



Contribution of polio eradication initiative to strengthening routine immunization: Lessons learnt in the WHO African region



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ABSTRACT

Background: Important investments were made in countries for the polio eradication initiative. On 25 September 2015, a major milestone was achieved when Nigeria was removed from the list of polio-endemic countries. Routine Immunization, being a key pillar of polio eradication initiative needs to be strengthened to sustain the gains made in countries. For this, there is a huge potential on building on the use of polio infrastructure to contribute to RI strengthening.

Methods: We reviewed estimates of immunization coverage as reported by the countries to WHO and UNICEF for three vaccines: BCG, DTP3 (third dose of diphtheria-tetanus toxoid- pertussis), and the first dose of measles-containing vaccine (MCV1). We conducted a systematic review of best practices documents from eight countries which had significant polio eradication activities.

Results: Immunization programmes have improved significantly in the African Region. Regional coverage for DTP3 vaccine increased from 51% in 1996 to 77% in 2014. DTP3 coverage increased >3 folds in DRC (18–80%) and Nigeria from 21% to 66%; and >2 folds in Angola (41–87%), Chad (24–46%), and Togo (42–87%). Coverage for BCG and MCV1 increased in all countries. Of the 47 countries in the region, 18 (38%) achieved a national coverage for DTP3 $\geq 90\%$ for 2 years meeting the Global Vaccine Action (GVAP) target. A decrease was noted in the Ebola-affected countries i.e., Guinea, Liberia and Sierra Leone.

Conclusions: PEI has been associated with increased spending on immunization and the related improvements, especially in the areas of micro planning, service delivery, program management and capacity building. Continued efforts are needed to mobilize international and domestic support to strengthen and sustain high-quality immunization services in African countries. Strengthening RI will in turn sustain the gains made to eradicate poliovirus in the region.

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1. Introduction

Significant progress has been made to interrupt wild poliovirus (WPV) transmission since the 1988 launch of the World Health Organization (WHO) Global Polio Eradication Initiative (GPEI) by the World Health Assembly [1]. Global polio eradication was to be achieved within the Expanded Programme on Immunization (EPI) and the framework of strengthened primary health care. Routine immunization (RI) is a key pillar of polio eradication efforts which aims to ensure that all children receive the recommended childhood immunizations, including three doses of oral polio vaccine (OPV). To enhance population immunity in low coverage

areas, RI efforts are complemented with supplemental immunization activities (SIAs) and mass mop-up campaigns which are conducted to administer additional OPV doses to children [2,3].

Since 1988, implementation of the recommended polio eradication strategies (i.e., strong RI, SIAs and well performing acute flaccid paralysis (AFP) surveillance systems) have successfully reduced the global incidence of polio by 99%. Despite success in interrupting WPV transmission, several countries in the African region have experienced widespread polio outbreaks in the recent past. Since 2001, polio outbreaks have occurred in 31 previously polio-free African countries [4]. Prior to 2015, Nigeria had yet to interrupt endemic WPV transmission and was the source of WPV responsible for polio outbreaks in 25 formerly polio-free African countries [5,6]. An extensive set of outbreak response and preventative SIAs were conducted in the countries experiencing polio outbreaks. On

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25 September 2015, a major milestone was achieved in the WHO African region when Nigeria was removed from the list of polio-endemic countries leaving only two countries (i.e., Afghanistan and Pakistan) that have never interrupted endemic WPV transmission [7]. This remarkable achievement brings Nigeria and the African region closer to being certified polio-free and is the result of an extensive response by domestic and international partners that saw sizeable investment in human and financial resources for immunization programs in the region. Objective 2 of the Polio Eradication and Endgame Strategic Plan 2013–2018 further reinforced the resolve to build on build on polio eradication gains, including infrastructure to strengthen immunization programs, phased withdrawal of OPV starting with type-2 containing OPV, and the introduction of inactivated polio vaccine (IPV) into RI programmes globally [8]. This has inspired discussions on how GPEI and RI can benefit from each other especially how polio assets and infrastructure can strengthen RI, and how a strong RI system can accelerate polio eradication.

With the eradication of polio from the African continent fast approaching, questions have been raised as to whether polio eradication efforts in the region contributed to strengthening RI in the African region, especially in those countries with considerable polio eradication infrastructure. The impact of vertical eradication programs on health systems has been a much debated topic in public health [9,10]. Polio eradication activities in the Western Pacific Region resulted in both successful interruption of wild poliovirus (WPV) transmission and strengthened routine vaccine delivery, mainly in previously poor performing countries [11]. Although anecdotal evidence suggests a positive contribution, there is still little documentation on the impact of polio eradication initiatives on routine immunization in Africa. This paper examines the contribution if any of polio eradication activities on RI in eight African countries which had polio outbreaks in the recent past.

2. Methods

We reviewed the estimates of immunization coverage for each country as reported by WHO and the United Nations Children's Fund (UNICEF) from the online information system, which contains immunization and surveillance data reported to the WHO African Regional Office by Member States. The analysis included three common vaccines in the routine infant immunization schedules i.e., *Bacillus Calmette–Guerin* (BCG), the third dose of diphtheria–tetanus toxoid–pertussis vaccine (DTP3), and the first dose of measles-containing vaccine (MCV1). DTP3 is used as a proxy for vaccination coverage and performance [12].

The two modalities of delivering OPV in the African region were through RI services including Periodic Intensification Routine activities (PIRI), child health days and also through conducting several rounds of polio SIAs. These include national immunization days (NIDs), subnational immunization days (SNIDs), and mop-up rounds. Several doses of OPV were administered to a target population of mostly children aged <5 years.

We conducted a systematic review of best practices documents and other relevant reports from eight countries which had WPV transmission and which had significant polio eradication activities (i.e., Angola, Cote D'Ivoire, the Democratic Republic of Congo [DRC], Ethiopia, Nigeria, Tanzania, Chad, and Togo). The selected best practices were then grouped into four thematic areas describing the specific contribution: microplanning, implementation and service delivery, capacity building and program management. Best practices from the eight countries were considered as representative of all the other AFR Member States. Immunization coverage trends for DRC, Ethiopia and Nigeria countries were also analyzed from 1996 when the polio campaigns were introduced in the AFR after the PEI was launched in 1988.

2.1. Microplanning

Polio campaigns have contributed to the identification of settlements or villages with high number of unvaccinated children by spearheading the development of improved microplans using innovative technology. Use of global positioning systems (GPS) to create accurate, coordinate-based maps for polio-endemic states in Nigeria improved microplans that were consequently utilized to provide routine vaccines [13].

In almost all the eight countries, polio eradication activities (PEI) supported exercises to update health facility microplans named in Nigeria “reach every ward” (REW microplans) to capture previously unreached settlements, improving access and utilization of the immunization services by reestablishing immunization service delivery points (fixed sites) in wards with existing facilities and outreach or mobile sites.

2.2. Implementation and service delivery

Strategies used for unreached children during polio campaigns were leveraged to ensure RI services are provided in identified areas. In addition to delivering OPV, the NIDs or SNIDs and child days were used as opportunities to administer other routine vaccines in all countries in addition to the micronutrient vitamin A.

In DRC, Polio eradication activities facilitated negotiations with armed groups for the vaccination of children during NIDs and also during RI outreach sessions in the eastern part of the country through interpersonal meetings and education of those armed groups.

A similar situation was observed in Angola where the Angolan Army Health Services (AAHS) over the past 20 years have been fully involved in immunization services in hard to reach areas using helicopters and trucks as well as providing RI services on daily basis in their military health facilities and hospitals.

In Tanzania, PEI supported use of village health workers during immunization services in the community.

In Chad, the Ministry of Health worked closely with the National Program of Health for Nomads (PNSN) and the Ministry of Livestock and Animal Resources (MERA) to synchronize vaccination activities for humans as well as cattle and sheep at least twice a year. Key activities included identifying the movements of nomads with their seasonal itineraries, identifying leaders and representatives of nomads, for advocacy, organizing a multi-sector, interagency meetings and developing an action plans for immunization of nomadic children and pregnant women.

2.3. Capacity building

Polio funded staff were used to support other public health activities such as health care worker capacity building activities in the eight priority countries. These included training of health workers in all areas of immunization and supportive supervision.

In Ethiopia, polio funds were used to increase the number of supportive supervision visits to poorly performing zones using an integrated portable digital assistant (PDA) checklist by WHO field officers. Officers analyzed and used the data for action at their level.

Similarly, in Nigeria, PEI contributed to strengthening supportive supervision and using text messages to transmit data and drive corrective actions, known as Nigeria's Real-time Tracking of Routine Immunization Supervision (NRTRIS). After cascade orientation sessions were conducted at national, State and local government area (LGA) level, the polio staff carried out supportive supervision to the health facilities on a weekly basis. An abridged checklist was used to monitor implementation of the planned immunization sessions.

At LGA level, polio funds enabled supervisors to conduct several visits to polio surge staff and provide on-the-job training, address staff problems and provide guidance to improve their performance. Regular meetings were also held between the village committees and health facility staff to improve linkages and enable good turn-out during outreach and mobile services. Community trainings provided an opportunity for field volunteers to support health workers in revising micro plans to identify new outreach points.

2.4. Program management

In all the eight countries, polio processes, human and financial resources, vehicles and tools were used in managing other priority health programmes, mainly routine EPI. The polio funded vehicle fleet was “polyvalent” and benefited many other priority health programs and administration at all levels, especially for surveillance and supervision.

In Chad, PEI led to inception of monthly monitoring and decision making meetings that took into account not only immunization issues but also all existing problems in the health sector. Health sector decision-making monthly meetings are held at the regional and central level chaired by the regional governor and the Head of State respectively.

In Ethiopia, PEI supported orientation meetings with all zonal, woreda managers on “reaching every district” (RED) approach; microplanning and quarterly monitoring review meetings. They also supported technical development, printing and distribution of tools to monitor RI programs.

In Tanzania, health workers with experience in polio management were recruited to provide RI and other services in an integrated manner in remote villages which lacked adequate health services.

In Nigeria, funds from the polio program were used by health facilities to collect vaccines from LGAs and State cold stores thereby ensuring uninterrupted supply of vaccines at the end points. We also reviewed RI data from the WHO Africa Regional Office to put the data from the documentation of the eight countries in a wider context to establish the contribution of PEI to RI.

3. Results

Fig. 1 shows the national trends in infant immunization rates for BCG, DTP3 and MCV1 from 1989 to 2014 in the three countries. During this period, there was a gradual increase of the vaccination coverage in the 3 countries. This trend was observed in the 8 countries and even all countries in the region as shown on Fig. 2. In DRC and Nigeria, the coverage of the DTP3 increased more than three-fold during the same time period i.e., in DRC, from 18% to 80%, and in Nigeria from 21% to 66%. In Angola, Chad and Togo, the increase was twofold or more (i.e., Angola 41–87%, Chad: 24–46% and Togo: 42–87%). A moderate increase was observed in Cote d'Ivoire (58–67%), Tanzania (82–97%), and Ethiopia (55–77%). A similar trend was observed for BCG and MCV1.

According to WHO and UNICEF coverage estimates, the regional coverage for DTP3 vaccine increased from 5% in 1980 to 77% in

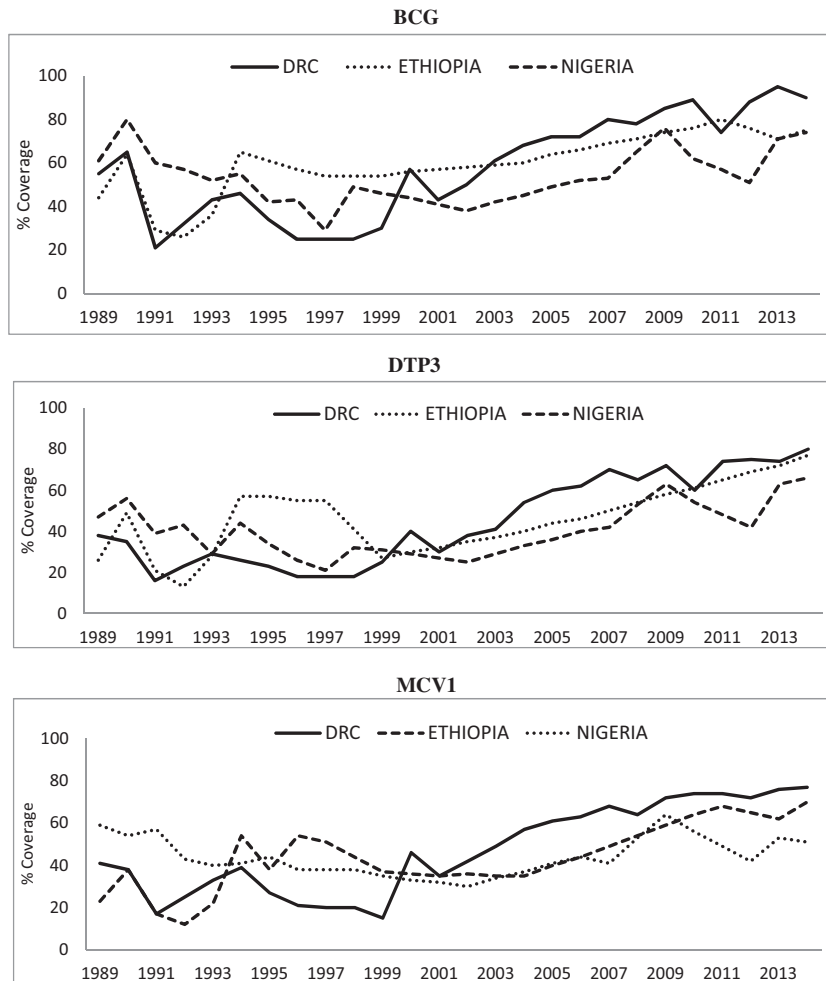


Fig. 1. Vaccination coverage for BCG, DTP3 and MCV1 in DRC, Ethiopia and Nigeria, 1989–2014.

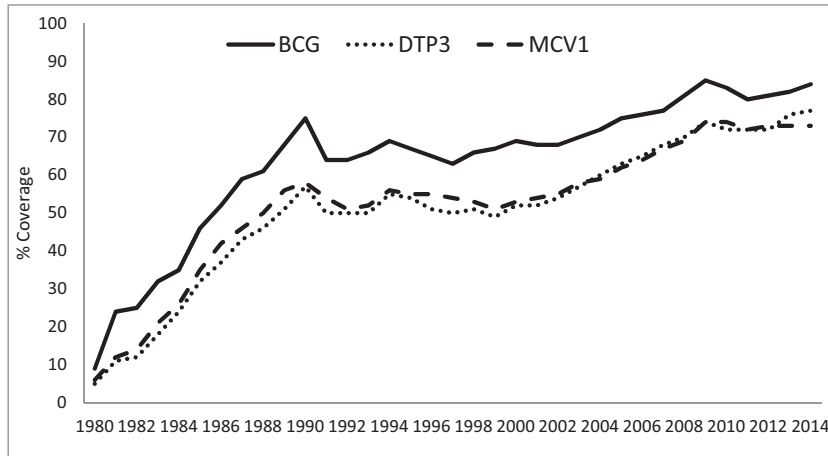


Fig. 2. Coverage of DTP3, MCV1 and OPV3 vaccines in the African Region, 1980–2014. Source: WHO/UNICEF estimates.

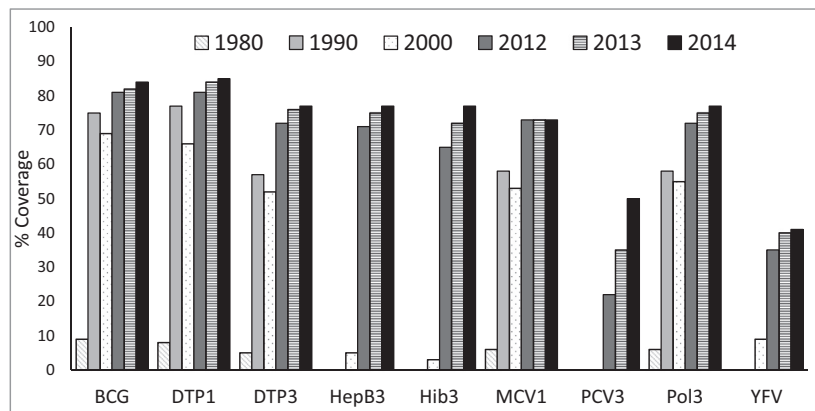


Fig. 3. Vaccination coverage by antigen and year WHO/AFR*. WHO/UNICEF estimates. http://www.who.int/immunization/monitoring_surveillance/data/ga_afrprofile.pdf?ua=1.

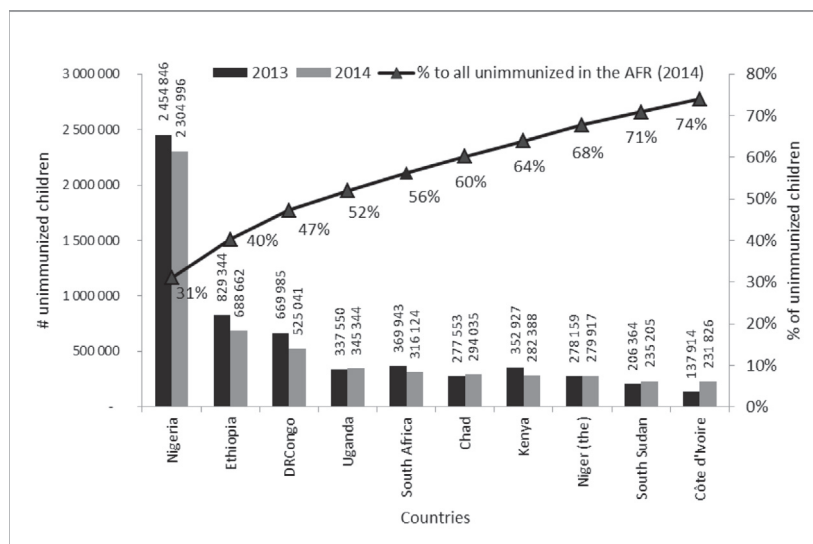


Fig. 4. Estimated number of children who did not receive the third dose of pentavalent vaccine during the first year of life among 10 countries in Africa with the largest number of unimmunized children, and cumulative percentage of all incompletely vaccinated children in Africa, 2013–2014*. WHO/AFRO/FRH/IVD database.

2014. This trend was observed also for polio 3 and MCV1 (Fig. 2) and even other antigens of the programme (Fig. 3).

In 2014, almost 7.4 million children in Africa missed out on routine immunization services and 75% of these missed children were located in 10 countries, with 50% of these children located in Ethiopia, DRC, Nigeria, and Uganda (Fig. 4). Five of the 10 countries are among AFR priority countries and receive support for the development and implementation of national routine immunization programs and efforts to reach unreached children.

Table 1 shows that out of the 47 countries in the region, 18 countries (38%) achieved a national coverage for DTP3 containing vaccine of $\geq 90\%$ meeting the Global and Regional Vaccine Action (GVAP) in 2014 (Table 1). An increase in national vaccination coverage was reported in Ethiopia, DRC and Nigeria while a decrease was noted in 17 countries, including the three Ebola-affected countries i.e., Guinea, Liberia and Sierra Leone.

4. Discussion

In our review of the contribution if any of polio eradication activities on RI in eight African countries which had polio

outbreaks in the recent past, we found that coverage for DTP3 vaccine has increased in all the 8 countries. This upward trend observed in almost all countries in the region resulted in an increase of the regional coverage from 5% in 1980 to 77% in 2014. Lower coverage were achieved in 2014 in Chad, Nigeria and Cote d'Ivoire where they were 46%, 66% and 67% respectively. The overall improvement in coverage is probably the results of multiple factors among which strengthening capacities that have happened during polio processes that may have been applied for routine immunization.

It is worth to note that since 1974 when WHO launched the EPI program to provide routine vaccinations against tuberculosis, polio, diphtheria, tetanus, pertussis and measles to all children [3], extraordinary progress has been made in expanding the reach of RI programmes in Africa owing in part to several international and regional initiatives, coupled with strong commitment by Member States.

Data presented in this paper demonstrates significant improvement of RI coverage over the years compared to the pre polio eradication era denoting the potential positive contribution of polio eradication activities to strengthening routine immunization

Table 1
Vaccination coverage for EPI antigens by country, WHO/AFR, 2014.*

Countries	BCG	DTP3	MCV1	MCV2	OPV3	Rota_last	PAB	YFV
Algeria	99	95	95	99	95		92	
Angola	81	80	85		81	18	78	77
Benin	88	70	63		72		93	64
Botswana	98	95	97	85	96	82	92	
Burkina Faso	98	91	88	17	91	91	89	87
Burundi	92	95	94	60	95	96	85	
Cabo Verde	99	95	93	79	95		92	
Cameroon	82	87	80		86	46	85	80
CAR	74	47	49		47		60	48
Chad	59	46	54		54		60	40
Comoros	76	80	80		79		85	
Congo	95	90	80		90	60	85	65
Côte d'Ivoire	84	67	63		66		82	43
DRC	90	80	77		79		82	65
Equatorial Guinea	71	24	44		30		70	
Eritrea	97	94	96		94	25	94	
Ethiopia	75	77	70		75	63	80	
Gabon	91	70	61		68		85	60
Gambia	96	96	96	73	97	92	92	96
Ghana	99	98	92	67	98	98	88	92
Guinea	72	51	52		42		80	53
Guinea-Bissau	94	80	69		78		80	53
Kenya	81	81	79		81	19	76	
Lesotho	87	96	92	82	95		83	
Liberia	73	50	58		49		89	54
Madagascar	75	73	64		73	50	78	
Malawi	97	91	85		87	83	89	
Mali	79	77	80		84	13	85	64
Mauritania	98	84	84		84	5	80	
Mauritius	97	97	98	85	98		95	
Mozambique	93	78	85		78		83	
Namibia	97	88	83		88		85	
Niger	76	68	72	3	67	19	81	70
Nigeria	74	66	51		66		55	49
Rwanda	99	99	98		99	98	90	
Sao Tome & Principe	95	95	92	71	95		91	93
Senegal	95	89	80	13	85		85	80
Seychelles	98	99	99	98	99		80	
Sierra Leone	90	83	78		83	53	64	80
South Africa	77	70	70	60	71	72	88	
South Sudan	46	39	22		44		81	
Swaziland	99	98	86	89	98		85	
Togo	97	87	82		85	35	88	82
Uganda	93	78	82		82		85	
Tanzania	99	97	99	29	97	97	75	
Zambia	95	86	85	33	78	73		
Zimbabwe	99	91	92		92	48		

* 2014 WHO/UNICEF estimates.

program in Africa. All the reviewed countries had existing PEI activities from which best practices had effects on RI. The main areas where PEI capacity improved RI were micro planning, service delivery, program management (i.e., “polyvalent approach” and review meetings) and capacity building (i.e., training and supervision). RI also benefited from available polio funds used to develop guidelines.

The key role played by the support of the Gavi Alliance starting in 2002, in strengthening RI programmes should not be overlooked. Social mobilization component also played an important part in the increase of vaccination coverage as communication was a crucial component of PEI activities, successes were used to develop integrated communication strategies for RI which were adapted for individual countries and led to increased buy-in from communities, so that more people participated in the campaigns.

The improvements in RI in the region demonstrate the mutual benefit of strong RI programs have on accelerating the interruption of poliovirus while improving access to routine vaccines. RI provided a platform for the introduction IPV, the switch from trivalent OPV to bivalent OPV and in time the eventual withdrawal of all OPV vaccines. PEI activities in the region increased the technical workforce for RI programs in the region. Polio-funds enabled experienced technical EPI managers to be recruited in all countries in the region. Having competent staff as country-level EPI managers translated to better run immunization and surveillance programs, including polio eradication. GPEI is currently working with the Immunization management Group (IMG) in 10 countries targeted by the Polio End Game Strategy for legacy planning, building on the documented use of polio infrastructure in those countries [14].

Our review had the some limitations: Generalizing the results of the documentation on the best practices exercise in the eight countries beyond areas that were studied or even beyond the country has to be performed cautiously; the identification of respondents was not done randomly, and they were reporting on a program that they themselves are charged with implementing

In conclusion, There is clear evidence that the huge investment made for PEI have resulted in the interruption of wild poliovirus as well as strengthening capacity in almost all areas of immunization system therefore contributing substantively to the increase of immunization coverage observed in all countries.

Despite good progress, there is still much to be done to sustain gains made in availing vaccines, since even the best performing countries have pockets of underserved population. The Regional Vaccine Action Plan 2014–2020 (RVAP) has an ambitious goal to achieve 90% national coverage and 80% coverage in each district of EPI vaccines by the end of the target year. Availability of adequate resources remains a challenge and continued efforts are needed to mobilize national, regional and international support to strengthen and sustain high-quality immunization services in African countries. Strengthening RI will in turn sustain the gains made to eradicate poliovirus in the region and help build a stronger system to deliver other lifesaving vaccines.

We recommend that documentation of best practices in the 8 countries to provide much more tangible results that will be directly linked to the effect of the PEI. Countries are encouraged to really capitalize the huge investment made during PEI in the development of their legacy planning.

We also recommend that exchange of experience from countries that have benefited with huge polio infrastructure should be shared with others for them to benefit from it.

Conflict of interest

The authors have not conflict to declare.

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