

## Report



# The role of polio emergency operations centers: perspectives for future disease control initiatives in Nigeria

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**Received:** 04 Aug 2023 - **Accepted:** 07 Aug 2023 - **Published:** 08 Aug 2023

**Domain:** Epidemiology, Immunization, Polio eradication

**Keywords:** Polio eradication, emergency operations center, wild poliovirus, transition

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**Cite this article:** Fiona Braka et al. The role of polio emergency operations centers: perspectives for future disease control initiatives in Nigeria. Pan African Medical Journal. 2023;45(2):8. [doi: 10.11604/pamj.sup.2023.45.2.41308]

This article is published as part of the supplement **Global Partnership towards Polio Eradication Efforts**, commissioned by **US CDC (Atlanta, USA), CDC Nigeria Country Office, (Abuja, Nigeria), Nigeria FELTP (Abuja, Nigeria)**.

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**Available online at:** <https://www.panafrican-med-journal.com/content/series/45/2/8/full/>

## Abstract

The Nigeria Polio Emergency Operations Centre (EOC) was established in October 2012 to strengthen coordination, provide strategic direction based on real-time data analysis, and manage all operational aspects of the polio eradication program. The establishment of seven state-level polio EOCs followed. With success achieved in the interruption of wild poliovirus (WPV) transmission as certified in 2020, the future direction of the polio EOC is under consideration. This paper describes the role of the polio EOC in other emergencies and perspectives on future disease control initiatives. A description of the functionality and operations of the polio EOC and a review of documentation of non-polio activities supported by the EOC was done. Key informant insights of national and state-level stakeholders were collected through an electronic questionnaire to determine their perspectives on the polio EOC's contributions and its future role in other public health interventions. The polio EOC structure is based on an incident management system with clear terms of reference and accountability and with full partner coordination. A decline in WPV1 cases was observed from 122 cases in 2012 to 0 in 2015; previously undetected transmission of WPV1 was confirmed in 2016 and all transmission was interrupted under the coordination of the EOCs at national and state levels. During 2014-2019, the polio EOC infrastructure and staff expertise were used to investigate and respond to outbreaks of Ebola, measles, yellow fever, and meningitis and to oversee maternal and neonatal tetanus elimination campaigns. The EOC structure at the national and state levels has contributed to the positive achievements in the polio eradication program in Nigeria and further in the coordination of other disease control and emergency response activities. The transition of the polio EOCs and their capacities to support other non-polio programs will contribute to harnessing the country's capacity for effective coordination of public health initiatives and disease outbreaks.



Annex 1: key informant perceptions on the contribution of the EOCs to public health programs, Nigeria					
		Strongly Agree	Agree	Uncertain	Disagree
1	Polio EOCs have played a major role in the interruption of WPV1	18 (100%)	-	-	-
2	The following public health programs have benefited from the polio EOC at the national and state levels:				
i	Routine immunization	17 (94%)	1 (6%)		
ii	Measles elimination	13 (72%)	4 (28%)		
iii	Maternal and neonatal tetanus elimination	8 (44%)	3 (17%)	3 (17%)	2 (11%)
iv	Integrated disease surveillance and response	11 (61%)	2 (11%)	3 (17%)	1 (6%)
v	Response to outbreaks	10 (56%)	4 (22%)	2 (11%)	
vi	Child health	1 (6%)	4 (22%)	4 (22%)	8 (44%)
vii	Maternal health	6 (33%)	5 (28%)	4 (22%)	
viii	Primary health care/health systems strengthening	7 (39%)	6 (33%)	4 (22%)	
ix	Others: Ebola, Yellow Fever, Malaria, MNCH Weeks, Nutrition, NTDs, Meningitis, Lassa				
3	Polio EOCs have generated some resources for other public health programs				
i	Accountability systems	14 (78%)	4 (22%)		
ii	Governance systems	10 (56%)	6 (33%)	1 (17%)	
iii	Data management	16 (89%)	2 (11%)		
iv	Financial resources	8 (44%)	5 (28%)	5 (28%)	
v	Information & communication equipment	12 (67%)	2 (11%)	3 (17%)	1(6%)
vi	Laboratories	6 (33%)	3 (17%)	7 (39%)	2 (11%)
vii	Networks and processes for surveillance	12 (67%)	4 (22%)	1 (6%)	1 (6%)
viii	Skilled manpower for public health activities	15 (83%)	1 (6%)	2 (11%)	
ix	A platform for community engagement	13 (72%)	4 (22%)	1 (6%)	
x	Corporate management of the programs and offices	9 (50%)	7 (39%)	2 (11%)	
xi	Vehicles and transport for interventions	12 (67%)	2 (11%)	3 (17%)	
xii	Vehicles and transport for program management	8 (44%)	4 (22%)	5 (28%)	
xiii	Work locations like EOCs	15 (83%)	1 (6%)	1 (17%)	
xiv	Office running costs	9 (50%)	3 (17%)	5 (28%)	
4	Has the polio EOC support to other areas of work impacted the work of the EOC?				
i	Negatively	1 (17%)	9 (50%)		
ii	Positively	15 (83%)	1 (17%)		
	Is the current capacity of the EOC sufficient to address other public health interventions?				
i	Disease surveillance	11 (61%)	7 (39%)		
ii	Epidemic preparedness and response	9 (50%)	8 (44%)		
iii	Measles elimination	12 (67%)	6 (33%)		
iv	Routine immunization	16 (89%)	2 (11%)		
v	PHC/ health systems strengthening	11 (61%)	5 (28%)		
5	Additional resource needs for the polio EOC to fulfil these functions				
i	Human resources	13 (72%)			
ii	Training for EOC staff	15 (83%)			
iii	Funding	13 (72%)			
iv	Space	9 (50%)			
v	Equipment	10 (56%)			
6	Would the resources required to ensure the functionality of the EOCs be affordable and fulfilled by the health system at the federal and state level?	Yes 8 (44%)	No 10 (56%)		
7	What would be the implication of the withdrawal of polio EOCs on other public health interventions?				
i	Negative impact on coordination of activities	15 (83%)			
ii	Inadequate human resources	13 (72%)			
iii	Inadequate financial resources	10 (56%)			
iv	More time available	3 (17%)			
v	Complacency from program staff	1 (17%)			
vi	Human resource mobilization will be affected	1 (17%)			
8	Which of the following would be a good transition for the polio EOCs after eradication is achieved?				
i	Coordination of outbreak response activities	10 (5)			
ii	Coordination of routine immunization	3 (18%)			
iii	Surveillance	3 (18)			
iv	All	2 (12%)			

EOC: Emergency operations centre, MNCH: maternal, newborn, and child health, NTDs: neglected tropical diseases

by NPHCDA and partners. We reviewed polio reports summarized from the national polio database. Likewise, we assessed records and reports on non-polio-related activities coordinated by the EOCs. Key informant interviews were conducted to obtain information on the role of the polio

EOCs in the coordination of non-polio-associated activities during 2014-2019 and future perspectives after certification of WPV1-free status.

**Setting:** the assessment was implemented at the national level (Polio EOC, Nigeria Centre for Disease Control [NCDC], GPEI partners) and state level (Polio EOCs and State Primary Health Care Development Agencies [SPHCDA]).

### Organization of the emergency operations centre

We examined the organization and structure under the incident management system (IMS) which includes an Incident Manager and Deputy Incident Manager designated by NPHCDA with the authority to execute decisions related to the program on behalf of the Executive Director of NPHCDA. Similarly, State EOCs set up in seven states (i.e., Borno, Kaduna, Kano, Katsina, Sokoto, Bauchi, and Yobe) have designated Incident Managers and Deputy Incident Managers from the SPHCDA. The National EOC structure has five subgroups that facilitate the functions of the EOC: Strategy, Data Management, Operations, Communication, and Polio Surveillance (with a small subgroup also focusing on mobile populations), and, supported by Monitoring and Accountability (M and A) Officers and a facility management team (Figure 1). The emergency operations centre has five operational components:

**1) War-room approach:** a layout facilitating the display of maps, up-to-date polio program performance indicators, and video and teleconference facilities that link with the state EOCs. The EOC members meet twice a week in the war room, while the subgroups of the EOC hold separate meetings during the week. However, during outbreaks, the number of meetings may increase in frequency.

**2) Dedicated cross-functional talent:** the National Primary Health Care Development Agency provides the leadership team for the National EOC and more than 50 M and A Officers with direct contact to states and high-risk LGAs. WHO and the Nigeria Office of the US Centers for Disease Control and Prevention (CDC) provide polio experts, epidemiologists and data analysts, while UNICEF provides expertise to address communication, social mobilization, non-compliance, and logistics management. WHO, UNICEF, CDC (through its implementing partner Africa Field Epidemiology Network (AFENET)/ National Stop Polio (NSTOP) Program and Core Group of Polio Partners (CGPP) deploy thousands of 'boots on the ground' to support state and local governments right down to community level in implementing and monitoring polio eradication activities, including surveillance and mobilization.

**3) Fast-paced analytics and frequent synthesis:** the EOC analyses data periodically and in real-time for prompt action. Pre-, intra-, and post-vaccination campaign data are analyzed and displayed in monitoring dashboards, and strategies to improve SIA quality are systematically evaluated.

**4) Rapid decision-making and synthesis:** the EOCs ensure that all relevant decision-makers are under one roof to review performance data from the field and make decisions rapidly. There is delegated authority from the NPHCDA to the Incident Manager to execute decisions of the EOC.

**5) Intensive program management:** rigorous and daily tracking of activities in the field through telephone, satellite imagery, GIS technology, open data kit (ODK), and other mechanisms, as well as overall monitoring of outcomes against clear targets set out in the annual National Polio Eradication Emergency Plan, helps to maintain a sense of urgency at all times.

**Study participants:** key informants from the Federal and State level EOCs were selected from government and partner agencies based on their senior level of responsibility and involvement in coordinating public health programs. Eighteen key informants responded to the interview questionnaire which covered several thematic areas including resources for polio EOC, the role and impact of EOCs on other programs/responses etc (Annex 1). The location (and number) of the participants spanned across the National EOC/ NPHCDA (4), NCDC (2), State EOC (6), State Primary Health Care Development Agency (SPHCDA)/ State Government (2), Partner Agencies (WHO, UNICEF, CDC, BMGF, Rotary International) (4). All participants selected had some degree of involvement with, knowledge of, or exposure to polio eradication activities and participated in the coordination of activities at the Federal or State level. The 18 participants were involved in other program areas: routine immunization

Annex 2: non-polio disease outbreaks and immunization campaigns supported by the polio EOCs, Nigeria, 2014-2019					
Outbreak Response/SIA	Year	Location	Details of response	Polio EOC support	Outcome
Ebola Virus Disease (EVD)	2014	Lagos, rivers	Set up of incident management system for coordination  Implementation of standard operating procedures for contact tracing, case management, infection prevention and control, safe and dignified burial, decontamination, laboratory services, and points of entry and exit (POE)	<ul style="list-style-type: none"> <li>• Coordination of response using the Incident Management System (Deputy IM of Polio EOC was IM for Ebola EOC and Technical staff from Polio EOC deployed)</li> <li>• Polio surveillance structure used for investigation, active case search, and contact tracing</li> <li>• Technology for real-time tracking of cases</li> <li>• Adopted approaches for the mobilization of communities and addressing non-compliance</li> </ul>	<ul style="list-style-type: none"> <li>• Control of the EVD outbreak within 93 days</li> <li>• 892 contacts followed up, with only 1 lost to follow up</li> <li>• Blood specimens collected from 61 suspect EVD cases, 19 (31%) were positive</li> <li>• Overall case fatality rate of 40%</li> </ul>
Meningitis	2018	Yobe	A mass vaccination campaign targeting persons aged 1-6 years	<ul style="list-style-type: none"> <li>• Engagement of polio structure, best practices, and expertise for coordination, investigation, and response</li> <li>• Supervision and monitoring</li> <li>• Data management support</li> </ul>	862,455 children were vaccinated with the men's A vaccine in Feb 2018
	2018	Sokoto, Zamfara, Kastina	Reactive vaccination campaign targeting persons aged 1-29 years		248,725 persons were vaccinated across 12 Wards in 10 LGAs on 20 <sup>th</sup> -29 <sup>th</sup> of April 2018 using the conjugate vaccine
Yellow fever	2017	Kwara, Kogi, Zamfara	Reactive vaccination campaign for 9 months-45 years age group	<ul style="list-style-type: none"> <li>• Location of coordination meetings</li> <li>• Support for the development of an International Coordinating Group (ICG) for yellow fever requests</li> <li>• Deployment of National Supervisors</li> <li>• Data management support</li> <li>• Engagement of PEI house-to-house mobilizers and other social mobilization structures at State &amp; LGAs</li> </ul>	3,056,103 persons were vaccinated across 18 LGAs in 3 states through 3 reactive campaigns
	2018	Edo, Niger, Kebbi, Sokoto,	Reactive vaccination campaign for 9 months-45 years age group		3,093,104 persons aged 9 months-45 years were vaccinated across 14 LGAs during reactive campaigns in 4 States
	2018	Kwara, Kogi, Zamfara, Borno, Sokoto, Kebbi, Niger, FCT, Plateau	Preventive vaccination campaign for 9 months-44years age group		26,722,417 persons were vaccinated in two phases in February and November

Outbreak Response/SIA	Year	Location	Details of response	Polio EOC support	Outcome
				<ul style="list-style-type: none"> <li>Data management and</li> <li>Post-campaign coverage surveys (PCCS)</li> <li>Engagement of PEI house-to-house mobilizers and other social mobilization structures at State &amp; LGAs</li> </ul>	
	2019	Edo, Ondo, Delta, Benue, Ebonyi	Reactive vaccination campaign for 9 months-45 years age group	<ul style="list-style-type: none"> <li>Deployment of national supervisors</li> <li>Vaccine tracking</li> </ul>	2,357,846 persons vaccinated
	2019	Borno, Kastina, Ekiti, Rivers, Anambra	Preventive vaccination campaign for 9 months-44 years age group	<ul style="list-style-type: none"> <li>Location for campaign coordination and weekly meetings of the National Technical Coordination Committee (NTCC)</li> <li>Support for TCs to states for Liaison officers</li> <li>Supported development and distribution of GIS maps</li> <li>Engagement of PEI social mobilization structures at State &amp; LGAs</li> </ul>	21,159,937 persons were vaccinated between September and December 2019
Measles	2017	Northern states (17 + FCT)	Preventive campaigns for children 9 - 59 months old	<ul style="list-style-type: none"> <li>Location of coordination meetings and support for teleconferences with participating states</li> <li>Microplan validation</li> <li>Deployment of national supervisors</li> <li>Data management and</li> <li>Post-campaign coverage surveys (PCCS)</li> <li>Coordination of national review meetings</li> <li>Coordination of documentation of best practices and manuscript workshops</li> </ul>	Post campaign coverage survey validated 35,939,346 children vaccinated with the measles vaccine with national coverage of 87.5%. Coverage ranged from 84% in the Northwest to 92% in the North Central State
	2018	Southern states (19)			
	2019	Borno	Outbreak response campaign for 6 months-9 years age group		

Outbreak Response/SIA	Year	Location	Details of response	Polio EOC support	Outcome
Maternal and Neonatal Tetanus Elimination (MNTE)	2016	Ekiti, Ondo, Osun, Enugu, Imo, Ebonyi	2-3 rounds of TT campaigns targeting women of childbearing age (WCBA) 15-49 years old in high-risk LGAs	<ul style="list-style-type: none"> <li>• Support of national monitors and supervisors</li> <li>• Data management and use of open data kit (ODK) for tracking personnel performance</li> <li>• Support for archiving of program data</li> <li>• Post-campaign coverage survey</li> </ul>	2,366,433 and 2,470,764 WCBA were vaccinated in 2 campaigns rounds conducted in March and September 2016
	2017	Oyo	2 rounds of TT campaigns targeting WCBA 15-49 years old in high-risk LGAs		124,852 and 126,204 WCBA were vaccinated with the TT vaccine in September and October
	2018	Oyo, Ogun	2-3 rounds of TT campaigns targeting WCBA 15-49 years old in high-risk LGAs		160,417 WCBA were vaccinated in the 3rd round in Oyo state and 2 rounds in a small community in Ogun, covering approximately 600 WCBA in June and July
	2019	SW and NC states	2-3 rounds of TT campaigns targeting WCBA 15 -49 years in high-risk LGAs		4,920,960 WCBA were vaccinated in Round 1 across 94 LGAs and 2,473,891 in Round 2 across 56 Wards in 4 states. 396,520 WCBA were vaccinated in 8 LGAs of Bayelsa in August 2019.
LGA=Local government areas; NW=Northwest; SW=south west; TT=Tetanus toxoid; WCBA= Women of childbearing age					

(15; 83.3%), communicable disease control (12; 66.7%), emergencies and outbreak response (12; 66.7%), child health (11; 61.1%), maternal health (8; 44.4%), health systems strengthening (7; 38.9%) and operations (7; 38.9%).

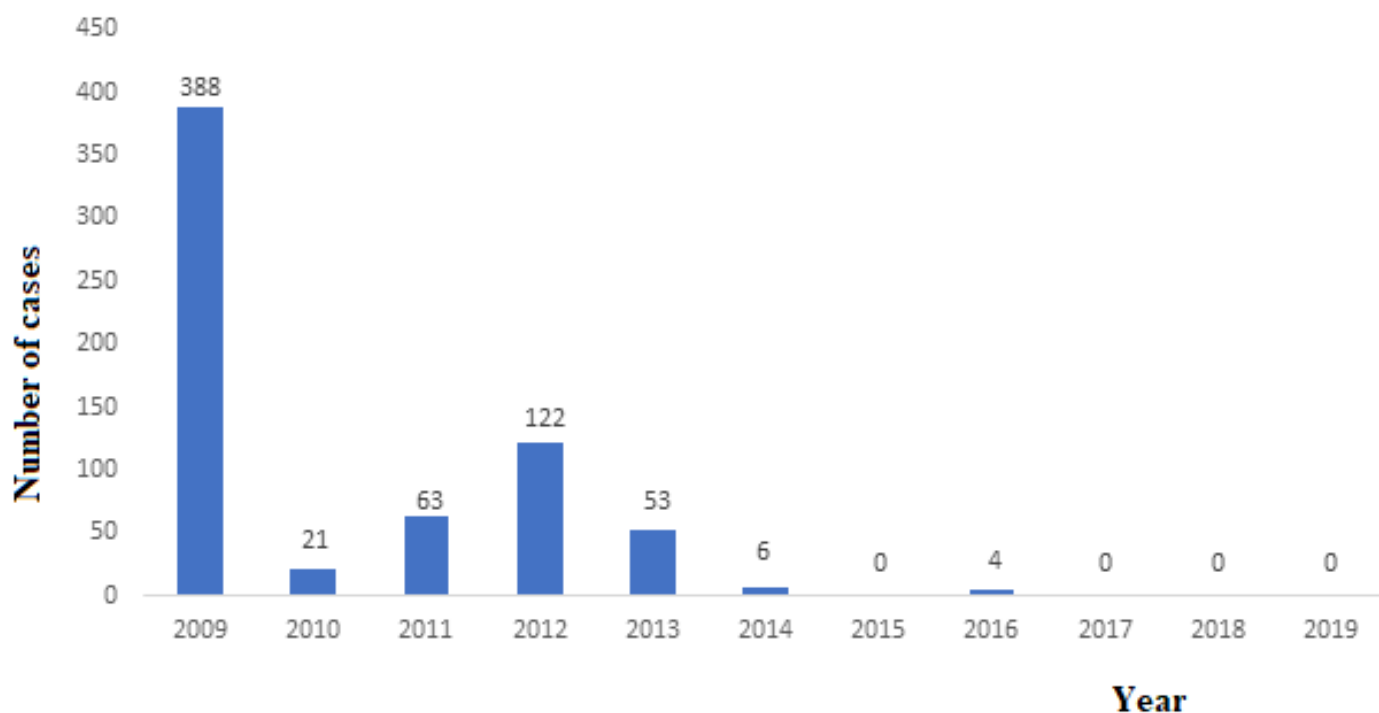
**Data collection and analysis:** we obtained information about the polio EOC, operational costs, and involvement in other disease control efforts from records and published literature. In addition, an electronic questionnaire was administered to key informants at the federal and state level using a survey platform on Google. An open-source data collection tool was designed specifically for the survey, and the responses were anonymous. After downloading the responses in Comma-Separated Values (CSV) format, we generated charts and determined the frequencies of quantifiable responses using Microsoft Excel, and identified common themes for qualitative analysis.

**Ethical considerations:** the assessment was part of the National Polio Transition Plan of the Government of Nigeria, which included documentation of best practices and lessons learned from the polio program to benefit other public health initiatives. We obtained permission from the National EOC to review reports and reference documentation on the contribution of the Polio EOCs. Informed consent was obtained from each survey participant at the start of the questionnaire; consenting participants continued filling out the questionnaire.

## Results

**Trend in wild poliovirus incidence:** following the inception of the EOC in 2012, the number of WPV1 cases dropped from 122 in 2012 to 0 in 2015. In August-September 2016, four WPV1 cases were confirmed from Borno State in areas that had not been accessible to the programme for three to four years because of insecurity, with resident populations that were larger than estimated remaining in some areas. Transmission was confirmed in three Local Government Areas (LGAs) of Jere, Gwoza and Monguno in Borno State. An aggressive response was mounted and coordinated by the National EOC and Borno State EOC, which included innovative approaches, such as the use of security personnel to reach children in inaccessible areas (i.e. areas not accessible to vaccination teams) with the oral polio vaccines. The last confirmed case had an onset of paralysis on 21 August 2016 (Figure 2).

**Operational costs of the emergency operations centers:** the national polio EOC is housed on rented premises, while the State governments provide the buildings to house the State EOCs. The management of the EOCs is outsourced by BMGF to a third party (e-Health Africa). Running costs are incurred for utilities, security, cleaning and maintenance services. The total annual cost for the renting and operations of the eight EOCs is estimated at USD 5,625,346.4121.



**Figure 2:** trend in type 1 (WPV1) cases, Nigeria, 2009-2019

**Support for non-polio related activities:** the polio EOC structure provides a platform for coordinating the responses to disease outbreaks, particularly related to vaccination response activities for Vaccine preventable diseases (VPDs). Government and partner efforts are coordinated under one roof to facilitate planning, monitoring preparedness for campaigns, tracking intra- and post-campaign activities, managing and analyse data, and providing feedback. During 2014-2019, the country experienced outbreaks of Ebola, meningococcal meningitis, measles, and yellow fever. The polio EOCs served as the location for coordinating the outbreak responses at the federal and state levels. In addition, the polio EOC staff were deployed to support response activities such as surveillance, suspect case investigation, microplanning, implementation, community mobilization, supervision, and monitoring (Annex 2). Furthermore, as part of the country's efforts to achieve maternal and neonatal tetanus elimination (MNTE), mass vaccination campaigns were conducted in selected high-risk states with the support of the polio infrastructure and EOC coordination.

**Informants' insights:** all key informants (100%) were unanimous in their opinion that the polio EOCs played a significant role in the interruption of WPV1 in Nigeria. Besides polio eradication activities, respondents noted that the Polio EOCs strongly contributed to other public health programs, notably routine immunization strengthening, measles elimination and integrated disease surveillance and response (IDSR). There was some agreement that the EOCs also contributed to MNTE and Primary Health Care (PHC)/ health systems strengthening, while less contribution was perceived towards maternal health and least in child health (Annex 1). The resources at the EOCs were noted by 89% of key informants to have strongly supported data management and analysis; provided workspace for program staff, deployed a skilled workforce for public health systems; implemented accountability systems; provided platforms for proposals to expand community engagement; increased effective use of information and communication technology, vehicles and transport, governance systems, and networks; and strengthened the processes for surveillance. There was some agreement that contributions were also made towards office running costs and corporate management, while the laboratories were perceived to have made a less or uncertain contribution towards other programs.

Over 60% of respondents perceived that the current capacity at the EOCs is enough to address other public health interventions, notably routine immunization strengthening, measles elimination, disease surveillance, and enhancing PHC health systems. In contrast, only half of the respondents agreed the capacity was adequate for epidemic preparedness and response. Additional resources would be needed at the EOCs to effectively meet the needs of other programs, notably in capacity building, human resources, and funding. 56% of respondents felt the resources to meet these needs are not affordable by the government at the federal and state levels and would require external support. Of the 18 respondents, the majority noted that the withdrawal or closure of the EOCs would negatively impact coordination (15; 83%), human resources (13; 72%), and external financial support (10; 56%) for other interventions. Following the achievement of polio eradication, the transition of polio EOCs would be best towards coordination of outbreak response activities (n; 53%), routine immunization (n; 89%), surveillance (n; 61%) or all three areas mentioned (n; 12%).

## Discussion

Key informants involved in Nigeria's polio efforts unanimously agreed that Polio EOCs played a major role in coordinating and implementing the activities that led to the interruption of WPV transmission and have also provided a platform for coordinating other disease control initiatives in Nigeria, demonstrating the benefit for the transition of the EOCs for future, broader public health use. After the achievement of WPV-free status, the polio EOC is working to interrupt the circulating vaccine-derived poliovirus type 2 (cVDPV2) outbreak, which is currently occurring in Nigeria and several other countries and regions that had achieved WPV free certification. Emergency Operations Centres succeed with clear leadership through an IMS with an Incident Manager and delegated responsible areas, with standardized roles and clear triggers for action. The IMS promotes a unified command structure and decision-making, clear terms of reference, consolidated plans with targets, accountability, integrated communication, and a comprehensive strategy to efficiently manage all resources available to the EOC [8,9]. The polio EOC operation in Nigeria is based on the IMS. The EOCs are government-led, and

members (including designated partner representatives) have the decision-making authority to act quickly in implementing a joint plan.

The coordination of the polio program under the EOC structure at federal and state levels and specific intensified efforts at the field level was effective in significantly reducing the burden of WPV in Nigeria. A review of polio eradication initiative (PEI) coordination structures in Angola, DRC, Côte d'Ivoire, and Chad showed that coordination structures in place led to synergistic effects that enabled the polio program to achieve its objectives, with important spill-overs in the coordination of other public health programs [4]. A central coordination mechanism was augmented by subnational structures that decentralized coordination to lower level in all the countries, closest to public health action. The Polio Eradication and Endgame Strategic Plan 2013-2018 placed a strong and clear emphasis on the necessity of improving routine immunization (RI) to achieve and sustain global polio eradication [10]. The plan recognized that as the eradication target approaches, there is a need for GPEI to contribute to strengthening RI towards achieving the last mile in polio eradication by transferring effective elements of the polio program to national immunization programs. The Polio Endgame Strategy 2019-2023 further reinforced the necessity of integration for joint delivery and coordination of PEI with other VPD control and elimination targets, and polio surveillance with VPD surveillance [11]. This was demonstrated in the case of the Polio EOC of Nigeria, with significant contributions made in non-polio VPD outbreak responses. Through systematic collaboration with other public health actors, integrated capacities and contributions beyond GPEI can help achieve and sustain eradication. At the same time, GPEI assets, knowledge, and expertise can be channeled to protect populations by supporting the strengthening of RI, health systems and emergency responses. Other public health programs can benefit from the technical and operational capacity and funding to make substantive program improvements [12]. Many polio eradication assets and lessons learned have already been applied to global and African regional measles elimination efforts, as the PEI and measles elimination efforts have similar strategies and program implementation infrastructure needs [13].

In alignment with the GPEI strategy, our assessment demonstrated that the Nigeria polio EOCs' capacities were successfully re-purposed to support other health emergencies such as outbreaks of Ebola, measles, yellow fever, and meningitis, and towards strengthening the immunization system. Our findings align with previous reports that documented the positive contribution of the polio EOCs in other disease control initiatives [5,6,14,15]. The Government of Nigeria's response to the coronavirus disease- 19 (COVID-19) pandemic has also benefited from the polio infrastructure and assets, similarly to other countries with polio-funded staff presence. The polio staff used their skills and experience to lead rapid response teams and utilized polio EOCs for COVID-19 while providing strategic leadership in the COVID-19 response. These examples indicate the successful transfer of skills and assets when the need arises. PEI has been associated with increased government spending on strengthening routine immunization systems and related improvements, especially in micro-planning, service delivery, supportive supervision program management and capacity building [16-18]. Similarly, the integrated disease surveillance system, data management and analysis capacity, and laboratory systems in Nigeria have also benefited from the polio-funded infrastructure, as reported here and for other countries in the WHO African Region [19-21].

With additional training and human resources at the EOCs, the functions can effectively be expanded for the long term to support other emergency responses, with expanded and contracted staffing as needed, VPD surveillance, and routine immunization strengthening. The expansion of roles of the Polio EOCs is being considered as part of the National Polio transition plan in Nigeria [7]. Our assessment is limited to three aspects. First, there were many other complimentary efforts made to systematically address the poor performance of the polio program in 2012 and later years, in addition to the establishment of the EOCs. We did not assess the contribution of other initiatives toward the interruption of WPV transmission. Secondly, due to the intensity of polio eradication activities and the occasional need for overlap of non-polio activities and campaigns, polio EOC staff were sometimes stretched with their primary responsibilities hindered the extent to which they could provide direct support to other public health programs, even though PEI field staff contributed substantially. NPHCDA eventually worked towards harmonizing a calendar of activities to ensure the overlap was minimized and that the use of available assets was maximized. In addition, polio EOC staff were able to provide mentoring and capacity-building based

on experiences in the polio program. Thirdly, only 18 respondents were included in the assessment and participants were mostly internal to the polio program, which could have biased the views as against external respondents.

## Conclusion

The IMS under the EOC was felt by key informants to have strengthened coordination of government and partners towards achieving polio eradication in Nigeria, with benefits to other emergencies and the broader immunization system, including improving funding efficiencies. The EOC concept applies to managing effective support for various public health emergencies, such as disease epidemics, natural disasters, and humanitarian crises. The Government of Nigeria should maximize the infrastructure built at the polio EOCs, and their demonstrated capacity and experiences in managing emergencies and RI strengthening for long-term benefits to primary health care and health security.

**Disclaimer:** the findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

## Competing interests

The authors declare no competing interests.

## Authors' contributions

All the authors have read and agreed to the final manuscript.

## Acknowledgments

In Nigeria, the Polio EOCs were led by a dedicated group of Public Health Officials who gave their time and resources to ensure poliovirus circulation is interrupted. The tireless efforts of the Incident Managers and Deputy Incident Managers in the eight EOCs is highly acknowledged. The National and State Primary Health Care Agencies' leadership as GPEI partners in the country and the thousands of dedicated polio vaccinators, supervisors, community volunteers, and the surveillance network is highly appreciated.

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