Health Organ. 2010;(July):1-398.
2. Federal Democratic Republic of Ethiopia. Public Health Emergency Management. Guidelines for Ethiopians. 2012: 1-140.
3. Federal Democratic Republic of Ethiopia Population Census Commission. Summary and Statistical Report of the 2007 population and housing census. 2008 (December):1-113.
4. World Health Organization. Protocol for the Assessment of National Communicable Disease Surveillance and Response Systems. Who/Cds/Csr/Isr. 2001; 2:69-122.
5. Phalkey RK, Shukla S, Shardul S, Ashtekar N, Valsa S, Awate P et al. Assessment of the core and support functions of the Integrated Disease Surveillance system in Maharashtra , India. BMC Public Health. 2013 Jun 13; 13:5752013.
6. United States General Accounting Office. Challenges in Improving Infectious Disease Surveillance Systems. 2001;(August).
7. Lukwago L, Nanyunja M, Ndayimirije N, Wamala J, Malimbo M, Mbabazi W et al. The implementation of integrated disease surveillance and response in uganda: a review of progress and challenges between 2001 and 200 Health Policy Plan. 2013; 28(1):30-40.
8. Weber IB. Evaluation of the Notifiable Disease Surveillance System in Gauteng Province, South Africa. Community Health Health Sci Fac. 2007;MsC(January):106-106.
9. Khuzwayo LS, Kuonza LR, Ngcobo NJ. Evaluating the acute flaccid paralysis surveillance system in South Africa, 2005-2009--an analysis of secondary data. Pan Afr Med J. 2013;14:86-86.
10. Begashaw B, Tesfaye T. Assessment of integrated disease surveillance and response implementation in special health facilities of Dawuro Zone. J Anesthesiol. 2016; 4(311):11-5. PubMed | Google Scholar

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Research

Assessment of source of information for polio supplementary immunization activities in 2014 and 2015, Somali, Ethiopia

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Abstract

Introduction: communication is key for the successful implementation of polio vaccination campaigns. The purpose of this study is to review and analyse the sources of information utilized by caregivers during polio supplementary immunization activities (SIAs) in Somali, Ethiopia in 2014 and 2015.
Methods: data on sources of information about the polio campaign were collected post campaign from caregivers by trained data collectors as part of house to house independent monitoring. The sources of information analysed in this paper include town criers (via megaphones), health workers, religious leaders, kebele leaders (Kebele is the lowest administrative structure in Ethiopia), radio, television, text message and others. The repetition of these sources of information was analysed across years and zones for trends. Polio vaccination campaign coverage was also reviewed by year and zones within the Somali region in parallel with the major sources of information used in the respective year and zones. 57,745 responses were used for this analysis but the responses were received from < or = 57,745 individuals since some of them may provide more than one response. Moreover, because sampling of households is conducted independently during each round of independent monitoring, the same household may have been included more than once in our analysis. The methodology used for independent monitoring does not allow for the calculation of response rates. Monitors go from house to house until information from 20 households is received.
Results: from the total 57,745 responses reviewed, over 37% of respondents reported that town criers were their source for information about the 2014 and 2015 polio SIAs. Zonal trends in using town criers as a major source of information in both study years remained consistent except in two zones. 87.5% of zones that reported at least 90% coverage during both study years had utilized town criers as a major source of information while the rest (12.5%) used health workers.
Conclusion: we found that town criers were consistently the major source of information about the polio campaigns for Somali region parents and caregivers during polio immunization days held in 2014 and 2015. Health workers and kebele leaders were also important sources of information about the polio campaign for parents.

Introduction

Polio is a highly contagious and potentially fatal infectious disease that can lead to paralysis [1-3]. There is no cure, but there are safe and effective vaccines. The eradication of polio is a top global health priority [4]. The strategy to eradicate polio is therefore based on preventing infection by immunizing every child until transmission stops and the world is polio free [5]. The polio eradication effort demands a communication approach that addresses the specific context of the country that enables the communities to be fully informed and actively participate in vaccination activities. It is also essential that the communication strategies are grounded in research [6].

The last indigenous case of wild poliovirus (WPV) in Ethiopia was confirmed in 2001, however, thereafter, several importations were experienced from neighboring infected countries. Ethiopia had been polio free for four years until August 2013 when a case of WPV was imported into the Somali region of Ethiopia from Puntland, Somalia. An additional 9 outbreak-associated cases were identified with the last case having onset of paralysis in January 2014. All cases occurred within the Doolo Zone of the Somali region making this area vulnerable for further WPV transmission. Supplementary immunization activities (SIAs), mass vaccination campaigns that aim to administer additional doses of oral poliovirus vaccine (OPV), are a key strategy of the Global Polio Eradication Initiative (GPEI). SIAs and routine immunization strengthening activities were implemented in Somali Region and other high risk areas of the country to increase population immunity against polio [7,8]. Somali Region has a challenging geographic terrain with rural hard to reach areas, pastoralist communities and also an influx of refugees from Somalia. As part of outbreak response, Ethiopia implemented four National Immunization Days (NIDs) and 12 Subnational Immunization Days (SNIDs) between June, 2013 and September, 2015.

The Advisory Committee on Poliomyelitis Eradication (ACPE) recommended the implementation of independent monitoring of SIAs in all infected countries in November 2009 to rectify the problem of delayed and poor quality of SIA data provided by many countries as well as improve the credibility of the program [5,7-9]. Independent monitoring of SIAs provide an objective measure of SIA quality that can be used to guide improvements to reach more children by enabling corrective action both during SIAs and in planning for the next vaccination campaign. Immunization decision making is not a straightforward process for parents. Information influences parental decision making on whether they immunize their child or not [9, 10]. The most common primary reason for non-vaccination is lack of awareness and misconception. In this regard, communication helps to provide health information to raise awareness, create and sustain demand, and encourage acceptance of vaccination services [11]. Immunization messages can be communicated through media, health workers, town criers, drama, and songs by local musicians [12]. Utilizing a communication channel which reaches the largest proportion of the target population is crucial to achieve desired success [13,14]. Hence it is essential to review where parents receive their information about polio SIAs for strengthening its influence towards parental decision making. The parent's source of information regarding the polio campaign, which is the focus of our analysis, is one of the key SIA indicators to be assessed by independent monitoring teams. We conducted a review of the sources of information for polio SIAs in Somali Region to determine which approaches could be strengthened to improve demand and acceptance for polio vaccination.

Methods

The World Health Organization (WHO) in Ethiopia coordinated the implementation of independent monitoring for all SIAs. Independent monitors travelled from house to house as well as to locations out of the household during the last two days of the SIA as well as for 2 days after the SIA was completed.

Study Area: the Somali Region found in Eastern Ethiopia has nine zones (i.e., Siti, Fafan, Jarar, Nogob, Shabele, Korahey, Afder, Liben, and Doolo) which cover an area of 350,000 square kilometres. Based on the 2007 census conducted by the Central Statistical Agency of Ethiopia (CSA) and inferring its growth rate, the Somali region had an estimated population 5 million in 2013, the majority of whom (90%) are pastoralists and agropastoralists [15] (Figure 1).

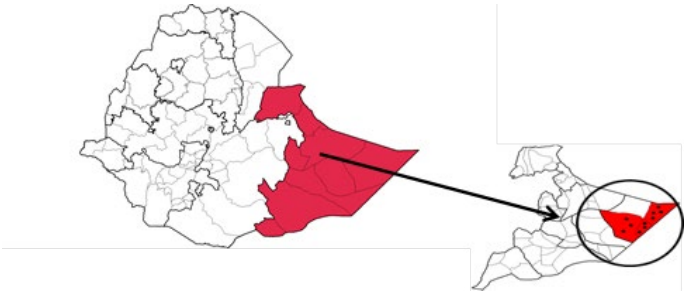

Figure 1
location of WPV1 Cases, Dollo Zone, Somali Region, Ethiopia, 2013-2014

Sampling: sampling for the independent monitoring assessment was according to the global independent monitoring guideline which requires monitors to assess 20 households per kebele [7].

Vaccination Coverage: children who receive polio vaccine during the campaign have their left little fingers marked with indelible markers which last for several weeks. During independent monitoring, data collectors physically check to see if the children have been finger marked as a way to assess campaign performance [7]. The scope of this paper as mentioned in the topic was to study the 2014 and 2015 SIAs rounds hence the first 5 rounds conducted in 2013 were not included in this study. During 2014-2015, 11 SIAs and the corresponding 11 rounds of independent monitoring were conducted.

Data Collection: independent monitors collect information from parents or caretakers in households where children under 5 years old reside using a standardized data collection instrument. Information is collected on number of children in the household eligible to receive vaccine, number of children that are vaccinated and if not, the reason why they were not vaccinated. In addition, information is collected on sources of information used by parents and caregivers to convince them to vaccinate their children with oral poliovirus vaccine (OPV) during the SIAs.

Data Analysis: we conducted a descriptive analysis with the pooled quantitative data from polio SIAs conducted in 2014 and 2015 (SIAs rounds 6-16) in Somali Region. We analysed data on the major parental sources of information about the polio SIAs and trends in these data across the nine zones of Somali Region. The theme of our analyses related to where the respondents accessed information including single or multiple sources of information, how vaccine coverage was influenced by the sources of information in urban and rural settings, and the contribution of health workers, religious leaders, and kebele leaders as sources of information in 2014 and 2015 SIAs.

Results

We analysed a total of 57,745 responses given in 2014 and 2015 by caretakers or parents of children targeted to receive OPV during polio SIAs in the Somali Region of Ethiopia. Respondents reported that the major source of information was megaphones used by town criers (37.6%), and the least common source of information were "other" sources (0.8%) (Table 1). Other major sources of information about Polio SIAs include health workers (24.3%) and kebele leaders (21.3%). When analysing the major sources of information across nine zones; out of the eight sources of information analysed in the data, town criers, kebele leaders, and health workers were the only three to be used repeatedly or at least once as a major source of information across the nine zones in 2014 and 2015.

Table 2 shows OPV vaccination coverage in 2014 and 2015 in relation to the major sources of information used in different zones in the Somali region. Two zones had coverage of at least 90% and the other seven zones achieved less than 90% in 2014. In 2015, six zones had coverage of at least 90% whereas three zones remained below 90%. Figure 2 shows the contribution of health workers, kebele leaders, and religious leaders in 2014 and 2015 SIA in mobilizing people to immunize their children.

Among the three groups health workers had the highest contribution (24.3%) to mobilizing parents and caretakers to vaccinate their children followed by kebele leaders (21.3%); religious leaders (3.6%) were reported to have the least contribution.

Figure 3 shows the proportion of sources of information categorized as "other" across nine zones in 2014 and 2015. The proportion of "other" sources of information as compared to the rest of the seven sources was consistently reported to have low contribution (≤ 1.9%) in all zones for both years except in Doolo zone that reported 6% in 2014.

Table 1: major sources of information used in 2014 and 2015 polio SIA in Somali Region, Ethiopia

Sources of information used	Number (%) of respondents mobilized by the source					
	2014	%	2015	%	Total	%
Radio	4334	11.4	889	4.5	5223	9
Television	569	1.5	830	4.2	1399	2.4
Health workers	8445	22.2	5597	28.4	14042	24.3
Religious leaders	1452	3.8	640	3.3	2092	3.6
Kebele leaders	7602	20	4693	23.9	12295	21.3
Town Crier (Megaphone)	14804	38.9	6894	35	21698	37.6
Text message	482	1.3	79	0.4	561	1
Other	377	1	58	0.3	435	0.8
Total	38,065		19680		57745	

Table 2: proportion of OPV vaccination coverage in 2014 and 2015 in relation to the major sources of information by zone, Somali Region, Ethiopia

Zone	Major source of information In 2014	% Coverage (Finger marked)	Major source of information In 2015	% Coverage (Finger marked)
Afder	Kebele leaders	88.6	Health workers	92.5
Doolo	Megaphone	86.6	Megaphone	95.6
Fafan	Megaphone	100	Megaphone	95.5
Jarar	Megaphone	88.4	Megaphone	87.3
Korahe	Megaphone	87.2	Megaphone	98.3
Liben	Megaphone	91.2	Megaphone	95.7
Nogob	Megaphone	86.7	Megaphone	96.2
Shabelle	Megaphone	89.8	Megaphone	86.9
Sitti	Megaphone	85.9	Health Workers	72.0

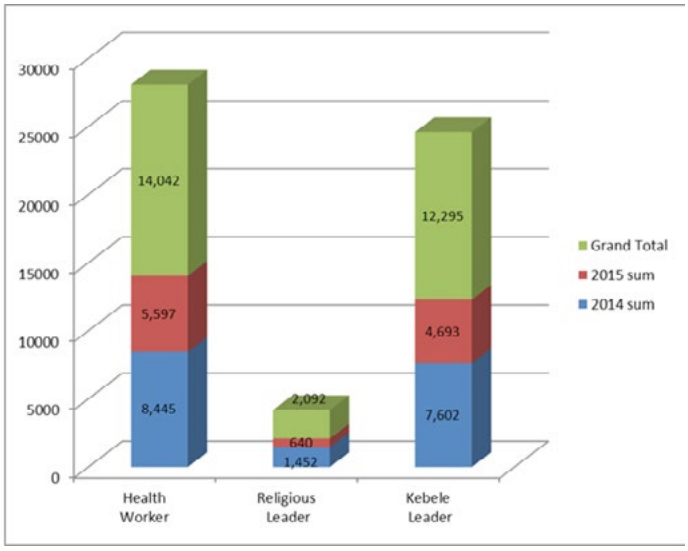

Figure 2:
contribution of health workers, religious leaders and kebele leaders as a source of information during Polio SIA, Somali Region, Ethiopia, 2014 and 2015

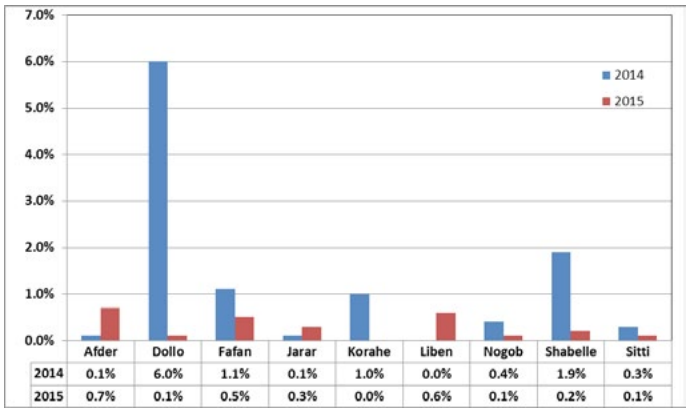

Figure 3
zonal trend in using "other" sources of information about polio campaigns across the nine zones of the Somali region, Ethiopia, 2014-2015

Discussion

We found information provided by town criers through megaphones to be the major source of information for parents and caregivers in deciding to vaccinate their children with OPV; accounting for more than one third of the sources of information in both years that we reviewed. Town criers were consistently the major source of information in 2014 in eight zones and also in 2015 in six zones in Somali Region.

The OPV coverage during SIAs in the nine zones of the Somali Region improved in 2015 as compared to 2014 SIAs. The effect of information provided through megaphones as source of information for parents and caregivers could have contributed to the improved coverage in 2015, among other efforts. Town criers are selected from community level and are provided with a simple, translated, standard message that they broadcast using a megaphone as they move within the community starting seven days prior to and during the SIA implementation. Population distribution differs from place to place hence averagely 1,000 people would be targeted per town criers. The message alerts caregivers and parents of the polio campaign, dates and benefit of vaccination. Similar to our study, Waisbord and Larson in 2015 observed that the use of megaphones accounted for increased vaccination coverage in peri-urban and rural areas in Mozambique [16].

In our study, media was not at significant source of information for parents and caregivers in their decision to vaccinate their children, which is different from what Porter et al. reported in 2000 that higher exposure to media messages correlated with higher vaccination coverage rates in Russia in Novgorod city, Voronezh [17]. This may be explained by the population's low access to media in the Somali region along with the limited use of media in this region.

In our review, health workers had a higher contribution as source of information for parents' decision to vaccinate their children as compared to kebele leaders and religious leaders. This performance was similar across the numerous zones in both study years. In Somali region, health workers educate the family on immunization while they conduct house to house vaccination. In their study in 2014, Shen Angela, Fields Rebecca and et al from USA Johns Hopkins University- Global Health; Bloomberg School of Public Health, Center for Communication Programs found that, caregivers consistently cite health workers as their most important source of information about vaccination campaigns [18]. We also compared the above three sources with the contribution of the mass media used in 2014 and 2015 SIA. The contribution of health workers and kebele leaders is relatively better than mass media in 2014 and 2015 SIAs. However, the contribution of religious leaders from this analysis was not significant and was lower than the contribution of radio. This was in contrast to findings from a study in Pakistan which indicated that most parents believe that religious leaders could play an important role in motivating

people to vaccinate their children [19]. Religious leaders' commitment may be challenged by the difficulty of accessing the population due to their scattered distribution and mobility. A study by UNICEF in the same intervention period in 2014 concluded that the dissemination of important messages and information is usually initiated and brokered by clan leaders and other community members of influence, including key cattle market traders and these were engaged to communicate polio related messages in Somali, Doolo Zone [20].

A study by Hill in London revealed that health workers who regularly visited individuals homes to promote health are credible sources of information that parents seek for their decision-making in immunization of their children (10). Political leaders and mass media have been shown to be trusted sources to address issues that impact the wellbeing of their community (11, 13). Our study had similar results for health workers and kebele leaders, which are the second and third contributors respectively, next to town criers, to impact parents to immunize their children but the religious leaders' and mass media results contrasts from the related studies mentioned above. We found that telephone text messaging was an infrequent source of information about the Polio SIAs. This could be due to low cell phone coverage in the region as well as the regularity of the implementation of this method of social mobilization.

Frieden reported that a community innovates based on actual existing practice to mobilize their people and implement public health programs and highlighted that such innovative practices need not be invented for each place but can be also adopted from other areas and be scaled up [21]. The finding from Doolo zone that reported a fairly high number of parents obtaining information from "other" sources may suggest a potential practice that could have been adapted to that area-specific context. A further qualitative study may be required to identify what other sources of information and social mobilization activities were being effectively used in Doolo zone.

Our analysis is subject to at least three limitations. First, we could not assess how appropriate the sources of information were to psychological or social factors or the different lifestyles of that community such as pastoralists, urban, and rural. Second, though the study sample was representative of all, the data reflects only where the IM team were able to reach and might not include very remote areas. Finally, we could not analyse the cost benefit of using these various sources of information because this information is not collected during independent monitoring. This limits our ability to recommend which sources of information would be most effective in urban, pastoralist and rural areas as well as their cost-effectiveness.

Conclusion

In summary, we learned that information provided by town criers through megaphones was cited by the majority of parents and caregivers as one of the means through which they learned about the need for OPV. Health workers and kebele leaders were also reported as major sources of information about polio campaigns but the contribution of religious leaders was found to be not significant. We recommend that zones that obtained at least 90% OPV coverage and also used information through megaphones, as well as those who reported kebele leaders and health workers as a major source of information should share their experience to other low performing zones. This might be helpful not only for polio SIAs but also for implementing other routine immunization activities. Further qualitative studies should be undertaken to determine the specific characteristics of "other" sources of information in Doolo zone in 2014 to help understand if this zone used any different locally adaptable source of information for parents and caregivers in their decision to vaccinate their children.

What is known about this topic

- The importance of communication before and during polio SIA to create demand for vaccination has been underlined on similar studies.

What this study adds

- We reviewed and analysed the source of information used during Polio SIA in Ethiopia, Somali region using independent monitoring data collected during 11SIAs to learn where parents receive their information about polio SIAs for strengthening its influence towards parental decision making;
- We conducted a review of the sources of information for polio SIAs in Somali Region to determine which approaches could be strengthened to improve demand and acceptance for polio vaccination;
- Accordingly, we found that the effect of information provided through megaphones as source of information for parents and caregivers contributed to the improved coverage of polio SIA in Somali in this study period among other efforts.

Competing interests

The authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

Selamawit Yilma: analysed data, drafted and edited, and coordinated overall writing up with co-authors. Dr Kathleen Gallagher: implemented collection of all independent monitoring data, read the draft and reviewed with constructive comment. Aron Kassahun Aregay: supervised collection of all independent monitoring data, data cleaning and analysis, read the draft and reviewed. Bashir Mohammed: read the draft and reviewed. Mohammed Adem Maalin: read the draft and reviewed. Hassen Abdisemed Hassen: read the draft and reviewed. Dr Yusuf Mohammed Ali: collected data, read the draft and reviewed. Dr Fiona Braka: provided leadership and oversight for all polio eradication activities, read the draft and reviewed with constructive comment. Dr Pierre M'pele Kilebou: provided leadership and oversight for all polio eradication activities, read the draft and reviewed with constructive comment. All authors have read and approved the final version of the manuscript.

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References

1. Heinsbroek E, Ruitenberg EJ. The global introduction of inactivated polio vaccine can circumvent the oral polio vaccine paradox. Vaccine. 2010; 28(22):3778-83.
2. Bonnet M-C, Dutta A. World wide experience with inactivated poliovirus vaccine. Vaccine [Internet]. 2008; 26(39):4978-83.
3. Dutta A. Epidemiology of poliomyelitis'Options and update. Vaccine. 2008;26(45):5767-73.
4. Patel M, Zipursky S, Orenstein W, Garon J, Zaffran M. Polio endgame: the global introduction of inactivated polio vaccine. Expert Rev Vaccines. 2015;14(5):749-62.
5. Cochi SL, Freeman A, Guirguis S, Jafari H, Aylward B. Global Polio Eradication Initiative: Lessons Learned and Legacy. J Infect Dis. 2014;210 (suppl 1):S540-6.
6. Unicef. Strategic Communication - for behaviour and social change in South Asia. 2005; 89. Accessed 9 Dec 2015.
7. Global Polio Eradication Initiative. Global Guidelines Independent Monitoring of Polio Supplementary Immunization Activities (SIA). 2014;1-23. Accessed 18 Sept 2015.

8. Independent Monitoring Board. Independent Monitoring Board of the Global polio eradication initiative. Indep Monit Board. 2014;(10th report):36. . Accessed 13 Nov 2015.
9. European Centre for Disease Prevention and Control. Individual decision-making and childhood vaccination. 2013;(October):7. Accessed 13 Nov 2015.
10. Hill MC, Cox CL. Influencing factors in MMR immunisation decision making. Br J Nurs Mark Allen Publ. 2013;22(15):893-8.
11. European Centre for Disease Prevention and Control. Communication on immunisation - Building trust. 2012. 46 p. 9 Dec 2015.
12. Jegede Ayodele Samuel. What Led to the Nigerian Boycott of the Polio Vaccination Campaign? Policy Forum. PLOS Medicine. 20 Mar 2007; 4:3.
13. Sheikh A, Iqbal B, Ehtamam A, Rahim M, Shaikh HA, Usmani HA. Reasons for non-vaccination in pediatric patients visiting tertiary care centers in a polio-prone country. Arch Public Health. 2013;71(1):1.
14. Services PI. Engaging Communities Nigeria's Campaign to Increase Acceptance of Routine and Polio Immunization Services. Accessed 25 Sept 2015.
15. Central Statistical Agency. Ethiopian Census 2007. 2007;1751. Accessed Dec 09 2015.
16. Waisbord S, Larson H. Why invest in communication for immunization: evidence and lessons learned. June 2005. Accessed 24 Sept 2015.
17. Porter RW, Steinglass R, Kaiser J, Olkhovsky P, Rasmuson M, Dzhatdoeva FA et al. Role of health communications in Russia's diphtheria immunization program. J Infect Dis. 2000;181(Suppl):S220-7.
18. Shen AK, Fields R, McQuestion M. The future of routine immunization in the developing world: challenges and opportunities. 2014 Dec 1; 2(4): 381-94.
19. Jan M, Khan MS, Raheel A, Iqbal S, Arif BA. Social marketing and awareness about routine immunization among the parents of children under 5 years coming to a private hospital in Khyber Pakhtunkhwa. ResearchGate. 2015; 1:1.
20. UNICEF Eastern and Southern Africa. GPEI Polio Outbreak in the Horn of Africa. Accessed 17 Dec 2015.
21. Frieden TR. Six components necessary for effective public health program implementation. Am J Public Health. 2014;104(1):17-22.

PanAfrican Medical Journal

Research

Assessment of reporting sites for acute flaccid paralysis surveillance in Ethiopia: implications for planning of active case search visits

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Abstract

Introduction: the World Health Organization acute flaccid paralysis (AFP) surveillance standards recommend documentation of the role of each potentially reporting site for evidence -based planning and tailoring support for active surveillance visits. This study assessed the contribution of various sites as source and quality of AFP cases reported over a five -year period in Ethiopia.
Methods: we conducted a retrospective analysis of AFP surveillance data collected from 2010-2014 in Ethiopia. Analyses were done using EPI-INFO version 7 for calculating frequencies and proportions, and testing possible associations between reporting sites and key dependent variables.
Results: of the 5,274 AFP cases reported, hospitals and health centers reported 4627 (88%) of the cases. Hospitals in Addis Ababa (53%) and health posts in Benishangul Gumuz (48%) regions have contributed majority of the cases reported. Only 3% of cases were reported by private clinics nationally. The stool adequacy rate for health posts (81%) was lower than the overall national rate of 88% .Cases from health posts are more likely to be reported after 14 days of onset of paralysis, and 62% less likely to be investigated within two days of notification(OR: 1.82, 95% CI OR : 1.41-2.36, p-value <0.0001). Greater proportion (2.4%) of cases reported from health posts were either compatible, VDPV or WPV compared to cases reported by health centers (1.14%) or hospitals (1.4%).
Conclusion: though majority of the cases were reported by health centers followed by hospitals ,our findings suggest that all potentially reporting sites should be exhaustively identified, prioritized and regularly supported for quality case detection, investigation and reporting.

Introduction

In 2015 Ethiopia had an estimated population of 90 million living in nine Regional States and two City Administrations [1,2].The pyramidal age structure of the population has remained predominately young with 44.9% under the age of 15 years [2,3]. To reach the vast and predominantly rural population, Ethiopia has designed a unique flagship Health Extension Program (HEP), which delivers cost-effective basic health services to all Ethiopians, mainly women and children [4]. This innovative approach is defined by the core principle of community ownership that empowers communities to manage health problems specific to their communities, thus enabling them to determine their own health [5,6]. To implement this program, about 15,618 health posts were constructed and are staffed by two health extension workers each, mainly female and recruited from the kebele (the lowest administrative structure). To enhance integrated service provision, health posts are linked with nearby health centers in the same administrative boundary [6]. According to the 2014 Service Provision Assessment Survey , a total of 3,292 health centers and 3,990 private clinics were functional during 2014 in addition to these health posts [7]. The survey also revealed that there were 202 functional hospitals; ongoing construction of an additional 123 hospitals was reported from seven regions [6].

The World Health Organization (WHO) recommends four inter-related strategies for global eradication of polio. These strategies include routine immunization, supplemental immunization activities (SIAs), surveillance, and targeted "mop-up" campaigns [8,9]. Of these four strategies, acute flaccid paralysis (AFP) surveillance underpins the entire polio eradication program by monitoring progress of the implementation in other strategies. Without surveillance, it would be impossible to pinpoint where and how wild poliovirus(WPV) is circulating, or to verify when the virus has been eradicated in the world [8,10]. Ethiopia started the polio eradication activities in 1996 following the Declaration on Polio Eradication in Africa in the same year and has been fully implementing the four strategies since then [11].

The first links in the surveillance chain are staff in all health facilities - from the smallest health post to the largest hospital. In areas with few formal health workers, some countries use community surveillance, where traditional healers, religious leaders or other community informants serve as a source of information on paralyzed children [10]. Apart from promptly reporting every AFP case, public health staff make regular visits to health facilities and other reporting sites to search for AFP cases which may have been overlooked or misdiagnosed [9,10,12]. For surveillance to detect all possible AFP cases, all these potential reporting sites should be exhaustively identified and adequately supported through regular visits. WHO surveillance standards for AFP recommend that the frequency of active case search visits should take into account, among other factors, the case detection and reporting experiences of the health facilities considered [11]. Limited WHO field staff along with a rapid expansion of health facilities in Ethiopia requires evidence-based planning and prioritization for sites to be regularly visited. There is a need to support surveillance site prioritization with systematically collected evidence. We conducted a study to assess the contribution of various sites as sources of AFP cases reported from 2010 to 2014 (a 5-year period) in Ethiopia. Various quality indicators of AFP surveillance were also analyzed by type of reporting site.

Methods

We conducted a retrospective analysis of AFP surveillance data collected from 2010 to 2014. We extracted the data from the national AFP surveillance dataset that is maintained by the Expanded Programme on Immunization (EPI) Team of the WHO Ethiopia Country Office. We included only cases for which a reporting site was known in the dataset. Those cases with missing information on reporting site, date of notification, vaccination status (on both case-based investigation form and upon validation by field officers), stool condition and final classification status were excluded from our analysis. We included the following variables in our analysis: socio-demographic characteristics of cases (primarily age and place of residence), reporting site, dates of case notification and investigations, validation status, date of onset of paralysis, oral polio vaccine (OPV) vaccination status, dates of sample collection and condition of stool sample on submission to National Polio Laboratory, laboratory results and final classification of cases. We used the following operational definitions to describe the data:

Reporting site: the site where the case was initially notified, investigated and stool sample collected by a health worker.

Good stool condition: a case of AFP that fulfills the following criteria as evaluated by the National Polio Laboratory: two stool samples of at least 8 grams each collected 24 hours apart, transported and received with a temperature not exceeding 8°c. Additionally, the sample should be properly labeled and arrive within 72 hours of sample collection [13,14].

Late case: an AFP case for which the second stool specimen is collected more than 14 days after of onset of paralysis.

Discarded AFP case (Non-polio case): 1) an AFP case where two adequate stool specimens are submitted for analysis but no poliovirus is isolated, or 2) an AFP case where the stool specimens are deemed inadequate but where there is no residual paralysis after 60 days of onset of symptoms [14].

Compatible polio case: 1) an AFP case that has inadequate stool specimens and has residual paralysis after 60 days of onset of paralysis, or 2) an AFP case that is lost to follow up or dies before detailed clinical examination is done after 60 days of symptom onset [14].

Variable categorization: the time between onset of paralysis and second stool collection dates were classified into ≤14 days and >14 days. Data on reporting site was classified into health post, health center, hospital, private health facility, and other sites such as holy water and traditional healer sites. OPV vaccination status was categorized into known (i.e., labeled with exact number of doses) or unknown upon initial investigation by the reporting sites. The stool condition upon submission was classified as good or bad as measured by the sample reception desk of the National Polio Laboratory. Lastly, final classification of reported cases was grouped into discarded, compatible, wild polio virus (WPV) or vaccine-derived polio virus (VDPV), and non-AFP.

Data analysis: analyses were done using Epi Info version 7 (US Centers for Disease Control and Prevention). Frequencies and proportions were calculated for the key variables and presented using tables, graphs and narrative. Odds ratio and chi-square for trend were calculated to determine possible associations between reporting sites and key variables such as onset of paralysis, notification and investigation, stool collection and condition, vaccination status, and final classification. The results were interpreted using 95% confidence intervals and p-value of 0.05.

Ethical Clearance: there were no human subjects involved in this study and there was no need to obtain written permission.

Results

Between 2010 -2014, 5,274 AFP cases were reported; the majority (65%) were reported by health centers. Hospitals and health centers jointly reported 88% of the cases. The contributions of health posts and private health facilities in AFP case reporting were low (9% and 3%, respectively) (Table 1). The overall stool adequacy rate for cases reported from all types of reporting sites during 2010-2014 was 88%. The rate was relatively lower for cases reported from health posts (81%) and hospitals (87%) compared to other sites. Cases reported by health posts were more likely to be investigated and reported after 14 days of paralysis than other sites (OR: 1.82, 95% CI: 1.41-2.36, p-value: <0.00001) (Table 2). Health centers reported more than two-thirds of the AFP cases in Amhara (71%) and the Southern Nations, Nationalities, and Peoples' Region (SNNPR) (71%). Hospitals reported more than half of the cases in Addis Ababa (53%). Health posts reported about half (48%) of the cases in Benishangul-Gumuz and one-fifth of the cases in Somali (22%) and Afar (19%). Private health facilities reported about 13% of the cases in Addis Ababa and 14% of the cases in Afar (Figure 1).

Table 1: distribution of AFP cases by reporting sites and year, Ethiopia, 2010-2014

	Reported Cases by Year					
Reporting site	**2010 n (%)**	**2011 n (%)**	**2012 n (%)**	**2013 n (%)**	**2014 n (%)**	**Total n(%)**
Health Center	647(61)	553(62)	709(66)	758(68.5)	755(67)	3422(65)
Hospital	251(24)	227(26)	256(24)	220(20)	251(22)	1205(23)
Health Post	101(10)	83(9.3)	77(7)	89(8)	103(9)	453(9)
Private health facilities	58(5.5)	23(2.6)	27(2)	34(3)	16(1)	158(3)
Others	4(0.4)	3(0.3)	12(1)	6(0.5)	11(1)	29(1)
Total	**1061(100)**	**889(100)**	**1081(100)**	**1107(100)**	**1136(100)**	**5274(100)**

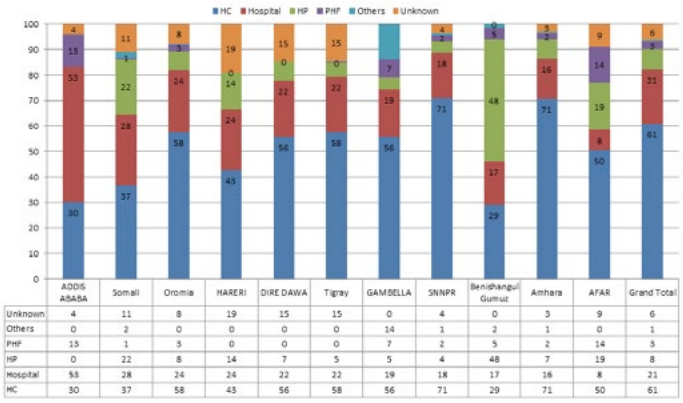

Figure 1
distribution (%) of AFP cases by type of reporting sites and region, Ethiopia, 2010-2014

Twenty-four percent of the reported 5,274 AFP cases were with unknown OPV vaccination status. AFP cases reported by hospitals were more likely to have unknown vaccination status than cases reported from health posts (OR: 1.92, 95% CI: 1.45-2.55, p-value: <0.001), while cases reported from health centers were more likely to have unknown vaccination status than those reported from health posts (OR: 1.71, 95% CI: 1.3-2.25, p-value: <0.001). About 13% of the reported cases had no history of OPV vaccination ("zero dose") (Table 3). Almost all (97%) of the reported AFP cases were investigated within 2 days of notification. Timeliness of investigation was lower in cases reported from health posts (93%) compared to those reported from other sites (97%). The odds of being investigated within two days of notification for cases reported by health posts were 62% lower than by other sites (OR: 0.38; 95%CI: 0.26-0.57 p-value <0.0001) (Table 4).

Of the 5,143 cases reported with the condition of stool recorded upon submission to the National Polio Laboratory, 86% were in good condition. Stool condition was below the target of 90% for all types of health facilities. Cases reported from private health facilities had lowest good stool condition (84%) compared to the other reporting sites. Stool samples collected from hospitals were more likely to be in good condition than those reported from health centers and this association was statistically significant (OR: 1.25, 95% CI: 1.02-1.53, p-value: 0.03) (Table 5). Of the 4,877 suspected AFP cases with known classification status, 4,759 (97.6%) were discarded as non-polio AFP cases. A total of 12 (0.2%) of these suspected cases were confirmed to be wild or vaccine derived poliovirus cases. One percent of the cases were classified as compatible polio cases. About 2.4%, 1.4% and 1.14% of cases reported from health posts, hospitals and health centers were either compatible, VDPV or WPV, respectively (Figure 2).

Table 2: stool adequacy rate (%) by reporting site, Ethiopia, 2010-2014

	Adequate samples		No. investigated after 14 days of paralysis onset		Odds Ratio (95% CI); p-value
Reporting site	**N**	**%**	**n**	**%**	
Health post	367	81	86	19	
Hospital	1048	87	157	13	OR: 1.82 (all other sites) (95% CI: 1.41-2.36) p-value: <0.00001
Health center	3046	89	376	11	
Private health facility	145	92	13	8	
Others	33	92	3	8	
Total	**4641**	**88**	**633**	**12**	

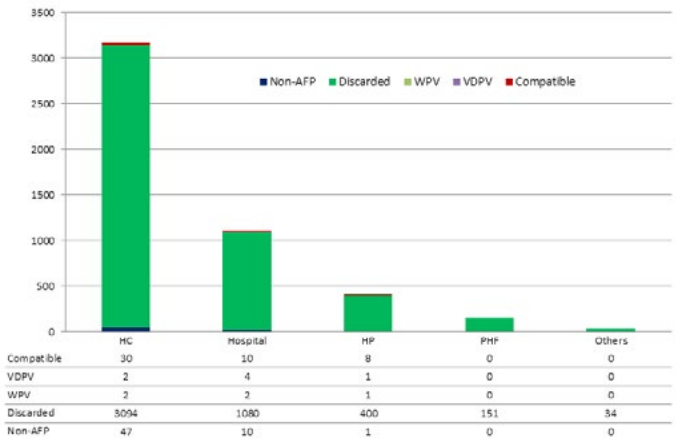

Figure 2
final classification of AFP cases by reporting sites, Ethiopia, 2010-2014

Table 3: distribution of unknown opv vaccination status from case investigation form of afp cases by reporting site, Ethiopia, 2010-2014

	Unknown		Known		Odds ratio (95% CI)
Reporting Site	**N**	**%**	**n**	**%**	
Health posts	71	16	382	84	1.00
Private health facilities	36	23	122	77	1.59 (1.01-2.49)
Health Center	825	24	2597	76	1.71(1.31-2.23)
Others	9	25	27	75	1.79(0.8-3.97)
Hospital	317	26	888	74	1.92(1.45-2.55)
Total	**1258**	**24**	**4016**	**76**	X^2 = 15.48658 p-value: 0.00008

Table 4: comparison of Timeliness of Investigation of Notified Cases by Reporting Site, Ethiopia, 2010-2014

	Investigated within 2 days	Investigated after 2 days	Total cases investigated	Odds Ratio (95% CI), p-value
Reporting Site	**n(%)**	**n(%)**	**N(%)**	
Health posts	420(93)	33(7)	453(100)	1.0
Health Center	3327(97)	95(3)	3422(100)	OR: 0.38 (Health post vs other sites) (95%CI: 0.26-0.57) p-value <0.0001
Hospital	1165(97)	40(3)	1205(100)	
Private health facilities	153(97)	5(3)	158(100)	
Others	35(97)	1(3)	36(100)	
Total	**5100(97)**	**174(3)**	**5274(100)**	

Table 5: stool condition by reporting site, Ethiopia, 2010-2014

	Good		Bad		Odds Ratio(95% CI))
Reporting Site	**n**	**%**	**N**	**%**	
Hospital	1038	88	139	12	1.00
Health Center	2851	86	478	14	0.799(0.65-0.98)
Health Post	378	85	66	15	0.761(0.56-1.1)
Private health facilities	132	84	25	16	0.707(0.44-1.12)
Others	34	94	2	6	2.276(0.57-19.8)
Total	**4433**	**86**	**710**	**14**	
Odds ratio for hospital versus health center: 1.25 (95% CI: 1.02-1.53, p-value: 0.03)					

Discussion

Our study found that a greater proportion of AFP cases were reported by health centers (65%) and hospitals (23%) compared to other sites. Only 9% of cases were reported by health posts. Though private health facilities reported a much larger proportion of cases in Addis Ababa (13%) and Afar (14%) compared to other regions, their contribution in AFP notification and investigation was low as they contributed only 3% of the reported cases. When case reporting by type of health facility was further analyzed for each region, most of the cases were reported by health centers. However, majority of cases in Addis Ababa (53%) and Benishangul-Gumuz (48%) were reported by hospitals and health posts,

respectively.

The contribution of health posts in AFP case notification was also much more significant in relatively underdeveloped and mostly pastoralist regions of the country, where health posts contributed about one-fifth of the AFP cases reported over the 5- year study period. This is a justification for need of scaling up and further strengthening of community-based surveillance in these regions. Low detection and notification of cases by private health facilities in Ethiopia might partly be due to unfamiliarity with the AFP case definition, lack of training or inadequate supervision by surveillance staff. Similar findings have been reported from other countries. A study conducted in Egypt showed that lack of knowledge on notification and investigation procedures played a role in low contribution of private facilities in AFP surveillance [15]. Though widespread in distribution throughout Ethiopia, contributions of holy water and other traditional sites were negligible (1%).This may be due to lack of proper documentation about notifying sites on the AFP case investigation form.

We also found that cases reported by health posts were more likely to be notified and investigated after 14 days of onset of paralysis. Case investigations are also delayed after being notified by health posts. Cases reported from health posts are less likely to be investigated after two days of notification. All these are against the standard recommendations for a sensitive AFP surveillance system [16]. Considering the increased accessibility of health posts to the community when compared with other types of health care facilities, this is an unexpected finding. The reasons for delay in notification and investigation at health post level might be due to irregular active case search visits by health extension workers, weak linkage with the community, delays in notification to health centers and woredas upon detecting suspected cases, and delay in case verification and sample collection and shipment by health workers at health centers after getting the call from health posts. A study in Luanda, Angola revealed similar findings that AFP cases pass through different levels of the system before they come to the attention of a more qualified health worker. This was considered as one cause of delay in actual case investigation and notification [17].

Another striking finding is that much higher proportion (2.4%) of cases reported from health posts were compatible polio, VPDV and WPV cases than those reported from other sites. The National Polio Expert Committee classifies cases as polio compatible when there is no adequate clinical, immunization and laboratory information to rule out with certainty the possibility of poliomyelitis [13]. These findings are contrary to the existing belief that increasing access to health services to communities can shorten the time lag between disease onset and care seeking for timely and appropriate interventions [18,19]. Lack of follow up or inadequate investigation of late cases by surveillance officers also increases the likelihood of compatible polio cases [10].

A positive finding for health posts is that cases reported by health posts were more likely to have a properly recorded OPV immunization status when compared to those cases notified by health centers and hospitals. This might be due the fact that the vaccination status of cases can be retrieved from their cards or immunization records kept at health posts, much nearer to the residence of cases. Moreover, most health extension workers, the primary vaccinators in the community, are more familiar with the children vaccination status. We also examined if there are obvious differences in quality of stool sample collection, transportation and condition on submission by type of reporting sites. Cases reported from health centers were more likely to be in bad condition than those reported from hospitals. The possible reason might be due to lack of direct public transport connections of these health centers with Addis Ababa, where the central polio laboratory is located, and the relatively longer distances to be travelled by sample transporters coming from health centers.

The primary limitation of our study is that the case investigation form, the primary data collection tool, was not designed to document each and every detail of case notifications. It lacks sections to clearly record contributions of traditional sites and other community level system in case notification. Thus, it is highly likely that the role of community in case notification is underestimated. The other limitation of the study is that the amount of active case search varies significantly by type of health facility and this could lead to varying degrees of underreporting. However, this limitation does not change the impression that each site providing traditional or conventional health care has a role in AFP surveillance.

Our findings suggest that regardless of the region, all sites have a potential to report AFP cases of varied quality and quantity. However, in situations where logistics, personnel and time are insufficient, sites with a good track record of detecting and reporting, and those silent for relatively long time should be prioritized and visited without undermining the contribution of other sites.

Conclusion

We conclude that, almost all cases are reported by health centers and hospitals in SNNPR, Amhara, Tigray and Oromia, the bigger regions of the country. Private health facilities in Addis Ababa and health posts in Benishangul-Gumuz, Somali and Afar have made significant contributions in AFP case notification and reporting. Cases reported by health posts are relatively lower quality. We recommend that all potentially reporting sites should be exhaustively identified, prioritized and feasible strategies designed to be regularly supported for quality case detection, investigation and reporting. Private health facilities in major towns of each region should also be targeted for surveillance strengthening. Furthermore, a review of the case investigation tools to determine the contribution of traditional sites in case reporting would increase the evidence for further strengthening of the surveillance system at community level.

What is known about this topic

- Health facilities are important sources of acute flaccid paralysis cases. Thus, epidemiologists should prioritize and make regular visits.

What this study adds

- Assessing the contribution of each health facility is critical for evidence based decision-making on subsequent planning of active case search visits;
- This issue is getting greatest attention in settings where health facilities are massively expanding while the number of health workers for visiting increasing numbers of health facilities for surveillance is still limited.

Competing interests

The authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

All authors have read and approved the final version of the manuscript.

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References

1. The Federal Government of Ethiopia. Proclamation of the Constitution of the Federal Democratic Republic of Ethiopia. Accessed on September 14, 2016.
2. Ababa A. Federal Democratic Republic of Ethiopia Central Statistical Agency Population Projection of Ethiopia for All Regions At Wereda

Level from 2014 - 2017. 2014;(August 2013).
3. Wulf M De. Population Pyramid of Ethiopia in 2015. 2015.
4. Mcpake B, Edoka I, Witter S, Taegtmeyer M, Dieleman M, Gama E et al. Bulletin of the World Health Organization Cost - effectiveness of community ¬ based practitioner programmes in Ethiopia , Indonesia and Kenya. 2016;1-11.
5. FMOH-Ethiopia. Health Sector Transformation Plan. (2015/16. 2015).
6. Moh. Health Sector Development Program IV: 2010/11 -2014/15. 2010.
7. Ephi, Fmoh II. Ethiopia Service Provision Assessment Plus (ESPA+). 2014. Accessed 6 June 2017.
8. Global Polio Eradication Initiative. Polio Eradication and Endgame Strategic Plan 2013–2018. Accessed on September 14, 2016.
9. CDC. Global Health - Polio - Who We Are: CDC and the Global Polio Eradication Initiative. 2013. Accessed on September 14, 2016.
10. Child Health Division India MOH. Field Guide. 2005.
11. EHNRI/FMOH. Guideline on Acute Flaccid Paralysis (AFP) Surveillance and Outbreak Management. 2013.
12. EPHI. Public Health Emergency Management. 2012.
13. WHO. WHO - recommended standards for surveillance of selected vaccine-preventable diseases. Bull World Heal Organ. 2003;03:1-51. Accessed on September 14, 2016.
14. Global Polio Eradication Initiative. Polio now. Accessed on September 14, 2016.
15. Testing clinical surveillance of acute flaccid paralysis in Egypt post-eradication of poliomyelitis - Abdel-Mannan - 2010 - Tropical Medicine & International Health - Wiley Online Library.
16. Abebe NA, Capozza KL, Des Jardins TR, Kulick DA, Rein AL, Schachter AA et al. Considerations for community-based mHealth initiatives: insights from three Beacon Communities. Journal of medical Internet research. 2013; 15(10): e221.
17. Macama A, Okeibunor J, Grando S, Djibaoui K, Yameogo RK, Morais A et al. Reasons and circumstances for the late notification of Acute Flaccid Paralysis (AFP) cases in health facilities in Luanda. Pan Afr Med. 2014;18:239.
18. Miller M, Barrett S, Henderson DA. Control and Eradication. In: Jamison DT, Breman JG, Measham AR, et al., editors. Disease Control Priorities in Developing Countries. 2nd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2006. Chapter 62. Available from: https://www.ncbi.nlm.nih.gov/books/NBK11763/ Co-published by Oxford University Press, New York. Accessed on September 14, 2016.
19. Okiror SO, Bisrat F, Lutukai M, Bhui R. Community-based surveillance on polio eradication in the Horn of Africa. African Health Monitor. 2015; 19.

Supplement article

PanAfrican Medical Journal

Research

Measles outbreak investigation in Guji zone of Oromia Region, Ethiopia

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Abstract

Introduction: despite the increase of immunization coverage (administrative) of measles in the country, there are widespread outbreaks of measles. In this respect, we investigated one of the outbreaks that occurred in hard to reach kebeles of Guji Zone, Oromia region, to identify the contributing factors that lead to the protracted outbreak of measles.
Methods: we used a cross-sectional study design to investigate a measles outbreak in Guji zone, Oromia region. Data entry and analysis was performed using EPI-Info version 7.1.0.6 and MS-Microsoft Excel.
Results: in three months' time a total of 1059 suspected cases and two deaths were reported from 9 woredas affected by a measles outbreak in Guji zone. The cumulative attack rate of 81/100,000 population and case fatality ratio of 0.2% was recorded. Of these, 821 (77.5%) cases were < 15 years of age, and 742 (70%) were zero doses of measles vaccine. Although, all age groups were affected under five years old were more affected 495 (48%) than any other age groups. In response to the outbreak, an outbreak response immunization was organized at the 11th week of the epidemic, when the epidemic curve started to decline. 6 months to14 years old were targeted for outbreak response immunization and the overall coverage was 97 % (range: 90-103%). Case management with vitamin A supplementation, active case search, and health education was some of the activities carried out to curb the outbreak.
Conclusion: we conclude that low routine immunization coverage in conjunction with low access to routine immunization in hard to reach areas, low community awareness in utilization of immunization service, inadequate cold chain management and delivery of a potent vaccine in hard to reach woredas/kebeles were likely contributed to the outbreak that's triggered a broad spread epidemic affecting mostly children without any vaccination. We also figured that the case-based surveillance lacks sensitivity and timely confirmation of the outbreak, which as a result outbreak response immunization were delayed. We recommend establishing reaching every child (REC) strategy in Guji zone with particular emphasis too hard reach areas to enhance the current immunization service, and furthermore to conduct data quality self-assessment or cluster coverage survey to verify the reported high vaccination coverage in some kebeles. We also recommend conducting the second opportunity as a form of supplemental immunization activities in 2-3 year interval or consider the national second dose introduction in the routine immunization system to improve population immunity. We further recommend that there is a need to boost the sensitivity of case-based surveillance system to be able to early detect, confirm and react to future epidemics.

Introduction

Despite the availability of safe and effective measles vaccine since 1963, measles still remains a public health concern. However, with the introduction of the measles accelerated control strategy and mortality reduction goal, the mortality has decreased in both developed and developing countries. In 2001, countries in the World Health Organization (WHO) African Region started implementing the regional measles mortality reduction goal to reduce the estimated number of measles deaths by half in 2005 compared to 1999 [1]. The measles mortality reduction strategies include the following three elements: 1) improving routine measles vaccination coverage; 2) providing a second opportunity for measles vaccination through supplemental immunization activities (SIAs); and 3) monitoring the impact of vaccination activities through case-based measles surveillance, and improving measles case management [1]. To this end, the assessment conducted in 2010 indicated that global mortality from measles has been reduced by 74% of the global estimate in 2000, and 85% reduction in the African region has been documented [2]. In 2002 Ethiopia adopted the African regional accelerated measles morbidity and mortality reduction goal to reduce measles mortality, including the pre-elimination goal which ended in 2012 [3]. Since the routine immunization started in 1980 measles vaccination is provided at 9 months of age for infants throughout the country. On top of this, measles catches up campaigns were conducted for all <15 years old in phase manner at the beginning of the accelerated control program, and in 2-3 years interval supplemental immunization activities was conducted. However, despite all these efforts, the estimated measles first dose (MCV1) coverage in Ethiopia was 56% in 2010 and 57% in 2011 and the percentage of woredas, which is the lowest administrative units reporting ≥80% MCV1 coverage was 45% in 2010 and 43% in 2011 [4]. As a result of the low population immunity and buildup of the susceptible population, widespread measles outbreaks were occurring in 2015 throughout the country, and the numbers of districts affected by measles epidemic were more than 280 as per the weekly measles report. The objective of this investigation is to assess the magnitude and identify the contributing factors for the measles outbreak in Guji and generate evidence for the prevention and control of future outbreaks.

Methods

Study Area: this investigation was conducted in Guji zone in the Oromia region, which is located in the southeastern part of Ethiopia. Oromia region is the most populous region in the country, with a population of 39 million as per the 2007 census, and a growth rate of 3.8% per annum. The Region has 20 zones characterized by varying ecologies, climates, and populations. The zones are divided into 246 woredas and, which is further divided into kebeles. Guji zone is administratively the zone is divided into 14 rural and two town administrations. The total population of the zone is estimated to be 1,787,760 according to the 2007 census and housing projection.

Study design: we conducted a cross-sectional study, including a review of the medical records and interviews.

Study subjects: all children affected by measles were subject of the study. A line list and a semi-structured questionnaire were used to obtain information on the risk factors associated with the outbreak. Demographic information was collected on patient characteristics, including date of onset, date of visit to health facilities, outcome, and vaccination status. Additional data were collected on cold chain management and patient management. We also conducted house-to-house and community active case searches for unreported cases of measles.

Laboratory methods: serum specimens were collected from five suspected cases and sent to the national measles laboratory for IgM test and a test done as per the global and national guidelines.

Data analysis: data were entered and analyzed using Epi-Info7 version 7.1.0.6 and Microsoft Excel. All data were cleaned for completeness before analysis. Attack rates, vaccination status, and case fatality rates were calculated and results were presented using graphs and tables.

Case definitions

Suspected measles outbreaks: defined as the occurrence of five suspected measles cases in one month in a defined geographic area such as a kebele, woreda or health facility catchment.

Confirmed measles outbreaks: defined presence of three or more laboratory-confirmed measles cases in a one-month time per kebele or woreda or health facility.

A suspected measles case: any person with generalized maculopapular rash and fever plus one of the following: a cough or coryza (a runny nose) or conjunctivitis (red eyes).

A laboratory confirmed cases: a suspected case, which has laboratory results, indicating infection (IgM positive or isolated for a measles virus).

Not eligible: children age < 9 months affected by measles outbreak or not eligible for vaccination.

Results

From January 8 to March 9, 2015, a total of 1059 suspected measles cases and 2 deaths (Case Fatality Rate=0.2%) were reported from nine Woredas in Guji zone. Of those, 5 (0.47%) were confirmed by laboratory investigation (IgM positive), while the rest were epidemiologically linked and clinically compatible cases. The median age was 36 months ranging from 3 to 360 months (interquartile range 24 to 72 months) and there were 515 (51%) females and 544 (49%) males (Table 1). Among the 1,059 cases, 698 (65.9%) were <5 years old (Table 1 and Figure 1). The age-specific attack rates vary and were 17/100,000 and 36/100,000 populations for the age group <1 year and 1-4 years respectively, while the overall attack rate was 81/100,000 population. In total nine woredas (9/16) and 118 kebeles (118/ 369) were affected, and the attack rate varies from woreda to woreda and ranged from 222 cases per 100,000 populations in Dama district to 11 cases per 100,000 in the Hamble Wamena woreda (Table 2).

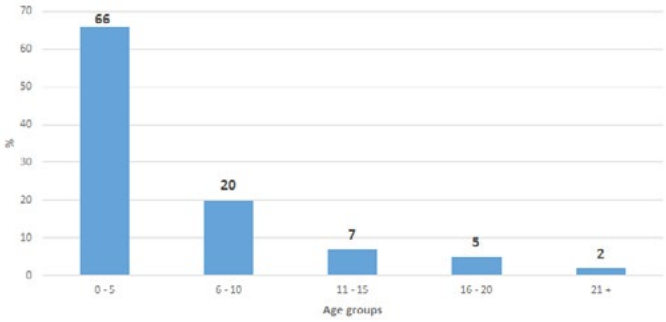

Figure 1
distribution of Measles Cases by age group, Guji zone, Ethiopia, June 2015 (n=1059)

The index case date onset was on January 8, 2015, and was reported from Braga district, Haru kebele of Guji zone, and seen at health facility level on January 12, 2015. The cases started to build up slowly with a fluctuating trend and reached a peak on February 20, 2015, which then started to decline shortly although it showed an inconsistent trend (Figure 2). Regardless of its remoteness and difficulties in providing immunization service, the review of immunization coverage for the last 6 years indicate an overall coverage of 93.5%, while it varied from woreda to woreda (ranged 70-112%). On the other hand of those affected children, 792 (75%) of them were with zero doses, while 163 (16%) of the cases had received only 1-2 doses of measles, and interestingly of those cases unvaccinated, 496(71%) were < 5 years old (Table 2, Figure 3).

The outbreak occurred in remote kebeles with many hours walk on foot from the main road which makes it difficult to provide routine immunization service. Despite, the difficulties an outbreak response immunization was conducted starting on March 15, 2015, targeting children from 6

Table 1: vaccination status of children affected by measles in Guji zone, Ethiopia (n=1059)									
Age	Sex			Vaccination status			specimen collected		Result (+ve)
	Male	Female	Total	Not vaccinated	Not eligible	Vaccinated (1+dose)	Yes	No	
0-5	329	369	698	495	79	123	1		1
6-10	42	33	216	184	0	29	2		2
11-15	34	14	75	63	0	5			
16-20	14	8	48	34	0	5			
21+	96	120	22	16	0	1	1		1
Total	**515**	**544**	**1059**	**792**	**79**	**163**	**5**		**5**

Table 2: administrative immunization coverage and measles attack rate, Guji zone

Name of woreda	2009	2010	2011	2012	2013	2014	Average Immunization coverage	Attack rate/100,000 population in affected woredas
Adola Rede	66	66	78	71	56	90	71.2	119
Adola Wayu	88.6	86.9	90	53	56	109	80.6	NA*
Anasora	65	71.1	113	74	95	134	92.0	124
Bore	63	60.8	63	79	71	129	77.6	61.9
Dama	89.1	66.6	104	91	89	115	92.5	222
Girja	65.5	97.8	123	61	99	86	88.7	19.3
Goro Dola	92.5	92.6	99	85	89	115	95.5	NA*
H/ Wamana	134.7	76.8	82	107	110	121	75	10.9
Kercha	87.1	73.8	63	104	79	110	86.2	49
Liban	98	75	85	84	87	93	87.0	NA*
Negele T	101.6	116.3	138	153	175	237	153.5	NA*
Odo Shakiso	112	71.9	105	63	88	121	93.5	106
Sababoru	123.6	117.2	100	81	100	108	105.0	NA*
Shakiso T	NA	NA	NA	NA	79	76	25.8	NA*
Uraga	93.1	81.9	99	97	91	95	92.8	85
Wedera	75.8	74	123	72	58	93	82.6	NA*
Zone	91	78.9	104	87	87	112	93.3	81.2
* None affected woredas								

months to14 years, Although, the disparity between woredas exist 97% administrative coverage was achieved, while it ranges from 90.3% to 103% (Figure 4).

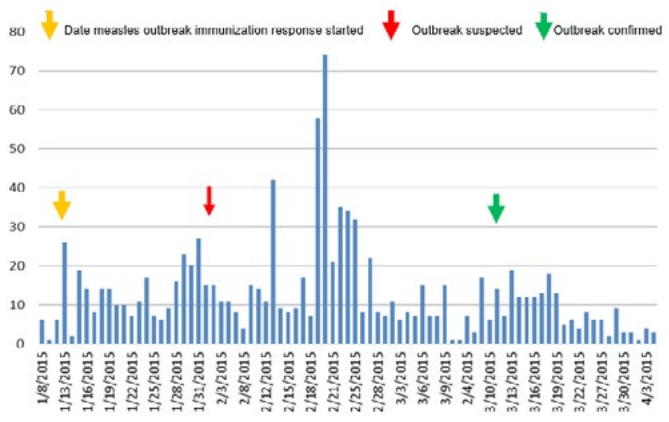

Figure 2
epi-curve of Measles cases by date of onset, Guji zone, Ethiopia, June 2015 (n=1059)

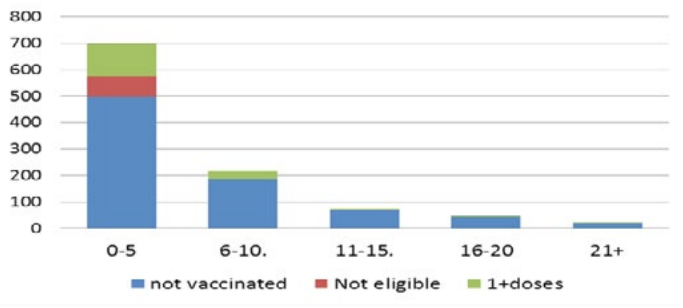

Figure 3
vaccination status of measles cases by age group Guji, 2015 Oromia Region (n=1059)

The nomadic nature of the population and hard to reach areas challenged the routine immunization delivery system and during an outbreak investigation, it was witnessed that health posts in outbreak affected areas suffered from a lack of constant delivery of potent vaccine and regular maintenance of cold chain equipment.

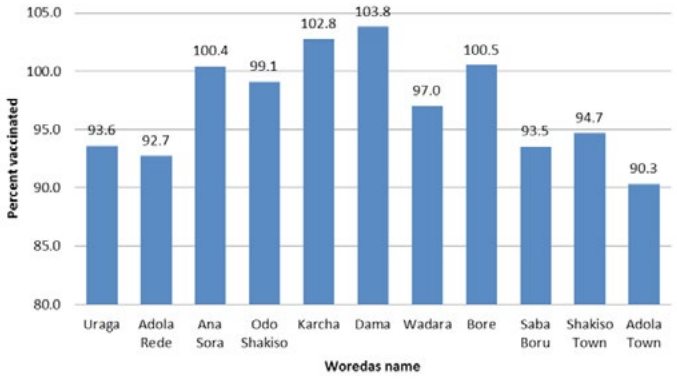

Figure 4
outbreak immunization response coverage by Woreda, Guji zone, Ethiopia

Discussion

Our outbreak investigation showed that more male children were affected than females, and also more <15 years of age were primarily affected by the outbreak. A high proportion of unvaccinated children (77%) were affected in this outbreak indicating the low level of population immunity despite high coverage reported in the zone. The zone like the rest of the country had conducted an initial catch-up campaign for those who are <15 years old and periodic SIAs for children <5 years old with an interval of 2-3 years. The outbreak affected all age groups, even older than 15 years, which may indicate the persistent low routine immunization coverage over several years and the accumulation of the susceptible population in the older age group that may have led to the current outbreak. Inadequate and poor cold chain management system coupled with hard to reach kebeles makes difficult to provide potent vaccine in routine immunization service likely also contributed to the outbreak. While the zone made some prominent progress in improving routine immunization, there is still pocket and hard to reach areas that are difficult to reach and provide routine immunization despite the introduction of routine immunization for over three decades. The number of unvaccinated children in our findings was higher than (75%) the studies reported from Marshall Islands (59%), and the study conducted in Rio de Janeiro, which was 7.2% in < 1 years old [5-7].

We found also a higher attack rate than the attack rate of measles outbreak recorded nationally, 4.1 per 100,000 population, in 2008 [8]. We also found the disparity in the attack rate among woredas. This may be due to delayed detection and confirmation of the epidemic, which leads to a delayed response to the epidemic. On the other hand, the higher attack rate may be due to the build-up of the susceptible population which may have contributed the spread of the disease faster than esxpected. The disparity of attack rate may be the reflection of routine immunization as the performance of woredas in regard to routine immunization is different between woredas. The response vaccination conducted at the time of the decline of Epi-curve may have had little or no impact on the overall epidemic control since many of the children may have been already exposed or contracted the infection and may have recovered from measles illness. The highest attack rate (219 cases per 100,000) was observed among children <1 year old, which is the reflection of weak routine immunization in the affected woredas, and the finding is similar to a study condcuted in S.Africa [9]. The attack rate in our finding is higher than the cumulative attack rate, reported(37/100000) in South Africa's and other studies conducted including Shimada district (41/100000) in Ethiopia [9,10]

Additionally, a relatively large proportion of cases <9 months were affected by the epidemic, which creates a concern as regard to the age at which vaccination should start. This may be due to contributing factors like malnutrition, and it may also be that children of this age group may have no maternal antibody at the very begging which may indicate a long standing problem with measles vaccination. The case fatality rate in this study was low (0.2%), while in general measles case fatality can reach from 3 - 5% in developing countries and may goes up to 10% in closed outbreaks [11] when it is compounded by malnutrition [12]. The lowest case fatality rate in this study may be due to the fact that death at the community level is not registered and this only includes health facility deaths. The study conducted in Simada district in Ethiopia indicated a higher CFR rate (13.4%), including the study done on hospital admitted cases in Zimbabwe, Kenya, and Niger [13-15]. However, our findings are similar with that of Sudan (0.9%) [16].

To prevent measles outbreaks or interrupt transmission and to enhance elimination of measles, 95% population immunity is needed. However, the administrative coverage of measles vaccination in the zone under review range from 78.9-112% for the last six years with great disparity between woredas, which indicates suboptimal population immunity to prevent an outbreak. The absence of functional fridge at health post level and hardship topography setup coupled with long travel distance to get the vaccine from the health center may have contributed to the potency of the vaccine, and as a result, it could be the contributing factors for low population immunity while high coverage reported in some woredas where the epidemic occurred.

The limitation of our study may be incompleteness of data and the inclusion of non-measles cases that doesn't fulfill the case definitions as line list were collected by health workers at a lower level. Additionally, death recorded only captures those deaths that occurred at health facility level, and community death is not reported.

Conclusion

We conclude that, almost all cases are reported by health centers and hospitals in SNNPR, Amhara, Tigray and Oromia, the bigger regions of the country. Private health facilities in Addis Ababa and health posts in Benishangul-Gumuz, Somali and Afar have made significant contributions in AFP case notification and reporting. Cases reported by health posts are relatively lower quality. We recommend that all potentially reporting sites should be exhaustively identified, prioritized and feasible strategies designed to be regularly supported for quality case detection, investigation and reporting. Private health facilities in major towns of each region should also be targeted for surveillance strengthening. Furthermore, a review of the case investigation tools to determine the contribution of traditional sites in case reporting would increase the evidence for further strengthening of the surveillance system at community level.

What is known about this topic

- Measles accounts for much of the vaccine-preventable disease burden in Ethiopia;
- Despite the increase in measles coverage, frequent outbreaks of measles continue to occur in Ethiopia;
- Measles outbreaks responded with immunization and surveillance activities to manage outbreaks at the local level in Ethiopia. Timely responses to outbreaks usually not meet in Ethiopia.

What this study adds

- The study provides valuable information on the measles outbreak in very hard to reach and pastoralist zone;
- The study provides also information on the impact of early immunization response to control outbreaks of measles;
- The study also indicates the need to have sensitive and strong surveillance to timely detect and respond to an outbreak of measles.

Competing interests

All authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

KB participated in the investigation and drafted the manuscript, AT critical reviewed, did the analysis and incorporated all comments, MG reviewed the manuscript and gave final approval for submitting for publication, IH and BB critically reviewed and gave final approval to the version to be published. All authors have read and approved the final version of the manuscript.

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References

1. Masresha BG, Fall A, Eshetu M, Sosler S, Alleman M, Goodson JL et al. Measles mortality reduction and pre-elimination in the African Region, 2001-2009. J Infect Dis. 2011 Jul 1;204(suppl 1):S198-204.
2. Simons E, Ferrari M, Fricks J, Wannemuehler K, Anand A, Burton A et al. Assessment of the 2010 global measles mortality reduction goal: results from a model of surveillance data. The Lancet. 2012;379(9832):2173-8.
3. Mitiku K, Bedada T, Masresha BG, Kegne W, Nafo-Traoré F, Tesfaye N et al. Progress in measles mortality reduction in Ethiopia, 2002-2009. J Infect Dis. 2011 Jul 1;204(suppl 1):S232-8.
4. CDC. Measles - Horn of Africa, 2010-2011. Accessed on September 24, 2016.
5. Yaméogo KR, Perry RT, Yaméogo A, Kambiré C, Kondé MK, Nshimirimana D et al. Migration as a risk factor for measles after a mass vaccination campaign, Burkina Faso, 2002. Int J Epidemiol. 2005;34(3):556-64.
6. Hyde TB, Dayan GH, Langidrik JR, Nandy R, Edwards R, Briand K et al. Measles outbreak in the Republic of the Marshall Islands, 2003. Int J Epidemiol. 2006 Apr 1;35(2):299-306.
7. de Oliveira SA, Soares WN, Dalston MO, de Almeida MT, Costa AJ. Clinical and epidemiological findings during a measles outbreak occurring in a population with a high vaccination coverage. Rev Soc Bras Med Trop. 1995 Dec;28(4):339-43.
8. EHNRI, Federal Democratic Republic Of Ethiopia. Guideline on measles surveillance and outbreak management. January 2012. Addis Ababa, Ethiopia.
9. Ntshoe GM, McAnerney JM, Archer BN, Smit SB, Harris BN, Tempia S et al. Measles Outbreak in South Africa: epidemiology of laboratory-confirmed measles cases and assessment of intervention, 2009-2011. PLOS ONE. 2013 Feb 20;8(2):e55682.
10. Aragaw M, Tilay T. Measles outbreak in Simada District, South Gondar Zone, Amhara Region, May - June 2009: Immediate need for strengthened routine and supplemental immunization activities (SIAs). Ethiop J Health Dev. 2012;26(2):115-8.
11. Mandomando I, Naniche D, Pasetti MF, Cuberos L, Sanz S, Vallès X et al. Assessment of the epidemiology and burden of measles in Southern Mozambique. Am J Trop Med Hyg. 2011 Jul 1;85(1):146-51.
12. Rice Amy L, Sacco Lisa, Hyder Adnan Black, Robert E. Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries. Bull World Health Organ. 2000;78(10):1207-1221.
13. Kambarami RA, Nathoo KJ, Nkrumah FK, Pirie DJ. Measles epidemic in Harare, Zimbabwe, despite high measles immunization coverage rates. Bull World Health Organ. 1991;69(2):213-9.
14. Borus PK, Cumberland P, Sonoiya S, Kombich J, Tukei PM, Cutts FT. Measles trends and vaccine effectiveness in Nairobi, Kenya. East Afr Med J. 2003 Jul;80(7):361-4.
15. Nandy R, Handzel T, Zaneidou M, Biey J, Coddy RZ, Perry R et al. Case-fatality rate during a measles outbreak in eastern Niger in 2003. Clin Infect Dis Off Publ Infect Dis Soc Am. 2006;42(3):322-8.
16. Coronado F, Musa N, Tayeb ESAE, Haithami S, Dabbagh A, Mahoney F et al. Retrospective Measles Outbreak Investigation: Sudan, 2004. J Trop Pediatr. 2006 Oct 1;52(5):329-34.

Supplement article

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Research

Analysis of acute flaccid paralysis surveillance in Ethiopia, 2005-2015: progress and challenges

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Abstract

Introduction: Ethiopia joined the global effort to eradicate polio in 1996, and interrupted indigenous wild poliovirus transmission by December 2001. However, the country experienced numerous separate importations during 2003-2013. Sensitive Acute Flaccid (AFP) surveillance is critical to rule out undetected circulation of WPV and VDPVs.
Methods: in this study described, we used a retrospective descriptive study design to characterize the surveillance performance from 2005 to 2015.
Results: the none-polio AFP rate improved from 2.6/100,000 children <15 years old in 2005 to 3.1 in 2015, while stool adequacy has also improved from 78.5% in 2005 to 92 % in 2015. At the national level, most AFP surveillance performance indicators are achieved and maintained over the years, however, AFP surveillance performance at sub-national level varies greatly particularly in pastoralist regions. In addition, the minimum standard for non-polio enterovirus isolation rate (10%) was not achieved except in 2007 and 2009. Nevertheless, the proportion of cases investigated within 2 days of notification and the proportion of specimens arriving in good condition within 3 days to the laboratory were maintained throughout all the years reviewed.
Conclusion: we found that the AFP surveillance system was efficient and progressively improved over the past 10 years in Ethiopia. However, the subnational AFP surveillance performance varies and were not maintained, particularly in pastoralist regions, and the non-polio enterovirus isolation rate declined since 2010. We recommend the institution of community-based surveillance in pastoralist regions and conduct detail review of the laboratory sensitivity and the reverse cold chain system.

Introduction

Polio is a paralytic illness with a permanent disability, varying in severity from asymptomatic to severe, primarily affecting children below 5 years old. Only less than one percent of children infected with polio become paralyzed, and for every paralyzed child there are approximately 200 children infected and asymptomatic around [1]. The Global Polio Eradication Initiative(GPEI), the most astronomical immense public health program ever in the history of disease eradication, aimed to eradicate the disease by 2000 and has since revised the target for global certification by 2018 [2]. Sensitive Acute Flaccid Paralysis (AFP) surveillance is one of the critical strategies for polio eradication aiming at capturing a high number of AFP cases in children below 15 years old including those with polio. Poliomyelitis remains endemic before the endorsement of the polio eradication initiative in most countries in the African content, particularly in countries with difficult situations [3].

Since 1996, Ethiopia has been implementing polio eradication initiative activities using standard World Health Organization(WHO) recommended strategies [4], with significant success recorded, resulting in interruption of transmission of indigenous wild poliovirus (WPV) in December 2001, just five years after launching the "Kick polio Out of Africa" campaign [5]. However, the country has experienced numerous separate WPV importations from neighboring countries, including the 2013 polio outbreak, which was genetically linked to the virus circulating in neighboring countries, Somalia and Kenya, and related to the virus circulating in West Africa [6-8]. Ethiopia has been conducting case-based surveillance for Acute Flaccid Paralysis(AFP) countrywide since 1997 [9], and it is mandatory for all surveillance sites in the country to notify any suspected cases of AFP that fulfill the national case definitions including weekly zero case reporting. On top of this the case-based surveillance performance system is frequently reviewed and regular feedback provided using the main global surveillance performance indicators to all partners at national and sub-national level, including to the WHO African Region and Ineter Country Support Team(IST), and inaddition an in-depth external review is conducted every 2 to 3 years by external assessors.

We report the results of a retrospective analysis conducted to describe the characteristics of AFP surveillance performance, progress and challenges, and chachetrstics of reported AFP cases, between 2005 and 2015 to evaluate the case based surveillance performance using the WHO and nationally recommended surveillance standards, in order to review challenges and draw lessons learned.

Methods

Study area: Ethiopia is one of the most populous countries in Africa with an estimated total population of over 91 million as per 2007 population census projection. Administratively the country is subdivided into nine Regional States and two City Administrations, which are further subdivided into zones, woredas (which are equivalent to districts) and Kebeles.

Study design: we conducted a descriptive study design to make use of secondary data reported to the WHO Ethiopia Country Office surveillance database.

Study population: all children below15 years old with sudden onset of weakness or floppiness in one or more limbs and any adult above 15 years old that a clinician suspects polio.

Investigation of cases: initial investigations of suspected cases were done by health workers, using a standard case investigation form to capture demographic, clinical and epidemiological information. Additionally, WHO surveillance officers validated at least 80% of the cases and conducted a detailed investigation for all late and inadequate cases. Furthermore, the National Polio Expert Committee (NPEC) composed of personnel with different expertise classified cases upon submission of full documentation.

Laboratory methods: when a case was suspected two stool samples were collected and transported to the WHO accredited national polio laboratory where the global and national guidelines for testing samples was followed.

Data collection and analysis: we used the case based data from 2005-2015, which was entered into an MS Access database on a daily basis for program monitoring purposes in the WHO country office. We converted the MS Access database into MS-Excel, and into Epi Info version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, United States), where all descriptive analysis frequencies, tables, and graphs were generated.

Ethical approval: the WHO Country Office and Ethiopian Public Health Institute gave ethical approval for analyzing and publishing the data.

Definitions of terms

Suspected AFP: any child below 15 years of age with weakness or floppiness of one or more limbs or any person of any age in whom a clinician suspects polio.

Confirmed polio case: a suspected case with WPV isolation from a stool sample.

Non-polio AFP cases: discarded cases or all AFP cases excluding WPV and compatible cases.

Non-polio AFP rate = Number of non-polio AFP cases < 15 years old X 100,000/ Total number of children < 15 years old

Stool adequacy rate = Total # AFP cases with 2 stool specimens within 14 days of onset of paralysis * 100/ Total AFP cases reported

Results

The current study reports the results of surveillance for non-polio AFP cases that were investigated between January 2005 and December 2015. Between these periods a total of 11728 AFP cases were reported, of which 7,037(58.1%) were male, and the majority 7994(68.2%) were below 5 years old. The mean age was 5.1 years with standard deviation (SD) ±3.8 years (Table 1). Fever at onset of paralysis was record for 8302 and since 2007 on average 86.5% of the cases developed fever at onset of paralysis ranging from 84.3% to 89.6%. The mean number of days from onset of paralysis to notification of AFP cases was 7.4 days ranging from 6.0 days to 9.2 days, and more than 95% of the cases were investigated within less than 2 days from notification. The mean number of days from notification to second stool specimen collection was 2.4 days (range from 1.9 to 3 days), while the mean days from second stool collection to laboratory arrival was 1.6 (range from 1.4 to 1.9 days).

The proportions of stool specimens arriving in good condition in the laboratory throughout the study period were above the minimum expected target of 90% except in 2010, 2013 and 2014, when there was a decline to 88.3%, 81.6%, and 80% respectively. On the contrary, the non-polio enterovirus isolation rate has been declining since 2010, and the minimum standard (10%) was not maintained except in 2005, 2007 and 2009 (Table 2). The national non-polio AFP and the stool adequacy rates substantially improved and were maintained above certification level in all the years that were reviewed with the exception in 2005 and 2007, where the stool adequacy rate was below standard (Figure 1).

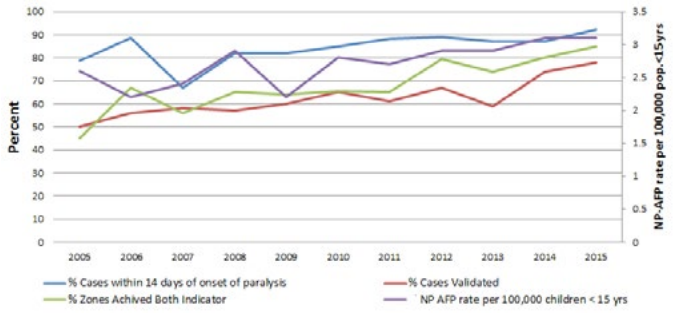

Figure 1
trends of main surveillance performance indicators 2005-2015

Table 1: characteristics of Acute Flaccid Paralysis cases, 2005-2015, Ethiopia

Parameter	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	average
AFP cases reported	950	815	910	1098	1001	1110	1080	1183	1189	1213	1179	11728
%Male(N=7037)	60	56.6	57.6	58.4	57.1	60.4	53	59	59.4	57.6	60	58.1
%Female(n=4691)	40	43.4	42.4	41.6	42.9	39.6	47	41	40.6	42.4	40	41.9
% 0-5 Years(n=7994)	73.3	75.8	70.6	74.1	69.7	66.9	64.5	63.7	66.8	61.9	62.5	68.2
% 6-9 Years(n=2280)	17.4	14	19.1	17.6	17.7	18.7	21.8	23.5	21.1	23.6	19.3	19.4
% 10-15+ years(n=1462)	9.3	10.2	10.3	8.1	12.6	14.4	13.6	13.7	12.2	14.5	18.2	12.5
% Fever at onset of paralysis (n=8302)	0	0	85.9	89.6	89	87	86.6	85.2	84.8	86.3	84.3	86.5
% asymmetric paralysis (n=5951)	62.5	65.0	63.2	47.7	44.1	50.3	41.9	40.7	42.5	39.6	60.6	50.8
% paralysis progressed within 3 days(n=9001)	78.7	75.7	77.4	81.1	80.7	77	80.4	76.4	72.6	71.7	72.5	76.7
% True AFP cases after investigation(n-11643)	100.0	100.0	100.0	99.1	100.0	99.9	99.1	99.0	98.7	98.7	97.5	99.3

Table 3: main surveillance indicators by Region, 2005-2015

Regions	Indicators	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Addis Ababa	NP-AFP rate	2.5	2.1	3.1	2.2	2.1	2.4	2.1	2.1	1.6	3	2.4
	St. Adequacy	81	97	96	94	94	94	97	94	82	90	88
Afar	NP-AFP rate	2.4	2.3	3.6	4.3	4	4.7	2.6	2.6	1.8	3.8	4
	St. Adequacy	94	94	88	73	93	97	90	88	100	83	92
Tigray	NP-AFP rate	5	3.4	2.6	2.6	2.7	2.8	2.6	2.6	1.9	2.6	2
	St. Adequacy	76	96	93	96	89	92	89	98	88	90	87
Amhara	NP-AFP rate	2.2	1.6	2	2.6	2.5	3	2.4	2.4	2.9	2.7	3.5
	St. Adequacy	79	92	83	85	79	87	75	87	86	85	92
Benshangule Gumuz	NP-AFP rate	6	3.3	3.6	4	3	4	4	3	4.4	4.4	3.8
	St. Adequacy	92	88	71	88	78	67	83	70	71	85	76
Oromia	NP-AFP rate	2.4	2	2.3	3.3	3	2.6	2.5	2.8	2.7	3	2.9
	St. Adequacy	73	90	87	87	86	85	88	90	88	88	91
SNNPR	NP-AFP rate	2.6	2.5	3	3	2.6	3.1	3	3	2.7	2.9	2.6
	St. Adequacy	92	92	93	93	93	94	96	96	92	93	97
Dire Dawa	NP-AFP rate	3.5	2.5	2	3.5	0.5	2	2.5	2.5	3	2	4
	St. Adequacy	71	100	100	100	100	75	100	89	100	100	100
Gambella	NP-AFP rate	11	2	2	10	7	2.5	3.5	3.5	2.8	2	2
	St. Adequacy	45	100	100	54	86	60	88	70	88	69	100
Hareri	NP-AFP rate	9	12	5	4	1	3	5	5	2	5	3
	St. Adequacy	100	92	100	75	50	75	60	100	50	67	100
Somali	NP-AFP rate	2	2.4	1.8	1.5	1	1.3	1.2	1.2	3.4	5	4.3
	St. Adequacy	84	70	76	79	72	61	73	60	62	74	92

The table 3 shows that all regions except Addis Ababa, Tigray, Dire Dawa, Hareri and Somali have achived the NP-AFP rate since 2005, however only two regions have achived stool adeqcy rat within the period of analysis.

Table 2: case investigation, sample transportation and classification of cases by year 2005-2015, Ethiopia

Parameters	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	average
Onset to notification in days	9.2	7	7.2	7.7	8.1	7.4	7	6.9	7.9	7.3	6	7.4
Mean Days to notification to second stool	3	2.4	2.6	2.4	2	1.9	2.2	2.2	2.3	2.4	2.5	2.4
% Investigated < 2 days of notification	89.9	96.7	95.6	95.2	98.1	98.5	97.7	96.8	95.4	96.2	94	98.5
Second stool to lab arrival in days	1.4	1.4	1.5	1.4	1.6	1.7	1.9	1.6	1.6	1.6	1.6	1.6
%Specimen arriving at lab within 3 days	98.8	98.8	98.5	99.2	99	99.1	98.3	98.6	98.3	96.9	98	98.5
% of Specimen arriving in good condition	99.4	98.9	99.6	91.4	99.7	88.3	91.4	91.5	81.6	79	80	91
% of NPENT cases isolated	12	7	11.6	8.3	10.6	6.5	6.9	4.5	9.2	7	3.2	7.9
%Suspected Polio Virus Isolation Rate	4	5	5.4	3.3	3.8	7.8	2.2	1.2	7.3	8	4.5	4.4
Confirmed WPV cases	22	17	0	3	0	0	0	0	9	1	0	52*
Compatible	25	26	15	11	30	38	17	15	37	17	1	232*
Discarded	903	772	895	1079	969	1055	1039	1139	1119	1179	1164	1313*
None AFP cases	0	0	5	0	0	11	11	24	19	14	14	98*

The national non-polio AFP rate ranged from 2.2 -3.1/100,000, children < 15 years with an increase from 2.6 in 2005 to 3.1 by the end of 2015, while the stool adequacy rate increased from 78.5% in 2005 to 92% in 2015, and ranged from 67% - 92% (Figure 1). Although there had been a remarkable improvement, it had been below operational standard in 2005 and 2007.

All the 11 Regions reported AFP cases; the majorities were from Oromia (36.8%), SNPPR (21.9%) and Amhara (21.6%) Regions. However, in terms of overall performance, only South Nations and Nationalities People's Region(SNNPR) achieved and maintained the two main AFP surveillance performance indicators above certification level, while Addis Ababa, Afar, and Tigray failed to achieve non-polio AFP rate in 2013, and Amhara in 2006, while Benshangule- Gomuz, Oromia, Dire Dawa and Gambella regions Have achieved the minimum expected None Polio AFP (NP-AFP) rate all the years' reviewed. Nevertheless, the stool adequacy rate in Oromia was lower than expected in 2005, and Dire Dawa in 2005 and in 2010. On the other hand, Gambella, Harari, Benshangul-Gumuz, and Somali Regions did not achieve and maintain the two main surveillance indicators particularly the stool adequacy rate.

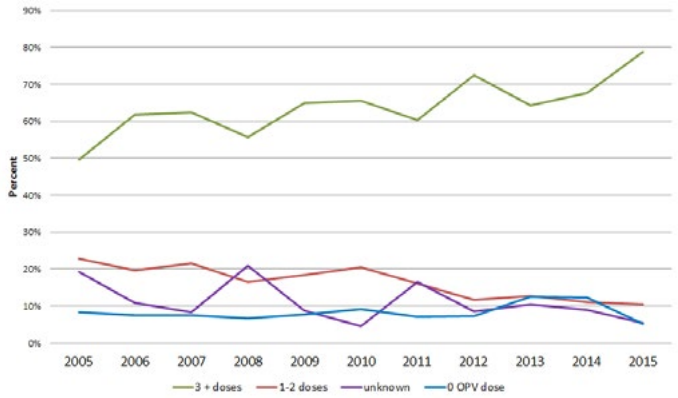

Figure 2
immunization status of reported AFP cases 2005-2015, Ethiopia

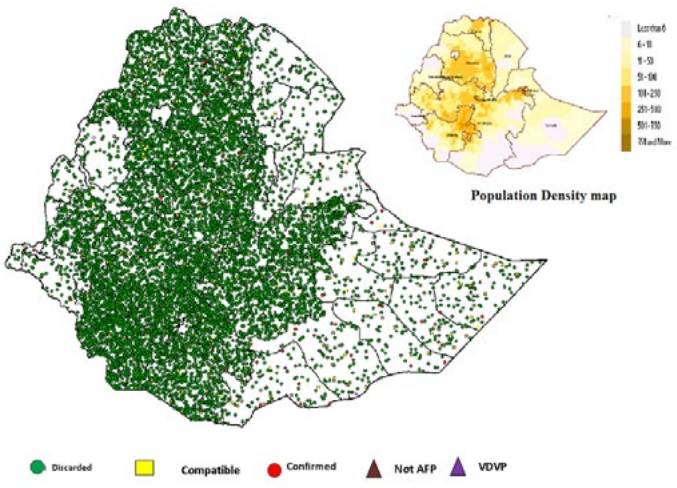

Figure 3
final classification of AFP case in relation of population density 2005-2015, Ethiopia

The surveillance performance indicators in these regions fluctuated from year to year and did not show a discernible trend except Somali and Harari Regions, which was persistently low (Table 3). In Somali Region, both surveillance performance indicators were below expected standard for almost all the years analyzed except in 2005 and 2014(Table 3). The mean proportion of AFP cases with zero doses of Oral Polio Vaccine (OPV) was 5%, while the proportion of cases who had received three or more doses of OPV showed a steady increase over the study period from 50% to 79 % (Figure 2). A total of 53 WPV type 1 cases were detected between 2005 and 2006, and 10 cases between 2013 and 2014, all cases were attributed to importations. Of the total AFP, cases notified 11313 (96.5%) of the cases were discarded, while 233 (2.0%) were classified as compatible (Table 2 and Figure 3).

Discussion

Our analysis provides evidence that AFP surveillance performance indicators progressively improved at the national level over the years. The highest number of AFP cases was reported in Oromia, Amhara, and SNNPR Regions, which may be due to the size of the population of these regions as they are contributing to more than 80% of the country's population [10]. In addition, these regions have a better infrastructure, a relatively well organized and well-staffed health delivery system, which may be a reason for increased surveillance sensitivity. Sensitive surveillance is critical not to miss undetected circulation, and investigate and collect specimen as quickly as possible. There were fluctuations below standard in stool adequacy rate in 2005 and 2007at national level and in the achievement of key performance indicators at Regional level, notably in pastoralist Regions (i.e. Somali, Gambella, and Benshangul-Gumuz) and Harari region. This may be attributed to the nomadic lifestyle, hard to reach, insecure areas and understaffed health delivery system.

The health sector development program (HSDP IV) also reflected the lack of appropriate health service delivery package in pastoralist regions [11]. We also found that the non-polio enterovirus isolation rate was persistently low since 2010 and this may be due to low cell and reference virus cells sensitivity in the laboratory and issues with the reverse cold chain system from stool collection to arrival at the laboratory. Studies conducted in other countries indicate a higher rate of non-polio enterovirus isolation rate than what we found [12]. However, a study in Kurdistan Province, Western Iran' indicated a lower rate which is consistent with our findings [13] .

Vaccination coverage with three or more doses of OPV among AFP cases was 79%. This may indicate, besides other explanations, that the actual vaccine coverage is lower than the expected population immunity to prevent outbreaks, which may be even worse in pastoralist regions. Evidence from the national demographic health survey conducted in 2011 indicates polio three coverage of 44.3%, even less than what we found [14], while other similar studies conducted elsewhere indicate a higher rate [15].

In addition, we found that the sex distribution of AFP cases reported over the years have no significant difference among boys (58.1%) and girls (41.9%) ($p>0.05$), a study done in Nigeria showed a higher rate for females than boys, while. AFP cases below 5 years old to be 68.2%, which is lower than some studies done elsewhere, which found a higher rate [16,17], but still our result is higher and consistent with other studies [18,19]

Our study had a number of limitations. First due to data incompleteness, we used a dataset from 2005 onwards. Second, some variables were missing, so to try and mitigate we excluded cases with missing variables and used only those cases with required information available for analysis. Despite the limitations, our study highlights important strengths and aspects for improvement of the AFP surveillance system in the country in order to keep on the tracks towards certification of polio eradication. Secondly, missing data for some variables indicates a need for data improvement.

Conclusion

In conclusion, we found that the AFP surveillance system was effective over the 10 years period between 2005 and 2015 in Ethiopia; meeting the surveillance performance indicators at national and subnational level. However, the sub-national performance in some regions remains a concern, particularly in pastoralist regions. We also discovered that the non-polio enterovirus isolation rates have been declining since 2010, and the stool condition didn´t meet the expected minimum (90%) in 2010, 2013, 2014 and 2015. Nevertheless, major strengths of the surveillance

system include timely detection and transportation of specimen from corners of the country even in remote and hard to reach areas. We recommend that the two key AFP surveillance indicators be strengthened further to better enhance the overall performance, especially in pastoralist Regions (Somali, Gambella, and Benshangul-Gumuz). We also recommend that in view of the prevailing risk of wild poliovirus importation, community-based surveillance is intensified with a focus on pastoralist regions and border areas in order to increase the sensitivity of the surveillance system and to provide a high degree of confidence for timely detection of importation and any emerging event. Finally, we recommend an operational study be conducted aimed at improving the low non-polio enterovirus isolation rate, including a capacity review of laboratory sensitivity and the reverse cold chain system.

What is known about this topic

- Ethiopia eradicated indigenous polio in 2001;
- Acute flaccid paralysis is one of the polio eradication strategies that country implementing;
- Surveillance performance indicators being monitor to achieve polio eradication.

What this study adds

- The study provides valuable information on surveillance performance over years comparing with regional and global standards;
- The study also identifies challenges and progress, and recommends ways of improving the surveillance performances for certification;
- The study also indicates the focus needs to high risk and hard to reach areas to improve.

Competing interests

All authors declare that there are no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

AT Design the study and drafted the manuscript and incorporated all comments, FB coordinated and critically reviewed the manuscript and gave final approval for submitting for publication, ME critically reviewed and gave final approval to the version to be published. FT & AK worked on the data analysis and structure, BB worked on the testing of specimen and commented the manuscript. EW, DJ, and AB reviewed the manuscript. All authors have read and approved the final version of the manuscript.

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References

1. Government of India, Ministry of Health and Family Welfare. Field Guide: Surveillance of Acute Flaccid Paralysis. 2005.
2. Global Polio Eradication Initiative. Polio Eradication and EndgameStrategic Plan 2013-2018. 2013.
3. World Health Organization. Weekly epidemiological record. Wkly Epidemiol Rec. 2013; 88(20):201-16.
4. World Health Organization. WHO-Recomm Stand Surveill Sel Vaccine-Prev Dis. 2003; 3:28-30.
5. Okwo-Bele JM, Lobanov a, Biellik RJ, Birmingham ME, Pierre L, Tomori O, et al. Overview of poliomyelitis in the African Region and current regional plan of action. J Infect Dis. 1997; 175 (Suppl): S10-5.
6. Mesfin G, Schluter W, Gebremariam A, Benti D, Bedada T, Beyene B et al. Polio outbreak response in Ethiopia. East Afr Med J. 2008; 85(5):222-31.
7. FDRE MoH;Disease Prevention control department & Family Health. Polio Outbreak in Ethiopia Annual Review Meeting proceedings. WHO MOH,(2005) issue No 15.
8. Mach O, Tangermann RH, Wassilak SG, Singh S, Sutter RW. Outbreaks of paralytic poliomyelitis during 1996-2012: the changing epidemiology of a disease in the final stages of eradication. J Infect Dis. 2014; 210(Suppl 1):S275-82.
9. World Health Organization. National review of Ethiopia's surveillance system for acute flaccid paralysis (AFP) and other vaccine-preventable diseases. Accessed on September 09, 2016.
10. Federal Democratic Republic of Ethiopia, Central Statistical Agency. 2007 Population and Housing Census of Ethiopia. CSA 2007.
11. Federal Democratic Republic of Ethiopia Ministry of Health: Health Sector Development Programme IV 2010/11- 2014/15. Vol. IV. 2010.
12. Zaid M. Evaluation of acute flaccid paralysis surveillance system in Kerkuk governorate. Ann Coll Med. 2008; 3(1):59-65.
13. Soltani J, Esmailnasab N, Roshani D, Karimi M, Amjadi M-J. Acute flaccid paralysis and its differential diagnosis in Kurdistan Province, Western Iran: an 11-year surveillance. Iran J Pediatr. 2014 Apr; 24(2):131-9.
14. Lakew Y, Bekele A, Biadgilign S. Factors influencing full immunization coverage among 12-23 months of age children in Ethiopia: evidence from the national demographic and health survey in 2011. BMC Public Health. 2015; 15(1):728.
15. Length F. Performance of acute flaccid paralysis surveillance system in Zambia: 2000 to 2009- Analysis of secondary data. Int J Public Health Epidemiol. 2014; 3(10):75-81.
16. Bassey BE, Rui VG, Gasasira AN, Pascal M, Weldegbriel G, Mulum TJ et al. Characteristics of acute flaccid paralysis reported by the surveillance system and verified by WHO Officer in Akwa Ibom State-Nigeria, 2006-2012. Health (N Y). 2014; 6(19):2602-10.
17. Mughal TM, Khan AM, Haq EU, Khan M. Evaluation of AFP surveillance sensitivity in AJK. Research Gate. 2014 Nov 1; 25(11):76-9.
18. Lam RMK, Tsang THF, Chan KY, Lau YL, Lim WL, Lam TH et al. Surveillance of acute flaccid paralysis in Hong Kong: 1997 to 2002. Hong Kong Med J. 2005; 11(3):164-73.
19. Wen N, Fan C-X, Fu J-P, Ning J, Ji Y-X, Luo H-M et al. Enhanced surveillance of acute flaccid paralysis following importation of wild poliovirus in Xinjiang Uygur Autonomous Region, China. BMC Infect Dis. 2014; 14(September 1994):113-113.

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Research

Measles burden in urban settings: characteristics of measles cases in Addis Ababa city administration, Ethiopia, 2004-2014

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Abstract

Introduction: in developing countries, measles was a major cause of morbidity and mortality before the wide spread use of measles vaccine. The purpose of this study was to describe measles burden in an urban setting, Addis Ababa- since the implementation of measles case-based surveillance in Ethiopia. We analyzed measles surveillance data for 2004 -2014.
Methods: incidence of measles was described by sub city, by year and by age groups. Age specific incidence rate were calculated. Logistic regression was used to identify the predictors of confirmed measles cases.
Results: of 4220 suspected measles cases 39% were confirmed cases. Males and females were equally affected. The mean affected age was 7.59 years. Measles cases peaked in 2010 and 2013-2014. Incidence of measles is higher among children less than five years old. Outer sub cities were more affected by measles in all years.
Conclusion: sub cities bordering with Oromia Regional State were more affected by measles. Older age groups were more affected than younger age groups (age ≤ five years old). Efforts to close immunity gaps against measles and further strengthen surveillance in urban settings, particularly among children below five years old, should be prioritized.

Introduction

Measles is an acute viral illness with the potential for severe and life threatening complications. In the pre-vaccine era, measles was one of the major causes of childhood morbidity and mortality. Although significant reduction in morbidity and mortality has been achieved since the widespread use of measles vaccine, it is still a major global public health problem [1]. Measles incidence is associated with urbanization because of high influx of migrants and high population density; cities have become important hubs for the transmission of infectious diseases [2-10]. In 2000, a total of 39.9 million measles cases, and 777,000 deaths were reported globally; Africa and Southeast Asia accounted for 70% of measles cases and 84% of measles-related deaths. Eleven countries including Ethiopia, accounted for 66% of deaths [11]. In 2001, the African Region adopted the Global Measles Mortality Reduction Initiatives and began the implementation of the recommended strategies. The region set the following targets to be achieved by the year 2012: 1) to improve measles containing vaccine (MCV1) coverage. MCV1 is the first dose of measles containing vaccine, 2) to provide a second opportunity for measles vaccine (MCV2), MCV2 is the second dose of measles containing vaccine 3) to improve measles case management, and 4) to establish case-based surveillance with laboratory confirmation of all suspected measles cases. Successful implementation of these strategies resulted in a 93% reduction in reported measles cases and 92% reduction in the estimated number of measles deaths in the African region between 2000 and 2008 [12-14]

In 2008, the African Region, adopted a pre-elimination goal to be reached by the end of 2012 with the following targets: 1) greater than 98% reduction in estimated regional measles mortality compared with 2000; 2) annual measles incidence of fewer than five reported cases per million population nationally; 3) greater than 90% coverage national and >80% MCV1 districts, and 4) greater than 95% MCV coverage in all districts during supplementary immunization activities (SIA) [15] Ethiopia failed to achieve most of the targets for the pre-elimination goal in 2011:- the estimated MCV1 coverage was 57% in 2011 and the percentage of districts reporting at least ≥ 80% MCV1 coverage was 43 % in 2011 (16). However, the administrative coverage of the 2010-2011 nationwide follow up measles SIAs in children under 5 years of age was 106 % with 91% of districts achieving at least 95 % coverage. National coverage for the SIA based on a population survey was 88.2 % (95% CI=85.1%, 90.6%) In 2011, reported measles cases among children under 5 years of age decreased by 66% compared with 2010 [16] In 2014, data from the Addis Ababa City Administration Health Bureau Health Information and Management System (HIMS) indicated that all sub cities in the city administration reported at least one measles outbreak, with a total of 276 suspected measles cases.

We reviewed 4220 measles records to describe measles incidence in Addis Ababa between 2004 and 2014, in effect reviewing 10 years since the implementation of cases based measles surveillance in Ethiopia. We also reviewed MCV1 coverage from 2005 to 2013 and tried to assess the impact of measles vaccination among under 5 years old children (improvement in routine immunization coverage over years is associated with declining in the number of measles cases in children under 5 years of age). The study was conducted to propose effective interventions for measles elimination to the city administrators.

Methods

Study area and setting: Addis Ababa is the capital city of Ethiopia with an estimated 2015 population of 3,194,999 [17]. The city is divided into 10 sub cities (which are equivalent to zones) and 116 woredas, which are equivalent to districts [17]. There are five central, six regional and 36 private hospitals, 93 public health centers and more than 500 private health facilities. In Addis Ababa, surveillance data for suspected measles cases are routinely collected at all levels of the health delivery system using standardized measles case based surveillance form and specimens are sent to the national measles laboratory. A single serum specimen is collected for serologic confirmation of measles at the first contact with the case any time between the day of onset of rash and 30th day afterwards. Data from the health facilities are sent to the national measles laboratory with the serum specimen, copied to sub cities, and the regional health bureau. Data is entered into the measles case-based surveillance system database, for consolidation, cleaning, analysis and dissemination for action. Monthly measles immunization performance reports are sent from health facilities to higher levels for analysis and action. Measles vaccination coverage was calculated by dividing the number of doses of measles vaccine given to children in the target age group by the number of surviving infants estimated by the Central Statistical Agency (CSA) [17] Important variables captured in the case-based surveillance forms include:- patient´s name, age, sex, vaccination status, area of residence, date of rash onset, date of first investigation, dates of specimen arrival and dispatch of results from the national virology laboratory, specimen condition on arrival at national virology laboratory, measles IgM test result, and final case classification. Feedback on the final case classification is given to the reporting facility.

Study design: we conducted a retrospective record review of the national measles- surveillance dataset for the period of 2004 - 2014 and measles coverage data for the period of 2005 - 2013 to assess the incidence of measles cases by sub city, year, and age group and calculate age specific incidence rate by year. Measles vaccination data was not found for the year 2004. Age specific population data from 2004-2014 were used to calculate incidence rates [17].

Data analysis: we assessed achievement of the city administration towards the target set for measles mortality reduction and pre-elimination goals. The proportion of confirmed measles cases were calculated from total reported cases. Logistic regression was done to assess the association between the dependent variable (measles cases) and the independent variables (sex, age, and timing of specimen collection). Permission and ethical clearance was obtained from Ethiopian Public Health Institute; Patient names and addresses were omitted from the analysis. Confidentiality was assured and maintained.

Definitions

Suspected measles case: any person with fever and generalized rash and cough and runny nose or conjunctivitis.

Confirmed measles case: a measles IgM positive case or a suspected measles case linked to a laboratory confirmed cases or a compatible case.

Compatible measles case: a suspected case with no laboratory testing or with measles IgM test that is repeatedly indeterminate.

Measles outbreak: five or more suspected measles cases per month per district.

Results

We reviewed a total of 4220 measles records of which: 1659 (39%) were confirmed measles cases. The female: male ratio was 1:1. The mean age of the suspected measles cases was 7.59 years with standard deviation (+SD) of 6.96 years. Measles cases were reported throughout 2004-2014: two small peaks were noted in October 2006 and 2009. In 2010, 521 confirmed cases of measles were reported before the measles SIA, a total of 250 and 283 confirmed measles were reported in 2013 and 2014 respectively (Figure 1).

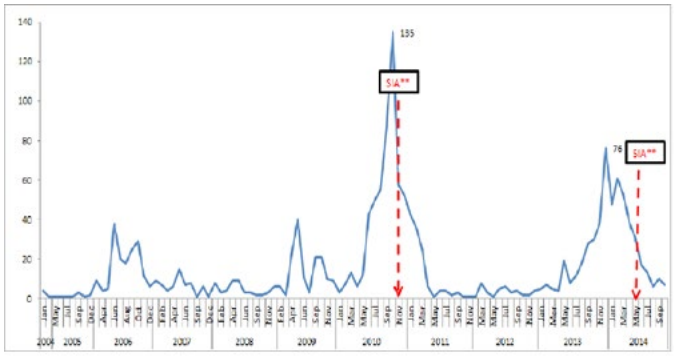

Figure 1
trends of main surveillance performance indicators 2005-2015

The incidence rate of measles cases per 100,000 populations per year was higher in age groups between 1 and 5 years (range 13 to 125 cases/100,000), followed by children under 1 year of age, children 5-15 years and persons older than 15. In 2010, the annual incidence rate of confirmed measles cases was 18.1/100, 000 population per year, in 2013 measles incidence rate was 8 cases /100,000 population per year and in 2014 the incidence rate was 8.9 cases/100,000 population per year (Table 1). Regional measles vaccination coverage was 81%, 79% and 92% in 2009, 2010 and 2011 respectively. In 2013, the regional coverage was 95%: ranging from 58 % in Gulele and to 122% in Bole sub city (Table 2). The lowest number of measles cases were reported in 2004 (5), 2005 (10) and 2012 (39). Peaks in confirmed measles cases were observed in 2009-2010 and 2013-2014, with the highest number recorded in 2010 with 521 cases (Table 3). Confirmed measles cases were reported by 20% of the sub cities in 2004 and by 40 % of the sub cities of the Addis Ababa city administration in 2005. There was no confirmed measles case reported by Akaki Kality sub city in 2011 and by Lideta sub city in 2012. Large numbers of measles cases were reported by all sub cities in 2010, 2013 and 2014 (Table 3).

Table 1: incidence rate confirmed measles cases per 100, 000 population per year by age group, 2004-2014, Addis Ababa, Ethiopia

Year	Age group (years)				
	<1	1-5	5-15	>15	Overall incidence rate
2004	13	13	3	0	0.2
2005	16	54	12	0.3	0.4
2006	84	120	25	3.4	6.4
2007	44	53	11	1.3	2.4
2008	35	76	14	1	1.9
2009	37	55	21	1.3	5.2
2010	208	146	45	7.2	18.1
2011	100	67	17	2.5	4.2
2012	43	142	45	2	1.3
2013	95	122	44	5.5	8.0
2014	122	125	50	5.2	8.9

Table 2: administrative coverage of measles vaccination through routine services by sub city and region wide, 2005–2013, Ethiopia Region

Sub city	2005	2006	2007	2008	2009	2010	2011	2012	2013
Addis Ketema	35	35	37	46	64	73	72	52	60
Akaki Kality	65	53	57	59	58	63	104	113	104
Arada	69	57	57	70	111	112	123	117	120
Bole	70	66	71	94	100	91	122	119	122
Gulele	46	54	40	44	48	42	71	58	58
Kirkos	50	44	41	46	76	61	71	99	76
Kolfe Keranio	85	88	81	93	69	107	101	119	116
Lideta	94	73	79	79	130	89	77	73	73
Nefas-Silk Lafto	84	82	77	87	98	69	104	104	102
Yeka	90	81	51	47	68	71	73	83	76
Total	**68**	**63**	**59**	**67**	**81**	**79**	**92**	**95**	**92**

Table 3: distribution of confirmed measles cases by sub city by year, 2004- 2014, Addis Ababa, Ethiopia

Addis Ketema	Akaki Kality	Arada	Bole	Gulele	Kirkos	Kolfe Keraniyo	Lideta	Nefas Silk L	Yeka	Total
0	0	1	0	0	0	0	4	0	0	5
0	1	5	2	0	2	0	0	0	0	10
15	1	13	35	14	14	36	13	15	10	166
1	24	8	9	2	2	10	1	2	5	64
7	2	9	13	4	2	2	2	7	4	52
4	33	9	5	10	23	30	5	13	13	145
46	24	42	51	60	56	101	48	53	40	521
10	0	14	8	25	6	21	11	12	18	125
3	1	4	3	6	2	12	0	3	5	39
18	38	14	38	22	9	45	17	21	28	250
19	12	13	35	36	13	62	15	38	40	283

In 2005, 63% of IgM+ measles cases were children age below 5 years old, where as in 2013 the proportion reduced by 18% compared to 2005; of all IgM+ measles cases 45% were age below 5 years old. An eight percent increase in the proportion of less than five years old confirmed measles cases was noted in in 2011 compared to 2010. The regional measles vaccination coverage was 68 % in 2005 and 92% in 2013 (Figure 2). In 2004 and 2008, the proportion of confirmed measles cases in children under 5 years old was higher compared with the proportion of confirmed cases among above 5 years old. However, in 2013, the proportion of confirmed measles cases in children under 5 years old age group was 10%, lower than the proportion of confirmed measles cases in above 5 years old age group (28 % in 2013) (Table 4).

Logistic regression analysis showed that female suspected measles cases were 1.4 times more like to be confirmed than males (95% CI= 1.18-1.58). Children older than 5 years were 1.5 times more likely to be confirmed measles cases compared with those less than 5 years old (95 % CI= 1.30-1.74). Suspected measles cases from whom serum specimen was collected after ≥4 or more days were 2.4 times more likely (95% CI =2.02-2.73)to be confirmed measles cases compared with cases in whom specimen was collected within 4 days of rash onset.

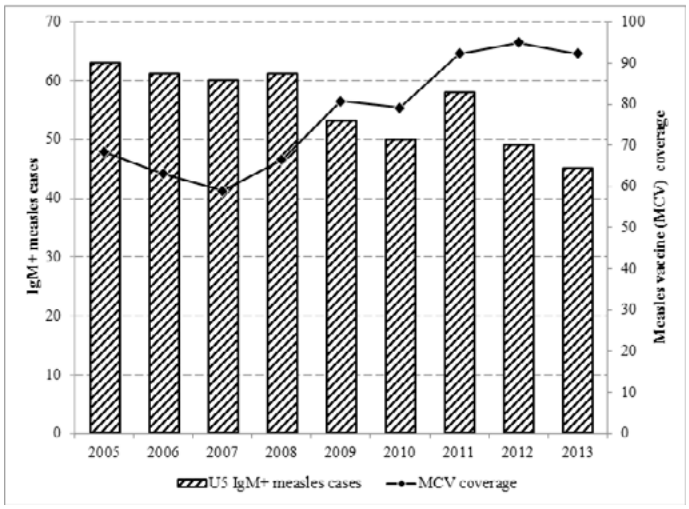

Figure 2
proportion of under 5 years' old IgM+ measles cases, city level measles (MCV1) administrative coverage, Addis Ababa, Ethiopia, 2005–2013

Table 4: distribution of confirmed measles cases in less than five and above five years by year

Year	< 5years		≥ 5 years	
	No	% *	No	%*
2004	3	8	2	5
2005	3	2	7	5
2006	73	17	93	22
2007	27	15	37	20
2008	31	14	21	9
2009	60	25	85	35
2010	240	32	281	38
2011	56	18	69	22
2012	17	3	22	4
2013	65	10	185	28
2014	85	12	198	28

*% calculated from the total (confirmed cases cases) + discarded

Discussion

In our review of measles surveillance data from Addis Ababa in the years 2004 to 2014, we found that sub cities in Addis Ababa which share a common border with Oromia regional state reported more measles cases. All of the six outer sub cities are expansion and resettlement areas. Influx of migrants from rural areas could have led to overcrowding and created

favorable conditions for measles transmission. The relationship between urbanization and measles control has shown that measles is a common cause of childhood morbidity in peri-urban areas which could be related to high population density, and low measles vaccination coverage [8]. Surprisingly relatively fewer confirmed measles cases were reported by Akaki Kality sub city in 2006, 2010, and 2014 compared with inner sub cities. Akaki Kality sub city is one of the expansion areas, shares a common border with Oromia regional state and with relatively low health service coverage and low measles vaccination coverage. The sub city was expected to report more measles cases than the inner sub cities.

In 2004-2005, during the first 2 years of case based measles surveillance implementation, only 15 cases of confirmed measles cases were reported. The low measles reporting rate could have been due to lack of awareness of the new measles case based measles surveillance system. Significant progress was made in measles surveillance activities starting from 2006: all sub cities have been reporting at least one measles case per year. Improvement in measles performance indicators were also recorded at the regional level with several efforts made to strengthen surveillance through capacity building among other interventions [12].

Our study found that the incidence rate of confirmed measles cases per 100,000 people was highest among children aged 1-5 years in all years except in 2010 and 2011 when it was highest among under 1 year olds; incidence was lowest in the age group above 15 years old. This was comparable to findings from a study in New Zealand which reviewed measles cases from three sources:- hospitalization, notification and laboratories [18]. We observed a declining trend in measles cases in less than 5 years old age group compared to the above 15 years old age group. This could be explained by improved routine immunization coverage in general and measles vaccination coverage in particular in more recent years [18]. Large numbers of measles cases were reported in 2014, six months before the nationwide 2013 SIA. Of 446 reported measles cases 189 (32 %) were aged between 1 and 4 years. These children were the target age group for measles SIAs in 2013, implying poor quality planning of the 2013 measles SIA in Addis Ababa.

We recognize some limitations of our study. Firstly, the denominators that we used to calculate, incidence and vaccine coverage may be inaccurate due to high urban- rural migration. This could tend to increase the incidence rate. Reported measles cases (numerator) were not also included in the denominator. Secondly, there may be under reporting of measles cases for various reasons; measles cases may not be allowed to get out of the home and are frequently managed at home with diet, herbal drinks and bath [19]. Hence, a significant number of parents may not seek medical assistance for their sick children, believing measles is self-limiting diseases. However, we do not feel that either of these limitations significantly affected the findings of our study.

Conclusion

In conclusion, our study showed that measles is still a common cause of childhood morbidity, and Addis Ababa sub cities bordering the Oromia Region were the most affected. We also conclude that improvement in routine immunization coverage over years is associated with declining in the number of measles cases in children under 5 years of age. We recommend that government and partners involved in the immunization program revisit their approach in addressing measles pre-elimination goals through: - strengthening routine immunization, conducting higher quality SIAs and achieving measles surveillance goals in all sub cities of Addis Ababa. We recommend that surveys be done in the outer sub cities of Addis Ababa to identify high risk areas for measles transmission in view of limitations in accurate population estimate in the city administration given population migration. We also recommend further study to assess the effect of urbanization on measles morbidity (the effects of overcrowding and influx people from rural areas where vaccination coverage is suboptimal on measles burden). We also recommend that the city administration regional health bureau, the six outer sub cities health offices, and neighboring woredas should closely work with other sectors offices and the Oromia Regional Bureau.

What is known about this topic

- Measles account for much of the vaccine preventable diseases burden in Ethiopia;
- Measles is the major contributor for less than five years old morbidity and mortality in Ethiopia;
- Measles incidence has been declining since the introduction of measles vaccine in Ethiopia.

What this study adds

- The study provides valuable information on measles distribution in urban settings: Addis Ababa;
- The study provides information on the impact of vaccination on measles incidence in Addis Ababa;
- The study also reveals that, the quality of measles supplementary immunization activities.

Competing interests

The authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

A Mersha, A Ademe, B Fiona and K Gallagher conceived and designed the study. A Kassahun undertook the statistical analysis. All authors contributed and approved the final version of the manuscript.

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References

1. WHO-Regional Office for Africa. Guidelines for Measles Surveillance 2004.
2. Alirol E, Getaz L, Stoll B, Chappuis F, Loutan L. Urbanization and infectious diseases in a globalized world. Lancet Infect Dis. 2011;11(2):131-141.
3. Ferrari MJ, Djibo A, Grais RF, Bharti N, Grenfell BT, Bjornstad ON. Rural-urban gradient in seasonal forcing of measles transmission in Niger. Proc Biol Sci. 2010;277(1695):2775-82.
4. Hyde TB, Dayan GH, Langidrik JR, Nandy R, Edwards R, Briand K et al. Measles outbreak in the Republic of the Marshall Islands, 2003. Int J Epidemiol. 2006;35(2):299-306.
5. Yaméogo KR, Perry RT, Yaméogo A, Kambiré C, Kondé MK, Nshimirimana D et al. Migration as a risk factor for measles after a mass vaccination campaign, Burkina Faso, 2002. Int J Epidemiol. 2005;34(3):556-564.
6. Borus PK, Cumberland P, Sonoiya S, Kombich J, Tukei PM, Cutts FT. Measles trends and vaccine effectiveness in Nairobi, Kenya. East Afr Med J. 2003;80(7):361-364.
7. Yamaguchi S, Dunga A, Broad head RL, Brabin BJ. Epidemiology of measles in Blantyre, Malawi: analyses of passive surveillance data from 1996 to 1998. Epidemiol Infect. 2002;129(2):361-369.
8. Minetti A, Kagoli M, Katsulukuta A, Huerga H, Featherstone A, Chiotcha H et al. Lessons and challenges for measles control from unexpected large outbreak, Malawi. Emerg Infect Dis. 2013;19(2):202-209.
9. Aaby P. Malnutrition and overcrowding/intensive exposure in severe measles infection: review of community studies. Rev Infect Dis. 1988;10(2):478-491.
10. Aaby P, Knudsen K, Jensen TG, The arup J, Poulsen A, Sodemann M et al. Measles incidence, vaccine efficacy, and mortality in two urban african areas with high vaccination coverage. J Infect Dis. 1990;162(5):1043-1048.
11. Stein CE, Birmingham M, Kurian M, Duclos P, Strebel P. The global

burden of measles in the year 2000- a model that uses country-specific indicators. J Infect Dis. 2003;187 Suppl(Suppl 1):S8-S14.
12. Masresha BG, Fall A, Eshetu M, Sosler S, Alleman M, Goodson JL et al. Measles Mortality Reduction and Pre- Elimination in the African Region, 2001 - 2009. J Infect Dis. 2011; 204: Suppl 1.
13. Goodson JL, Masresha BG, Wannemuehler K, Uzicanin A, Cochi S. Changing Epidemiology of Measles in Africa. J Infect Dis. 2011;204(Suppl 1):205-214.
14. Mitiku K, Bedada T, Masresha BG, Kegne W, Nafo-Traoré F, Tesfaye N et al. Progress in measles mortality reduction in Ethiopia, 2002-2009. J Infect Dis. 2011;204(Suppl1):232-238.
15. Ababa A. Report of the Second Meeting of the African Regional Measles Technical Advisory Group (TAG) Recommendations. 2008.
16. Report MW. Morbidity and Mortality Weekly Report (MMWR) Measles - Horn of Africa , 2010 - 2011. Morb Mortal Wkly Rep. 2015;87(October 2010):329-336.
17. Central Statistical Authority(CSA).. Summary and Statistical Report of the 2007 Population and Housing Census- Population Size by Age and Sex. 2008 p. 113.
18. Mansoor O, Blakely T, Baker M, Tobias M, Bloomfield A. A measles epidemic controlled by immunisation. N Z Med J. 1998;111(1079):467-471.
19. Muhe L, Kidane Y, Shamebo D, Krantz I, Freij L. The Butajira Rural Health Project in Ethiopia: mothers perceptions and practices in the care of children with acute respiratory infections. Int J Health Sci. 1994 Oct; 5:3.

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Research

Introducing an accountability framework for polio eradication in Ethiopia: results from the first year of implementation 2014-2015

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Abstract

Introduction: the World Health Organization (WHO), Ethiopia country office, introduced an accountability framework into its Polio Eradication Program in 2014 with the aim of improving the program's performance. Our study aims to evaluate staff performance and key program indicators following the introduction of the accountability framework.
Methods: the impact of the WHO accountability framework was reviewed after its first year of implementation from June 2014 to June 2015. We analyzed selected program and staff performance indicators associated with acute flaccid paralysis (AFP) surveillance from a database available at WHO. Data on managerial actions taken were also reviewed. Performance of a total of 38 staff was evaluated during our review.
Results: our review of results for the first four quarters of implementation of the polio eradication accountability framework showed improvement both at the program and individual level when compared with the previous year. Managerial actions taken during the study period based on the results from the monitoring tool included eleven written acknowledgments, six discussions regarding performance improvement, six rotations of staff, four written first-warning letters and nine non-renewal of contracts.
Conclusion: the introduction of the accountability framework resulted in improvement in staff performance and overall program indicators for AFP surveillance.

Introduction

Accountability is the ownership of responsibilities combined with the obligation to report on the discharge of those responsibilities [1]. An accountability framework makes roles, responsibilities and expectations clear, and supports the availability of reliable and timely reports about intended and actual results [2]. The framework further delineates performance measures to ensure the efficient, effective and transparent management of resources for its mandated objectives [3]. Accountability has always been embedded in the structure of WHO and its operational policies and procedures. However, in response to the evolving environment of reform that constitutes accountability and transparency as core principles, coupled with the declaration of polio eradication as a public health emergency of international concern in 2014, the 2006 WHO Accountability Framework was revised. The revised WHO Accountability Framework is designed to support the Organization's results-based management approach whereby delegated responsibility, authority, and accountability exist in a decentralized environment at all levels of the Organization, and to underline its commitment to the shared values and culture of accountability and transparency [4]. The Polio Eradication Initiative was launched in 1988 and has since then recorded substantial achievements in kicking polio out of the African continent. Despite the encouraging gains, the initiative has faced several setbacks over the years. One of the setbacks, specifically in the Horn of Africa (HOA), was the importation of wild poliovirus (WPV) into Somalia in mid-2013, which then spread to Kenya and Ethiopia. A total of 223 confirmed WPV type 1 cases were reported from the HOA; of these 199 cases were from Somalia, 14 were from Kenya and 10 were from Ethiopia. During this time, efforts to introduce an accountability framework into the existing monitoring and evaluation system of the WHO Ethiopia's Expanded Program on Immunization (EPI) program had started, and the importation of the poliovirus in mid-2013 provided an opportunity to fast track the activity, considering the increase in technical surge capacity in the country, particularly in the affected Somali Region. Following the confirmation of the first WPV in Somalia, response activities were initiated that included supplemental immunization activities (SIAs), and intensified surveillance. The response necessitated an increase in WHO presence in the field in order to rapidly interrupt poliovirus transmission. By the end of 2014, a total of 75 "surge" staff had been recruited and deployed in Ethiopia, mainly to the Somali Region. A monitoring and accountability mechanism to track performance of the newly-recruited and existing staff become more critical to improve performance and ultimately reduce the risks of further transmission of the virus.

The EPI team in the WHO country office, totaling 113 in 2014-2015, is deployed at central, regional and zonal levels, in alignment with the country's administrative levels. Regional coordinators, delegated and present in the 9 regions and 2 administrative cities, coordinate and link the field team with the central team that is organized into three technical subunits: Surveillance, Routine Immunization and Monitoring and Evaluation (M&E). The staffing in Somali Region was uniquely structured following the WPV1 importation, with officers present at the lowest administrative level (woreda), reporting to zonal coordinators who then reported to the regional coordinator. The Accountability Framework tool was adopted from the global framework in 2014 with key principles that included better accountability as an organization to the outcomes WHO is committed to delivering [4]. Although the M&E unit at the WHO country office had a system where monthly reports from field officers were submitted and feedback regularly given, there was no systematic way of monitoring other expected program deliverables, and the accountability component was missing. We describe the process and initial results of implementing an accountability framework to guide the management of the WHO Ethiopia EPI program and improve performance of staff.

Methods

Developing the accountability framework: a review of the Standard Operating Procedures (SOPs) for EPI staff at WHO Ethiopia was conducted to identify deliverables at different levels. Additionally, the Terms of References, (TORs) for the central team, field officers and zonal and woreda facilitators were reviewed and a list of key deliverables to be monitored at the individual officer level was determined. A total of 17 deliverables were selected. Based on the SOPs and TORs at different levels, the deliverables were grouped into themes: routine immunization, SIAs, M&E and program management (Table 1). The next step was to identify reporting timelines, quality indicators and monitoring levels. The timeline of reporting for each deliverable was set for submission to the regional and central level. Monthly deliverables were to be submitted to regional/zonal coordinators before the 7th day of the following month and before the 15th to the central level. Quarterly deliverables were expected to be delivered at regional level before the 15th of the following month and before the end of the same month at the central level. The same timeline of reporting was applied for biannual and annual set of deliverables, but SIA and outbreak deliverables were ad hoc and expected whenever there was a campaign and outbreak in a given area. The deliverables submission was monitored both at the regional and central level, and a template to track timelines by the individual officers was introduced at the regional level. Besides timeliness, the tool monitors quality of submitted deliverables using selected indicators, which the regional Coordinator compiles and shares with central level. The quality monitoring indicators and the respective score is presented in Table 2. The quality monitoring template and scoring was done through a consultative process between central and field officers in late 2013. Finally we developed a template and generate a summary dashboard showing performance by individual officer by quarter that is shared among the team at the end of each quarter.

Table 1: list of deliverables categorized by program thematic areas, WHO Ethiopia, 2014-2015

Surveillance	Routine Immunization (RI)	SIA	Monitoring and Evaluation	Program Management
Proportion of Validated AFP Cases	Zone and Woreda level RI data submission (quarterly)	Pre-campaign, intra and post assessment	Annual basic data submission	Annual work plan
Timeliness of 60 days follow up	RI prioritization (quarterly)	Submission of admin coverage data	Timeliness of Personal Digital Assistant (PDA) data submission (monthly)	Monthly activity report
Non-polio AFP (NPFAP) rate		Submission of IM data	Biannual Data Quality Self-Assessment (DQS) (bi-annually)	Quarterly work plan update
Stool adequacy rate		Submission of Rapid Convenient Survey (RCS) data	Outbreak investigation report	
Contact sampling (High-risk areas)				
Polio (quarterly); Measles (bi-annually) ; Neonatal Tetanus (NNT) (annual) Risk Assessment				
# HFs visited monthly				

Table 2: monthly activity report quality monitoring indicators, WHO Ethiopia, 2014-2015

INDICATOR	DEFINITION	Score
Use of previous feedback	Whether action is taken for the previous month, feedback given by the Central Team	15
Consistency	No conflicting information, data, etc.	15
Use of weekly update	If data from weekly update is used for subsequent planning and actions	10
Use of PDA data	Whether data/information from PDA is used for reporting and subsequent planning and actions	40
Use of standard reporting format	If standard format is used to report	10
Completeness	Filling out all the components of the reporting format	10

Study population: a total of 38 staff were studied. All WHO field officers namely regional coordinators, zonal officers and woreda officers, were included in the accountability framework.

Data collection: we designed a relational database in Microsoft Access, at the central level that systematically captured all submitted deliverables. All deliverables are shared electronically, and the information is captured from a central mailbox that was created exclusively for this purpose and collated into the database. The system has embedded dates of expected submission and classifies individual deliverables accordingly. The database is also linked to the polio surveillance database whereby surveillance and related staff performance indicators are generated at the end of each quarter. The deliverables were reviewed for a twelve month period: July 2014 - June 2015.

Definitions

AFP case validation: reported AFP cases are expected to be validated by WHO field officers. The validation includes confirming if the case is truly acute flaccid paralysis and if the information included on the case investigation form is accurate. Each officer is expected to validate at least 80% of all reported cases in his/her catchment area.

Late AFP case: an AFP case is classified as "late" when a) the first stool is collected more than 14 days after onset of paralysis and/or b) when the time between 1st and 2nd stool collection is more than 24 hours and/

or c) the stool condition is bad, based on the amount of stool collected and temperature at receipt of specimen, as evaluated by a laboratory technician.

60-day follow up: follow- up assessments of late AFP cases are done my WHO officers 60 days after the onset of paralysis. Officers are expected to complete follow-up reports for 100% of late AFP cases. In addition to calculating the proportion of late AFP cases with 60 days follow-up report, we analyze timeliness of follow-up reports, for those late cases with follow-up reports, using time between date of onset of paralysis and date when follow-up was done. According to the national guideline, all follow-up of late cases should be done before 90 days of onset of paralysis.

Non polio AFP (NPAFP) rate: a rate of reported AFP case for the under 15 years of age population in a defined geographical unit within 12 months. Woreda, the third geographic unit, is used to calculate the rate. A minimum of 2 AFP cases are expected to be reported for 100,000 under 15 years population in 12 months time.

Stool adequacy rate: this is calculated based on the number of reported AFP cases which are not classified as late cases divided by the total number of reported cases within 12 months in a geographic unit. The indicator is calculated starting at Woreda level up to regional level and the minimum target is 80%.

Results

The trend in number of regions meeting the minimum proportion of all AFP cases validated by Field Officers increased from five regions in 2013(Amhara, Benishangul-Gumuz, Oromia, SNNPR and Tigray) to seven Regions in 2014 to all regions (except Hareri) in 2015. The proportion of validated AFP cases in Somali Region increased from 39% in 2013 to 86% in June 2015 (Table 3). The proportion of late AFP cases with 60-day follow-up done and report submitted nationally was 83% in 2013, 77% in 2014 and 58% in 2015. We disaggregated the proportion by regions and found that Somali region was 62% in 2013 and reached 84% in 2015 (Table 3). Furthermore, the proportion of 60 day follow-ups done within 90 days of onset of paralysis was 67% in 2013, 69% in 2014 and 88% in 2015.

Table 3: validation of reported AFP cases by Region by year: 2013 - June 2015, WHO Ethiopia

	2013			2014			Jan-June 2015		
	% AFP cases Validated	% FU Late AFP cases Done	% FU Done 60-90 Days	% AFP cases Validated	% FU Late AFP cases Done	% FU Done 60-90 Days	% AFP cases Validated	% FU Late AFP cases Done	% FU Done 60-90 Days
ADDIS ABABA	21%	100%	0%	52%	100%	0%	100%	100%	100%
AFAR	54%	100%	33%	70%	75%	33%	100%	NA	NA
AMHARA	81%	89%	73%	80%	69%	72%	93%	56%	90%
B/GUMUZ	93%	86%	100%	85%	100%	67%	86%	0%	NA
DIRE DAWA	71%	NA	NA	0%	NA	NA	100%	NA	NA
GAMBELLA	63%	100%	0%	92%	100%	25%	100%	NA	NA
HARERI	100%	0%	NA	33%	100%	0%	50%	0%	NA
OROMIA	74%	85%	71%	81%	71%	75%	86%	63%	95%
SNNPR	83%	85%	75%	82%	85%	94%	83%	50%	33%
SOMALI	39%	62%	29%	83%	84%	66%	86%	50%	80%
TIGRAY	93%	91%	60%	100%	83%	60%	89%	100%	100%
NATIONAL	**74%**	**83%**	**67%**	**81%**	**77%**	**69%**	**88%**	**58%**	**88%**

Data Source: National AFP Surveillance, WHO Ethiopia

When we analyzed selected program performance indicators, NPAFP and stool adequacy rates, the NPAFP rate at the national level was at 2.7 cases per 100,000 children under 15 years old in 2013, 3.1/100,000 in 2014 and 3.2/100,000 in 2015; which is above the target of 2.0/ 100,000 children under 15 years old. There were three regions, Addis Ababa, Afar and Tigray regions, with NPAFP below the expected standard in 2013 while all regions achieved the expected rate in 2014 and maintained this through June 2015 (except Tigray). The stool adequacy rate at the national level increased from 88% in 2013 to 93% in 2015. Three regions did not achieve the minimum target of 80% in 2013 and 2014 but by 2015 all regions had achieved the 80% target (Table 4). We analyzed program indicators in Somali region by zone, and identified that Nogob and Dollo zones performed above the expected rate throughout the study period: the NPAFP rate in Dollo zone was 14.0/100,000 at the end of 2013 and increased to 20.7/100,000 in 2014, and the rate is at 20.0/100,000 as of June 2015. In Nogob zone, the NPAFP rate was at 9.0/100,000 in 2013, 14.0/100,000 in 2014 and 16.0/100,000 as of June 2015. All zones achieved the minimum target 0f 2.0/100,000 except Fafan zone, in 2013 and 2015, and Afder in 2013 (Figure 1).

Table 4: AFP surveillance performance indicators by region, 2013- June 2015, Ethiopia

	2013			2014			Jun-15		
REGION	NPAFP Per 100,000	Stool Adq (%)	Achieved Indicators	NPAFP per 100,000	Stool Adq(%)	Achieved Indicators	NPAFP per 100,000	Stool Adq (%)	Achieved Indicators
ADDIS ABABA	1.6	91	One indicator	3.0	86	Both Indicators	2.9	80	Both indicators
AFAR	1.8	100	One indicator	3.8	87	Both Indicators	5.0	100	Both indicators
AMHARA	2.9	88	Both Indicators	2.7	86	Both Indicators	3.6	92	Both indicators
BENISHANGUL	3.0	69	One indicator	4.4	85	Both Indicators	3.1	86	Both indicators
DIRE DAWA	3.0	100	Both Indicators	2.0	100	Both Indicators	2.0	100	Both indicators
GAMBELLA	2.8	100	Both Indicators	2.0	69	One Indicator	2.0	100	Both indicators
HARERI	2.0	50	One indicator	5.0	67	One Indicator	4.0	100	Both indicators
OROMIA	2.7	89	Both Indicators	3.1	88	Both Indicators	3.1	91	Both indicators
SNNPR	2.7	92	Both Indicators	2.9	92	Both Indicators	2.7	97	Both indicators
SOMALI	3.4	64	One indicator	4.9	74	One Indicator	5.2	93	Both indicators
TIGRAY	1.9	86	One indicator	2.6	90	Both Indicators	1.6	81	One Indicator
NATIONAL	2.7	88	Both Indicators	3.1	87	Both Indicators	3.2	93	Both indicators

Data Source: National AFP Surveillance, WHO Ethiopia

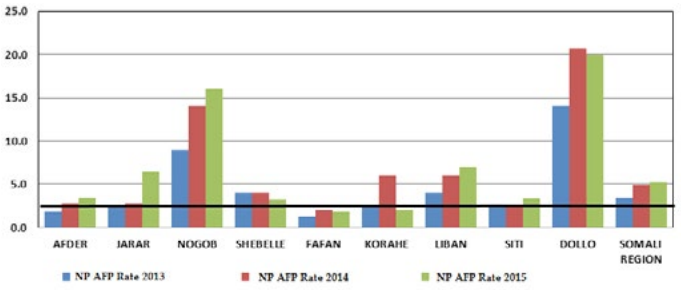

Figure 1
trend in non-polio AFP Rate by zone, Somali Region, Ethiopia 2013 – June 2015

Only three zones in Somali region achieved the stool adequacy target in 2013 and this increased to five zones in 2014. All zones but Fafan achieved the target in 2015 (Figure 2). Since the start of the monitoring and accountability system, the following managerial actions were taken based on the performance dashboard: 11 written acknowledgments to good performing staff , six discussions for improvement, six rotation of staff, four written first warning letters, and nine non-renewal of contract for poor performing staff were issued or implemented respectively.

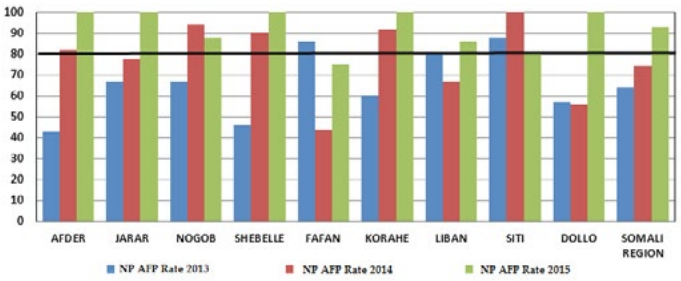

Figure 2
trend in stool adequacy rate by zone, Somali Region, Ethiopia, 2013 – June 2015

Discussion

We found that instituting the accountability framework into the existing monitoring and evaluation system for the WHO Ethiopia EPI team contributed to improved staff performance. We also found out that there was an overall improvement in key program performance indicators during the study period.

The proportion of validated AFP cases significantly improved both at the national and regional levels following the introduction of the monitoring system; chronically low-performing regions including Somali, Gambella and Afar have shown good improvement. A similar trend was observed in the proportion of late AFP cases with follow-up report submitted within 90 days of onset of paralysis from only 67% of the cases with follow-up reports in 2013 to 88% at the end of June 2015.This study highlighted the improvement in program indicators, NPAFP and stool adequacy rate, from only six regions achieving the minimum target for both indicators in 2013 to all regions except Tigray achieving both targets in 2015. Instituting accountability into health programs is becoming increasing popular, according to a study by O'Hagan et al. Healthcare providers are constantly striving to improve quality and efficiency by using performance management systems and quality improvement initiatives. Creating and maintaining a culture of accountability are important for achieving this end because accountability is the reason for measuring and improving performance [5].

Our findings on the impact of the accountability framework on performance are similar to that observed in Nigeria, where the WHO country office has been implementing a systematic accountability framework to improve performance of the polio eradication program. According to Tegegne et al [6], a significant change in process indicators of both AFP surveillance and routine immunization was demonstrated over the first year of implementation of the accountability framework. The WHO Representative in Nigeria attributed the progress in interruption of WPV transmission in Nigeria to the institutionalization of accountability framework by the government and partners to ensure those personnel delivered as expected with appropriate actions being taken based on performance, among other key contributing factors [7].

Various United Nation organizations have used different types of accountability frameworks. According to a joint inspection report by M.Mounir Zahran et al, United Nations organizations possess a stand-alone formal accountability framework (seven United Nations Organizations). Three secretariat entities possess a program level accountability framework. Other United Nations system organizations have various key components of accountability to varying degrees, several of them with strong internal control systems or components in place [8]. As an example, the UNICEF accountability framework highlights key functional elements of staff and management accountability at all levels of the organization. These basic functional elements are articulated in roles, responsibilities, and processes outlined in office-specific management plans and individual job descriptions [9]. Accountability frameworks are also becoming popular in nongovernmental organizations (NGOs). A study by Cunningham et al. at Oxfam Ireland argues that imposed accountability frameworks increase accountability towards donors and stakeholders, but do not increase accountability towards beneficiaries. However, the authors note that through the application of the adaptation measures outlined within their report, NGOs can balance each level of accountability, which can lead to an overall increase in program impacts towards beneficiaries [10].

We cannot conclude that the introduction of the accountability framework is solely responsible for improvement in program indicators where increased human resource in Somali Region, government focus to an outbreak that could enhance surveillance and other contributing factors interplay with performance. However, the improvement in individual level performance can be attributed to the transparent and performance monitoring framework instituted into the monitoring and evaluation system of the country office. Improved accountability is often called for as an element in improving health system performance. At first glance, the notion of better accountability seems straightforward, but it contains a high degree of complexity. For accountability to serve effectively as an organizing principle for health systems reform, conceptual and analytical clarity is required [11].

Conclusion

In conclusion, introducing an accountability framework that is evidence-based to enhance staff performance and increase transparency, in programs such as polio eradication, was very useful and effective in improving performance towards meeting program targets in WHO Ethiopia. The accountability framework should be maintained and further strengthened to incorporate other aspects of the immunization program towards achievement of eradication and elimination targets. We further recommend expanding the accountability framework to other country programs to contribute to progressive staff and organizational performance improvement.

What is known about this topic

- An accountability framework in polio eradication has already been implemented in Nigeria: one of the three polio endemic countries in the world. In the published article by the team, the monitoring framework is believed to have brought an impact and is gearing the program closer to eradication;
- Recently the African Regional office, WHO AFRO, has instituted a similar accountability framework tool to monitor program performance at country level. This is driven based on the experience at country level of Nigeria and Ethiopia and the positive outcomes of the monitoring tool.

What this study adds

- The study provides additional evidence of positive impact from similar monitoring systems. Clearly identifying deliverables and continuously monitoring performance at the individual level is very important in eradicating diseases like Polio;
- The study could be a reference for other public health problems in similar context, including elimination of measles and rubella. Such a study should be documented as part of the Polio legacy to benefit other programs.

Competing interests

The authors declare no competing interests. The views expressed in the perspective articles are those of the authors alone and do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated and the position of World Health Organization.

Authors' contributions

All authors have read and approved the final version of the manuscript.

References

1. Free Management Library. Basic Guide to Program Evaluation (Including Many Additional Resources). Accessed Oct 12, 2015.
2. Provincial Government Programs Cabinet Secretariat, Executive Council – Newfoundland Labrador. Developing an accountability framework resource and reference guide.
3. UNOCHA. Performance and accountability framework (PAF) for the Central Emergency Response Fund (CERF). Accessed Oct 12, 2015.
4. World Health Organization. WHO Accountability Framework - March 2015 (Pdf). Accessed Dec 3 2015.
5. O'Hagan J, Persaud D. Creating a culture of accountability in health care. Health Care Manag (Frederick). 2009 Apr-Jun;28(2):124-33.
6. Tegegne SG, MKanda P, Yehualashet YG, Erbeto TB, Touray K, Nsubuga P et al. Implementation of a Systematic Accountability Framework in 2014 to Improve the Performance of the Nigerian Polio Program. J Infect Dis. 2016;213(suppl 3):S96-100.
7. World Health Organization. WHO Representative reaffirms commitment to Polio Eradication in Nigeria. Accessed Dec 3, 2015.
8. Sahran MM. Accountability frameworks in the United Nations system. Accessed Dec 3 2015
9. United Nations Economic and Social Council. Report on the

accountability system of UNICEF. Accessed Dec 3, 2015
10. Cunningham A, Murphy S. Accountability Frameworks: Who do they Benefit? By Cunningham etal A, OXFAM, University of Dublin.
11. Derick Brinkerhoff - Abt Associates Inc. Accountability and health systems: overview framework and strategies. Accessed Dec 3, 2015.

Notes