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Roll Back Malaria

Prevention and control of malaria epidemics

3rd Meeting of the Technical Support Network

World Health Organization

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Editor: Dr Charles Delacollette
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Roll Back Malaria is a global partnership founded by the governments of malaria-afflicted countries, the World Health Organization, the UN Development Programme, the UN Children's Fund and the World Bank. Its objective is to halve the burden of malaria for the world's people by the year 2010 by saving lives, reducing poverty, boosting school attendance and making life better for millions of people living in poor countries, especially in Africa.

If you are interested in becoming part of the Roll Back Malaria movement, receiving the RBM newsletter and becoming part of the global success story in reducing malaria, please write to:

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Acronyms used in this report

ADDS	Africa Data Dissemination Service
AFRO	WHO Regional Office for Africa
ACT	Artemisinin-based combination therapies
CSR	Surveillance and Response Team (WHO Communicable Diseases cluster)
EMRO	WHO Regional Office for the Eastern Mediterranean
FEWS	Famine Early Warning System
GFATM	Global Fund on AIDS, Tuberculosis and Malaria
GIS/EIS	Geographical/Environmental Information Systems
Healthmap	UNICEF/WHO Health Mapping Programme
HIMAL	Highland malaria project-MARA
IDS	Infectious Disease Surveillance
LSHTM	London School of Hygiene and Tropical Medicine
LSTM	Liverpool School of Tropical Medicine
ICP	Intercountry Programme
MALSAT	Environmental information systems for malaria based in the LSTM, UK
MARA	Mapping malaria risk in Africa
MDR	Multi-drug resistance
MDS	Multi-disease surveillance
MEWS	Malaria Early Warning Systems
MSF	Médecins sans Frontières
NGO	Non Governmental Organization
POA	Plan of Action
RANET	Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information
RBM Mekong	Roll Back Malaria in Mekong countries (Cambodia, China, Lao PDR, Myanmar, Thailand and Viet Nam)
RBM Sahel	Roll Back Malaria in Sahelian countries (Burkina Faso, Mali, Mauritania, Niger, Senegal and Tchad)
RS	Remote Sensing
SADC	Southern African Development Cooperation
SAMC	Southern Africa Malaria Control based in Harare (WHO)
SARCOF	Southern Africa Regional Climate Outlook Forum
STD	Sexually Transmitted Diseases
USGS	US Geological Survey
TOR	Terms of Reference
TSN	Technical Support Network

INTRODUCTION

ACCORDING to various estimates from countries and international databases, more than 100 million people live in areas prone to malaria epidemics in the African continent alone, contributing to around 10% of the malaria burden on the continent. Outside Africa, malaria epidemics may occur locally or across a country, mainly in relation to population movements and climatic changes. Population movements within countries or across international borders are linked to political instability and economic reasons.

There is at present no systematic effort to report malaria epidemics to WHO, partially due to the difficulty of adopting a globally or even regionally applicable definition of malaria epidemics. Epidemics can only be locally detected and documented and epidemic thresholds have to be established according to local epidemiological settings.

Early recognition, local verification and notification constitute key elements in the decision chain for timely implementation (eg, within two weeks of epidemic onset) of pre-planned cost-effective control options. There are enormous amounts of data collected and kept in health care facility records that health workers and epidemiologists at district and central levels are not using—either for local use (early detection of unusual events followed by appropriate action), or to set up and validate decision-tree models. To improve the effective use of data that are routinely generated at peripheral level is a key challenge for WHO Member States and epidemiologists working on epidemic surveillance and monitoring systems.

There has been a growing interest in linking health data to relevant routinely collected information from other sectors like meteorological or agricultural services and international agencies dealing with global / regional climate monitoring changes. It is now better documented that important malaria epidemics in certain locales have been linked to El Niño / La Niña unusual events (the cyclical ENSO phenomenon), which may lead to better prediction in terms of the magnitude of malaria epidemics and their health implications. Linking global research activities and (relevant) results to local epidemiology and constraints is one of the key challenges to RBM partners in general and in particular for the members of the technical support network.

Another important challenge to the network members is the evidence-based choice of preventive and control options, from the insecticides to be used (eg. environmentalists challenging the use of residual DDT) to the choice of antimalarial drugs (partners such as NGOs challenging governments and programmes to use artemisinin combination therapies). Selection of appropriate insecticides and antimalarial drugs has direct implication for governments and funding partners as regards the set up and maintenance of emergency stocks at the country / sub regional level and at the global level.

Between implementers and academic researchers, the 'landing angles' may be different but there are complementary objectives. There is definitely a need to improve early detection and control—there is also definitely a need to implement preventive interventions that are based on accurate forecasting systems rather than applied on a blanket scale. Public health warning systems (including the sharing of data) should be considered as 'public goods' and be routinely delivered free of charge to the public health sector. This 3rd TSN meeting has been attended by participants from the field and from research institutions, to ensure that both ground and academic concerns are met, and to ensure that any research activities will assist WHO Member States and control programmes to identify cost-effective detection systems and control options. Better coordination between key actors and partners will lead to the development of common proposals to attract international donor agencies' interest and strengthening articulated implementation in the field.

Capacity-building is one of the key components to ensure sustainable implementation of epidemic prevention and response systems. The current growing interest in malaria epidemic prevention and response has to be translated into increasing human resources and skill at all levels. The results of this meeting will increase common understanding, interest in and the capacity to respond to, malaria epidemics.

Charles Delacollette

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OPENING REMARKS

David Alnwick, RBM Project Manager, welcomed the participants to this 3rd meeting of the RBM Technical Support Network for the Prevention and Control of Malaria Epidemics. He outlined the role of the TSN within RBM and the scope for RBM's future in relation to the emergence of the Global Fund for AIDS, TB and Malaria (GFATM). His challenge to the participants was whether or not forecasting, early detection and prevention of malaria epidemics should be considered like malaria vaccine development—highly desirable but not an imminent possibility—or like insecticide-treated nets—of immediate operational value.

The Chairman (Jonathan Cox) and the Rapporteur (Stephen Connor) were appointed.

Charles Delacollette, Manager of the TSN for the Prevention and Control of Malaria Epidemics, outlined the Terms of Reference of the TSN agreed upon in 1998. He then outlined progress made towards meeting expected outputs. In particular he described the detailed epidemiological analyses that had been made as a result of TSN initiatives—with retrospective analysis of data completed, or ongoing, in most SADC countries, Ethiopia, Kenya, Mali, Senegal, Sudan, Tanzania and Uganda. Weaknesses highlighted were limited technical skill at the district level and limited support from the central level.

Progress had been made in terms of MARA mapping malaria risk according to specific criteria but as yet limited feedback to the field had been received and maps were not sufficiently accurate as yet. Healthmapper has been developed as a tool for disease surveillance, and has potential as a tool to help predict and detect malaria epidemics. Strong links with other 'ministries' (especially meteorological services) are beginning to bear fruit. A sub-regional workshop was held in Mauritania and draft POAs for epidemic prevention have been developed for Sahelian countries.

Among the key constraints identified were that in most countries malaria is not on the list of weekly reported epidemic diseases and consequently there is no centralised reporting of malaria epidemics in WHO. Ongoing studies on the development of early warning and early detection systems are producing positive results and guidelines are needed which include: drug and insecticide choice during epidemics, use of malaria early warning systems, and the cost-effective use of early detection systems.

There is still much to do in terms of improving information sharing, database building, dissemination and the training of personnel. Proposed points for discussion were:

- The TORs of the TSN and the roles of TSN members;
- Advocacy and fundraising including the development of a consolidated proposal (for possible submission to funding partners, eg. the Gates Foundation or GFATM);
- The TSN POA within and outside Africa for 2002-2003.

SUMMARY OF PRESENTATIONS

Global and regional forecasting & detection systems: progress on models and field applications in Africa

Eve Worrall, LSHTM, discussed the economic implications of using malaria early warning systems. She described the development of a biological model, driven by climate data, which was tested on an independent data set from Hwange district, Zimbabwe where she obtained cost data on malaria cases and on malaria prevention activities. She compared the cost effectiveness of intervention (spraying) compared with no intervention (case management) at a range of proportional spray coverage. The optimal control strategy identified, for Zimbabwe, was to provide high spray coverage during high transmission years and that September/October are the optimum months for completion of the annual spray round. The model showed clear benefits of timely action—based on a reasonably accurate malaria early warning. Questions of the costs of a wrong forecast, costs to the household, 'costs' to political decision making were also discussed.

Madeleine Thomson, LSTM, presented work carried out by MALSAT in respect to epidemic early warning, with an emphasis on predictors that can be monitored in various epidemic settings:

- seasonal climate forecasts—use and limitations, environmental monitoring and the availability of new remotely sensed environmental data, parasite and vector monitoring and its inherent limitations in the African context;

- population movement and the potential for improved monitoring and surveillance methods. She discussed the trade-off between accuracy and timeliness of early warning and detection indicators.

Finally she presented information on the new tools available for communication at the periphery eg. the RANET radio –satellite system used by the meteorological services to inform farmers in remote communities in Niger.

Tony Kiszewski, Harvard School of Public Health, presented preliminary results of work in epidemic prone areas of Ethiopia where case data from 85 health facilities in 23 districts had been obtained with an average time series length of 10 years. Where possible these data sets were compared with current or lagged ground-based meteorological data—(rainfall, temperatures, RH) using a range of statistical techniques. He presented some provisional evidence of relationships between case anomalies and unusually high minimum temperatures. Absolute rainfall, maximum temperature and relative humidity were less consistently predictive of anomalous malaria transmission in these analyses.

The results of an exercise in threshold setting based on minimum temperature anomalies indicated that a threshold set at the 30th percentile provides a 50% greater chance of predicting an epidemic than a random drawing based on the expected frequency of epidemics. He suggested that refinements of these analyses would be needed to convert indicators into more biologically meaningful formats (e.g. temporal rainfall distribution on a daily basis patterns versus absolute monthly precipitation), to better account for interactions between indicators and to clarify and quantify them in terms of early warning.

Simon Hay, University of Oxford, presented results of an evaluation of epidemic surveillance techniques against epidemiological data from three health facilities in epidemic zones in western Kenya, altitude >1600m. The surveillance indicators were based on the following: (i) 'Normal channel, 3Q-based', (ii) '+2sd' from Cullen *et al.*, and (iii) the 'C-sum.' He suggested that these techniques are only appropriate for 'true' epidemics and a cumulative system would be more appropriate for picking up high inter-annual variability in these low endemic settings. He also provided a review of long-term data (95 years) for four regions in Kenya, Uganda, Rwanda and Burundi against evidence of climate change responsible for malaria growth. An outline of temporal changes in malaria risk through re-running the MARA model using climate data 1901-1995 was also presented. He also discussed progress in mapping malaria risk in East Africa using parasite ratios.

Jon Cox, LSHTM, presented work carried out at LSHTM with respect to epidemic malaria. Main areas: Interannual variability in climate (ENSO) and temporal trends in malaria in India, Venezuela and Colombia; Malaria risk in Highland areas of Africa–an outline of HIMAL I. Meeting at Salt Rock, South Africa with 3 country control programmes outlining their epidemic control needs. Development of HIMAL II–funded by the Gates Foundation– with emphasis on 'Flag 3' early detection using improved surveillance in six study districts in Uganda and Kenya. This will involve computer-based systems for collating analysing and real time transfer of data from periphery to centre. Later it is planned to incorporate meteorological indicators (including RS) to develop and validate epidemic risk indicators. The evaluation of the decision making process and institutional issues for the adoption of a MEWS as well as the predicability of the systems will be assessed.

Sub-regional forecasting & detection systems: experiences in Africa

Ricki Orford, WHO-SAMC, outlined progress of epidemic forecasting, detection and response within the Southern African Epidemiological Block. In particular he outlined activities in the epidemic cycle: forecast, prevention, preparedness, early warning, early response, event, response, post-epidemic analysis. He described the development of and response to a series of epidemics in 2000/2001. Epidemic response guidelines for the sub-region have been developed and work is now under way to develop country specific guidelines. Regional developments include preparation of a regional forecast at the SARCOF meeting. Review of epidemic surveillance thresholds based on: constant case, 5-year seasonal mean x2, mean x 2std, 3rd quartile (latter thought to be good but too sensitive). Best choice appeared to be mean x 1.5std. Support to countries for epidemic preparedness includes the strengthening of surveillance systems, including the routine use of the Healthmapper software and rainfall difference mapping, and testing of epidemic thresholds. He also outlined the constraints and opportunities for epidemic prevention and control in Southern African countries and priorities for 2002-2003.

Edith Lyimo, WHO-AFRO, presented experiences of the East African Inter-Country Team: Eritrea, Ethiopia, Kenya, Uganda, Burundi, and Rwanda. She started with an overview of the history of epidemics in the region and described progress towards mapping epidemic prone regions, alongside the development of national epidemic guidelines, and the establishment of district epidemic committees. Complacency over malaria is widespread and the disease is rarely seen as a priority. She emphasized that epidemic areas are often only a small part of a district and therefore mapping those at risk must be achieved at an appropriate scale. Testing of thresholds is currently under way in Uganda. Constraints and setbacks included no intersectoral collaboration, no MEWS, no analysis at the district level, no feedback from the centre, poor information flow and poor response to alerts. Future activities must involve strengthening collaborations with other sectors, the development of forecast indicators, threshold development from retrospective analysis, strengthened supervision and training—further stratification of epidemic prone districts, development of emergency stocks and increasing advocacy to all levels.

Stephane Tohon, ICP/MAL, West Africa described the experience of recent malaria epidemics in the West African Epidemiological Block—16 countries—46% of the African population. Five countries have reported epidemics in last 6 years: Mali, Mauritania, Niger, Senegal and Tchad. Regional workshops (eg. in Niger and Nigeria) and the launching of RBM Sahel identified priority technical areas to be investigated and financially supported in the sub region. Main recommendations were to work together and to work with others, particularly the meteorological community. Key areas to establish are surveillance systems; regional stocks of drugs and insecticides; and multi-sectoral collaboration for a regional epidemic forecasting system. Key recommendation to the countries is that malaria be included in epidemic surveillance systems such as IDS and that partnerships be developed in the sub-region for epidemic forecasting, prevention and detection.

Case studies on epidemic detection and response

Wiseilat Zaroug Ibrahim, Director of malaria surveillance, Ministry of Health (MoH) Sudan, described her country's experience in epidemic detection and response. Malaria is considered to result in 7-8 million cases annually and 35-40,000 deaths. Sudan is a large country, with a large population at risk of epidemics in the central and northern region (26, 000,000 at risk) where there is a long history of epidemics. POAs with regard to malaria epidemics have been developed for use at the State level.

These plans propose a situation analysis, followed by a series of strategies for improving intersectoral collaboration and community participation, along with the development of early warning indicators and the development of a response plan. A large number of sentinel sites for weekly reporting have been developed across the epidemic region (76 in Khartoum alone). The information reported is used to estimate drug and insecticide requirements. Efforts were being made to increase the number of sites reporting weekly.

Lamine Diarra, WHO/EHA Burundi, presented the situation for epidemic detection and response in Burundi. He described the situation as one of chronic insecurity (UN classification IV). The recent epidemic has affected seven provinces (the largest number since 1990). There has been a long-term steady increase from 200,000 cases in 1984, with the first documented epidemic in the Highlands in 1990 to the current 2001 situation of over 3 million reported cases. This trend is particularly noticeable since 1993 when control was abandoned as a result of the civil war.

From October 2000 to May 2001, the situation was clearly of epidemic nature compared to previous years. The cumulative result of the civil war and ensuing complex emergency (high population movement, long-term breakdown in control efforts and unacceptable level of *P. falciparum* resistance to chloroquine) has been responsible for steady and greatly increased malaria endemicity in Highlands. This is described in the MoH document updating the malaria stratification in Burundi (MoH, 2000). 1,287 deaths were reported in 2001 but the real death rate, estimated from household surveys may be 10-15 times higher. Investigations by MSF found a dipstick positivity rate of 60-80% among fever cases.

A major constraint is the lack of coordination between the MoH/WHO and NGOs particularly with regard to the choice for a first-line drug. There has recently been a move from Chloroquine to SP as the first-line drug. There is also frustrated communications from periphery to central level and vice versa—especially in the less secure districts. However, now recent institutional developments include an epidemics committee and a national team for rapid intervention, increased surveillance and rapid notification and response.

Global alert and response

Mike Ryan, WHO coordinator global alert and response, presented the work of WHO in developing surveillance and response networks for epidemic diseases such as yellow fever, Ebola and meningitis (currently malaria is not included in the CSR database). After pointing out that epidemics constitute a health, political and economic emergency he described priority setting for epidemic diseases and asked which diseases require a forecasting, surveillance and response process.

For example—what is the risk/time since last outbreak, frequency of previous outbreaks, recent disease trends? What is the impact in terms of morbidity, mortality, and likelihood of spread, traveller health and international trade? Are effective and affordable control measures available and what are the resources required for an effective response? He also discussed the progress with the revision of the International Health Regulations, which will now include alert and response to all disease outbreaks of international importance, including malaria epidemics.

Experience from outside Africa

Krongthong Thimasarn, RBM Mekong, presented key issues surrounding the prediction prevention and detection of malaria epidemics in the South-East, Western Pacific Asian regions. In most countries malaria is unstable, epidemics being mainly associated with population movements, disturbances to local ecology and with multi-drug resistance. On the Thai-

Cambodia border *P. falciparum* epidemics are associated with massive population movement and multi-drug resistance. Multi-disease surveillance (MDS) systems are being developed for sharing data across country borders. As part of early epidemic detection, case surveillance systems use a range of threshold techniques. Simple early detection systems, eg 'pin board' mapping and simple use of the median for an epidemic threshold enables analysis at local level. In her experience in Thailand, proper epidemic investigation is often neglected in the rush to respond. POA and technical guidelines for rapid response are badly needed.

Intersectoral collaboration

Stephen Connor, LSTM, outlined the need for greater intersectoral collaboration in early warning, prevention and control of epidemics. While early detection relies on strengthening health surveillance systems, early warning relies explicitly on indicators from outside the health sector. Stephen proposed that an RBM workshop be called in 2002 to bring together key technical partners from the other sectors (eg. meteorology, agriculture, food security, drought monitoring) to identify common problems and discuss roles and responsibilities in furthering the development of epidemic early warning.

Discussion

When does an increased case-load signal a malaria 'epidemic'?

The definition of what constitutes an epidemic is central to whether or not one is declared and acted upon. Declaring an epidemic too late will lead to avoidable and unnecessary morbidity and mortality. Declaring an epidemic prematurely may lead to over-reaction at the expense of scarce resources, and may distort the reality of the situation. For example: once an epidemic has been declared antimalarial drugs may be released free of charge and public sector health facilities may become overburdened with patients who would normally seek treatment elsewhere, giving a false impression of changes in the true number of cases. Districts may benefit from declaring an epidemic by getting access to resources that would otherwise be unavailable. Pressure groups may use the situation for political purposes.

The problem is that traditionally epidemic thresholds have been developed for 'true' epidemics (ie, an epidemic occurring in an area where malaria is normally not a major public health problem). Such thresholds are not necessarily suitable for areas of high seasonal and inter-annual variability, or where creeping epidemics develop over many years due to a control programme failure, socio-economic factors and political unrest.

Epidemic severity is often linked to vulnerability, ie, a high susceptibility among a population to severe disease outcomes due to poor socioeconomic status, civil unrest, and a lack of capacity to predict, prevent, detect or respond to epidemics. For example, the high death rate during the 2001 Angolan epidemic contrasted with the lesser impact of the same epidemic situation in Namibia. Within countries, epidemics tend to occur in the least secure districts. Vulnerability should thus be considered an integral component in epidemic risk mapping and assessment.

Malaria epidemics must be defined, predicted and declared in the context of local situation analysis. This can only be undertaken at the response level, usually the district. Thresholds will need to be refined over time and must be centred around opportunities and capacity to respond. Significant support is required from the national level. In regions that are epidemic prone, malaria surveillance should be incorporated into the national epidemic surveillance system. Different thresholds may be needed for a) the early warning of an epidemic and b) the declaration of an epidemic. Such a two-stage system is currently used in meningitis early warning and early detection.

Malaria epidemics are currently not routinely reported to WHO.

Cost-effective timing and targeting a response

The type of response to an epidemic situation should be graded and appropriate in terms of timing and cost-effectiveness. Expert opinion needs to be incorporated into a decision support structure, taking into account the time left to respond. In Zimbabwe and other SAMC countries such a system is in place. There are different options to improve communications with peripheral areas, including the use of for instance the 'WorldSpace' radio/satellite system. The cost-effectiveness of these new technologies should be investigated for epidemic situations.

Modelling of the economics of early warning systems suggests that one should carry out vector control interventions such as IRS when the mosquito population is small and that there is a cut-off point when spraying becomes ineffective in terms of lives saved. This has considerable implications for the choice of insecticide, as the residual effect must last long enough to remain active throughout the season. This model supports the use of DDT (expected efficacy of six months) which is currently being re-introduced in Southern Africa. A proposal to document the economic impact of epidemic malaria and cost-effectiveness of control efforts is attached in Annex 4.

The population at risk of malaria is too often given at very crude spatial scales such as the district, while the actual population at risk may be from only a small geographic area within a district. Improving the estimates of at-risk populations will greatly improve the ability to target resources appropriately. Epidemic detection thus needs to be done based on the most peripheral data available (ie, not only hospital-based data) to target interventions to high-risk areas.

Setting up a Malaria Early Warning System (MEWS)

Many sectors apart from the health sector are now recognising the importance of health as a development issue, and many are establishing programmes with explicit health linkages, eg. climate/health, agriculture/health, water resources/health. This coincides with a strong demand to mobilize political support for direct collaboration in epidemic early warning, prevention and response. The TSN needs to identify key partners in the relevant sectors and discuss clearly on common interests, roles and responsibilities for the further development of MEWS. While the development of practical weather/environment related epidemic indicators and thresholds for the district level might not always be easy or possible, the advantage is that this information is created and disseminated by the meteorological services, and its use for health would not incur additional costs.

Seasonal forecasts

Seasonal forecasting institutions are also drawing in the health sector. However the health sector still only has a limited understanding of how to use this information, contrary to agriculturalists and specialist agro-meteorologists who use it routinely. A key obstacle is the format of the information (presented as probability distributions for different outcomes) which is currently not well understood by the end-user. There is therefore a need to reformat these seasonal forecasts for individual end-user application. An example is SAMC where these weather forecasts were transformed into malaria season forecasts, classified as below, normal or above. The development of something like 'epi-meteorology' as a particular approach with appropriate skills is required.

One area of where knowledge is still limited is the interaction of weather variables, eg. temperature, rainfall and relative humidity, in combination with geo-morphological and socio-economic characteristics of risk areas. For instance, depending on the circumstances, high rainfall can mean less or more malaria. It is also not clear how the effects of different climatic variables are balanced within the mosquito vector, for instance low humidity and high temperature reduce the daily survival rate but simultaneously reduce the extrinsic incubation period. These interactions deserve closer investigation through empirical study.

Despite these uncertainties, it is clear that for areas where rainfall is obviously the key epidemic indicator, simple forecasting products (such as accumulated rainfall differences) can and should be produced now and disseminated through the FEWS-ADDS site .

Capacity at the regional, national and district levels

A serious lack of capacity, which hampers the development of district-based epidemic early warning, prevention and response, was noted by a number of participants. The role of the TSN in providing direct technical support to the field was questioned—if the TSN cannot provide sufficient technical support in the field who can? Scope for the development of capacity through links to academic institutes was also raised. It was noted that Southern Africa has had a lot of support from external groups, which has been translated into considerable progress in the region. This situation contrasts greatly with the situation in East and West Africa.

NGOs are often in the front line of epidemic response. Often the partnership between NGOs, MoH and WHO is weak—particularly in relation to antimalarial drug choices during epidemics in and outside health care facilities, including mass drug administration. This is an area where partnerships through the TSN should be reinforced.

SUMMARY OF GROUP DISCUSSIONS AND RECOMMENDATIONS MADE TO PLENARY

Group 1: Recommendations on priority interventions

1. Strengthening the surveillance / communication system for early detection and reporting.

2. Strengthening and assessing the surveillance system at community level.

3. Assessment and validation of existing and innovative diagnostic tools to confirm malaria epidemics (eg. rapid diagnostic tests).

4. Development of decision-making guidelines for use during epidemics or in case of epidemic threat.

5. Strengthening partnership around epidemic preparedness and response at all levels (district, national, regional and global).

6. Strengthening links between implementing and research actors.

7. Development of rapid assessment guidelines.

Group 2: Recommendations

From plenary discussion, the following points were mentioned:

■ Advocacy and training materials on malaria epidemics need to be developed, preferably in at least five languages (English, French, Spanish, Portuguese and Arabic)

■ The Horn of Africa needs an interregional approach for malaria epidemics like the Mekong area, bridging the operational gap between AFRO and EMRO

■ Epidemic prevention and control systems can be up and running in SADC countries within the next two years. Effective links with climate data producers can be put into place for the Sahel within the next two years, but having a functioning early warning system might take a bit longer.

■ For 'true' epidemics, the role of climate and weather data monitoring would be to put the spot light on risk areas, which should respond by increased disease surveillance (weekly reporting for instance) in order to pick up a possible epidemic at the earliest stages.

■ In areas with 'seasonal epidemics', the preparedness, monitoring and response logistics could be combined between malaria and other seasonal diseases such as meningitis and cholera.

■ For better comprehension, there is a need to insert the different graphs for the three types of epidemics: a single peak for true epidemics, repeated peaks for seasonal epidemics, and a gradually upward moving line for neglect of control activities (for instance as a result of chronic complex emergencies).

■ As for funding the epidemic response, the 'true' epidemics may be the domain of international outbreak response mechanisms (also as part of the revised International Health Regulations), seasonal epidemics would normally demand an outbreak response mechanism at national or subregional level, and gradual epidemics due to the disintegration of control activities would need long term sustainable interventions funded by for instance the Global Fund, supplemented by the humanitarian aid community. Conceptual and organizational framework for operational activities and research on epidemic malaria preparedness and response should be adjusted to the three previously described epidemic situations.

Group 3: Recommendations on economics of epidemic malaria

See Annex 4.

Group 4: Recommendations on Asian perspectives on epidemic prevention and control

See Annex 5.

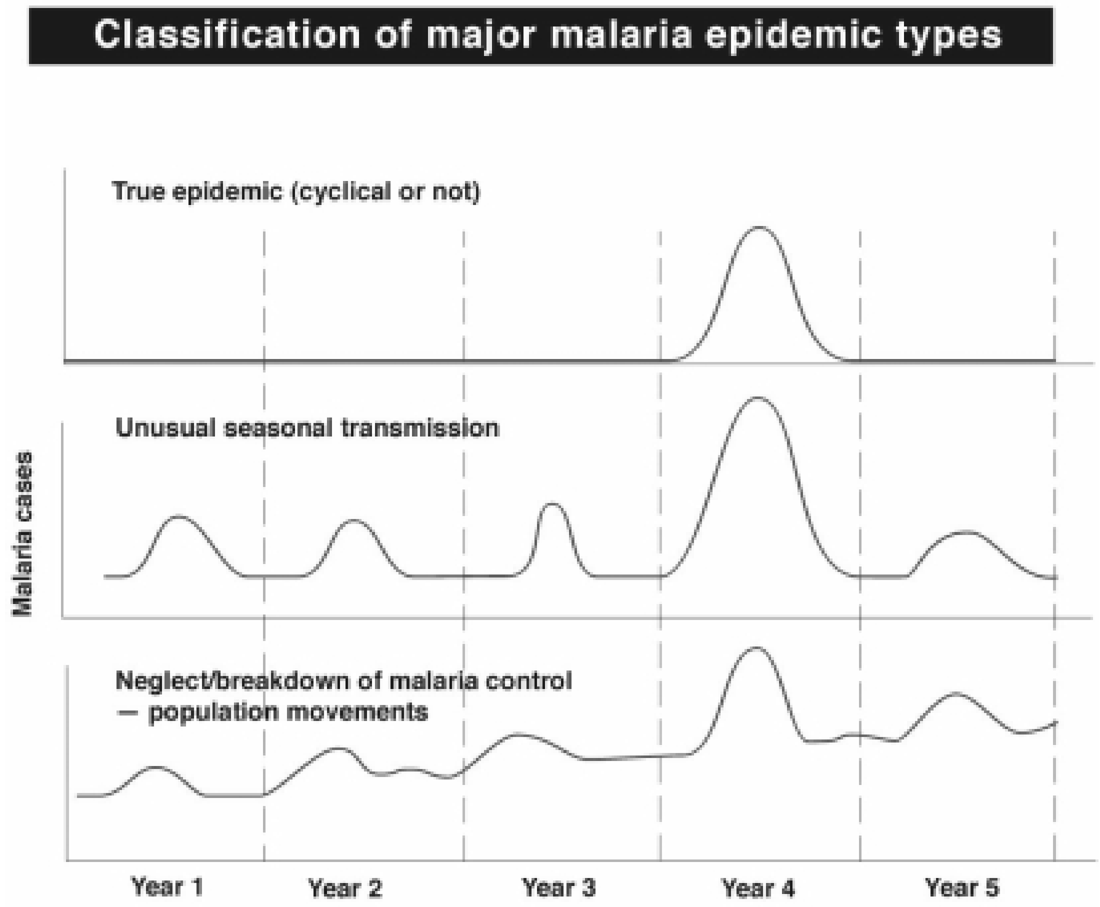
Matrix stratification of activities by epidemic risk profile

(incorporating suggestions made in plenary)

Epidemic risk profile	MEWS	Preparedness	Response	Possible funding sources	Post-Epidemic documentation
True epidemics	Implement existing knowledge Use tools to issue warnings at RBM level, leading to focussed surveillance and preparedness in risk areas Continue development of MEWS indicators	Stockpile resources at intercountry level Form emergency response teams	Country/District Level Event-based	International outbreak response mechanisms	Study document for particular events
Strongly seasonal transmission	Implement and support establishedassociations and indicators in surveillance systems (eg. early detection, climatic anomalies)	Calendar-based (but responsive to annual variation) planning and staging of resources at the country level Stockpile resources at country and sub-regional level for unusually heavy seasonal peaks	Country/District Level Calendar-based	Outbreak response at the national level or subregional level	Annual Seasonal Summaries
Complex emergencies (or neglect)	Monitor developments at the regional level	Stockpile resources at the sub-regional level Form sub-regional response teams Build capacity	Needs long term sustainable interventions Sub-regional response teams or National disaster response agencies	Global Fund, supplemented in CE by the humanitarian aid community	Study document for particular events

Definitions

1. True epidemics—infrequent/cyclical outbreaks in relatively non-immune populations related to climatic anomalies (mainly arid and semi-arid zones)
2. Strongly seasonal transmission—variable but relatively predictable transmission influenced by variations in normal climatology
3. Complex emergencies—malaria transmission exacerbated by population movements and country political instability. May include (1) and (2).
4. Neglect/breakdown of control—where malaria has re-emerged due to neglected control activities (not necessarily linked to a complex emergency situation) with subsequent increase of endemicity and transmission



KEY PROPOSALS AND PLAN OF WORK 2002–2003

Updated TORs

The TSN will continue to build on past activities and results obtained so far to:

- develop, validate and implement effective forecasting and early warning systems in order to either prevent or control / truncate epidemics at very early stage;
- implement effective weekly-based early detection systems in order to detect and control epidemics in a timely manner;
- assist countries to develop preparedness POA including effective preventive or control options;
- document the cost/burden of malaria and undertake cost-effective analysis of integrated interventions in epidemics;
- stimulate multisectoral approaches to prevent or control epidemics.

Priority interventions from TSN

- Development of methodologies to support epidemic-prone countries:-
  (i) for forecasting and prevention; and
  (ii) for early detection and control of malaria epidemics.
- Support to the development of regional, sub-regional and country strategies for epidemic preparedness and effective response;
- Validation of risk indicators;
- Identification of Institutional partners to support and disseminate risk indicators;
- Support to operational research needs (eg. decision tree models);
- Strengthening of malaria surveillance at community, district, country and inter- country levels according to epidemics risk classification;
- Development of consolidated guidelines for epidemic investigation;
- Review optimal communication systems;
- Definition of strategies for rapid delivery of epidemic control methods;
- Development of methodologies for post-epidemic assessment;
- Identification / strengthening of links between ‘epidemiological blocks’;
- Promotion of integrated epidemic surveillance approaches;
- Development of guidelines on epidemic prevention and control;
- Further work needs to be carried out to assess the costs of epidemic malaria and the cost-effectiveness of early warning, early detection and early control response;
- Organization of an RBM Workshop for Key Technical Partners (Multi-sector) in support of MEWS.

CONCLUSIONS

The Technical Support Network has been established for three years. During that time a large number of activities have been undertaken—particularly in Africa—to increase epidemics knowledge and to establish solid foundations for epidemic detection and control interventions. However there is still much to do in terms of action. One of the main challenges is to implement tangible products, which can make a difference to epidemic prediction, prevention, detection and control, at the district level. Implementation of key interventions at district level means strengthening of technical expertise at national and sub-regional level.

A consensus was reached around the need to define epidemics in terms of response, with different strategies being selected for what are considered as 'true epidemics', unusual seasonal fluctuations and long-term increases in endemicity, due to control failure, and/or in complex (chronic) emergency situations.

Data analysis and epidemic alerts need to be undertaken and declared at the response level(s). For effective response this means staff having technical and logistical support to identify and declare an epidemic, drawing on established response plans. Capacity must also be developed at the central level in order to provide effective technical and operational support to the periphery when required, as well as contributing to the establishment and maintenance of emergency stocks. Existing epidemic surveillance thresholds have been tested in East and Southern Africa. Results indicate that thresholds need to be tailored to the epidemic response setting, and that new warning and detection thresholds need to be developed and validated to be used effectively by convinced decision-makers.

One of the targets of the Abuja Declaration agreed upon by African leaders in April 2000 was that two-thirds of epidemics should be picked up within two weeks of their inception. To achieve this in the African context health services, through a weekly recording system, and partners outside health need the capacity to take a more proactive role. They need to be better informed as to 'where and when' to look for epidemics. Therefore integral development of both early warning and early detection linked to predefined cost-effective control options must be ensured.

Malaria Early Warning Systems have immediate operational value in areas where excess rainfall is the major epidemic indicator (eg, the Sahel, semi-arid lowlands in the Horn of Africa and the desert-fringes of Southern Africa). Simple products such as cumulative rainfall difference maps are being used now in Southern Africa but this could be greatly extended if tailored products are produced and disseminated routinely, for the continent, through the FEWS-ADDS website. Work towards this has to be supported immediately.

Multi-sectoral collaboration is needed. This was highlighted many times during the meeting. An RBM workshop bringing together key technical partners from other sectors with a common interest in malaria, (eg. food security systems, meteorological services, drought monitoring, etc) was proposed for 2002. The aim of the workshop is to clarify the nature of the problem, discuss solutions and ratify respective roles and responsibilities.

Economic information on epidemic malaria is lacking. It was recognised that there is a need for further work to assess the costs of epidemic malaria and the cost-effectiveness of early warning, early detection and early control response. Plans to develop this work are to begin immediately.

Guidelines as well as training modules need to be developed for epidemic prevention and control and they need to be tailored to specific epidemic response settings.

Last, but not least, systematic information on any malaria epidemics around the world is missing. There is an urgent need to establish a system to channel the relevant information and to document epidemics through an appropriate database.

ANNEX 1. GOALS OF THE MEETING

Goals, objectives, method of work and expected outcomes

General objectives

- To assess progress made against the TORs of the Technical Support Network (TSN) for the Prevention and Control of Malaria Epidemics (TORs attached as Annex).
- To plan 2002-3 activities supported by the TSN.

Specific objectives

- Review / update on current activities.
- Define further priority activities.
- Develop a plan for country/regional support.
- Explore priority interventions outside Africa.

Method of work

- Nomination of Chairperson and Rapporteur.
- Presentation of progress made by the TSN Manager.
- Presentation of experiences / current / future activities by selected TSN members to be followed by discussion.
- Development of a 2-year draft plan of action.

Overview of progress with conclusions and recommendations made

- 2002-3 priority interventions (agreed upon as part of country support) identified; country mechanisms budgeted.
- Ongoing and future interventions among technical partners and country projects as well as RBM/HQ regional POAs articulated.
- Agreement reached on next steps to be taken with respect to technical support to epidemic prone countries outside Africa.

ANNEX 2. AGENDA

Monday 10 December 2001

09.00	Opening remarks by RBM Project Manager *David Alnwick*
09.15	Election of Chairman and Rapporteur
	Progress made according to the TORs of the RBM Network *Charles Delacollette*
10.20	LSHTM: Economical aspects of malaria epidemics *Eve Worrall*
10.40	Global and regional forecasting & detection systems: progress on models and field applications in Africa
10.40	LSTM *Madeleine Thompson*
11.00	Harvard School of Public Health *Tony Kiszewski*
11.20	Oxford University *Simon Hay*
11.40	LSHTM *Jon Cox*
12.00	Discussion and wrap-up of main points
14:00	Sub-regional forecasting & detection systems: experiences in Africa
14.00	SADC Team, Harare *Ricki Orford*
14.30	Intercountry team, Kampala *Edith Lyimo*
15.00	Intercountry team, Lomé *Stephan Tohon*
15.30	Discussion and wrap-up of main points
16.20	Experience on epidemic detection and response
16.20	Sudan *Wiseilat Zaroug Ibrahim*
16.50	Discussion
17.00	Burundi *Lamine Diarra*
17.30	Discussion and wrap-up of main points

Tuesday 11 December 2001

08.30	Recapitulation of main points from the first day *Rapporteur*
	Epidemic detection systems and response for communicable diseases
	Mike Ryan, CSR/HQ and Amadou Yada, CSR/AFRO
09.20	Discussion
09.30	Malaria epidemics from Mekong perspectives *Krongthong Thimasarn*
09.45	Informal discussion on experience from outside Africa: next main steps
10.50	Development of the draft Plan of Action *Charles Delacollette*
11.00	Group Work: Development of 2002-3 plan of work according to regional epidemiological situations and needs
14.00	Group work: Development of 2002-3 plan of work according to regional epidemiological situations (continued)
15.30	Plenary presentation and discussion of outcomes
	Budget matters: Funds requested, approaches for fund raising, potential interest
16.45	Workshop in 2002 together with technical experts from the different sectors/partners to see how MEWS could be integrated into wider initiatives *Steve Connor*
17.15	Plenary discussion

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ANNEX 4. ECONOMICS OF EPIDEMIC MALARIA

Economics of Epidemics

There are two main areas to consider:

- Cost/burden of malaria epidemics
- Cost-effectiveness of interventions in epidemics (including early warning, surveillance and detection)

Initial focus should be on first area. The second area could possibly be examined as part of evaluation of efficacy/effectiveness of interventions in various or low levels of endemicity.

Cost of Epidemics

Background/Justification

Work is being carried out to examine disease outcomes at different levels of transmission intensity. However, there is a large information gap regarding the relative importance of epidemics in contributing to the burden of malaria morbidity and mortality. These issues are important for priority setting and advocacy reasons.

Burden of Epidemics

Epidemics have impact at all levels (individual/household, district, national) and on all sectors (household, private and public) of the economy. The cost of epidemic malaria to the household sector is an area where knowledge is particularly lacking. Ministries of Health may also find it useful to know how much epidemics cost them in order to prepare emergency budgets for epidemics and to advocate for funding in epidemic situations.

Household Costs and Coping Mechanisms

The household costs of malaria can be defined as direct, indirect and intangible costs. Direct costs incurred by households will be the cost of prevention and treatment activities including things such as transport or food costs incurred whilst travelling to receive treatment or in hospital. Indirect costs will be more diverse and will include things such as the lost productivity due to morbidity and mortality (paid work, household activity, subsistence farming etc.), panic sales of assets, delayed or forgone investment opportunities, school absenteeism etc. Intangible costs include the costs associated with pain, suffering and bereavement.

A household survey would be a suitable tool to identify all these costs and compare the costs incurred and behavioural changes resulting from an epidemic.

Household Costs of Malaria at Different Levels of Transmission

Phase 1—Protocol Development, Retrospective Analysis

Possible Countries: Ethiopia, Madagascar, Uganda.

Survey Design

i) Key informant interviews with district medical staff, community members to inform development of pilot survey.

ii) Survey development/design carried out by anthropologist, sociologist and economist in order to capture relevant economic and behavioural data.

iii) Pilot testing of survey and make necessary changes.

Study Sites—A district will be selected for which a time series (5 years +) of good quality, district level epidemiological data is available and readily extractable. Within this district three areas of varying transmission (low/none, medium and high) will be selected for the survey.

Data Collection and Analysis—field workers will carry out the survey and data entry and the data sent to LSHTM for analysis by economist and anthropologist. Key differences between the economic impact of different levels of malaria transmission at the household level to be identified and quantified.

Reporting and Recommendations—Reports of findings will be made to the country and to WHO-RBM. The protocol will be developed and modified where necessary to produce a guideline/tool for country level analysis of the economic costs of epidemics at the household level.

Phase 2—Country Level Use of Tool During or Immediately Following Epidemics.

The protocol/tool developed will be used in other districts/countries at the country level with support from WHO-RBM if necessary.

Cost to the Ministry of Health

A methodology was developed on a WHO-RBM epidemic mission to estimate the different cost of malaria control to the MoH during varying transmission years (Worrall & Hongoro, in prep.). This methodology will be applied at the same time as the household analysis in order to examine the cost of epidemics from an additional perspective. This will enable further development of the existing methodology.

ANNEX 5. ASIAN PERSPECTIVES FOR THE TSN ON THE PREVENTION AND CONTROL OF MALARIA EPIDEMICS

Surveillance system

In most Asian countries the health infrastructure is relatively well-developed and epidemiological data for epidemic prevention and control are available. However, surveillance usually consists of routine submission of information to the upper or central level—instead of being a tool for epidemic prevention and control which can be carried out in a timely and regular manner by the peripheral level. Data are not analysed and used quickly either for peripheral decision making or for post-epidemic assessment analysis. There is a need to strengthen early warning and detection system to enable malaria control programmes to better tackle the major problems of epidemics: failure to verify epidemics, untimely detection of and response to real epidemics, lack of post-epidemic assessment, etc.

Stratification of malaria risk

Most countries stratify malaria risk by area and by identifying populations at risk. However, in most Asian countries, the definition of 'population at risk' is not well defined, for instance 'population living in malaria endemic areas, migrant labourers, refugee, forest-related workers, etc.'

Inter-country comparison of data is difficult because the various epidemiological data and practical variables used at country level are not standardised and may apply to completely different epidemiological settings. The Network should assist countries to revisit the stratification procedures so as to make them applicable for the region as a whole.

New technologies such as GIS and remote sensing developed by the Network to assist African countries in proper forecasting of epidemics can be introduced in Asian countries.

Capacity of countries in Epidemiological Investigation

Most countries have to strengthen and improve their surveillance system (early detection, verification and notification). This can only be accomplished through well-trained field staff, who are in short supply at present. There is a need to increase capacity to do the following:

i) Identification of causes or major determinant factors of previous / current epidemics;

ii) Early detection, verification and notification of epidemics through simplified and rapid methods that can be easily applied by field staff;

iii) Selection of cost-effective control interventions according to epidemiological setting;

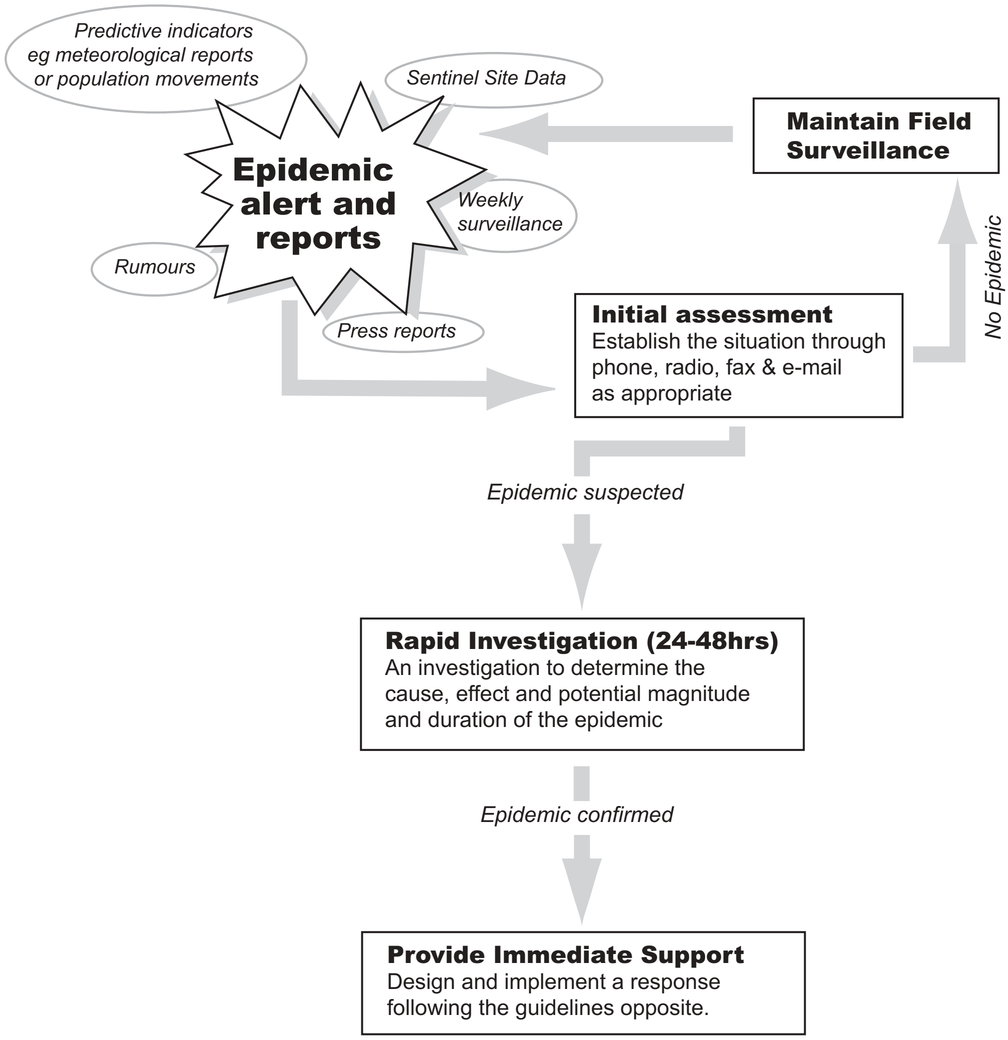
iv) Assessment of the impact of interventions (methodological guidelines are needed for post-epidemic evaluation).

Inter-country and inter-WHO Regional collaboration

As it is realized that many major epidemics occur as a result of the population movement crossing international borders (and inter-WHO Regional borders). Some epidemics take place in vast areas covering more than one country. Such epidemics can not be effectively managed by one country alone. Therefore it is strongly recommended that collaboration should be built up to increase awareness of malaria control programmes regarding epidemic forecasting, detection and control. The good example was raised of the collaboration of Mekong countries in strengthening integrated disease surveillance, under the umbrella of the Mekong Basin Disease Surveillance, supported by the Rockefeller Foundation.

ANNEX 6: MALARIA EPIDEMIC RESPONSE

A checklist for effectively responding to malaria epidemics



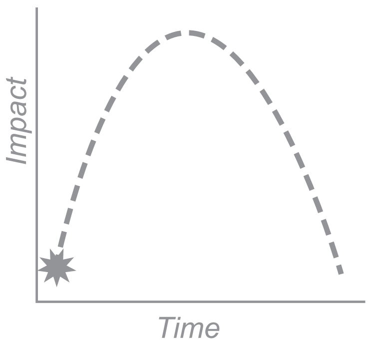
DESIGNING THE RESPONSE

At all epidemic stages

- Ensure all clinics and health facilities are operational and have sufficient drugs, equipment and trained staff
- Establish treatment centres (temporary clinics or mobile clinics) where access is a problem or health facility coverage is low
- Ensure that the correct diagnosis and treatment is provided at all health facilities and at community level
- Promote pro-active clinical case detection and management/referral
- Reinforce the referral system and consider the introduction of artesunate suppositories and artemether IM as a temporary measure where these are not already used
- Intensify/maintain effective preventive measures for pregnant women
- Reinforce health information systems for reporting and epidemic monitoring, preferably on a weekly basis
- Conduct specific epidemic health education campaigns
- Organize regular press releases/conferences/articles for public information

A. Epidemic start

In the early stages of an epidemic, in addition to reinforcing case management (see above), it is still possible to reduce the potential impact of the epidemic using vector control interventions such as indoor residual spraying (IRS).

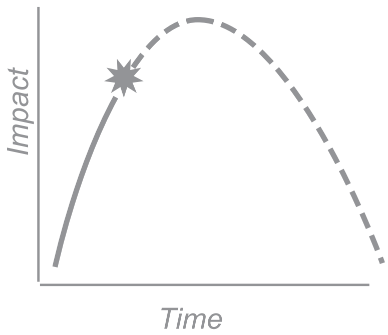


Additional specific interventions:

- IF the area is in principle already protected by IRS: establish coverage and quality of vector control using techniques such as bio-assays.
- IF the area is not already protected, but the malaria epidemiology, type of housing and available logistics allow rapid deployment of effective IRS: implement IRS in target areas.
- CONSIDER—Properly-timed fogging in highly populated areas such as refugee/IDP camps especially if shelters are small, and if IRS is not an option
- CONSIDER—Reimpregnation or use of ITMs (insecticide treated materials including bednets) if there is a history of ITM use in the area, or if the capacity to enforce such a programme exists (e.g. within a concentrated workforce).

B. Epidemic acceleration

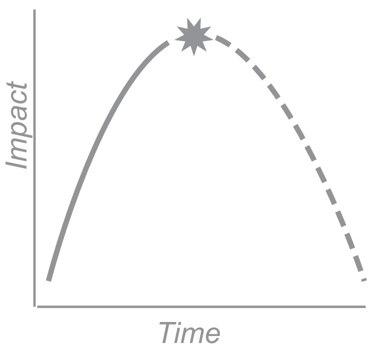
Case management (see above) is the priority at this stage. Aiming to reduce the potential impact of the epidemic through indoor residual spraying (IRS) and other vector control measures is only an option if (1) there is considerable operational capacity trained and readily available, and (2) preparedness levels have been high.



Additional specific interventions:

- CONSIDER—Establishing coverage and quality of vector control, using techniques such as bio-assays, if the area has already been sprayed
- CONSIDER—IRS if the area is not already protected
- CONSIDER—Changing chemicals for IRS if observed susceptibility is low
- CONSIDER—Properly-timed fogging in highly populated areas such as refugee/IDP camps especially if shelters are small, and if IRS is not an option

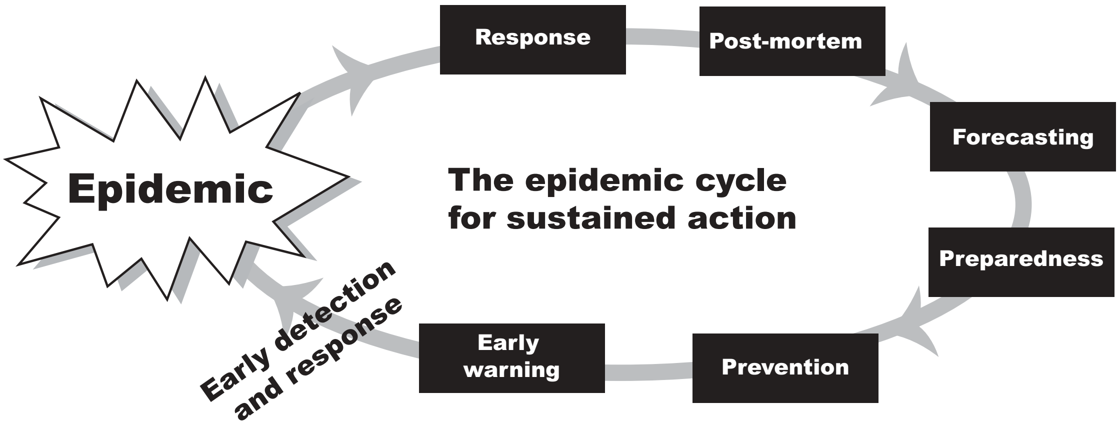
C. Epidemic peak



The epidemic has already begun to stabilise at this point and the number of new cases is beginning to decrease. Vector control interventions to reduce the potential impact of the epidemic have no public health value at this late stage. Resources should instead be directed at case management to reduce malaria mortality. (See above.)

After epidemics

Ensure lessons-learned exercise for next epidemic ('post mortem').



Pre-season preparedness and early identification provides the malaria manager with an increasing number of tools to deal with an epidemic.
Maintain surveillance,
keep database up-to-date,
think ahead,
BE PREPARED

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