MEASLES RESURGENCE IN NIGERIA: A REVIEW ON THE ATTRIBUTABLE FACTORS

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ABSTRACT

Measles is an acute viral infection, community related and a common childhood communicable febrile disease characterised by generalised rash among infected children. Known world-wide for nearly 2000 years, but is still globally remains one of the important causes of childhood morbidity and is also reckoned to be one of the greatest killer-diseases of children in the history of the world. Its death rate is however more in the developing countries than in the industrialised world.

Despite the existence of the globally acclaimed effective measles vaccine, the viral aetiology continues to cause sporadic and epidemic of diseases throughout the world. Most recent outbreaks have involved either children who were too young to be vaccinated or older children and teenagers, most of whom had been previously vaccinated.

Although the reasons for this global resurgence were not too fully understood, some of the established attributed factors include failure to maintain adequate vaccination coverage, environmental thermal inactivation of the heat-sensitive vaccine, poor handling of vaccine at the vaccination centres by health personnel, and inadequate cold chain systems for vaccine storage and distribution especially in the tropical countries like Nigeria. The most significant potential factor speculated was the possibility of antigenic difference between the wild and vaccine strains of measles virus: a major factor of immunological importance and interest.

In Nigeria, the vaccine-in-use is the imported one made of the Edmonston strain of measles virus. Its use in vaccination programmes over the last three decades in Nigeria have not had any significant impact on children morbidity and mortality due to measles. This paper therefore reviews the effect of measles among Nigerian children, factors responsible for the resurgence particularly among the vaccinated population and further suggest ways for possible measles eradication in Nigeria.

INTRODUCTION

Measles is an acute viral infectious, highly contagious droplet-borne common communicable and community related febrile disease of children. The disease is characterised by prodromal fever, conjunctivitis, coryza, cough, Koplik's spots on the buccal mucosa. It has a characteristic generalised blotchy body rash appearing on the 3rd to 7th day, beginning on the face, becoming generalised, lasting 4-7 days and sometimes ending in brain desquamation which is often commonly associated with leucopaenia [1]. Measles, a devastating illness and a notable major cause of childhood morbidity and mortality world-wide is, reckoned to be one of the greatest killers of children in the history of the world [2-5]. The disease is however more of a problem in the developing countries than in the industrialised countries of the world, claiming much more lives of children in the former than the latter [6-11].

In Nigeria, measles has been particularly known to be common, endemic and often referred to as an inevitable developmental childhood disease [12-17]. The detection of anti-measles immunoglobulin M (IgM) in previous vaccinees and past Nigerian adult measles patients further suggest a concrete evidence of measles virus re-infection and further strengthen the fact that measles is endemic in Nigeria [18]. According to Akesode [19], out of the over 5 million infants born annually in Nigeria, about 1.2 million of them die before their first and fifth birthdays because the contract one or more of the six vaccine-preventable diseases (i.e. diphtheria, pertussis, tetanus, measles, polio and tuberculosis).

Among these six vaccine-preventable diseases under the World Health Organisation-Expanded Programme for Immunisation (WHO-EPI), Measles has consistently been shown to have the highest incidence over a period of 30 years (Tables 1 & 2) [20-21].

Table 1: Reported annual incidences of the six EPI targeted diseases in Nigeria, 1973-1989.

Diseases	Incidences per year																
	1973	1974	1975	1976	1977	1978	79	80	81	82	83	84	85	86	87	88	89
Diphtheria	110	129	32	333	1050	455	274	165	164	1170	275	733	1996	1871	671	-	59
Measles	78550	115634	134976	153560	282897	188727	176468	162106	129671	139785	136778	182591	161768	115743	72966	53132	17217
Pertussis	416348	34362	37949	42452	45440	58719	48996	56913	77830	70024	62751	92266	42193	46669	18810	-	-
Poliomyelitis	360	452	569	521	437	657	469	816	335	395	392	625	959	453	558	317	151
Tetanus	2356	2773	2596	2416	3365	3223	3370	3095	3035	3479	2577	2924	2796	2269	2289	1473	1260
Tuberculosis	14925	19716	8498	15334	14750	14292	13587	9897	10838	10949	10212	11439	14937	14071	19512	-	-

Source: EPI (1991) 20

TABLE 2: REPORTED CASES AND (DEATHS) OF MEASLES BY STATE IN NIGERIA, 1990-1994

S/No	STATE	1990	1991	1992	1993	1994
1	Abia	NS	NS	34(0)	53(0)	57(1)
2	Adamawa	NS	NS	8,321(107)	1,586(74)	3,866(74)
3	Akwa Ibom	1,700(3)	1,183(6)	1,881(29)	887(5)	1,302(3)
4	Anambra	1,035(0)	1,275(0)	666(0)	540(0)	507(0)
5	Bauchi	581(29)	261(10)	240(6)	-	598(35)
6	Bendel	4,804(22)	2,529(29)	OS	OS	OS
7	Benue	408(0)	2,011(0)	484(0)	82(0)	410(0)
8	Borno	0(0)	0(0)	616(12)	-	2,262(38)
9	Cross River	1,600(15)	620(7)	893(18)	975(4)	1,911(9)
10	Delta	NS	NS	852(0)	743(0)	834(2)
11	Edo	NS	NS	682(10)	358(2)	974(8)
12	Enugu	NS	NS	357(0)	1,191(0)	3,295(0)
13	FCT, Abuja	349(0)	71(0)	100(0)	103(1)	146(0)
14	Gongola	37,434(150)	3,176(16)	OS	OS	OS
15	Imo	791(0)	502(4)	300(0)	27(0)	251(0)
16	Jigawa	NS	NS	-	2,364(0)	21,124(176)
17	Kebbi	NS	NS	-	652(38)	1,574(45)
18	Kaduna	5,648(82)	3,019(120)	4,439(148)	2,230(33)	15,797(59)
19	Kogi	NS	NS	1,432(0)	1,313(1)	2,290(0)
20	Kano	31,813(257)	8,322(13)	12,457(3)	9,634(0)	17,895(0)
21	Katsina	2,160(24)	1,193(28)	8,888(492)	2,896(151)	4,156(98)
22	Kwara	2,313(0)	364(0)	672(0)	145(0)	120(0)
23	Lagos	5,897(20)	6,527(5)	11,332(36)	6,971(16)	4,484(7)
24	Niger	1,333(37)	1,145(30)	8,893(68)	6,526(7)	7,831(19)
25	Ondo	729(4)	530(3)	576(0)	395(0)	467(0)
26	Ogun	353(0)	0(0)	131(0)	390(0)	0(0)
27	Osun	NS	0(0)	4,560(14)	1,336(4)	3,440(1)
28	Oyo	664(0)	1,389(1)	3,445(23)	472(0)	0(0)
29	Plateau	85(0)	1,951(31)	5,259(32)	7,341(15)	1,213(0)
30	Rivers	649(0)	414(0)	1,537(0)	377(0)	86(0)
31	Sokoto	16,336(756)	7,644(85)	4,607(0)	3,310(78)	2,751(62)
32	Taraba	NS	NS	1,082(18)	782(5)	2,461(28)
33	Yobe	NS	0(0)	1,229(16)	1,055(0)	1,663(0)
TOTAL		**116,682(1,399)**	**44,625(388)**	**85,965(1,032)**	**54,734(367)**	**106,081(695)**

NS = Not Stated OS = Out of Stock Source:Anon (1995) [21]

AETIOLOGY AND HISTORY OF MEASLES

The causative agent of measles is a virus, Measles virus, belonging to the viral family Paramyxoviridae, subfamily Paramyxovirinae and genus Morbillivirus [22, 23]. The genus to date, consist of five established members: Measles virus (MV), Canine Distemper virus (CDV), Rinderpest virus (RDV), Phocine Distemper virus (PDV) and Peste-de-Petits Ruminants virus (PPRV) [24]. Measles virus genome is a single molecule of linear, single strand, non-segmented, negatively sensed RNA and is a prototype member of the genus Morbillivirus [25].

Historically the writings of Abu Becr [26] in 1748, known by his hometown name of Rhazes provided the earliest description of measles. He lived in the 10th century, but he quoted other authors on measles from as far back as Al Yehudi, who lived in the 7th century. Rhazes in his studies considered measles to be more dreaded than smallpox, which was described earlier by Galen in the 2nd century AD.

Rhazes used the word *"Hasbah"* an Arabic word to describe measles. The word carries much the same connotation as the English word "Eruption". The Arabic word was in Latin came to be described with the terms *"Rubeola"* and *"Morbilla"* only during the middle ages. The Teutonic languages have a common root word *"Mazer"* which became *"Masern"* in German and *"Mislingar"* in Icelandic as well as "Measles" in English. The divergence of the Teutonic words suggests considerable antiquity for the recognition of the disease in Northern Europe [27].

There was massive measles epidemic in the Roman Empire starting in 165 and 251 AD and two similar epidemic in China in 162 and 310 AD. Syndenham [28] in 1922 was first to describe measles in Northern Europe but the first demonstration of procedure showing analogy of measles to smallpox in 1759 was attributed to Home [29]. History records suggest that smallpox came first in West and measles first in the East. In 1846, Peter Panum went to the Faroe Island to give help during a measles epidemic. He was able to define the 14-day incubation period and to show that the infection conferred lifetime immunity [30]. In 1883, Hirsch [31] then built on Panum's work to reach the conclusion that an epidemic persisted *"so as long as there are found susceptible individual affording (habouring) the poison (virus) in a soil (environment) adapted to its reproduction, whilst it perishes if there is no ground to reproduce itself"*. In 1906, Hamer [32], formulated the concept of an epidemic cycle involving input of new birth and output of immunised to maintain a fluctuating population of susceptibles within stable limits.

Studies carried out during the years 1906-1953 contributed as much confusion as elucidation of the cause of measles. In the later year, specifically 1953, Enders and Peebles isolated measles virus and developed serological test to immunity [33]. Soon after this, Katz *et. al.* [34] followed this with the development of an effective vaccine in 1960. The vaccine was licensed in 1963 and it permitted very effective control of the disease in countries with the will, resources and infrastructure to immunise assiduously.

MEASLES VACCINES: HISTORY, VACCINATION PROGRAMMES AND ITS IMPACTS ON THE INCIDENCE OF MEASLES IN NIGERIA.

The development of live attenuated measles virus vaccines began soon after the isolation of the virus by Enders and Peebles. By the end of the 1950s, Enders and his colleagues had developed the Edmoston -B strain of the live attenuated measles vaccine. By the mid to late 1960s, new strains of measles vaccines had been developed in the USA, Japan, Yugoslavia, the USSR and China by further attenuation of the Edmoston isolate to get other vaccine strains of the virus (Table3)[35].

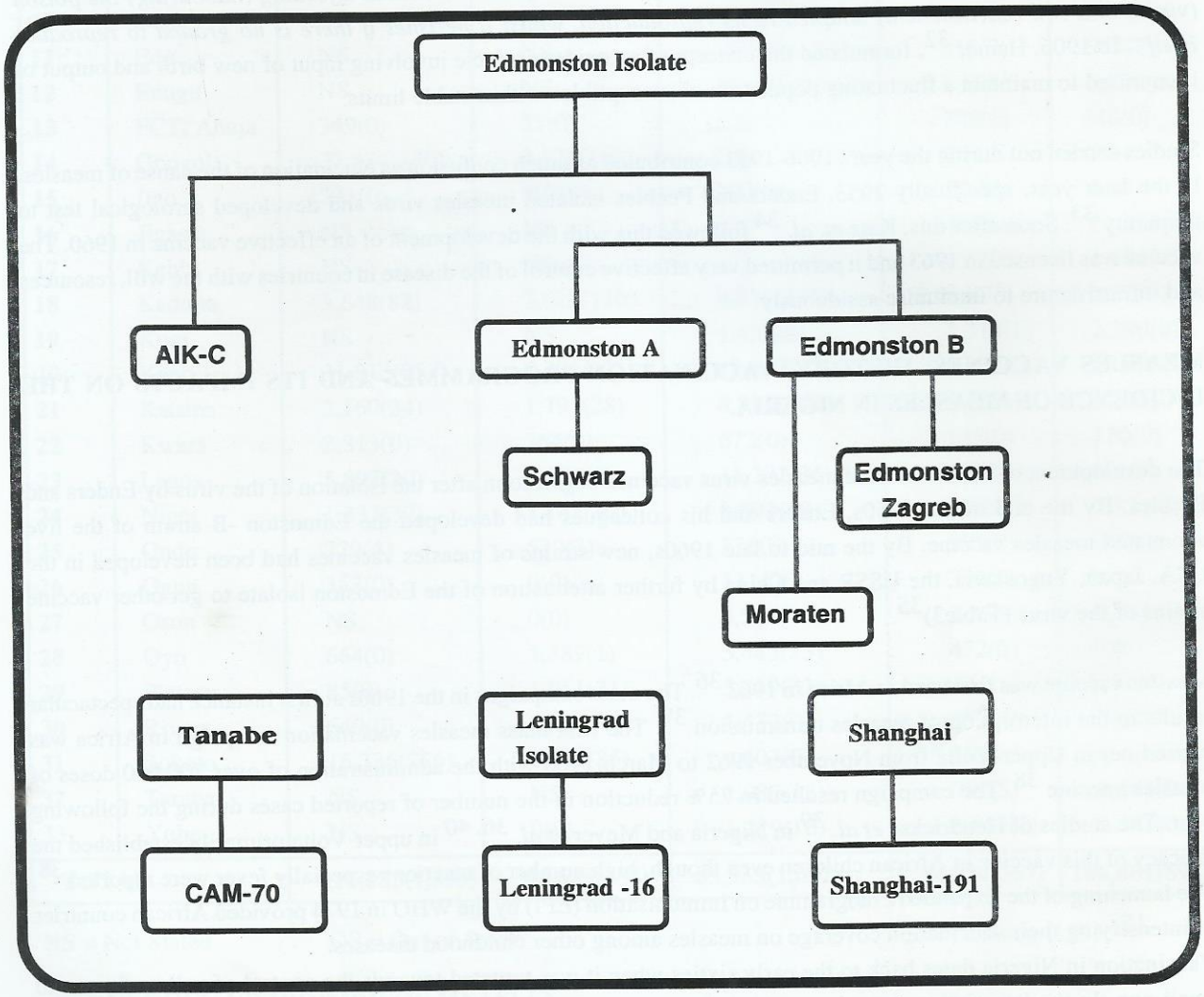
Measles vaccine was first used in Africa in 1962 [36]. The mass campaigns in the 1960s at first instance had spectacular results in the interruption of measles transmission [37]. The first mass measles vaccination campaign in Africa was carried out in Upper-Volta from November 1962 to March 1963 with the administration of over 700,000 doses of measles vaccine [38]. The campaign resulted in 75% reduction in the number of reported cases during the following year. The studies of Hendrickse *et al.* [39] in Nigeria and Meyer *et al.* [36, 40] in upper Volta primarily established the efficacy of this vaccine in African children even though, high number of reactions especially fever were reported [38]. The launching of the Expanded Praogramme on Immunisation (EPI) by the WHO in 1974 provided African countries of intensifying their vaccination coverage on measles among other childhood diseases.

Vaccination in Nigeria dates back to the early sixties when it was targeted towards the control of yellow fever and small pox. In the late sixties, mass immunisation campaigns were carried out against smallpox and measles with smallpox being eradicated in Nigeria in 1970. The launching of the EPI by WHO in 1974 made the federal government of Nigeria to adopt the policy. The aim of the programme was to provide immunization against the six major children killer-diseases: pertussis, tetanus, measles, diphtheria, poliomyelitis and tuberculosis. The State governments were urged to set up an administrative arrangement for the planning and implementation of EPI [41].

The programme started off in Oyo State in 1975, after a pilot study conducted at Ikire in Irewole Local Government area [42]. Evidence from the pilot study supported mass immunisation strategy using collecting point approach and mobile teams with the attitudes of the community found favourable [43]. In 1979, EPI was launched nation-wide in Nigeria [44, 45] but began operations in 1980. The implementation of the programme over the next 5 years (1979-1983) resulted in low coverage and low disease impact [46]. Based on these

support from WHO and UNICEF, a revised EPI was launched in all the Nigerian States in October, 1984 [44, 45, 47], using a new set of strategies developed in Owo local government authority (LGA) of Ondo State [48]. This model was replicated at the capital LGAs and subsequently expanded to all LGAs by September 1987. By the end of 1987, when the coverage level was still low, it appeared that the 1990-Universal Child Immunisation (UCI) would not be realised. Hence in 1988 through 1990, National Immunisation Days (NIDs), State Immunisation Days (SIDs) and Local Government Immunisation Days (LIDs) were conducted to promote the public understanding of immunisation and increase the levels of coverage. The non- sustenance of the improved vaccination programmes at the various levels of government in Nigeria (LGA, State and Federal) due to economy recess has been one of major hindrances towards achieving the goal of measles eradication in Nigeria.

TABLE 3: ORIGIN OF SELECTED STRAINS OF MEASLES VACCINE



Sources: Cutts (1993) [35]

ATTRIBUTABLE FACTORS FOR MEASLES RESURGENCE IN NIGERIA

Despite the World-acclaimed effective and immunogenic measles vaccine (Edmoston-Zagreb strain), measles is still not fully controlled in Nigeria. In many urban areas, the median age at which children get measles is falling rapidly as the disease become hyper-endemic because of the constant influx of cases from rural areas or the neighbouring countries. Several studies done in Nigeria have raised the alarm that the protection afforded to vaccinees by measles vaccine declines with age [47, 49-51]. The sudden resurgence and upsurge of measles morbidity and mortality among Nigerian children, including the vaccinated population in the last 10 years has been attributed to some of the following identified and studied highlighted problems:

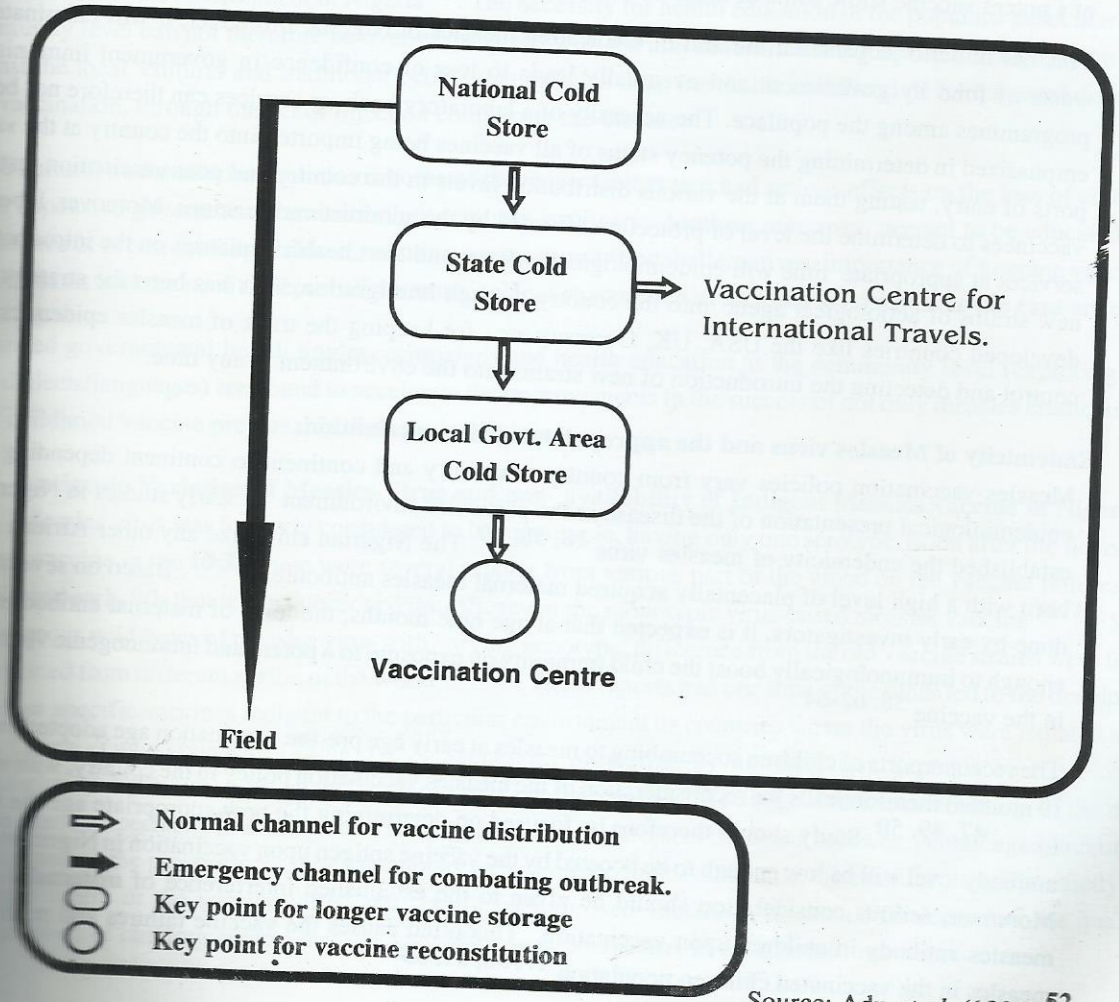
1. **Poor Data Collection and Gross under-reporting:**

Routine disease notification has been established to form the historical basis for following disease trends over the time in many countries of the world particularly the developed ones. In Nigeria, it has been observed that measles cases are grossly under-reported due to the inappropriate record keeping of both the government and private health sector who also do not report on incidence of measles and other EPI-diseases to health ministries. Based on this, data obtained from government hospital-reported cases is not sensitive enough alone to estimate the disease trend and impact of EPI on measles in Nigeria. Poor data collection therefore does not allow adequate planning for combating of measles and determining which area is more prone or devastated by the disease. Health ministries at Local, State and Federal levels should therefore embark on the education of hospital staff and involvement of private health sectors for improved data collection and record keeping.

2. **Inadequate vaccine cold chain system:**

Four levels of vaccine storage and distribution have been identified in Nigeria [52]: the National Central cold store (NCCS), the State cold store (SCS), the Local government cold store (LGS) and the Vaccination centres (VC). The NCCS is the high level of vaccine storage while the VC is the vaccine administration point to recipients (Table 4). Studies have shown that the vaccine potency deteriorates as the distribution channel goes down the ladder (i.e. from the NCCS to the VC level). Due to the long and often tortuous journey, from the international manufacturer to the NCCS and from where it moves down to the vaccination centres, great difference in the vaccine potency often result to due to heat exposure and other harsh conditions at the various levels of distribution [52, 53]. Improvement in the vaccine storage and distribution particularly in the area of public electrical power supply and other alternatives for stand-by power supply will go a long way in maintaining the potency of the expensively procured measles vaccines.

TABLE 4: THE LEVELS OF COLD CHAIN SYSTEM AND DISTRIBUTION CHANNELS OF VACCINES IN NIGERIA.



Source: Adu *et al.* (1996) [52]

3. **Environmental problems:**

The adverse environmental factors such as existence of chains of unauthorised vaccine salesmen and poor vaccine handling have been a major drawback in maintaining the potency of measles vaccine in Nigeria. These factors centred on the exposure of the vaccine to high heat and unfavourable temperature by various ways in our environment. Studies have shown that the virus titre of the vaccine drops drastically due to thermal in activation in the tropics of which Nigeria is one, where the ambient temperature recorded is high enough to inactivate the vaccine antigen, thereby dramatically reducing the potency and efficiency of the vaccine [47, 54, 55].

At various vaccination centres, studies have shown that vaccines were inappropriately handled and left to the harsh environmental temperature or held in palms for longer time than necessary before its administration into recipients [47, 51]. The resultant effect of this is the inactivation and/ or, killing of the life-attenuated viral-antigen in the vaccine, which subsequently will not be able to elicit any protective immunity in vaccinees. Heat and temperature of any environment is beyond human manipulation because it is a natural endowment therefore, education of personnel at vaccination centres on proper vaccine handling and storage is a necessity and must be enforced.

Enactment of appropriate laws against unauthorised vaccine salesmen will be a positive move by the government toward absolute elimination of heat-inactivated sub-potent and killed impotent vaccines circulating in Nigeria. This should also be coupled with the public enlightenment on the risks involved in purchasing such bad vaccines for immunisation.

4. **Lack of laboratory back-up services:**

Several works have identified the negative influence of this factor on the level of immunity proffered on the vaccinees upon vaccination. Studies done at the various level of vaccine storage in Nigeria showed that about 75% of measles administered in Nigeria were impotent and did not meet the WHO minimum standard of a potent vaccine while some of them were expired before being administered into children [47, 51, 52, 56].

This has hitherto jeopardised the aim of eradicating measles in Nigeria. Moreover, it will culminate into waste of fund by government and eventually leads to loss of confidence in government immunisation programmes among the populace. The necessity of a laboratory back-up services can therefore not be over emphasized in determining the potency status of all vaccines being imported into the country at the various ports of entry, testing them at the various distribution levels in the country and post-vaccination testing of vaccinees to determine the level of protection afforded by the administered vaccines. Moreover laboratory services at appropriate time will epidemiologically detect and alert health ministries on the introduction of new strains of aetiological agent into the country through immigration. This has been the strategy in the developed countries like the USA, UK, Germany etc., for keeping the track of measles epidemics under control and detecting the introduction of new strains into the environment at any time.

5. **Endemicity of Measles virus and the appropriate age for vaccination:**

Measles vaccination policies vary from country to country and continent to continent depending on the epidemiological presentation of the disease in the particular environment [57]. Early studies in Nigeria have established the endemicity of measles virus [18, 58, 59]. The Nigerian child like any other African child is born with a high level of placentally acquired maternal measles antibodies [60, 61]. Based on several works done by early investigators, it is expected that at age nine months, the level of maternal antibodies is low enough to immunologically boost the child immunity on exposure to a potent and immunogenic viral antigen in the vaccine [38, 62-64].

The recent reports of children succumbing to measles at early age pre-the vaccination age adopted in Nigeria (9 months) therefore calls for reconsideration of the measles vaccination policy in the country, with reference to age [47, 49, 50]. Study should therefore be focused on determining the new appropriate age the maternal antibody level will be low enough to be boosted by the vaccine antigen upon vaccination in Nigerian children. Moreover, serious consideration should be given to the established interference of maternally acquired measles antibody in children upon vaccination. This often causes the vaccine failures and resurgence of measles in the vaccinated children population [47, 50, 51, 65].

6. Vaccination Programmes and its Sustenance:

Since the official launching of EPI in Nigeria in 1974, the programme has not achieved its main goal of successful eradication of the six-killer diseases of childhood. Massive assistance have been received from world health bodies, national and international non-governmental organisations with the aim of combating the vaccine preventable diseases of children in Nigeria. Several immunisation programmes at all level of government in Nigeria were initiated: National immunisation days (NIDs) at the federal level, State immunisation days (SIDs) at the State level and the Local immunisation days (LIDs) at the local government level. At first instance of intervention, great impacts were made on the disease morbidity and mortality but due to the non-sustenance of the vaccination programmes on the premise for lack of funding and misplaced priorities of Nigeria government, the diseases still persist and unabated. The non-sustenance of these programmes has hitherto led to the failures observed in EPI now renamed as National Programme on Immunisation (NPI). This has thus caused the staggering and fluctuating resurgence of measles in Nigeria in the last decades [44-46].

The focus of health ministries during vaccination programmes should also be diversified to the various age groups, as their target age group for measles vaccination (under 1 year of age) had led to the age shifting of measles to higher age group of under-fives as also observed in some African countries including Nigeria [66-68]. Several other factors for the possibility of measles age shift have been observed, propounded and reported by some workers [66-71]. It is therefore of paramount importance to sustain the initiated and established vaccination programmes in Nigeria for achievement of the set goals of eradicating measles in Nigeria.

7. Poor Health Education and non-involvement of Community in Vaccination Programmes:

Sound and sustained health education on nutrition and environmental sanitation of the communities particularly for mothers have been shown to be a potential factor that would improve the quality of life for Nigerian children [72-74]. The active participation of communities in health and immunisation programmes against communicable diseases (including measles) have been reported to have great impacts and positively improved the educational opportunities and sanitation of the environment in Nigeria [75]. The necessity for health education of the populace particularly at the community level can not therefore be over-emphasized with the aim of re-orientating the minds of Nigerian parents against the local, cultural and traditional beliefs that measles is an inevitable childhood developmental disease and that vaccination, through the act of injection complicate the disease.

These cultural and traditional beliefs are some of the major factors that had serious effects on the loss of confidence in the expensive government vaccination programmes in Nigeria. Mothers moreover, needed to be educated on the importance of breast-feeding children, weaning practises, nutritional alternatives, importance of keeping vaccination appointments and the need to report all communicable diseases such as measles to hospitals as the case arise.

Continued governmental health jingles, campaigns and health education at the community level (exploring all the local dialects/languages) are bound to accelerate the improvements in the success of not only measles eradication but, other childhood vaccine preventable diseases in Nigeria.

8. Antigenic Variation of Measles Virus and non- availability of Indigent Measles vaccine in Nigeria:

Measles virus was formerly considered to be monotypic, having only one serotype. Soon after the licencing of the first vaccine in the 1960, there were several reports from various part of the globe on the vaccine failures in the late 80s and early 90s that really questioned the efficacy of the monotypic virus-based measles vaccine [76-79]. Several heterogenous wild types of measles virus with varying genotypic difference from the old vaccine strains were isolated and reported from different region of the world [80-100]. These reports had one time or the other led to the development of various specific vaccines indigent to the particular environment or countries where the virus were isolated such as USA, China, Yugoslavia etc. (Table 3) [78]. Successful protection by immunisation depends on the biological characteristics of the infectious agent, the molecular configuration of the antigen, the natural history of the disease and the immune mechanisms of the hosts. However advances in the epidemiological sciences, genetics and immunology have opened up the prospects for new vaccines as well as for the improvements in the existing ones. Specificity in the antigenic nature of the vaccine virus, and significant improved vaccine cold chain will determine the quality of immunisation of children against measles and subsequent eradication in the nearest future.

Until 1998, there exists no detailed work on the isolation of the local wild strains of measles virus circulating in Nigeria, a vast West African nation and the most populous African country. Nigeria till now still depend solely on imported measles vaccines from countries like France, India etc., where the virus strains used to produce such vaccine were peculiar to the country producing them. However, remarkable virological studies done in two Nigerian cities (Lagos and Ibadan) have reported the isolation of two different strains of measles virus that are antigenically distinct from the imported vaccine strains, co-circulating in each of the two cities.

The Lagos team (Oyefolu and Omilabu ofVirology Reasearch Laboratory, Dept. of Medical Microbiology and Parasitology, College of Medicine, University of Lagos) and the Ibadan team (Adu *et al.* ofVirology Dept. University College Ibadan) in collaboration with Professor C. P. Muller and his team (of WHO Collaborative Centre for Measles, Dept. of Immunology, Laboratoire Nationale de Sante, Luxembourg) reported the findings in 1999 in two international learned jounals [101, 102].

These viruses have been characterised antigenically, placed appropriately in the phylogenetic tree of the existing consensus global measles virus and sent to the world database on viruses for possible incorporation into future candidate measles vaccine that the WHO and other world health bodies might developed. This information is of great immunological importance and therefore might be the cause of the staggering high measles morbidity and mortality among Nigerian infants and children despite their vaccination. With a view of solving the problem of measles persistence and resurgence in Nigeria, it is therefore not improper to recommend the following:

RECOMMENDATIONS

1. The hospital staff and other health officers in charge of medical records should be educated and trained on the importance of data collection, processing and storage.
2. There is the necessity for adequate publicity and enlightenment programmes for the populace on the importance of maintaining good personal hygiene and sanitation of the environments.
3. The various initiated and established vaccination programmes of government (NIDs, SIDs and LIDs) through NPI should intensify its activities for sustenance and to involve the private health sectors and the communities for expected success of measles eradication in Nigeria.
4. Health education at the community level culminating in their active participation in vaccination programmes will enhance the coverage of missed (unvaccinated) children and also provide the opportunity of house-to house vaccination at the community level.
5. Need for funding towards the improvement and maintenance of the cold chain system and vaccine distribution channels in Nigeria is incontrovertible.
6. There is essentially the necessity for laboratory back-up services for ascertaining the potency status of all imported vaccines before their distribution and administration in Nigeria and also its efficacy in recipients post-vaccination.
7. More studies in Nigeria should be encouraged and funded for further isolation of the various wild strains of measles virus circulating in the other six healths geographical zones in Nigeria. This will give a total epidemiological picture of local wild measles virus strains circulating in Nigeria as a country.
8. There is the need for the immediate revitalisation and sustenance of the Federal Vaccine Production Laboratory towards the development of a potent, effective and safe indigent measles vaccine in Nigeria that will encompass all the isolated local wild strains in the country.

CONCLUSION

The immediate consideration and activation of the Federal Vaccine Production Laboratory to its full capability to achieve its set purpose will subsequently protect the Nigerian children from the threats posed by measles and other childhood killer diseases. Moreover, it may indirectly save the country from the great loss of Her treasures of lives of future brains that may salvage the dwindling ship of Nigeria economy. Health is wealth, and the flowers of tomorrows are all in the seeds of today.

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