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Leveraging on Prompt Proactive and Preventive Integrated Strategies (PPPIS) for Meningitis Control in Nigeria: Getting it Right

O. Ogbonna Brian[1*]

[1]Department of Clinical Pharmacy and Pharmacy Management, Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University, Awka, Nigeria.

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Background: Given the escalating morbidity and mortality recorded annually due to meningitis outbreak in Nigeria, it is fast becoming a disease of public health concern.
Objectives: This study described and discussed preventive strategies based on the disease pattern to generate information on the concept of prompt, proactive, and preventive integrated strategies (PPPIS).
Methods: The study was a narrative overview of relevant literatures obtained through hand search, databases, and authoritative materials.
Results: The highest suspected cases of meningitis 15733 was recorded in 1996 with 2411 (15.3%) deaths, and in 2009 when 54766 suspected cases and 2449 (4.5%) deaths were recorded. Meningitis was reported in five states of Northern Nigeria with 1407-suspected cases and 211 deaths between January 2016 and March 2017. This figure rose to 13, 420 suspected cases and 1, 069 deaths in 23 states with the five initial states inclusive. The fatality ratio was 8% in May 2017.
Conclusion: Meningitis has become an increasing contributor to disease burden with high mortality, morbidity, and economic consequences. Adoption of prompt, proactive, and preventive strategies among other integrated approaches could stem and reverse the trend.

**Corresponding author: E-mail: bo.ogbonna@unizik.edu.ng;*

Keywords: Meningitis; prevention; control; epidemic; integrated approach; Nigeria.

1. INTRODUCTION

Meningitis is a medical emergency characterized by infection of the meninges with the presence of pus and inflammatory cells in the cerebrospinal fluid and marked with high morbidity and mortality. The causative organisms vary from bacteria, to virus, fungus, protozoa, chemicals, or neoplasia depending on patients' age. However, epidemic meningitis is usually associated with *Neiserria meningitidis*. Clinical features include vomiting, fever, headache, photophobia, and alterations in level of consciousness. Other features include fever of unknown origin, stroke-like syndrome, seizures, acute psychosis, and dementia. Complications vary from subdural pus collection, cranial nerve palsies, epilepsy, heat stroke, and syndrome of inappropriate anti-diuretic hormone secretion. It is a major cause of morbidity and mortality especially among children in developing countries [1-6].

Approximately 8.7 million people were affected by meningitis globally leading to 379000 deaths (4.4%) in 2015 and 464000 deaths in 1990 [7,8]. It was prevalent in Europe and America between 1805 and 1874, and became prevalent in Asia, Africa, and Australia in 1875. In sub-Saharan Africa, seasonal hyper-endemicity is recorded at the peak of dry season between January and May before the unset of rainy season within the African meningitis belt. Weekly incidence rates of 10/100 000 has been recorded and sometimes exceeded 100/100 000 locally [9-12]. The first incidence in Algeria was in 1840 [13]. In late 18th century and early 19th century, the epidemic was reported in the western coast of Africa at Cape Coast [14,15]. PPPIS entails the use of the right proactive and preventive strategies promptly for the right disease prevention or control in a continuum while leveraging on all available and rational preventive and treatment measures. This study described and discussed preventive strategies based on the disease pattern to generate information on the concept of prompt, proactive, and preventive integrated strategies (PPPIS).

2. METHODS

This study was a narrative overview synthesized with information obtained from PubMed, Medline, hand search of related reference materials, and official documents. A total of 86 articles were obtained from the search, 47 were dropped for lack of merit leaving 39 articles used for the study. The search took place between December 2016 and March 2017. The search terms were meningitis, control, prevention, disease prevention, integrated approach, and Nigeria. The search terms were used individually and in series using AND/OR. Study utilized truncation and adjacency searching. Publications in English Language with unambiguous and clearly detailed methods were considered. We used studies carried out in Nigeria and those that reported meningitis outbreak in Africa and excluded all duplicates, poorly designed studies without clearly defined and logical methods.

3. RESULTS

Nigeria ranked 187 of the 191 countries in the world rated scale for health system in 2016. The life expectancy at birth for male/female was 53/56 in 2015. The total expenditure on health per capita (Intl $, 2014) was 2014 while the total expenditure on health per capita (*Per capita total expenditure on health* at average exchange rate (US***$,*** 2014) was 217, and with a total expenditure of 3.7% of GDP on health in 2014. Table 1 summarized meningitis outbreak in Nigeria from 1996 to 2017.

4. DISCUSSION

Nigeria has witnessed major epidemic outbreak of meningitis from 1970 to 2017. However, the highest prevalence was recorded in first half of 1996 when 109, 580 cases were reported out of which 11, 717 died [16,17]. From December 2016 to March 2017, epidemiological survey of meningitis in five states of Northern Nigeria revealed 1407-suspected cases and 211 deaths, a case fatality rate of 15%. By April 2017, the six states of Sokoto, Kebbi, Kastina, Yobe, Zamfara, and Niger were affected with estimated 8,057-suspected cases, 230 confirmed cases and 813 deaths, an epidemic threshold. Children within the age of 5 to 14 years were predominantly affected and constituted more than half of the suspected cases [18-20]. Of the 230 confirmed cases, 157 had serotype C of *Neisseria meningitidis*. This same serotype was found to be responsible for the 2014 and 2015 outbreaks in Nigeria. Other strains of *Neisseria meningitidis* namely A, B, W, and Y which cause meningitis globally have been less prevalent in Nigeria except serotype A whose vaccine is

Table 1. A summary of meningitis outbreak in Nigeria

Year	Month	Suspected cases	Deaths n (%)	Location (State)
1996	December to June	108, 568.0	-	-
1996		15, 733.0	2411.0 (15.3%)	12 states: Adamawa, Bauchi, Benue, Cross River, Kano, Kaduna, Katsina, Kebbi, Kwara, Niger, Sokoto, and Taraba
2003/4	December to June	659.0	-	-
2004	January to March	327.0	46.0 (14.1%)	Jigawa
2005	January to June	657.0	-	-
2006	January to June	5731.0	-	-
2007	January to June	2642.0	-	-
2008	December to June	6835.0	-	-
2009	December to June	-	2000.0 (*)	5 states in north west and north central: Kastina, Sokoto, Zamfara, Kebbi, and Niger
2009	January to February	5323.0	333.0 (6.3%)	-
2009	December to June	54766.0	2449.0 (4.5%)	16 northern states
2010	December to June	2983.0	-	-
2011	December to June	1165.0	-	-
2012	December to June	1206.0	-	-
2013	December to June	871.0	-	-
2013/14	December to June	-	2046.0 (*)	-
2015	January to March	652.0	50.0 (8.0%)	Kebbi and Sokoto
2016	December to June	-	336 (*)	
2017	March	12000.0	211.0 (1.8%)	5 States: Kastina, Sokoto, Zamfara, Kebbi, and Niger
2017	January to March	1966.0	282.0 (14.3%)	15 states
2017	January to May	13420.0	1069.0 (10.0%)	23 states

December to June: This represents from December of the previous year to June of the next year. The vacant spaces have no definite record attached from the data sources. (*) Represents incomplete data for percentages of death recorded due to non availability of data for suspected number of cases of meningitis

available [21,22]. On the second week of May 2017, 13, 420-suspected cases were reported in 23 states with 1, 069 deaths, and fatality ratio of 8% [23]. The number of suspected cases and death has been relatively high though irregular as shown in Table 1. This underscores the need for strategies to contain and begin to reverse the trend. It was predominantly localized to some states and local government areas in the northwest and north central part of Nigeria. This information is essential in concentrating efforts for prevention and control without compromise to proactive preventive measures in other states. Table 1 further suggests inconsistency in documentation of data e.g., documentation of yearly number of deaths may have been inconsistent. Consistencies in documentation helps in proper audit trail and follow up. It is invaluable in quantification for programs and services. Meningitis occurs predominantly between December and June during dry season in Nigeria characterized by high temperature distribution. *Neisseria* spp, *Haemophilus influenzae, Streptococcus pneumonia* have been implicated in the outbreak of meningitis over the years while *Neisseria meningitidis* sero group A caused epidemics in the past [24-27]. This information underscores the need for sustained and massive immunization campaign drive and coverage. The disease control unit necessary for immunization should not continue with the reactive approach of immunization response or coverage when cases have reached near epidemic dimension. Proactive response is of great essence with the requisite conjugate vaccines covering the serotypes. Hence, the threshold strategy that allows the disease to progress to detectable threshold. Provisions should be made for identified serotypes, which the vaccines could not cover adequately to take care of reactive cases. This process should be maintained in a continuous cycle [28-33].

Vaccines and their supply should be available for the different serotypes. Good surveillance, planning, monitoring, and evaluation of services are essential in prevention and control strategies. Disease surveillance update should be prompt and regular to detect and report initial cases promptly. Preference should be given to prophylactic conjugate vaccines with additional property of limiting transmission while conferring long lasting immunity [34-37]. The influence of socio-cultural determinants of diseases is another means of epidemic control. Some tribes where vaccinees refuse to accept vaccines from immunization vaccinators of opposite gender could be a limiting factor. Others where obtaining permission from the family head is mandatory before their subjects could access immunization are limitations. They all combine to adversely affect immunization coverage [38-39]. These could be addressed through routine interaction of relevant authorities with village heads and their subjects based on the principle of health education and community mobilization. Mumps meningitis, which occurs in 15% of mumps cases, recorded marked decline following prompt immunization against mumps [40].

Overcrowding and poor living conditions is common among outbreak locations. This is very common among pilgrims, military camps, refugee camps, internally displaced people's camps, and slums. Countries like Sudan, Chad, and Morocco have recorded meningitis outbreaks associated with returning pilgrims in 1988, 1988, and 1989 while Saudi Arabia had a similar case in 1987 [41,42]. This underscores the need to observe global best practices at every port of entry and immigration points in line with international health recommendations considering that diseases cross borders. The attack rate of most meningitis epidemics in sub-Saharan Africa exceed 1% before being reported. There is dire need follow where the disease is much lower, the trend of most developed countries. This is obtainable through improved warning systems and early detection of localized and widespread epidemics, regular data review, prompt reporting and rapid communication, investigation of affected cases, case definition, rapid assessment, and information dissemination across board [41-43]. Preventive strategies should be proactive to be effective. Any preventive mechanism in disease control no matter how expensive or effective can lead to disabilities and loss of lives if the interventions are not prompt. A proactive and preventive mechanism that is not prompt will be limited. Hence, the principle of Prompt, Proactive, and Preventive Integrated Strategies (PPPIS) in a continuum should never be compromised. This will help to prevent or minimize casualties in supposed epidemic outbreak. Strengthening health systems through the primary healthcare development agency and inter sectoral collaboration. Development and implementation of a comprehensive National Strategic Health Development Plan (NSHDP) through the National Health Bill and scaling up meningitis intervention plan as one of the priority interventions could be a booster to the entire mechanism. Study suggests paucity of data due to poor documentation practices by agencies involved. This is challenge to audit trails in epidemiological studied and leaves a gap for further investigational and intervention studies. Government and their collaborative agencies and partners could leverage on the concept of PPPIS in a continuum. Adoption, implemented and integration of this concept with other current measures in meningitis control could be promising in meningitis prevention and control.

5. CONCLUSION

Meningitis has become a major contributor of disease burden in Nigeria annually. High incidence of fatality that occurs annually despite reasonable information on the disease trend and patterns occasioned the need to consider salient preventive mechanisms. The concept of PPPS is essential in forestalling disease outbreaks from progressing to epidemic dimensions. All preventive mechanisms must be prompt, proactive, and integrated with other available methods, leveraging on all existing strategies. This approach should be applied in a continuum and repeated uninterrupted cycles in meningitis prevention and control for meaningful outcomes to be achieved given the rising trend of morbidity and mortality associated with meningitis in Nigeria. The culture of proper documentation is essential at all levels to aid to facilitate proper follow up and sustained availability of data for investigations in epidemiological surveys and disease control. Preventive approaches with other methods such as education, mass mobilization, good hygiene, and prompt reporting is the way to get it right.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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