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The Potential Contribution of Supplementary Immunization Activities to Routine Immunization in Kebbi State, Nigeria

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Abstract

Background: Among the strategies of the Polio Eradication Initiative, the landmark interventions are routine immunization (RI) and supplementary immunization activities (SIAs). RI is the provision of vaccination service at the health facility and conducted year-round. SIAs are a community-based intervention targeting large numbers of an eligible population within a short period. Hence, the study aimed to assess the contributions of SIAs on access and utilization of RI services. **Methods:** We conducted the study in 10 local government areas in Kebbi State, northwestern Nigeria. We analyzed RI data from January to September 2019 and included the 4 SIAs conducted in January, April, August, and September in the same years. The number of children vaccinated, the trend of BCG, pentavalent vaccine at 6 and 10 weeks, and measles coverage and dropout rates (DORs) were analyzed. **Results:** For all the selected vaccines, the highest contributions to RI were recorded during the August 2019 fractional Inactivated Polio Vaccine (fIPV) campaign. On the other hand, the least contributions were noted during January SIAs. The BCG coverage showed an erratic trend with the lowest in February and highest in July 2019. The coverage for the pentavalent vaccine at 6 and 10 weeks was lowest in February and September. The pentavalent vaccine DOR pattern showed the lowest in February with value of 0% and the highest in June with 12%. Except for May and June, the Pentavalent vaccine DORs for all other months were $<$10%. February 2019 had the lowest measles coverage. **Conclusion:** Our study demonstrated that the integration of RI into SIAs could improve RI coverage. and potentially reduce DOR, especially when the integration is of good quality and conducted at short and regular intervals. Although SIAs are instrumental at increasing RI coverage, the disruption of RI services may occur due to overlapping resources and poor planning. Therefore, SIAs should be adequately planned by program managers to strengthen RI service delivery during the SIAs implementation.

Keywords

underserved communities, prevention, primary care, community health, children, vaccines, routine immunization, supplemental immunization activities

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Introduction

Immunization is one of the most cost-effective public health interventions and constitutes a cornerstone strategy among numerous global health programs aimed at improving population health.[1] The 2 strategies for the delivery of this landmark intervention are a routine expanded program on immunization (RI) for eligible individuals and episodic supplementary immunization activities (SIAs). RI services are generally health facility-based and conducted year-round. SIAs are additional opportunities to provide supplemental vaccine dose(s) to an eligible population.[2] SIAs are often delivered within and outside of the health facilities. SIAs provides the means to reach individuals or populations that might have been chronically missed or underserved. Also, SIAs are aimed at reaching large numbers of a target group within a short period; otherwise termed as campaign or mass vaccination.[2-4] RI could be intensified during SIAs, espe-

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cially in countries that are endemic to certain vaccine-preventable diseases.[3]

The United Nations Sustainable Development Goals (SDGs) 3 is aimed at ensuring healthy lives and promoting the well-being of all people everywhere in the world. Vaccine-preventable diseases (VPDs) kill 2 to 3 million people annually all over the world. Consequently, numerous governments and partner agencies have been seeking to find better ways of improving the quality and expanding the vaccination delivery strategies.[5,6] One of the ways of expanding access to vaccination is by leveraging on SIAs, especially in polio-endemic countries where several rounds of SIAs or outbreak responses are held. The SIAs permits rapid access and concurrent administration of vaccine of interest and RI services. However, enormous resources are expended during the implementation of such SIAs with or without embedded RI services. SIAs and RI often employ the same pool of limited financial, human, and material resources. Hence, there is a need to objectively assess the influence of SIAs on RI indices toward achieving optimal outputs and outcomes. Available pieces of evidence regarding the effectiveness of this approach have yielded mixed results. Some studies showed SIAs' supportive (strengthening) effect on RI while others showed contrary findings (ie, weakening effect on RI).[7-11]

In light of the above, this study would provide a better understanding of the relationships between SIAs and RI, and provide immunization program managers and decision makers more robust evidence that will inform planning, resource mobilization, project implementation, and supportive supervision. Consequently, we assessed the contribution of SIAs on access and utilization of RI services in Kebbi State, northwestern Nigeria.

Methods

Study Area

Kebbi State is the study area, which is in the northwestern part of Nigeria. The state shares an international border with Niger and Benin Republics. It also borders Zamfara, Sokoto, and Niger states locally. There are 21 local government areas (LGAs), 225 administrative wards and 4 traditional Emirates in Kebbi State. The study focused on 10 LGAs of Kebbi State, namely Bagudo, Danko-Wasagu, Fakai, Gwandu, Koko-Besse, Ngaski, Sakaba, Shanga, Yauri, and Zuru.

Study Design

We conducted a descriptive study design to observe the potential and real contribution of SIAs on the RI program in the 10 LGAs of Kebbi State. Two Oral Polio Virus (OPV) campaigns, 1 Fractional Inactivated Polio Vaccine (fIPV), and 1 Maternal and Neonatal Elimination (MNTE campaign) were conducted in the selected LGAs in January, April, August, and September 2019, respectively.

In this study, we assessed Bacille Calmette Guerin (BCG), pentavalent vaccines (Penta 1 and Penta 3) and measles. BCG is the first vaccine given at birth, and the coverage indirectly measures accessibility to health services. Pentavalent vaccine (Penta) is a combination of 5 vaccines in a given dose that could prevent diphtheria, pertussis, tetanus toxoid, hepatitis B, and hemophilus influenza type B. Penta 1 is the first dose of pentavalent vaccine given at 6 weeks of age, and its coverage indicates service availability, access, and the initial use of immunization services by caregivers of the children. Penta 3 is the third and last dose of pentavalent vaccine given at 14 weeks. Penta 3 coverage denotes client satisfaction with the services provided, continuity of use by caregivers, and capability of the health system to deliver a series of vaccination sessions. The measles vaccine is given at 9 months of age, and its coverage is an indicator of immunization program strength while Penta dropout rate (DOR) indicates utilization of immunization services.[12,13]

Method of Sampling

The 10 LGAs were selected based on the four rounds of SIAs carried out from January to September 2019 and the completeness of the RI data. Other LGAs were excluded because the fIPV campaign held in August 2019 was not conducted in those areas or due to incomplete RI data.

Supplemental Immunization Activities Strategy

The 2 OPV campaigns conducted in January and April 2019 were implemented within the regular framework of the Immunization Plus Days (IPDs) to vaccinate children younger than 5 years. A 4-day house-to-house vaccination was conducted by a 3-member team consisting of a supervisor (who doubles as a recorder), a vaccinator, and a community leader. Special teams were also deployed, and were composed of a vaccinator, a recorder, and a town announcer. Special teams were responsible for vaccinating children at transit and special places. The special places were market, schools, religious centers (koranic schools and churches), motor parks, hospitals, water points, transit points, and playgrounds. There were also fixed post teams that were made up of a vaccinator and a recorder and were responsible for RI vaccine administration at health facilities.

In August 2019, the fIPV campaign targeted at immunizing children from 14 weeks to 5 years of age was implemented using temporary posts and fixed posts for 6 days. Each vaccination team was composed of a camp coordinator, a house to house mobilizer, a town announcer, a community leader, an instant noodles distributor, and a crowd

Table 1. Contribution of SIAs on RI for Selected Vaccine Types in 10 LGAs of Kebbi State, Northwest Nigeria, 2019.

	Months of implementation					
	January		April		August	
Type of RI vaccine	Number of children vaccinated	SIA contribution in %	Number of children vaccinated	SIA contribution in %	Number of children vaccinated	SIA contribution in %
BCG	11 163	30	9498	38	15 603	74
Penta 1	11 619	32	10 920	37	18 194	71
Penta 3	11 109	29	10 332	33	17 104	66
Measles	10 869	32	9141	42	14 203	65

Abbreviations: RI, routine immunization; SIA, supplementary immunization activities; BCG, Bacille Calmette Guerin; Penta, pentavalent vaccine.

controller as well as 3 vaccinators and 4 recorders. The eligible children were mobilized to the vaccination posts by community mobilizers. Instant noodles were used as an "add-on" to encourage acceptance or potentiate demands at the fixed posts where vaccination teams administered fIPV and RI vaccines.

The MNTE campaign was aimed at vaccinating women in the reproductive age-group with tetanus vaccine to prevent the occurrence of tetanus among newborns. The 8-day MNTE campaign was not integrated with routine immunization services. However, RI service providers were deployed for the implementation of the campaign.

Data Management

We used secondary datasets extracted from 2 sources in this study. The RI data were obtained from DHIS 2.0 platform. DHIS 2.0 is a free, open-source, web-based Java software package. It is a tool for collection, validation, analysis, and presentation of statistical data for health information management activities, including routine immunization. During data entry using the DHIS 2.0, checks were made to ensure that the data fell within an acceptable range and avoided duplication of data. These checks identified typing errors, hence preventing data entry errors and inconsistencies. After data entry, predefined routine reports were generated based on demand.

All children who received RI either at health facilities or outreach sessions were normally registered on RI data tools and compiled at the health facility level. The data were routinely entered in the DHIS 2.0 platform by the Routine Immunization Officers and Monitoring and Evaluation Officers at the local government level. The dataset included the hierarchy of Kebbi State DHIS 2.0 organizational unit of a county (state), subcounty (LGA), ward, and facilities. We accessed monthly records of BCG, Penta 1, Penta 3, and measles from the 10 LGAs covering the period from January to September 2019. We analyzed the datasets as a trend graph in the Nigeria DHIS 2.0 portal, https://dhis2nigeria.org.ng, and exported in a Microsoft Excel format.

We extracted information on 4 rounds of SIAs from January to September 2019 from the National SIAs Database entered at the State Level for Kebbi State. We extracted from the databases and collated on a Microsoft Excel format the exact dates the SIAs were conducted, the number of children who received RI vaccines administered by fixed and temporary post teams during the SIAs (IPDs and fIPV campaigns), and the types of vaccine used for the RI during SIAs.

We cleaned and analyzed SIA data with Microsoft Excel 2016 spreadsheet. In this study, we used percentages to report the performance of BCG, Penta 1, Penta 3, and measles. We calculated the DOR for Pentavalent vaccine using a standard formula, which is subtracting children vaccinated with Penta 3 from those with Penta 1 and then divide by Penta 1 and multiply by 100. We also estimated vaccine coverage by dividing the number of doses of specific RI vaccine by the target population.

Ethical Consideration

We obtained permission for the use of the data from the State Primary Health Care Development Agency. Approval from a research ethics review was not necessary since the secondary data were generated from the SIAs.

Results

Contribution of SIAs on RI

There were rounds of oral polio SIAs in January and April, fIPV campaign in August, and MNTE campaign in September 2019. RI services were integrated with the SIAs in all the campaigns except the MNTE campaign, and their contributions are presented in Table 1. For all the selected vaccines, the highest contributions (65% to 74% depending on the vaccine) were observed during August 2019 fIPV campaign. During the August 2019 campaign, at least two-thirds of the children vaccinated for all RI vaccines were reached during the campaign. On the other hand, the least contribution was noted during January SIAs.

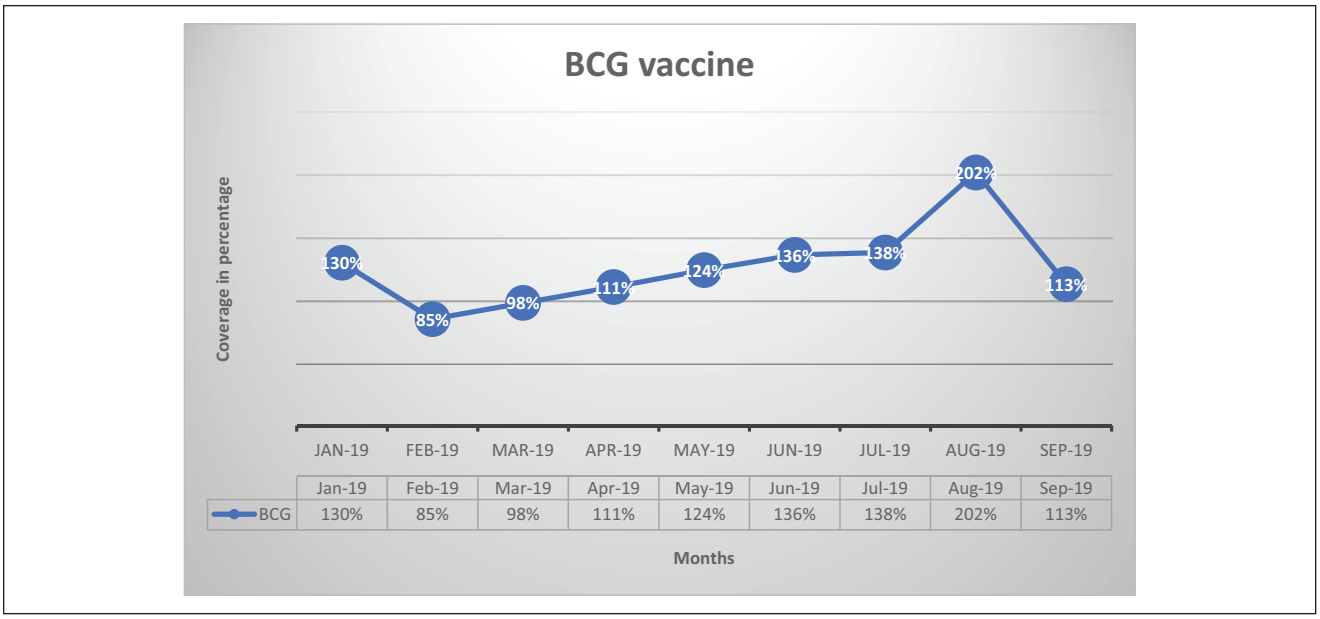

Figure 1. Nine months' trend of BCG (Bacille Calmette Guerin) vaccine coverage in 10 local government areas (LGAs) of Kebbi State, Northwest Nigeria, 2019.

Trend of RI Coverage for Selected Vaccines

Most of the monthly coverage of BCG, Penta 1, Penta 3, and measles vaccines were above 100% throughout the study period.

The lowest BCG coverage was shown in February with the coverage of 85%. Then, it gradually increased from March (98%) to July (138%) and peaked in August (202%). There was a steep decline in September to 113% (Figure 1).

As shown in Figure 2, both Penta 1 and Penta 3 vaccines had similar patterns during the study period. The coverage for Penta 1 and Penta 3 was 100% and 95% (lowest), respectively, in February. From March, the trends of both vaccines increased to their peak in August (Penta 1 was 237% and Penta 3 was 220%). The precipitous rise in August was followed by a similar pattern of decline in coverage (ie, Penta 1 and Penta 3 dropped to 121% and 117%, respectively) in September.

The Penta DOR pattern showed the lowest in February with a value of 0% and the highest DOR in June with 12% (Figure 3). Except for May and June, the Penta DOR for all other months were below 10%.

The lowest measles coverage reported was in February (91%). Like other vaccines, measles coverage showed an increasing trend from March (102%) with a steep rise from 129% in July to 185% in August (Figure 4).

Discussion

Our study found that the integration of RI services into the 4 rounds of SIAs conducted from January to September 2019 made varying contributions to the RI coverage of the 10 LGAs studied. Notably, the greatest contribution to BCG, Penta 1, Penta 3, and Measles coverage was observed during the August 2019 fIPV campaign, where "instant noodles" were used as an "add-on" while the least contribution was during the January 2019 SIAs. Our study also revealed the highest DOR in June. Furthermore, the pull of human resources (RI service providers) from routine vaccination posts at health facilities into the MNTE campaign without concomitant administration of routine immunization vaccines during the campaign could explain the observed drop in coverage in September for all the RI vaccines reviewed in all the LGAs studied.

The observed increment in vaccination coverage for all the RI vaccines is similar to findings in a study from Madagascar, which showed that the months SIAs were implemented were the period when the largest number of measles doses were administered.[14] This RI-strengthening approach using SIAs is in tandem with the GPEI Polio End Game Strategy, which strives to strengthen RI systems through various innovations and strategies, including SIAs.[4,15] Therefore, SIAs serves as a conduit for reaching communities that were previously missed or poorly covered by RI. Our study further demonstrated how SIA could be used to deliver optimized RI service by using the community-based delivery method (outside clinic setting), intensifying community mobilization, and the use of attractive incentives.

Another important finding was that the trend of RI coverage of all the vaccines over 9 months (from January to September 2019) in the 10 LGAs was mostly above 100%.

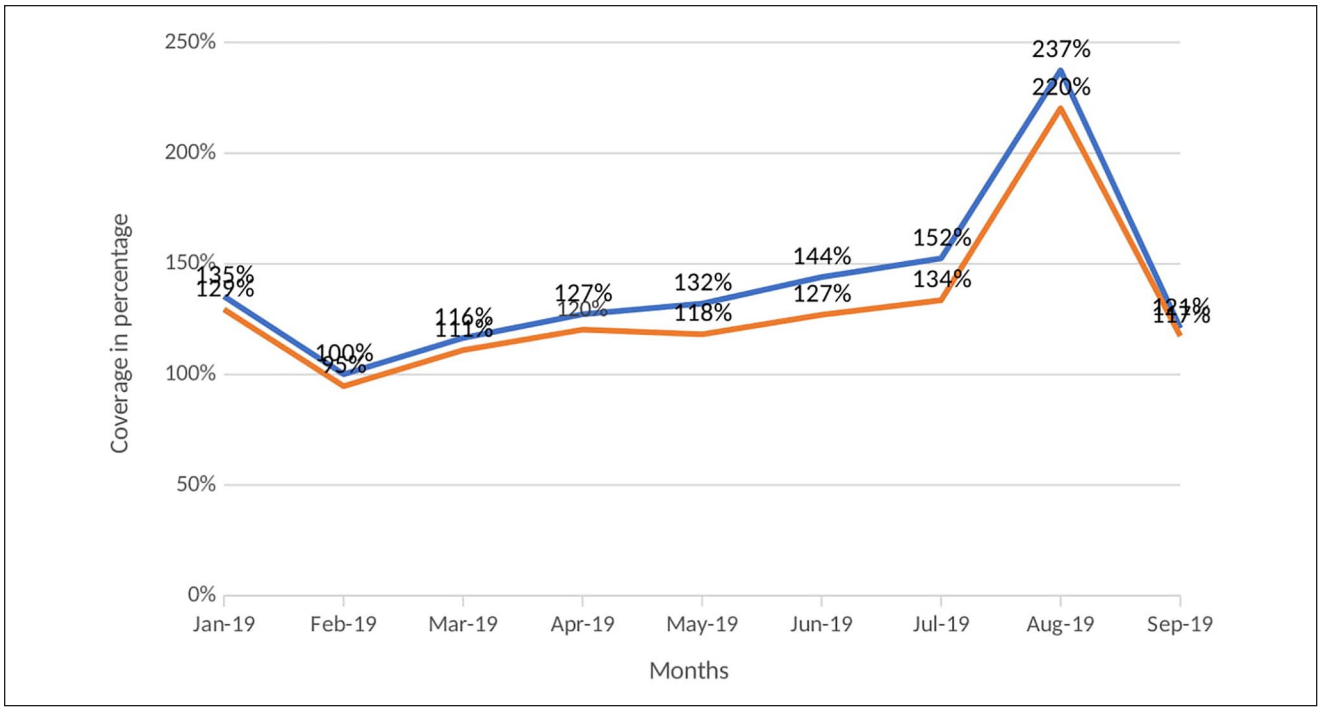

Figure 2. Nine months' trend of Penta 1 and Penta 3 vaccine coverage in 10 local government areas (LGAs) of Kebbi State, Northwest Nigeria, 2019.

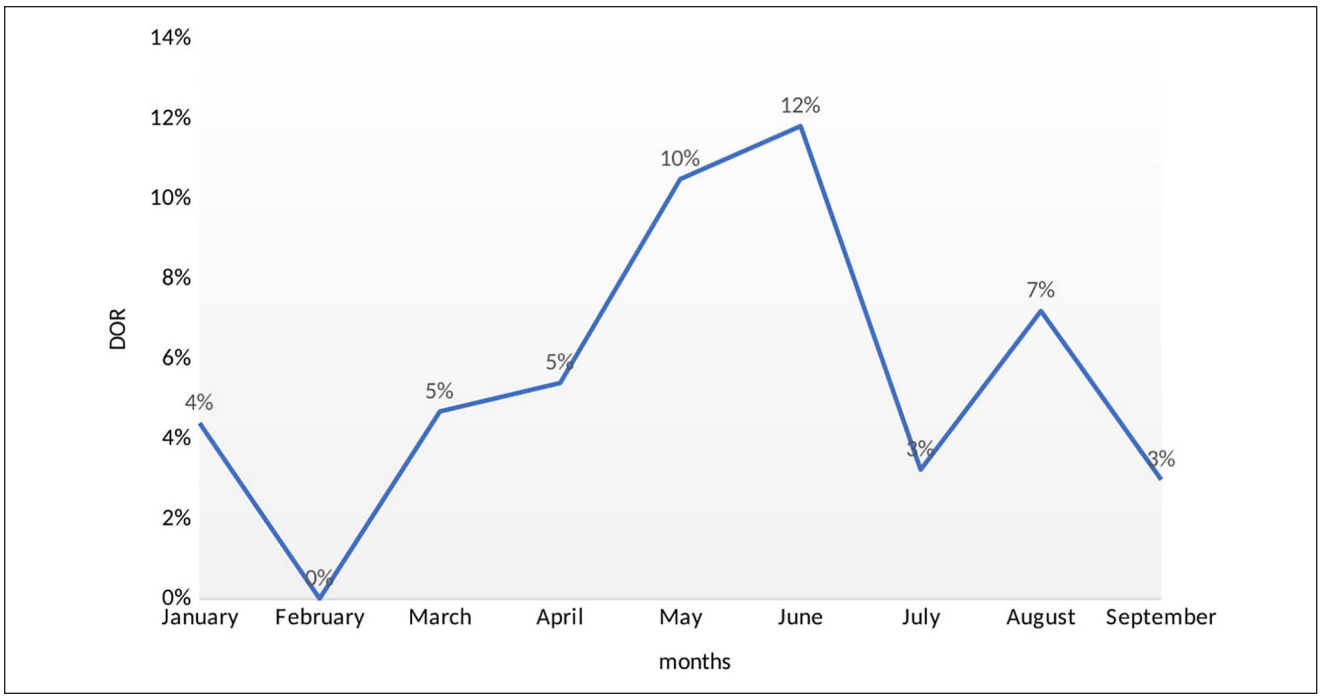

Figure 3. Nine months' trend of drop-out for Penta 1 and Penta 3 vaccine coverage in 10 local government areas (LGAs) of Kebbi State, Northwest Nigeria, 2019.

The exceedingly high coverage could be attributed to the intensified in-between-round (IBR) activities conducted in Kebbi State to boost RI coverage in addition to the routine (ie, fixed, outreach, and mobile) RI delivery strategies. WHO

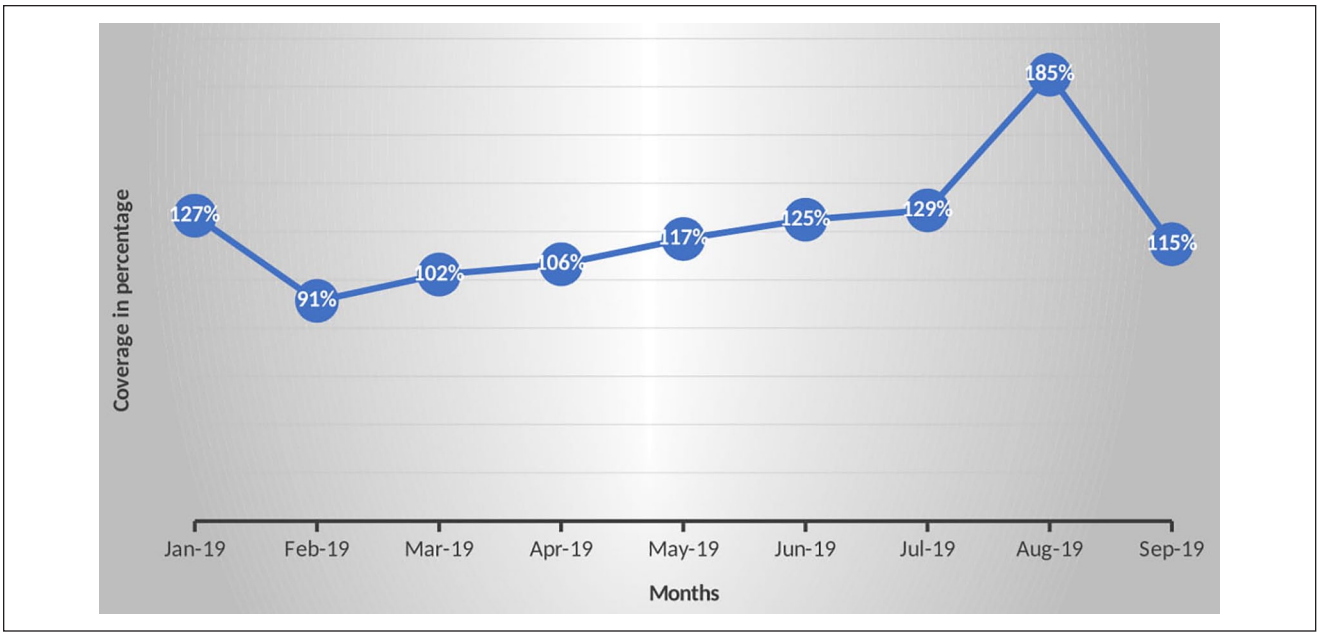

Figure 4. Nine months' trend of measles vaccine coverage in 10 local government areas (LGAs) of Kebbi State, Northwest Nigeria, 2019.

provided technical and logistic support to the state to implement busy market vaccinations and the quick-win interventions. The quick-win interventions were targeted vaccinations in underserved communities (such as hard-to-reach settlements, international and interstate border settlements, and nomadic settlements), areas with low immunization uptake, and densely populated communities. These interventions provided an excellent opportunity for children who have been deprived of life-saving vaccines due to the problem of geographical access, economic barrier, frequent mobility due to trade and culture, as seen among families of nomadic herdsmen and fishermen. Other areas targeted by the IBR were the major entry and exit points in Kebbi State, such as motor parks, transit areas, and checkpoints. Among other benefits, the IBR activities addressed the risk associated with the influx of persons with children whose immunization status were unknown.[16]

Similarly, the study in Madagascar also found that monthly RI coverage regularly exceeded 100%, which they attributed to inaccurate estimation of the target population.[14] Inaccurate estimation of the target population as a denominator in Kebbi State could also contribute to the explanations for the consistently high monthly RI coverage rates above 100% since the estimate used (i.e., denominator) was derived from the stale 2006 National Population Census figure. The denominator used for the Expanded Programme on Immunization (EPI) might be an underestimate, given the chance of error, fluidity in population and differences in population growth across states in Nigeria. A study conducted in Kaduna State, northwestern Nigeria showed that the projected census population that was used to compute RI denominator was fraught with errors and a gross underestimate of the target population (denominator) for RI when compared with a carefully conducted mini-census (ie, microplanning and walk-through).[17]

Nevertheless, a scrutiny of the RI coverage trend for BCG, Penta 1, Penta 3, and measles from January to September 2019, depicted a bit of an undulating pattern. There was a modest increase in coverage during the months when SIAs rounds were integrated with routine immunization. However, there was a steep decline in RI coverage in September when an MNTE campaign was implemented as a stand-alone, that is, without integration with the full complement of routine immunization services. One likely reason for this finding is the recruitment of RI providers as personnel for the SIAs at the detriment of RI service provision. Health care workers who routinely offer RI services were engaged as vaccinators during SIAs, particularly the MNTE campaign (without the routine delivery of RI services at health facilities during the period). A study conducted in South Africa concluded that SIAs might have a negative impact on the health systems by diverting resources from other activities, including RI and disrupting the regular functioning of service provision.[18] In the South African study, they assessed the impact of SIAs on some maternal and child health indicators, and it showed that there was a significant decrease in the total number of immunized children before 12 months of age.[18] Also, the study in Malaysia corroborated this finding as the monthly average number of doses of Measles vaccine administered through RI was significantly

lower in the months following each SIA suggesting a potential disruption of RI by SIAs.[14] In a qualitative study of 6 countries, EPI staff reported being overloaded with additional work during SIAs; there was a shortage of RI vaccines during SIAs in Vietnam; and additional remuneration during SIAs in Cameroon and Ethiopia was enough to motivate EPI staff to be more committed to SIA responsibilities. These reasons explained why health services, including RI, were interrupted during SIAs.[19]

Another important finding was the Penta DOR, which showed a gradual rise from 4% in January 2019, peaked in June 2019 (12%), but suddenly decreased to 3% in July 2019 and rose to 7% in August. The pattern observed in the Penta DOR from May to August could be explained by the fact that more children who had hitherto been missed or left out were reached and initiated through intensified RI activities, such as IBR, and RI services integrated with SIAs. The IBR intervention started in May and ended in July, thus explaining the gradual rise observed in DOR to 10% in May. The decrease to 3% and 7% in July and August 2019 respectively, could be the result of mop-up of previously unimmunized children that had been initiated into RI, thus resulting in a fewer cohort of unimmunized or dropout children within the communities. In fact, despite the pulling effect of August fIPV (that was strengthened by strong community mobilization, the provision of attractive add-ons, and the community-based delivery), there was no massive increase in the drop-out from the end of IBR activities in July, and to August. Furthermore, the figures in Table 1 supported the above explanation, which showed that the children vaccinated with Penta 1 vaccine during the fIPV campaign were 71% compared with 66% for Penta 3 for the target population in August 2019 in the 10 LGAs. During the August 2019 fIPV campaign, instant noodles (a form of pasta) was given to the children as an incentive after the administration of the RI antigens. The noodles acted as an attraction and might have attracted more eligible children, especially missed opportunities and left-outs, through their caregivers to the vaccination posts. Another possible reason for the patterns of Penta DOR observed might be due to the use of house-to-house community mobilizers who line-listed and mobilized eligible children during the pre- and intracampaign period, thereby improving the demand for the vaccines. The WHO recommends that the DOR should not be more than 10%.[20] In light of the above, SIAs integrated with RI can potentially address both coverage and drop-out issues, if they are of good quality and done over short and regular intervals within the year. However, the reliance on SIAs may negatively affect the sustainability of RI services in terms of cost and resilience of PHC services in delivering composite basic health services to the communities, especially the vulnerable and underserved populations.

Our study was not devoid of limitations. First, it was a descriptive study. Hence, we did not eliminate the influence of potential confounders, such as intensified RI activities and in-between Round Activities. Second, we analyzed and interpreted limited variables, because the data used for this study was hitherto collected for routine Polio Eradication Initiative/EPI programming and not intended for operational research. However, we were able to optimize the variables available to address the objectives of our study. However, despite these limitations, our article provides a further justification to strengthen the integration of SIAs with the full complement of routine immunization services. We further showed the relevance of intensifying community mobilization, community-based approach, and use of attractive commodities to stimulate vaccination uptake at especially in settings where there is low immunization coverage amid social deprivation.

In conclusion, our study demonstrated that the integration of RI into SIAs could improve RI coverage, especially if it is community-based and fortified with strong community mobilization and provision of attractive commodities (ie, add-ons). The integration of RI service provision during SIAs was commendable because it offered unimmunized children and defaulters from RI services (fixed or outreach sessions) an opportunity to be reached and get immunized. Although SIAs were instrumental at increasing RI coverage and could potentially reduce the drop-out rate, the disruption of RI services might occur due to overlapping resources and poor planning. Therefore, SIAs should be adequately planned by program managers to strengthen RI programs via integration during the implementation of SIAs. Even though the resources for RI services and SIAs could be pooled together, proper mobilization, allocation, and distribution of human and material resources would be needed to prevent adverse outcomes.

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Declaration of Conflicting Interests

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