Reflections on malaria control and research in Nigeria

Lateef Salako, CON, NNOM, DSc, FRCP, FAS
Emeritus Professor of Pharmacology
University of Ibadan

Correspondence
lateefsalako@yahoo.com

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INTRODUCTION
Malaria has always been associated with swamps. Indeed the name ‘malaria’ comes from the Italian for ‘bad air’ which associates the disease with the polluted air that emanated from the swamps of southern Italy where malaria was highly endemic until about a century ago. Hence without knowing anything about the association of swamps with the breeding of the insect vectors of the disease, Italians had embarked on drainage of swamps with favourable effects on the frequency of malaria in the affected area. The modern era of malaria control began with the discoveries of the malaria parasite in 1882 by a French army doctor, Laveran, working in Algeria; its transmission by mosquitoes in avian malaria by a British army doctor, Ronald Ross, working in India in 1898; and the mosquito transmission in human malaria by the Italian trio of Grassi, Bignami and Bastianelli the following year. These discoveries were followed by the intensification of the drainage of swamps and stagnant water collections first in Europe and then in other parts of the world as the primary method for the control of malaria.

This method of malaria control found its greatest application in Nigeria during the Second World War. The Apapa naval port in Lagos served as an intermediate staging post for troops being transported from Europe to the battle zones of the Far East. It transpired that during their short stay in Lagos a substantial percentage of the military personnel contracted malaria with a high mortality rate. The decision was then taken by the British military authorities to drain the swamps and creeks which occupied most of the landscape of the area. This project which covered about 20 square miles and took over a year to complete, and led to a drastic reduction in the number of mosquitoes found in the barracks with a corresponding reduction in the morbidity and mortality from malaria among the troops – a major contribution to the allied war effort.

THE ERA OF SWAMP DRAINAGE AS PROTECTION
THE ERA OF MALARIA CHEMOPROPHYLAXIS

Like many of the ideas for malaria control in the last century the use of chemoprophylaxis for malaria was also a fall out from the Second World War. The first drug developed principally for chemoprophylaxis was proguanil (Paludrine). One of the earliest clinical trials for this drug was conducted in Nigeria by Bruce-Chwatt and his colleagues and its efficacy led immediately to its use in Nigerian troops from about 1944, in what was then comically called the daily Paludrine drill. The drug became available to the entire population soon after the war, although it was later superseded by the equally effective pyrimethamine which had the advantage of a weekly administration.4

THE ERA OF MALARIA ERADICATION

After the Second World War, the World Health Organization (WHO) came into being as an agency of the United Nations. The eradication of malaria was one of the first issues to which the new organization addressed itself. It was reasoned that eradication was achievable by the intensive global use of the combination of dichlorodiphenyl-trichloroethane (DDT) discovered just before the war and chloroquine developed during the closing stages of the war. The insecticide DDT was regarded as a safe and highly effective method for destroying the mosquito vector, while chloroquine was a highly effective schizontocidal antimalarial which would eliminate the malaria parasite from its human reservoir. Doubts were expressed regarding the feasibility of the eradication programme in Africa. It was considered that Africa lacked the human and financial resources to execute such an intensive time-limited programme and, in any case, the knowledge of the epidemiology of malaria and bionomics of the vector was far too limited for prosecuting an effective eradication campaign.5 Instead, pre-eradication projects were undertaken in selected African countries including Nigeria.6,7 These studies confirmed the original fears about the impossibility of conducting the eradication campaign in Africa and so, justifiably, Africa was left out in the malaria eradication scheme which was carried out in the 1950s and 60s.

THE ERA OF MALARIA CONTROL

The eradication campaign was successful in a few of the countries in which it was undertaken, but by 1978 it had become clear that malaria could not be completely eradicated in many of the countries in which the eradication campaign was being undertaken, let alone Africa, where it was not even attempted. In some countries like India and Sri Lanka where eradication was achieved, the eradication could not be sustained and the disease soon reappeared.8 In view of these, the idea of eradication was dropped and replaced by control.

The current concept of malaria control is aimed at reducing the frequency of malaria in an endemic country to a level at which it no longer constitutes a major disease burden.9 The most important elements of malaria control are:

- reduction of morbidity and prevention of mortality through early diagnosis and prompt effective treatment
- use of chemoprophylaxis in high-risk groups
- reduction of transmission through vector control which includes reduction in vector population and reducing man-vector contact.
- strategic and operational research with a view to knowing more about the disease and its transmission and improving methods for achieving the main control objectives.

The principles of malaria control have remained unchanged since its reintroduction and redefinition after the abandonment of the eradication programme, but a variety of strategies to achieve this end have been employed over the years. All such strategies aim to set the right priorities and actions within the given levels of scientific knowledge about the disease. Indeed, malaria control measures put in place over the past 30 years have led to a reduction in the disease in practically every endemic region of the world, except Africa, where morbidity and mortality from the disease have continued to increase.

Malaria is now essentially an African disease. One only needs to look at the malaria situation in the world in general to be convinced about this. It is estimated that malaria is endemic in approximately 40% of the world’s population practically all of them in the tropics. About 300 to 500 million cases of malaria disease are estimated to occur globally every year. Of these about 90% occur in Africa. In the same way, 90% of the estimated 1-2 million deaths from malaria annually are presumed to occur in Africa. Malaria, therefore, really an African disease, and any plans for controlling the disease globally must have the solution of the problem in Africa as its major consideration. This means that special efforts have to be
made to control the disease in Africa. It is also noteworthy that to do this, African countries themselves have to spearhead malaria control efforts in line with what is being done or is capable of being done in other malaria endemic regions. This consideration has led, in the recent past, to the development of some malaria control initiatives in which Africa is the main focus.

In 1997, leading malaria researchers in Europe, America and Africa met in Dakar under the auspices of the United States National Institutes of Health (NIH) to map out research strategies that would lead to a better understanding of the malaria problem in Africa and increase the capacity of African countries and their researchers to undertake research aimed at solving the malaria problem and at producing new tools for use in malaria control. The Dakar conference on malaria recognized that insufficient understanding of the various aspects of the disease is one of the major problems militating against effective malaria control in Africa. The conference concluded accordingly, that malaria research needed to be pursued with greater vigour and with greater intensity, using methods at the cutting edge of science. This conference led to the establishment of the Multilateral Initiative for Malaria which is supported by many of the leading research funding bodies in the world, in particular the World Bank, the European Union, United States Agency for International Development (USAID), United States NIH and the Wellcome Trust. This initiative has for the past few years provided substantial annual funding to a number of African malaria researchers to support their research efforts.

Also there was the African Malaria Initiative, the brainchild of the then African Regional Director of the WHO, Dr. Ebrahim Samba. This programme, which set a 30-year target for reducing malaria in Africa to a level at which it would no longer constitute a major public health problem, eventually formed the backbone of the global Roll Back Malaria initiative in Africa.

Another recent initiative to speed up malaria control actions in Africa was the Accelerated Implementation of the Global Strategy for Malaria Control in Africa. Under this initiative, WHO (for the first time ever) in 1998 and 1999 gave substantial extra-budgetary allocations to selected malaria-endemic African countries specifically for malaria control at the country level. These grants served as start-off funds to set up or intensify malaria control activities in many African countries. All these activities in the closing years of the 20th century relentlessly led up to and became subsumed within the global Roll Back Malaria Initiative of the World Health Organization.

ROLL BACK MALARIA

Roll Back Malaria is a worldwide partnership to fight malaria. It is built on a network of national governments, international organizations, the private sector and various local bodies who are contributing their skills and resources to maximize the impact against malaria. It does not propose novel interventions and techniques, but aims to utilize existing strategies; build on existing efforts through local, national, regional and global partnerships; and maximize the impact of contributions from major stakeholders including affected countries, G8 nations, the World Bank, the UNDP, UNICEF, WHO and the private sector. The most important elements in this initiative are:

- bringing reliable, sustainable prevention and early treatment to affected populations
- investing in research and the development of effective, affordable tools
- evaluating achievements against clearly defined goals
- building human and institutional resources

The various groups in the partnership play their particular roles all leading towards the same objective of conquering malaria through sustainable, acceptable and affordable interventions that recognize the peculiar situation and needs of the community. The initiative took off in 2000 and is planned to run for at least ten years.

RESEARCH PRIORITIES FOR MALARIA CONTROL IN NIGERIA

Research is designed to generate new knowledge which can form the basis of disease control actions. In the case of malaria, research should aim to address the following issues:

- increased understanding of the nature of the disease and the burden it constitutes on the affected population
- development of interventions to control the disease and thereby reduce its burden on the people
• optimal use of available interventions for the control of the disease

UNDERSTANDING MALARIA

A lot is presently known about malaria. Its causation, transmission, pathogenesis, clinical course, epidemiology, etc, have all been known for a long time and indeed so much was known about malaria that during the eradication era it was widely believed that further research in malaria was unnecessary, enough being known to eradicate it. We now know that this was an erroneous view. Research, basic and strategic, would always be required to expand our knowledge of malaria. This could lead to the development of new interventions for its control. Nevertheless, it is true to say that we already know enough about malaria to undertake successful control programmes. In Nigeria, a good deal of what we know about malaria now comes from the Garki Project carried out by the WHO between 1969 and 1976 on the epidemiology and control of malaria in the Sudan savanna of the country. It covered the parasitology, entomology, immunology and the impact of specific interventions on the epidemiology of malaria in the study area and has become the reference point for subsequent malaria research in the country.

DEVELOPMENT OF INTERVENTIONS FOR MALARIA CONTROL

The main interventions currently available for malaria control are targeted towards the parasite, the vector and the human host. A variety of drugs are now available for the treatment of malaria. When used correctly and promptly they are generally capable of clearing the blood of the parasites and producing prompt relief from the illness.

Parasite resistance to chloroquine and sulfadoxine-pyrimethamine however, has meant that these two erstwhile drugs of choice for malaria, can no longer be relied upon to cure *falciparum* malaria in most of Africa, and are being replaced by newer and more effective drugs. To this end, drug susceptibility studies have been carried out to establish the effectiveness of the new drugs with a view to providing evidence in support of any drug changes that might be proposed. Such studies recently completed in Nigeria have shown clearly the efficacy of the artemisinin derivatives used singly or better still, in combination with other drugs.

Interventions directed against the vector have a major role to play in the control of malaria. Spraying with DDT is no longer considered to be environment friendly, but other traditional methods for reducing breeding of mosquitoes and killing adult ones continue to be used. There is a particular interest in the use of insecticide-treated bed nets in which a pyrethroid rather than DDT is used as the insecticide. With the increasing use of this intervention it should be possible to see a reduction in infection rate in the population in the near future.

Until recently targeting intervention at the human host was not given the same importance as the anti-parasitic and anti-vector interventions. The persistence of the malaria burden in most of Africa, while it is decreasing in other parts of the world, is largely due to the insanitary living conditions, particularly among the rural dwellers. In these people, malaria is a disease of ignorance, poverty, and squalor and the alleviation of these scourges should lead to greater success in the control of the disease. Measures to alleviate poverty and the accompanying squalor, as well as health education programmes to increase the knowledge of the population on the transmission of the disease would make the realization of the goals of malaria control easier. Cultural impediments to mothers taking prompt action in the absence of the family heads should also be tackled. The best way to execute these measures should be areas for intensive research and small-scale, pilot implementation studies.

Although interventions for malaria control are widely available and effective, research has to continue so as to develop novel and more effective interventions which would also be safer, technically easier to administer, affordable and more acceptable to the people. In this regard it has to be recognized that the malaria parasite and its vector are moving targets which develop resistance to the drugs and chemicals being used in destroying them. Hence research on mechanisms for resistance has to continue tirelessly to discover new approaches to the development of needed drugs and insecticides. This is the only way we can remain one step ahead of the parasites and vectors in our struggle to rid our country of the malaria burden.

OPTIMIZATION OF AVAILABLE INTERVENTIONS

It is obvious that the available interventions are not being used to maximal effect and so we are not getting the maximum benefit from them. Particularly, in the rural areas where the malaria burden is most severe, the
disease is not diagnosed early enough and after diagnosis the correct treatment might not be given, either because the drugs are not available or the distribution centres are not accessible. Operational research is necessary to establish why interventions proven to be effective are not available or accessible to the people in need of them. A recent multicentre study in Nigeria\textsuperscript{12,13} has demonstrated for example, that it is possible to educate the village dwellers to recognize malaria early and seek correct treatment for it in centres that have been set up for that purpose in their community. When this was achieved it had the dramatic effect of reducing the frequency of malaria and preventing death from it almost completely. If this pilot study is suitably scaled up and still found to give satisfactory results, then it can be incorporated into the National Malaria Control Policy and Plan of Action as the strategy to make community diagnosis and treatment of malaria a cornerstone for bringing down the malaria burden in this country to insignificant levels.

THE MALARIA VACCINE

There is no effective vaccine for malaria at the present time and although the whole world has been waiting for one for over 30 years, the prospect of achieving a breakthrough in this field in the near future does not look promising. Hopes have been raised a number of times, but they have turned out to be false. We need to continue to undertake basic research that could ultimately lead to the production of a vaccine, but we do not need to rely on the availability of a vaccine to control malaria. The burden of Malaria has been reduced everywhere in the past three decades without the use of a vaccine, except Africa. It should be possible to do the same in Africa. Malaria is preventable, treatable and curable with the tools presently at our disposal. All that is left for us is to pursue strategies for achieving the objectives of malaria control through the determined implementation of initiatives like Roll Back Malaria.

REFERENCES