Towards better Malaria Epidemic Surveillance, Preparedness and Response in Southern Africa

Introduction

Malaria is a major public health problem for countries of southern Africa and the Indian Ocean epidemiological bloc. Transmission of malaria by epidemic begins when the ability of anophelines to spread malaria increases due to changes in their density, human biting rate or longevity. It is when cases of malaria are reintroduced into an already suitable environment due to neglect, breakdown or non-existence of control measures.

A malaria epidemic is described simply as a sharp increase in the frequency of malaria transmission that by far exceeds the interseasonal variation normally expected; it is likely to occur when people who are not immune get bitten in increasing numbers by infective mosquitoes, particularly after rainfalls that follow prolonged periods of climatic conditions favouring malaria vector breeding.

Most of the malaria epidemics in southern Africa are caused by *Plasmodium falciparum*. Due to absence of acquired immunity, the clinical consequences are serious and tend to produce more severe disease with case fatality rates (CFR) of 5% to 10% in people remaining untreated. In southern Africa, the transmission of malaria falls with increasing aridity and altitude to 2-3 months a year, so that each person receives a few bites each year and acquires only limited immunity, even as an adult.

The “classic” malaria epidemics in southern Africa and the Indian Ocean region occur in areas where environmental conditions are marginal for mosquito vector and parasite development such as highlands and semi-arid areas. In these areas, there is seasonal fluctuation in the parasite rate, affecting all age groups and disease intensity. Therefore, the type of malaria experienced is unpredictable, and it is often of epidemic nature.

While these peaks in malaria incidence are easily identified in areas of infrequent transmission, they may be less obvious where increases in transmission occur against a background of highly stable malaria transmission or against a regular trend of general increase in malaria cases, facts that are common in areas of malaria stable transmission after the heavy rains and floods that normally follow tropical storms and cyclones along the Indian Ocean.

Drug and insecticide resistance have been documented in almost all countries of southern Africa. The region is also the epicentre of HIV, with the highest levels of HIV prevalence found anywhere in the world. Therefore, populations living in malaria epidemic-prone areas are the most vulnerable to severe disease outcomes; when epidemics occur, high CFRs are witnessed.

Although armed conflicts and political instability are close to zero, large pockets of refugees and some internally displaced people still exist in southern Africa. Such populations entering malaria-endemic areas are among the most vulnerable, and they suffer high mortality rates. Malnutrition, food insecurity and drought continue to be major challenges that affect most of the countries in the subregion and increase the vulnerability of populations affected by malaria outbreaks.

Southern African countries are endeavouring to minimize suffering and the loss of life in these situations. Most of them have malaria epidemic emergency
plans as well as epidemiological and environmental surveillance systems to predict and detect early epidemics. Most of the countries also have funds and personnel to carry out aggressive and effective control measures. In addition to national government efforts, international aid is another source of emergency response operations.

Malaria epidemic surveillance

The countries of southern Africa and the Indian Ocean epidemiologic bloc are committed to the Millennium Development Goals and the Abuja Declaration targets that include detection and effective control of at least 60% of malaria epidemics within the first two weeks of their onset. In order to achieve these targets there is a need to improve information-gathering about where and when malaria epidemics are likely to occur. The WHO guidelines on the development of malaria early warning systems (MEWS) are used as the framework for an integrated approach for malaria epidemic preparedness and response planning in southern Africa.

Basic elements of malaria control are forecast, early detection and control of malaria epidemics. Conventional control strategies based on health facility case-based surveillance are unable to provide sufficient early warning to allow effective measures to be taken in advance of major outbreaks. Satellite data on rainfall anomalies, moisture, temperature and other determinants for malaria using geographical information systems and weather satellite data are provided to countries to predict outbreaks in time to take effective preventive and response action.

The principles behind using environmental information systems (EIS) to forecast malaria is that the intensity of disease transmission in a given season often depends on climatic factors which affect the size of local vector population. Because the environmental changes that favour mosquito population growth occur before the number of malaria cases increases, monitoring changes in these conditions can give information that can be correlated to envisage future malaria severity. The main satellite information products which are linked to malaria are vegetation growth, rainfall and temperature.

Rainfall can be estimated by cold cloud duration (CCD). Research has found a strong relationship between using CCD imagery and malaria case records from health facilities. Excessive flooding in semi-arid and lower river valleys with optimal temperatures and water, and prolonged drought in highland areas also affect malaria incidence and epidemics. EIS can indicate when these events are likely to happen. Satellite images showing vegetation growth as a response to rainfall with consequent increasing of breeding sites that persist long enough to allow build-up of high vector densities result in increased malaria transmission. The temperature affects the speed of development in malaria parasites and mosquito life-cycles.

The WHO Intercountry Programme for Southern Africa and the Indian Ocean epidemiologic bloc, together with the Drought Monitoring Center and the International Research Institute for Environmental Sciences housed at Columbia University, New York, organizes an annual meeting attended by malaria epidemics focal points and meteorology experts from all countries in the subregion. The meeting produces a forecast for malaria and epidemic seasons and provides a unique opportunity to tackle all epidemiological, environmental and other risks related to malaria epidemics.

The importance of this partnership is to centralize climate as a driving factor for inter-seasonal variability and therefore equip countries with tools and information to improve prediction, prevention and control of epidemics. The level of implementation and timeliness of malaria prevention and control measures is also used to provide evidence to predict where epidemics are likely to be experienced.

Preparedness and response

To be properly prepared for malaria epidemics, decision-makers and programme managers need reliable information well in advance. Yet information from routine epidemiological surveillance merely confirms that epidemics are occurring or have occurred. The time lags between an event indicated by EIS and the impact on malaria transmission give real opportunity for countries to prepare for serious outbreaks or epidemics. Environmental satellite information is probably the only means of achieving the advance warning required for effective planning and mobilization of resources and control teams to respond to malaria epidemics.

Well-prepared programmes combine the use of epidemic thresholds and MEWS information to plan, mount and implement timely effective
responses to prevent epidemics from getting out of control. The response option will depend on the time when the outbreak is detected and the local capacity to handle the situation. All areas with epidemic potential are mapped and stratified, and their risk factors are identified in most countries of the sub-continent. This allows implementation of selected interventions according to the characteristics of the areas as well as providing early treatment for the cases that arise.

In responding to and controlling malaria epidemics, serious measures are taken against the vector. When used in a timely fashion, indoor residual spraying (IRS) can be a very important measure to control malaria epidemics and prevent its spread. Routine IRS that takes place prior to high malaria season, with coverage above 85% in most southern African countries, is the major strategy to prevent malaria epidemics in the subregion.

Environment management and manipulation are used as well to reduce vectors in the community. Usually this has minimal impact on the malaria vector because of the discrete and at times astronomical vector breeding sites. However, it is used as a way of persuasion and awareness raising and therefore to get communities involved in malaria control activities. The treatment of cases with anti-gametocyte drugs is seen as an important way of controlling the re-establishment of transmission within an affected community.

Even in areas with high coverage of control interventions, risk of isolated outbreaks still remains due to people’s lack of immunity to malaria. Therefore, surveillance and early detection tools are highly recommended and should be strengthened during the months of January to April in these countries.

Based on historical trends and the very low control coverage recorded during the previous seasons, countries may experience high malaria incidence and epidemics if the situation is not improved. Therefore, timely IRS, net retreatment, antimalaria drug availability, and epidemic and pandemic alert and response (EPR) are paramount if previous experiences are to be avoided.

It is strongly recommended that all malaria control programmes actively focus on high coverage of indoor residual spraying (> 85%) before the anticipated outbreak time, re-treat all mosquito nets, avail drugs for case management in all areas where malaria incidence is likely to increase, and build capacity for malaria EPR during the months of November, December and January. Malaria programmes should be prepared for flood and cyclone emergencies during the months of February and March in the districts that are usually affected. Social mobilization activities to raise malaria awareness within Southern African malaria-affected communities should be carried out; malaria weeks should be used as opportunities to increase coverage in all malaria control interventions.

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