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Mass Vaccination Campaigns in Nigeria and Sub Saharan Africa: A Review of Three Vaccines.

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Abstract:
Background: *Vaccines may be administered routinely or in vaccination campaigns which may be carried out for purposes of disease control or elimination, to improve coverage of routine immunization or to increase access for hard to reach communities. This review assessed the rationale, process and outcomes of three injectable vaccine; Inactivated polio vaccine (IPV), measles and meningitis vaccines used in campaigns in Nigeria and sub Saharan Africa.*
Methodology: *A literature search was carried out on pubmed using the search terms 'Vaccination AND Campaigns AND (Measles OR IPV OR Meningitis) AND Africa. The findings were summarized and presented for the three vaccines respectively.*
Findings: *Meningitis vaccination campaigns have been carried out annually in the African meningitis belt for controlling periodic outbreaks of meningococcal meningitis with great success. Vaccination coverage rates are generally high, probably as a result of high risk perception for meningitis despite logistic challenges. Massive region-wide vaccination campaigns using the MenAfrivac® vaccine will probably negate the need for similar campaigns in the future or at least reduce the scale of these.*
Measles eradication is being pursued globally but in Africa, this has lagged behind because of poor routine immunization coverage with measles-containing vaccines. To that extent periodic measles vaccination campaigns are recommended in countries with routine coverage less than 80% to increase coverage rates for the vaccine. In Nigeria there have been at least 2 which were successful despite failing to prevent outbreaks albeit smaller ones.
IPV was used for the first time in a campaign in Kenya, with the GPEI partners working closely with local partners vaccinated more than 126,000 children under 59 months of age. The success of that campaign provided evidence that 'limited campaigns' can be carried out using IPV, as has been the case in outbreak response measures in Nigeria.
Conclusion: *Vaccination campaigns have been carried out using injectable vaccines for a long time for various reasons with mixed success. Critical factors drive the success of these campaigns as well as vaccine avoidance behavior.*

I. Introduction:

Vaccines can generally be delivered in two ways, either as part of a vaccinating schedule in routine immunization, or on an adhoc basis limited by time and location in so-called vaccination campaigns.
Vaccination campaigns have been used successfully in many instances on a global, regional, national or subnational basis to administer vaccines to those in highest need.
Campaigns may be carried out for reasons including.
Part of disease elimination or eradication efforts.
To supplement routine immunisation and increase routine immunisation coverage.
To reach hard to reach populations with immunisation services.

An immunisation campaign conducted worldwide by the WHO from 1967 to 1977, resulted in the eradication of small pox which was one of the 'childhood killer diseases'. Polio, hitherto the leading cause of childhood paralysis is also on the brink of elimination because of massive vaccination campaigns worldwide.(WHO, 2014).

This review assessed previous vaccination campaigns with measles, meningitis and IPV campaigns in Africa in the last 14 years; the benefits and changes as well as lessons learned.

II. Methodology

A literature search was carried out on pubmed using the search terms 'Vaccination AND Campaigns AND (Measles OR IPV OR Meningitis) AND Africa.' It yielded 25 articles which were screened for timeliness i.e. no later than 2000, relevant content, duplication, publication in English and availability of the content.
Additionally publications of organisations like the World Health Organisation (WHO), United Nations' International Children Emergency Fund (UNICEF), Global Polio Eradication Initiative (GPEI) and the American Center for Disease Control and Prevention (CDC) were reviewed and relevant information extracted.
The information was summarized using a concept map and presented under the three different vaccines of concern.

Information included the reasons for the campaigns, source of vaccines used, relevant partners, successes recorded and challenges faced.

III. Results

Meningitis

Every year, bacterial meningitis affects the zone described by Lapeyssonie in 1963 as the meningitis belt extending across Africa from Senegal to Ethiopia. This is caused by *Neisseria meningitidis* (*N.M*) in 80-85% of cases although there is slight variation among the serotypes; the most predominant of which is A, with W135 and X accounting for emergent outbreaks.

The recommended meningitis epidemic control strategy involves surveillance, case management using antibiotics and reactive immunisation campaigns for the population in affected districts.

In response to these outbreaks, there have been several mass vaccination campaigns carried out in countries affected by the outbreaks, originally with a polysaccharide vaccine, and more recently with the men. A conjugate vaccine.(WHO., 2011) the conjugate vaccine is advantageous over the polysaccharide by providing immunity in young children, induce immunological memory and prevention of pharyngeal carriage.

The meningitis vaccine project (MVP) is a modern vaccine success story that saw the development of a new conjugate vaccine against men A within 10 years. It was the product of a partnership between the WHO, PATH, BMGF, Netherlands vaccine institute and manufactured in the serum institute of India at a selling cost of $0.50 per dose. Licensed with data on immunogenicity which showed a much stronger antibody response than the polysaccharide vaccine; (Sow et al., 2011)within 2 years, 6 of 25 affected countries by men A had introduced menAfrivac® with GAVI support;(WHO AFRO Meeting report /, 2013) the first of these being Burkina Faso where almost all children and adults <29 years were immunised, resulting in a massive drop of 94% in the crude incidence rate of meningitis the following year with no men A outbreaks recorded. This was replicated in Chad which also showed effectiveness of the vaccine in preventing meningitis and reduction of pharyngeal carriage following a campaign which covered an estimated 102% of the target population.(Daugla et al., 2014)(Kristiansen et al., 2013)

The Burkina Faso campaign was planned and executed by a committee formed the ministry of health, in collaboration with the authorities in Mali and Niger, facilitated by the WHO Intercountry support team (WHO/IST). The plan was based on district micro planning for measles campaigns. Funding was received from the Michael and Susan Dell foundation used to improve the cold chain capacity by procuring refrigerated vans, regional incinerators and laboratory supplies. Other support was from the WHO, GAVI and UNICEF. The campaign itself was completed under 10 days and was enthusiastically accepted by the population of about 11 million who received the vaccine.(Djingarey et al., 2012)in Niger, the coverage was lower at 90% (by card and history), despite about 7 million people vaccinated. Those more likely to be vaccinated were younger children less than 15 years, females, same house residence for more than 3 months and information about the campaign.(Caini et al., 2013)

In 2010, reactive vaccination campaigns were done in Nigeria to combat a reported 4699 cases with 322 deaths in 5 districts, with men A and W135 responsible. The campaign utilised 191,200 doses of trivalent polysaccharide vaccines obtained from the International Coordinating Group on vaccine provision for epidemic meningitis control (ICG), a marked reduction from 2009 which saw Nigeria receiving 7 million doses.

There was a high level of acceptance of vaccination among the targeted communities despite difficulties in ensuring the timely supply of vaccines. Coverage in Nigeria in the 2009 season was more than 80% in the areas affected mainly in the Northern states.(WHO, 2010) Data on the 2012 vaccination campaign with MenAfrivac in Nigeria are not publicly available.

Measles

Measles is a highly infectious disease with a high Ro which means it usually occurs in epidemics. Although there is a highly effective vaccine against measles, it requires coverage rates as high as 80% to eliminate susceptibles and interrupt its transmission.(FMOH Nigeria & WHO, n.d.) These high coverage rates are rarely achieved in developing countries, Nigeria having had rates between 30-70% from 1990 through 2008.

The strategy adopted is conducting mass vaccination campaigns in response to outbreaks in the face of poor routine immunisation coverage although SIAs are originally meant to administer second doses in accelerated measles control plan of WHO/UNICEF.

This strategy starts with a one-time catch up campaign, targeting children 9 months to 14 years of age followed by periodic follow-up campaigns every 2 to 4 years, targeting children less than 5 years of age.(World Health Organization, 2001) these strategies adopted by the WHO African region towards facilitating the regional elimination of measles, with pre elimination goals set of:(FMOH Nigeria & WHO, n.d.)

- ✓ 98% reduction in mortality by 2012 compared to 2000
- ✓ Reducing the incidence of measles to less than 5 cases per 100,000 population per year
- ✓ Attaining MCV 1 coverage >90% at national level and 80% in all districts;
- ✓ Achieving a non- measles febrile rash rate >2 cases per 100,000 population per year and
- ✓ ≥1 suspected measles case with serological investigation in at least 80% of districts per year.

As part of the strategies, measles SIAs are necessary in all countries with RI coverage rates less than 80% because outbreaks are likely to occur in these settings otherwise. These mass vaccinations are relatively cheap to perform, costing about $1 per child according to measles initiative estimates because the vaccine is very cheap at about $0.36 per dose and highly efficacious (95%).(Christie & Gay, 2011) Measles SIAs commenced in Nigeria in December 2005 with a nationwide catch up SIA implemented in 2 phases, the first in the 19 Northern states and Abuja in 2005 and in the southern states in October 2006, vaccinating a total of 54,862,767 children.

The campaign was successful, with an administration coverage of 90%; higher in the north (96%) than the South (83%). State-level coverage ranged from about 60% in Ogun state to 108% in Nassarawa state.. 49% of the 774 Local government Areas (LGAs) achieved coverage ≥95% with 25.5 having 85-94% coverage.

Follow up SIAs were conducted in November and December 2008 for Northern and southern states respectively reaching 28,363,469 children aged 9 – 59 months with estimated administrative coverage of 112% of population estimates; ranging from 76% in plateau state to 151% in Oyo state. In this round 48% of the LGAs achieved > 95% coverage.(Weldegebriel et al., 2011)

These and other strategies earlier elaborated have resulted in an estimated 92% decrease in measles-related deaths in the WHO AFRO region between 2000 and 2008, however heterogeneous coverage rates for routine immunisation against measles continue to threaten the goal of measles elimination as shown in 28 out of 46 AFRO countries who experienced lab-confirmed measles outbreaks in 2009-2010.(Center for Disease Control and Prevention., 2011) Another observation from a study in South Africa was a decline in RI coverage associated with SIA occurrence suggesting a negative impact of these SIAs on routine health systems.

Obviously the SIAs reduce the cost of accessing the vaccination for the care givers, but the decline was partly because people probably counted the SIAs as part of the routine shots. It is envisaged that the 'RED' strategy will help obviate the need for SIAs in the future while strengthening the routine immunisation services.(Verguet et al., 2012)

IPV

There is currently no plan to use IPV in mass immunization campaigns for catch up or other purposes. It is however possible that, in a few limited geographic areas of endemic countries, IPV could be used in combination with OPV for accelerating the eradication of the wild polio virus. (GPEI, 2014) One such area was in Kenya, close to the border with Somalia. In 2013, there was an outbreak in the horn of Africa affecting three countries; Somalia (194 cases), Kenya (14 cases) and Ethiopia (9 cases), as of march 2013.(CDC., 2013)

The Kenyan Ministry of health with collaboration from the GPEI partners carried out a campaign in December 2013 using IPV with OPV in Somali refugee camps and surrounding communities close to the border, a campaign which targeted 126,000 children <59 months. The aim was to shore up population immunity levels, ensure interruption of any residual WPV transmission and prevent spread from potentially new importations. This was in spite of one NID and five SNIDs conducted between May and November 2013.

The campaign required extensive mobilisation and planning which included focus group interviews which suggested a high likelihood of acceptance by the population of the intervention.

The campaign required 299 teams of health workers and volunteers who administered the vaccines in permanent and temporary fixed vaccination centres, with a few mobile teams deployed to reach the nomadic children.

Overall the campaign was successful, reaching a coverage of >90% albeit at a higher cost; the cost of immunising each child was about $3.27 compared to $0.50 spent during the OPV only SNID carried out in November 2013.

The challenges faced during the campaign were mainly to do with IPV administration, in which up to 11% of vaccinators made errors including administering a wrong dose of the vaccine; and storage of vaccines because of absence on the IPV of VVMs which were supposed show the viability of vaccines exposed to higher temperatures. The fact that IPV cannot be frozen was also poorly understood by the staff, potentially reducing

the potency of some of the vaccines used. Information was well disseminated although 46% of care givers whose children did not receive IPV said they were not aware of where to get the vaccine from.

Lessons learned showed that IPV could be given in a coordinated campaign with achievement of high coverage rates albeit at a higher cost; however it requires strong commitment from the health authority, proper micro planning, flexibility to move temporary fixed sites to other areas closer to the vaccine recipients and robust communication on the fears regarding the vaccine and its administration. There is however a need to investigate further on the effectiveness and cost-effectiveness of this strategy.(Sheikh et al., 2014)

IV. Conclusion

Vaccination campaigns have been carried out in Africa for a long time for various reasons. For injectable vaccines; measles, meningitis and IPV vaccines, the results have been mixed. The factors which have determined success include the partners involved, the degree of planning and the population vaccinated. With respect to the uptake of the vaccine, important factors include risk perception of the disease against which the population is being vaccinated, the fears regarding safety of the vaccine and previous experience with the vaccine are the ones which may drive vaccine avoidance behavior.

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