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Original Research Article

Effect of both Routine and Supplementary Immunization Activities on Oral Polio Vaccine Uptake in Edo State, Nigeria

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Abstract

Against the backdrop of poor routine immunization (RI) and high supplemental immunization activities (SIAs) coverage in Edo State, an analysis of data generated from both activities over a three year period was conducted. The data showed of coverage, 75%, 82% and 80% in 2012, 2013 and 2014 respectively, against an expected national minimum coverage of 87%. This study compared oral polio immunization plus days (IPDs) data with data generated from the district vaccine data management tool (DVD-MT) used for RI analysis in Edo State over a 3 year period; 2012-14. This is aimed at determining if there is a significant difference in the number of children vaccinated during RI and SIAs. The result showed a statistical significance at P≤ 0.05 in data generated for RI coverage compared to both rounds of SIAs for the 3 years in Edo State and in all the 18 LGAs. The annual OPV uptake was higher during the SIAs than RI for 2012-2014 in the State and in 17 LGAs except 1 LGA (Uhunmwonde) whose RI coverage was higher than the SIAs for the period under review though it was statistically insignificant at P≤ 0.05. The OPV uptake during RI was higher than both rounds of SIAs in 2014 at Ovia North East LGA; this was statistically significant at P≤ 0.05. The percentage coverage of the immunization activities and the year conducted are represented in bar diagrams

Keywords: Oral Polio Vaccine, Uptake, RI vs SIAs

INTRODUCTION

Immunization works by triggering the immune system to fight against certain diseases. If a vaccinated person comes in contact with these diseases, their immune system is able to respond more effectively (De wals et al;2000). This either prevents the disease from developing or reduces the severity. Immunization not only protects your own family, but also others by helping to control serious diseases in our community (Queensland Government, 2018). It has been established that immunization is a cost effective weapon in disease prevention, reduction of morbidity and mortality associated with infectious diseases and one of the most important public health interventions (Otten *et al*., 2005)

Immunization is a proven strategy for reducing morbidity and mortality among women and children in Africa. Substantial investment has been made in the past three decades to establish and maintain national routine immunization (RI) systems (Okwo-Bele and Cherian 2011; GAVI 2012; Kamara *et al.* 2013) and progress has been remarkable. In spite of these advances, equity in access to vaccination remains a challenge and coverage rates vary greatly among countries. Even within countries, where there is greater potential for consistent resource allocation, coverage is uneven (Bryce *et al.*, 2006; Hanson *et al.*, 2013).

Vaccination is not just a personal choice. The vaccinated community helps to protect those who are not vaccinated, a concept known as "herd immunity" or "community immunity (Wiysonge et al., 2015)." Simply put, when a person is vaccinated, they prevent disease from being spread to others in the community, including: Babies too young to receive vaccines, unvaccinated children and adults' pregnant women, the elderly, Individuals with weakened immune systems, such as those with asthma, chronic illness, or undergoing treatment for cancer and individuals who are allergic to vaccine components (Playtail and Bancroft, 2013)

When less than 90% of children are immunized in a particular community, these pockets of low vaccination create an environment where infectious diseases can take hold and spread. Only a very small percentage of children in the U.S. are completely unvaccinated about 3% however, they tend to cluster in certain geographic areas. Clustering of unvaccinated individuals in certain communities diminishes the benefits of herd immunity for everyone living in that area (Colorado immunization coalition 2010).

Supplementary immunization activities (SIAs) were introduced in the late 1980s as one of the 4 pillars of polio eradication, to complement routine immunization services in order to reach "at risk children" with the required number of oral polio vaccine (OPV) doses necessary to generate immunity (Helleringer *et al.*, 2012). SIAs are defined as immunization activities whereby a vaccine is taken simultaneously to many residents of a community within a defined short space of time (Kagina *et al.*, 2014). SIAs are mass vaccination campaigns that aim to administer additional doses of OPV to children less than 5 years of age irrespective of their previous immunization status. SIAs have been successfully used in different disease conditions, including typhoid, measles (Vijayaraghavan *et al.*, 2007; Wiysonge *et al.*, 2006), polio (Sutter and Maher, 2006) human papillomavirus (Brotherton *et al.*, 2011) and cholera (Schaetti et al., 2012). The major reported benefits of SIAs are increased immunization coverage, reduced disease spread and cost effectiveness (Dietz and Cutts, 1997). However, the use of SIAs to improve immunization coverage and prevent disease outbreaks in low- and middle-income countries (LMICs) relative to routine immunization services remains controversial (Weiss *et al.* 2013).

Uptake of vaccines delivered through routine immunization program remains variable, and often poor in many LMICs (Machingardze *et al*, 2013 and Tao *et al.*2013) suggesting that routine immunization services alone are insufficient to achieve optimal immunization coverage in LMICs (Verguet et al 2012). Taking into account that TB burden is highest in LMICs (WHO, 2012); it is likely that future effective TB vaccines will not reach thedesirable vaccination coverage in these settings if delivered only through the routine immunization services. Therefore, additional strategies will need to be adopted to improve immunization coverage, including supplementary immunization activities (Weiss *et al.*, 2013 and Yang *et al.*, 2005).

The factors leading to coverage disparities in immunization programs in Africa are generally not well understood; only a few studies ask why coverage has improved in some settings and not others (Gauri and Khaleghian, 2002; Pegurri *et al.*, 2005; Naimoli *et al.*, 2008).

Over two million deaths are delayed through immunization each year worldwide (World health organization, 2012), but vaccine preventable diseases (VPDs) still remain the most common cause of childhood mortality with an estimated three million deaths each year (Center for Global Development, 2005).Uptake of vaccination services is dependent not only on provision of these services but also on other factors including knowledge and attitude of mothers (Matsunmura *et al.,* 2005; Torun and Bakirci, 2006), health workers, accessibility to vaccination clinics and availability of safe needles (Anand and Barnighausen, 2007). Assessing immunization coverage helps to evaluate progress in achieving program objectives and in improving service delivery (Bonu *et al*,2003).

Edo State was created on August 27, 1991 when Bendel State was split into Edo and Delta States and it is divided into 3 senatorial district and 18 Local Government Areas: - Edo North (Akoko Edo, Owan East, Owan West, Etsako Central, Etsako East, Etsako West), Edo Central (Esan Central, Esan North East, Esan South East, Esan West, Igueben) and Edo South (Egor, Oredo, Ikpoba Okha, Orhionmwon, Ovia North East, Ovia South West). The State is a gateway to the East, West, North and heart of the Southern States, which makes it a hob of transportation activities. The State has been polio-free since 2009; therefore a high RI OPV coverage in consonance with a corresponding high SIA OPV coverage cannot be over-emphasized.

Since the release of the Polio Eradication and Endgame Strategic Plan 2013-2018, planning has begun worldwide to expedite the interruption of all poliovirus transmission and build stronger systems for the delivery of life saving vaccines (WHO 2014). Routine Immunization in Edo State has suffered a severe setback due to the high concentration of polio campaigns and Supplemental Immunization Activities (SIAs) to the detriment of routine immunization, including non-polio SIAs

In preparation for the eventual removal of all OPVs, WHO recommended in its position paper of January 2014

(Weekly Epidemiological Record, 28 February, 2014) that all OPV- using countries begin strengthening immunization systems and introduce at least, one dose of Inactivated Polio Vaccine(IPV) into routine programs by the end of 2015. It is against the backdrop of these that the Edo State team carried out data analysis of RI versus SIAs on OPV coverage in the state. The study was drawn from data generated over a three year period, leading to proposed plausible explanation why OPV coverage during SIAs is higher than that obtained during RI in the State.

Statement of Problem

Observed poor OPV coverage and high number of unimmunized children for RI which is the reverse for SIAs
Objective of Study: Rationale behind high OPV uptake during SIAs than RI
Justification: High OPV coverage for SIAs compared to R

MATERIALS AND METHODS

Study settings

Studies conducted in Edo State-Nigeria, with a projected total population of 2,159,484 and it is a medium income country as defined by the World Bank gross domestic product ranking in July 2013. Edo State is one of the 36 States, which along with the Federal Capital Territory, Abuja make up the Federal Republic of Nigeria. The State is in south-south geopolitical zone of Nigeria and the country's central gateway to the East, North-East and West. Edo State lies between 5°E and 6.45°E, latitude 6.1°N. Total land mass area of 19,281.93 square kilometers.

Types of outcome measures

i. Primary outcomes
Vaccination coverage of RI and SIAs from 2012-2014 in Edo State
Statistical significance of RI and SIAs coverage from 2012-2014 in Edo
ii. Secondary outcome
Statistical significance of RI and SIAs coverage at LGA level

The district vaccine data management tool (DVD-MT) was used for RI analysis while the tally sheet summary was employed in SIA data analysis.

Study Design

The retrospective cohort epidemiological approach was adopted. Available data information was gathered from the annual direct vaccine data management tool (DVD-MT) and used for RI analysis while the tally sheet summary from the 18 LGAs during IPDs was employed in SIA data analysis.

Statistical Analysis:

Statistical analysis was carried out using Chi-square to compare the means of both activities for each year. Data was subjected to the student T- test, while a P-value of P≤0.05 to be statistically significant.

RESULT

The overall data analysis for Edo State for the period under review (2012-2014) shows the highest annual RI OPV coverage at 82% in 2013 (Table 2) and the lowest 75% in 2012 (Table 1). While for that same period, the State recorded 116% as the highest SIA OPV coverage in 2012 and 2014 during IPDs[1] and 106% as the lowest in 2013 also during IPDs[1] (Table 2). There was a statistical significance at P≤ 0.05 for the State RI OPV uptake when compared to SIAs for the 3 years studied, the same pattern was observed for all the 18 LGAs. The data analysis also showed that 4 LGAs (22%) attained a higher RI OPV coverage against SIAs' namely Esan central (Table1), Esan SE (Table 2), Ovia SW (Table 2) and Uhunmwonde (Tables 1-3) this was statistically insignificant at P≤ 0.05. However, in 2014 at Ovia NE LGA, the number of children immunized during the IPDs[1] was far higher than that of IPDs[2], it was observed to be statistically significant at P≤ 0.05 (Table 3), this was the only LGA with a statistical significance between the two rounds of IPDs in terms of coverage.

Data from the 18 LGAs showed that in 2012, only 3 LGAs (16.7%) had an RI OPV coverage ≥87% (Esan Central, Esan south East and Uhunmwonde) in contrast to the two rounds of SIAs (IPDs1 and 2) for that same year where all 18 LGAs recorded an OPV coverage of ≥ 90% (Figure 1). In 2013, a slight improvement was observed in the OPV coverage during RI, with 6 LGAs (33.3%) namely Akoko Edo, Esan Southeast, Etsako central, Oredo, Ovia Southwest and Uhunmwonde recording ≥87% while the OPV coverage for 1st round of SIAs that year showed that 17 LGAs had ≥90% while 18 LGAs recorded ≥ 90% for 2nd round (Figure 2). The OPV coverage for RI in 2014 showed that 7 LGAs (38.9) had coverage of ≥87% and all the 18 LGAs had a coverage

Table 1. Number immunized and Percentage coverage for OPV in 2012

Local Government	RIA n (%) (JAN-DEC)	SIA n (%) (FEB)	SIA n (%) (MAR)	p-value
AKOKO EDO	5593(75)	61173(99)	58582(95)	0.000
EGOR	9189(83)	124354(156)	124109(156)	0.000
ESAN CENTRAL	3145(111)	27100(110)	27002(109)	0.000
ESAN NORTH EAST	3470(81)	33643(120)	31890(114)	0.000
ESAN SOUTH EAST	5477(96)	38183(97)	38754(98)	0.000
ESAN WEST	2674(66)	30159(102)	29362(99)	0.000
ETSAKO CENTRAL	2724(74)	24000(108)	24135(109)	0.000
ETSAKO EAST	3434(62)	35529(104)	349269(102)	0.000
ETSAKO WEST	4017(40)	46961(101)	47008(101)	0.000
IGUEBEN	1688(82)	1631(100)	16468(101)	0.000
IKPOBA OKHA	8991(71)	109606(126)	105693(121)	0.000
OREDO	11051(84)	116503(133)	109601(125)	0.000
ORHIONMWON	2618(51)	40710(95)	39894(93)	0.000
OVIA NORTH EAST	3002(69)	41400(115)	42409(117)	0.000
OVIA SOUTH WEST	2942(53)	35597(112)	37325(118)	0.000
OWAN EAST	3660(80)	39066(108)	37106(102)	0.000
OWAN WEST	1903(49)	25793(113)	24101(105)	0.000
UHUNMWONDE	3613(119)	28460(100)	28796(102)	0.000
TOTAL	79191(75)	874554(116)	857161(113)	0.000

Table 2. Number immunized and Percentage coverage for OPV in 2013

Local Government	RIA n (%) (JAN-DEC)	SIA n (%) (FEB)	SIA n (%) (MAR)	p-value
AKOKO EDO	10980 (87)	64740 (102)	63528 (101)	0.000
EGOR	11758 (73)	102147 (126)	126774 (155)	0.000
ESAN CENTRAL	3865 (80)	26777 (106)	26576 (105)	0.000
ESAN NORTH EAST	4782 (83)	28851 (100)	29250 (102)	0.000
ESAN SOUTH EAST	7576 (101)	39523 (98)	38576 (95)	0.000
ESAN WEST	3971 (77)	30108 (99)	30326 (100)	0.000
ETSAKO CENTRAL	4193 (95)	24406 (107)	24442 (107)	0.000
ETSAKO EAST	4861 (69)	33425 (95)	32504 (92)	0.000
ETSAKO WEST	6564 (65)	48750 (102)	48196 (101)	0.000
IGUEBEN	2633 (82)	16532 (99)	16813 (100)	0.000
IKPOBA OKHA	15243 (84)	96013 (107)	115620 (129)	0.000
OREDO	16037 (89)	105208 (117)	112598 (125)	0.000
ORHIONMWON	4522 (52)	39168 (89)	40231 (91)	0.000
OVIA NORTH EAST	6084 (84)	42133 (114)	44101 (119)	0.000
OVIA SOUTH WEST	5601 (129)	34084 (104)	35101 (108)	0.000
OWAN EAST	5396 (78)	38611(104)	38419 (103)	0.000
OWAN WEST	3129 (66)	23515 (100)	23523 (100)	0.000
UHUNMWONDE	5787 (99)	27817 (96)	27807 (96)	0.000
TOTAL	122982 (82)	821808 (106)	874385 (113)	0.000

Table 3. Number immunized and Percentage coverage for OPV in 2014

LOCAL GOVERNMENT	RIA n (%) (JAN-DEC)	SIA n (%) (MAR)	SIA n (%) (APR)	p-value
AKOKO EDO	10384 (80)	64246 (99)	62573 (95)	0.000
EGOR	12998 (77)	116180 (156)	117121 (156)	0.000
ESAN CENTRAL	4634 (85)	27170 (110)	26181 (109)	0.000
ESAN NORTH EAST	4591 (87)	30736 (120)	26196 (114)	0.000
ESAN SOUTH EAST	7903 (91)	39526 (97)	45600 (98)	0.000
ESAN WEST	4085 (64)	32042 (102)	29924 (99)	0.000
ETSAKO CENTRAL	4384 (96)	24309 (108)	24405 (109)	0.000
ETSAKO EAST	4978 (67)	34767 (104)	46521 (102)	0.000
ETSAKO WEST	6956 (68)	53124 (101)	39913 (101)	0.000

Table 3. Continue

IGUEBEN	3251 (93)	17375 (100)	17446 (101)	0.000
IKPOBA OKHA	14951 (81)	104298 (126)	113343 (121)	0.000
OREDO	16603 (90)	109078 (133)	79866 (125)	0.000
ORHIONMWON	4322 (47)	32740 (95)	21205 (93)	0.000
OVIA NORTH EAST	6372 (80)*	44718 (115)*	20929 (117)*	0.000
OVIA SOUTH WEST	6338 (94)	44718 (112)	35001 (118)	0.000
OWAN EAST	5681 (76)	41960 (108)	38565 (102)	0.000
OWAN WEST	2888 (60)	22720 (113)	23068 (105)	0.000
UHUNMWONDE	6471 (108)	30265 (100)	34920 (102)	0.000
TOTAL	127790 (80)	869972 (116)	802777 (113)	0.000

KEY:
n=Number immunized
(%) = percentage coverage

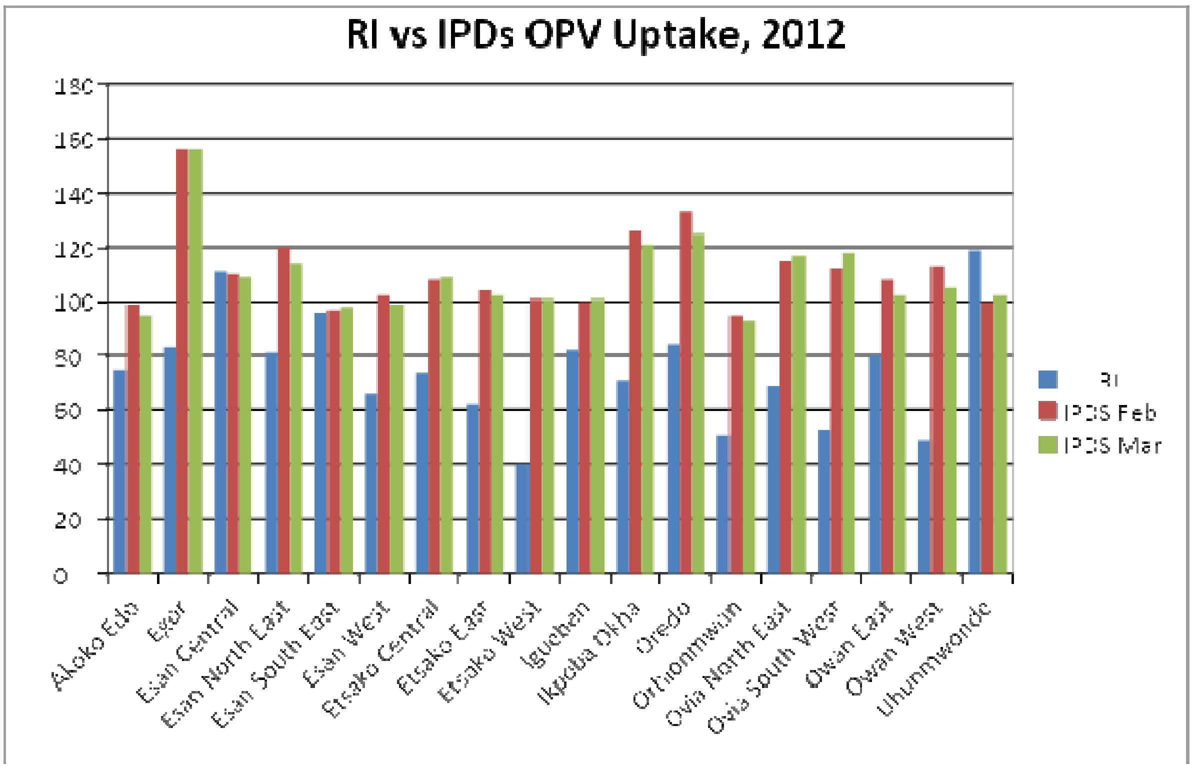

Figure 1. Bar chart showing OPV uptake 2012

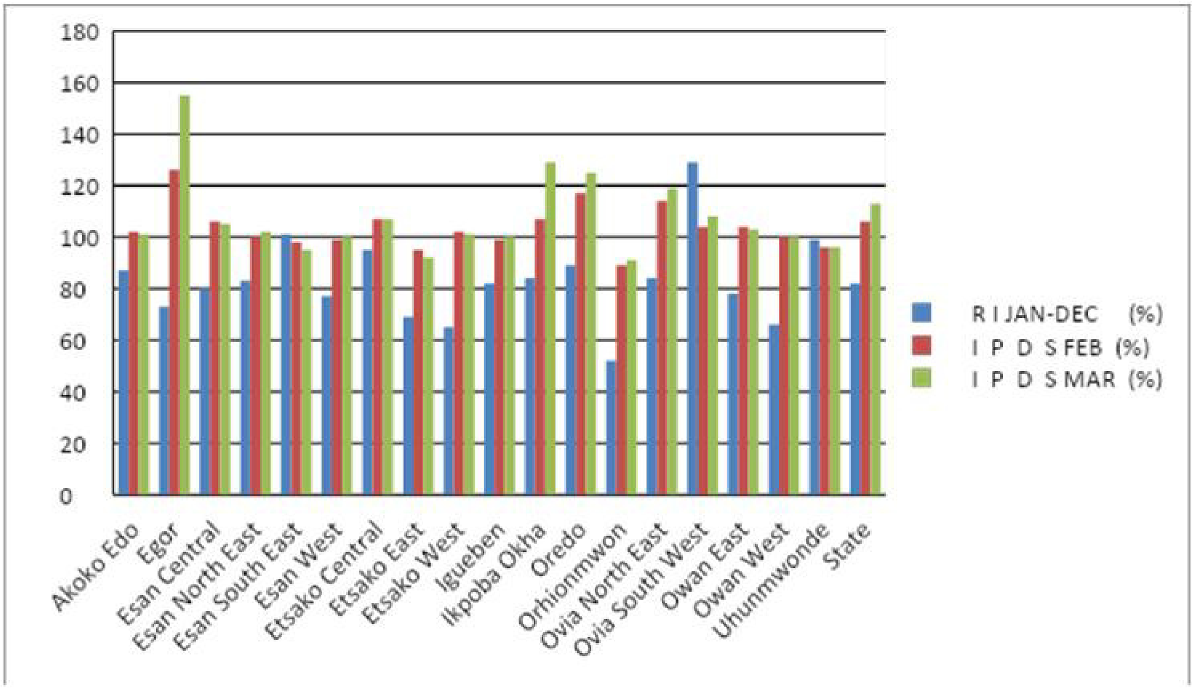

Figure 2. Bar chart showing OPV uptake 2013

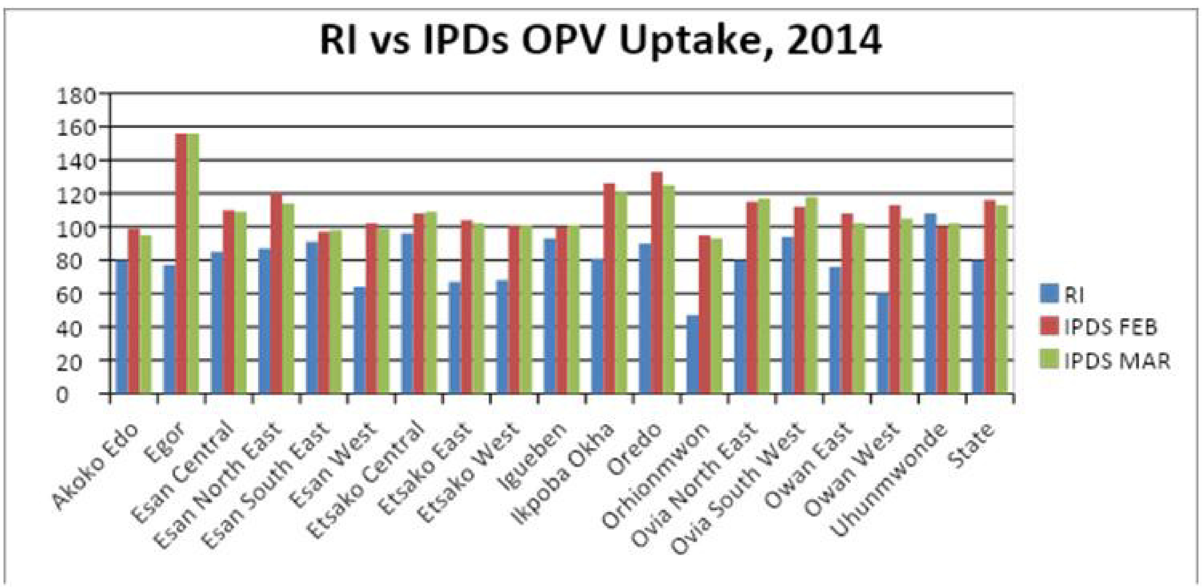

Figure 3. Bar chart showing OPV uptake 2014

≥90% for SIAs in relation to the 3 year review period (Figure 3).

DISCUSSION

There have been six rounds of polio supplementary immunization activities, that is IPDs within the period under review (2012-2014) in Edo State, which was geared towards reaching all eligible children (0-59months old). The state performance within the 3year for routine immunization (RI) and supplementary immunization activities (SIAs) showed a higher coverage in OPV uptake for SIAs (106%-116%) than in RI (75%-82%) Tables 1-3. It can be inferred from this study that RI has a poor impact on OPV uptake. On the other hand SIAs impacted positively on OPV uptake and observed reduction in the number of unimmunized children in Edo

State. This could be attributed to the quality of information provided to mothers in most Health facilities (HF) during the first RI contact and not necessarily the level of education of the mothers or an issue of access and utilization. This finding is in agreement with the work of Odusanya *et al*. (2008) who equally reported similar survey result attributingthe use of different social mobilization tools for information dissemination during SIAs as a bonus for high OPV uptake. The data analysis also provided information on the input of strategy being a contributory factor for a high OPV uptake. This is observed during SIAs, there is usually House-House strategy (taking OPV to children at home), special teams cover locations such as markets, churches, schools, motor parks, mosques, social events and day care centers. This strategy is not in place for RI, though Edo State has commenced market immunization which is in dire need of financial support for sustainability and improved RI coverage. The availability of pluses and other incentives in the acceptability of OPV during SIAs cannot be ruled out as a motivating factor in the OPV coverage, which also agrees with the finding of Onyeka *et al* (2014). The issue of lack of financial support for RI at the State and LGA levels is a major constraint in RI service delivery, this is not peculiar to Edo State alone as observed in the work of Kagina *et al*. (2014), Bonu *et al*., (2003), Gauri and Khaleghian (2002), it is more of a LMIC challenge (Uzicanin *et al.,* 2004). Other probable factors are, the incessant Health workers strike, poor tracking mechanism for migrant population, IDPs and riverine communities as well as a dis-connect of responsibility, accountability and authority at LGA and HF levels.

In the context of these changes that may affect the vaccination coverage, it is rational to hypothesize that at present the effects of SIAs in complementing routine immunisation services may be different from those reported in the past by Dietz and Cutts in 1997 "Little information is available on whether mass immunization campaigns (MICs) strengthen or interfere with the development of routine services". In support of this hypothesis, some authors reported that SIAs negatively affect the routine immunization services (Kagina et al., 2014) whereas some studies report the opposite; SIAs increase immunization coverage and reduce disease outbreaks (Tao *et al*., 2013; Zuber *et al*; 2001). Therefore, an up to date systematic review is critical to provide evidence on the relevance of SIAs in the current health systems environment. This evidence will be useful, particularly for LMICs, because these settings are the epicenter of vaccine-preventable diseases and (by definition) have limited resources.

An important finding from this research is the knowledge that LGAs with higher RI OPV coverage against SIAs have functional social mobilization, ward development and adverse events following immunization (AEFI) committees. This points to the fact that good community involvement, engagement and ownership is a key ingredient in quality RI accessibility and acceptability also reported by Khowaja *et al*., 2012.

However, the observed poor IPDs coverage in Ovia NE for 2014 can be attributed to an array of factors ranging from complacency on the part of vaccinators, inadequate political commitment to immunization/ vaccination hesitancy. This is in agreement with the findings of (WHO SAGE assessment report of the global vaccine action report, 2017). The new report provides a series of key recommendations aimed at accelerating progress and provides solutions to key challenges. When countries follow SAGE recommendations to strengthen routine immunization programs the results can go far beyond protecting people from vaccine-preventable diseases – they will build the foundation of resilient health systems for all (Verguet*et al*;2013). It is noteworthy to mention that Ovia NE is one of the few LGAs in the State with riverine component; it has a large number of migrant camps and these goes with a lot of security challenges which could have accounted for the poor IPDs coverage in 2014.

RECOMMENDATION

There is a need to use findings from this study as a justification to embark on studies on the impact of immunization interventions in enhancing OPV Uptake during RI. It is expected that this will bring RI coverage on the same pedestal with OPV uptake during SIAs. Funds for demand creation packages (e.g. SMS reminder to parents/caregivers) should be captured in budgets by all concerned RI partners.

CONCLUSION

Against the backdrop of the above, government at all levels have major responsibilities in enhancing improving and sustaining routine immunization service delivery in order to attain National OPV target coverage, and successfully implement the switch from tOPV to bOPV.

Competing Interest: None

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