Somalia National Malaria Epidemic Detection, Preparedness and Response Strategy 2015-2020

Developed and Endorsed by the Zonal NMCPs/MOHs of the Fedral Government, Puntland and Somaliland

June 2015

ACKNOWLEDGEMENTS

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CONTENTS

1. INTRODUCTION

Malaria epidemics have been shown to occur among nonimmune populations in urban centres, highlands, arid and semi-arid areas [Najera et al 1998; Abeku 2011] as a consequence of extreme climatic anomalies, population displacements, uncontrolled large scale developments and/or failure of control interventions [Najera et al 1998; RBM 2001]. In many countries in Africa where epidemics are likely to occur, their toll is exacerbated by lack of malaria early warning systems (MEWS), poor access to prevention and treatment services, drug and insecticide resistance, conflict, malnutrition and the burden of other infections [RBM 2001; WHO 2005].

Although poorly defined and documented, malaria epidemics were reported in Somalia as early as the 1940s and almost every decade since [Wilson 1949; Jama 1999; Warsame et al 1990; 1995]. Historically, these epidemics occurred after the rains following prolonged droughts. Since the 1960s, areas where epidemics have been reported include:

1950s-1960s: Choumara (1961) reported evidence of a severe epidemic in the western Somaliland in which with 7500 cases with a 1-2% mortality rate was reported in 1951. Anecdotally, epidemics have also been reported in in 1964.

1988: An epidemic was reported in town of Balcad along the Shabelle river in the Central zone, in 40km north of Mogadishu. Although a moderated excess rainfall was reported in the season, mild excess in preceding seasonal rainfalls was noticed but the epidemic was primarily attributed to the CQ resistance [Warsame et al 1990].

1997: The heavy El Nino rains towards the end of 1997 precipitated a widespread epidemic in Gedo and Bay regions and the lower parts of the Middle- and Lower Shabelle regions after. A WHO consultant reported its concerns about the potential burden of the prevailing situation. This period followed one of drought in 1995 and 1996 and early parts of 1997 making the population vulnerable to the consequences of subsequent epidemic [Kassatsky, 1998]. There are also unconfirmed reports of an epidemic in western Somaliland around this time.

2000 – 2012: Sahil, Awdal and MaroodiJeh have reported undocumented outbreaks with good response from NMCP and stakeholders led by WHO team

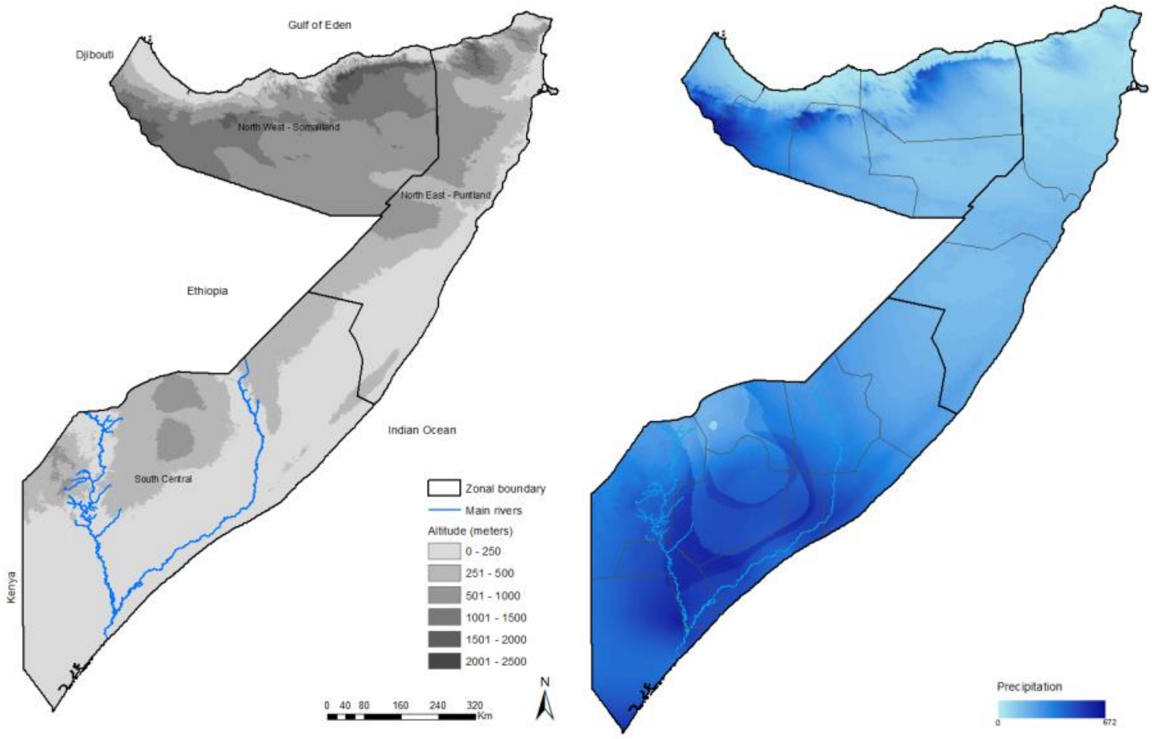
2012 - 2013: An epidemic was reported in Bosasso in Puntland in 27th Dec 2012 and ended on 30th May 2013, the total malaria cases recorded was 7089 (7031/*Pf* & 58/Pv) and 13 deaths with only one under 5 years.

2. GEOGRAPHY, DEMOGRAPHY, ADMNISTRATION AND CLIMATE

Somalia is the eastern most county in Africa and its terrain consists mainly of plateaus and plains with a few highland areas in the northern margins [Hadden 2007]. In the far north are the east-west ranges of the Karkaar Mountains rising as high as 2440 m (Figure 1A). On the eastern and northern sides is the longest coastline in Africa. On the west is the vast Somali plateau consisting of series of tablelands. In the East and the South, the plateau ends in arid steppes, from under 200 meters at the Indian Ocean. The plains drain into the Juba River in the south and Shabelle River in the centre, which disappears into a swamp before reaching the coast (Figure 1). Most of Somalia receives less than 500 mm of rain annually, and a large area encompassing the northeast and much of northern Somalia receives as little as 50 to 150 mm (Figure 1B). The southwest receives 330 to 500 mm.

Mean daily maximum temperatures throughout the country range from 30°C to 40°C, except at higher elevations and along the Indian Ocean coast. Mean daily minimum temperatures vary from 20°C to more than 30°C. Northern Somalia experiences the greatest temperature extremes, with readings ranging from below freezing in the highlands in December to more than 45°C in July in the coastal plain skirting the Gulf of Aden. The north's relative humidity ranges from about 40 in mid-afternoon to 85 at night, varying with the season. Temperatures in the south are less extreme, ranging from about 20°C to 40°C. The hottest months are February through April. The coastal zone's relative humidity usually remains about 70% even during the dry seasons. This diversity of climatic conditions from south to north has a marked effect on the distribution, abundance and infectivity of malaria by dominant vectors. Somalia is now split into three largely autonomous areas, referred to here as zones, and include the self-declared Republic of Somaliland, Puntland and Central South Zones (Figure 1A) all with separate ministries of health and national malaria control programmes. A recent estimate by UNFPA (PESS) suggests that Somalia's population was 12.3 million 2014.

Figure 1: A) altitude map showing the three zones of Somalia; B) mean annual precipitation map of Somalia



3. MALARIA CONTROL IN SOMALIA

3.1 National malaria strategic plan (NSP) goals and objectives

The second national malaria strategic plan for Somalia was developed in 2010 to cover the period 2011-2015. The main **GOALS** of the plan are:

1. By 2015, achieve near zero (<1% parasite prevalence) malaria transmission within areas of historically low transmission (Somaliland, Puntland and Central parts of CSZ)
2. By 2015, achieve and sustain universal coverage resulting in 50% reduction of malaria transmission in malarious areas of the country (Southern parts of CSZ)

The **OBJECTIVES** to support the attainment of these goals are:

1. At least 80% of suspected malaria cases are diagnosed using RDTs or microscopy within 24 hours of fever onset
2. 100% of confirmed Plasmodium falciparum malaria cases are treated with ACTs
3. 100% of households in malaria transmission areas own at least two LLINs
4. At least 80% of the population (under 5s and total population) used LLIN previous night
5. At least 80% of pregnant women used LLIN previous night
6. At least 85% of households in focal transmission areas in Somaliland and Puntland sprayed in previous 12 month
7. At least 80 % pregnant women receiving IPTp2 in malarious areas in CSZ
8. At least 90% of people living in malarious areas recognize the importance of using an LLIN, having their house sprayed, seeking treatment within 24 hours of fever onset for the prevention of malaria.
9. Strengthen the capacity of the ministries of health in close collaboration with national and international partners.

3.2 Progress in malaria control indicators

The first national malaria indicator survey (MIS) in Somalia was undertaken in 2013 with aim of measuring progress in key malaria control indicators [MIS 2014]. A summary of main results from the survey are shown in Table xx:

Table 1 Somalia MIS 2013- Summary of main results overall, by residence and zone.

	National	Urban	Rural	Central South	Puntland	Somaliland
Survey sample						
Number of clusters	267	98	164	160	37	70
Number of households	5,220	1,975	3,245	3,099	721	1,400
Number of household members	20,104	7,970	12,134	12,374	2,685	5,045
Number of women 15-49 years	3,262	1,276	1,985	2,192	329	741
Number of children under the age of five years	3,849	1,571	2,278	2,668	328	853
Vector control						
Percentage of households with at least one mosquito net	27.1	30.4	25.1	25.3	20.2	34.5
Percentage of Households with at least one LLINs	19.1	20.2	18.4	16.9	7.2	29.9
Percentage of Households with at least one LLIN per 1.8 persons	8.3	8.6	8.1	6.0	4.3	15.5
Percentage of households members who slept under net	28.4	32.8	25.6	25.5	22.4	36.4
Percentage of households members who slept under LLIN	19.8	23.0	17.7	17.1	8.1	28.9
Percentage of children U5 who slept under LLIN	22.5	25.8	20.7	17.3	14.4	36.5
Percentage of pregnant women who slept under a net	31.5	37.8	27.0	28.8	18.0	39.3
Percentage of pregnant women who slept under LLIN	23.0	28.4	19.1	19.2	8.6	32.8
Treatment seeking						
Percentage of persons who had fever in the last 2 weeks	20.2	11.2	26.1	25	15	11.7
Percentage of persons who had fever and took action	27.9	35.3	25.8	28.3	31.5	24.6
Percentage with fever in the last two weeks who action and treated at a public health facility	32.5	34.3	31.1	30.1	27.9	37.0
Percentage with fever in the last two weeks who took action	14.5	4.3	18.5	15.0	11.8	13.8

and were treated with antimalarials						
Percentage with fever in the last two weeks who took action and were treated with antimalarials and received AS+SP	59.4	43.8	60.9	50.1	77.8	52.6
Parasite prevalence						
Number of persons tested using RDT	16,388	6,457	9,931	10,162	1,439	4,787
Percentage parasite prevalence using RDT	1.8	1	2.4	2.8	0.6	0.1

3.3 Malaria case definition:

As per the National treatment Guideline “a patient with symptoms and/or signs of malaria, with parasitological confirmation (microscopy and/or rapid diagnostic test) of the presence of malaria parasites”. In short history of fever with presence of malaria parasites

4. CONTROL OF MALARIA EPIDEMICS IN SOMALIA

There is no existing well-resourced infrastructure to respond to epidemics and little documentation on how previous epidemics were contained. More recently, the failure of the long rains in Somalia in 2010 combined with the below average rainfalls in previous seasons (2008 and 2009) attributed to the La Niña weather phenomenon over the Pacific Ocean [NOAA URL] resulted in one of the worst droughts since the ‘season of the red winds’ of 1950 [Jama 1999; FEWSNET URL]. By October – December season of 2011 heavy rains were forecast in Somalia [FEWSNET URL] and the malaria transmission intensity was expected to increase later in 2011 and in the first few months of 2012. Consequently, there were serious concerns that there could be a malaria epidemic which could be compounded by the widespread malnutrition across the country and the security crisis especially in the southern areas where malaria risk is highest [FSNAU URL; Noor et al 2008a]. However, the evidence-base for resource planning was weak [WHO-RBM 2010] and sentinel surveillance sites designed to provide a malaria outbreak alert remain too few and their reporting is sub-optimal [WHO-RBM 2010]. Fortunately, several funders such UNICEF (R6 GF) and DFID assembled resources and procured vector control, diagnostic and procurement commodities to prevent this epidemic.

In 2006, a strategic framework for the control of malaria epidemics in Somalia [Guintran 2006] was developed. This led to a series of recommendation [Box 1] several of which have since been implemented.

Box 1: Recommendations from the Strategic Framework for Control of Malaria Epidemics in Somalia 2006-2007. Those shaded green have been implemented

1. Identification of epidemic prone areas and population at risk by:

Evidence-based modification of country stratification of malaria risk – Done through the Epidemic Risk Report [Noor et al 2014]

2. Set up and operate a reliable Early Detection System (EDS) in districts with the highest epidemics risk by:

Appropriate selection of 25 sentinel sites

Population based surveys in their catchment areas to provide baseline 2 to 9 years children prevalence rates and usual care seeking pattern

Collection of available retrospective morbidity/mortality data

Standardization and quality assurance of diagnosis

Improvement of case management for mild and severe cases

Standardization of case registration and reporting

Weekly monitoring of the most accurate EDS indicator (i.e. slide positivity rate when possible or proportion of suspected uncomplicated malaria among consultations by default)

Adoption of standard methodology for weekly data analysis by using quantitative definition of week specific epidemic thresholds based on the 85th percentiles over the last 5 years.

Creation of zonal investigation teams provided with methodology based on rapid survey of children prevalence with RDTs for the verification of alerts. only to some extent in SL & PL

3. Build capacity for zonal based cost-effective epidemic response by:
Best adaptation of control strategies to resources and the timing of the detection by selection of the most cost-effective interventions
Mobilization of multisectoral partnership (was done in Bossaso in the last year and the beginning of this year)
Participation of communities (was done in Bossaso in the last 2 years)
Ensuring wide and timely access to efficient treatment by expanding basic health services to peripheral affected communities involving HPs
Sufficient supply and free provision of drugs and equipment
Adaptation of treatment and diagnosis protocols for optimal case management of uncomplicated and severe cases
Weekly monitoring of slide positivity rates and performance indicators

4. Develop epidemic preparedness at national and zonal levels by:
Development of national guidelines for prevention and control of epidemic
Establishment of buffer stocks at zonal level to prevent drug shortages
Elaboration of epidemic preparedness plans in each zone

5. Operational research in areas with highest epidemic risk
To explore benefits of Early Warning System (EWS) in southern zones
Assess impact, cost and acceptability of focal preventive vector control interventions combining ITNs, IRS and larviciding in northern zones

5. MALARIA EPIDEMICITY AND ENDEMICITY

There is an inverse relationship between levels of malaria endemicity and the likelihood of epidemics as modulated by the acquisition of immunity [Najera et al 1998]. Populations living in areas of stable transmission to malaria develop immunity early in life due to the high frequency of exposure to infections [RBM 2001; WHO 2004; 2005]. Therefore, in areas of stable transmission, the disease is concentrated among children under the age of five years and clinical episodes become rarer with age [Snow & Marsh 2002]. In areas of unstable transmission, normally defined as areas of hypoendemicity (≤10% parasite rate among children aged 2-10 years), populations are likely to be wholly susceptible or of partial immunity that is likely to be lost due to reduced exposure during a prolonged drought or under sustained control. It is among populations in unstable transmission, where majority of the infected people are likely to become clinically ill, that epidemics occur [Najera et al. 1998]. Within these regions, however, areas where the vector density is likely to rise rapidly or have the weakest health and socio-economic infrastructure suffer the highest intensity of the epidemics.

6. EPIDEMICS OF MALARIA

6.1 Definition

Endemic malaria is defined by natural variations that are either seasonal as determined mainly by short weather patterns and periodic cycles that typically occur every 5-10 years. These patterns can also be mitigated by secular trends such as intervention scale up or deterioration, drug resistances and changes in environmental conditions such as construction of dams and irrigation schemes. Any additional cases above what is expected under such variations is normally a signal for malaria epidemic.

The WHO defines a malaria epidemic as a sudden increase in cases in an area beyond what is considered normal [Najera et al 1998; WHO 2004]. In addition *P. falciparum* fatality rates that exceed 1% overall or 20% among severe cases is an indication of a malaria epidemic. Epidemic typology is based on the nature of the causal factors and are as follows:

True (explosive) epidemics: These occur due to a disturbance of the natural epidemiological equilibrium and are largely due to natural (climatic anomalies) or man-made factors (e.g. construction of dams and irrigations).

These often occur in among relatively non-immune populations such as those in highlands, arid and semi-arid areas.

Exaggerated seasonal variation: Cases occur within normal transmission season but follow relatively predictable patterns influenced by normal climatic variations.

Complex emergencies: Mainly as a result of human population displacement due to conflict and natural disasters in which nonimmune populations move into malaria endemic areas or those that are facing explosive epidemics or exaggerated seasonal increase in transmission.

Resurgence: this follows where control measures have failed or withdrawn in a previously endemic area. Substantial increases of cases will be observed until the natural state of stability is achieved.

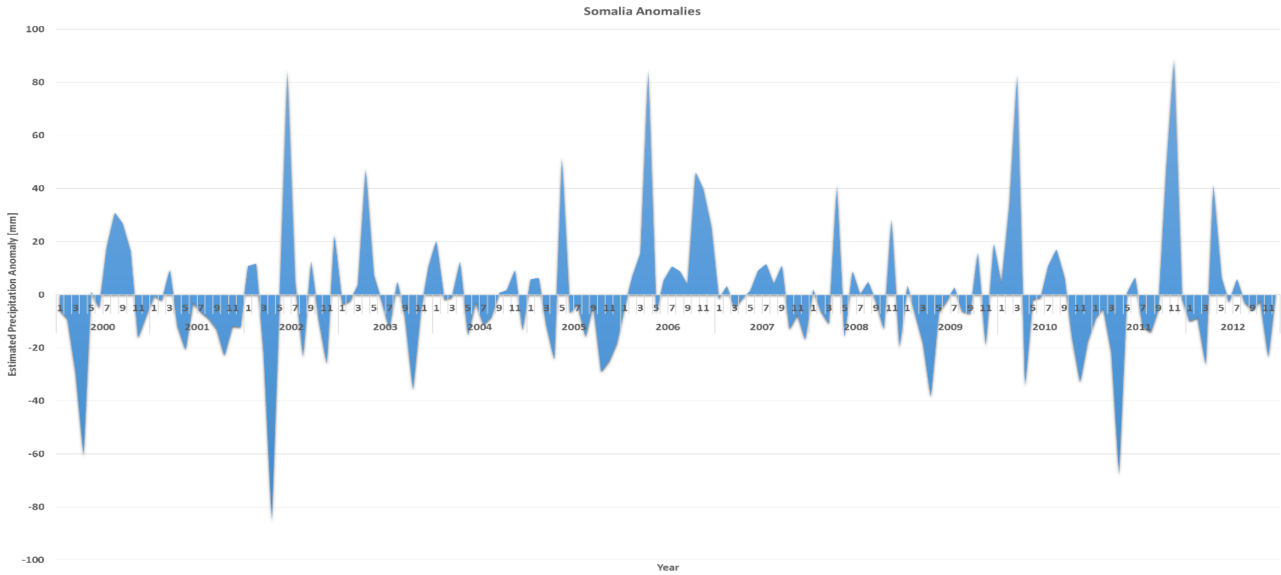
7. FACTORS THAT DETERMINE VULNERABILITY TO EPIDEMICS

a) Increase of vectorial capacity, e.g. increased vector density importation of a more efficient vector.
b) Deterioration of vector control operations e.g. poor environmental management, interrupted scale up of bed nets and IRS.
c) Immigration of non-immunes into an endemic or of infective persons into a receptive non-endemic area.
d) Resistance to antimalarial drugs and/or insecticides.
e) Natural increase mainly through above normal rainfall

8. DEFINING MALARIA EPIDEMIC PRONE AREAS

Malaria epidemics in Somalia are closely associated with periods of above normal rains followed by prolonged droughts. In Somalia, rainfall has a high inter and intra-annual seasonality associated with frequent anomalies (Figure 2). Another major risk factor is the population displacement due to the on-going conflict.

Figure 2: The monthly RFE anomaly computed as the difference between the mean monthly and short-term average RFE precipitation (mm) in Somalia from January 2000 to December 2012. Positive and negative anomaly values indicate above normal and below normal rainfall respectively.



A detailed analysis of the identification of epidemic prone areas and level of vulnerability in Somalia was undertaken in 2014 [Noor et al 2014]. A combination of data on monthly malaria cases, changes in rainfall patterns and maps of malaria transmission and climatic and ecological stratification was used to define areas at highest risk of epidemics. For the analysis of risk of epidemics, an understanding of the maximum likely transmission is required. Figure 3 shows a map of malaria risk in Somalia showing the endemicity levels before the scale up of interventions.

Figure 3 The distribution population adjusted *Plasmodium falciparum* parasite rate *Pf*PR_{2-10} (PAPfPR_{2-10}). This map shows an average pre-intervention malaria risk (parasite prevalence standardized to the age group 2-10 years) for Somalia. This map, and not the post intervention risk map, should be used for defining areas of potential epidemic risk and also for targeting vector control interventions.

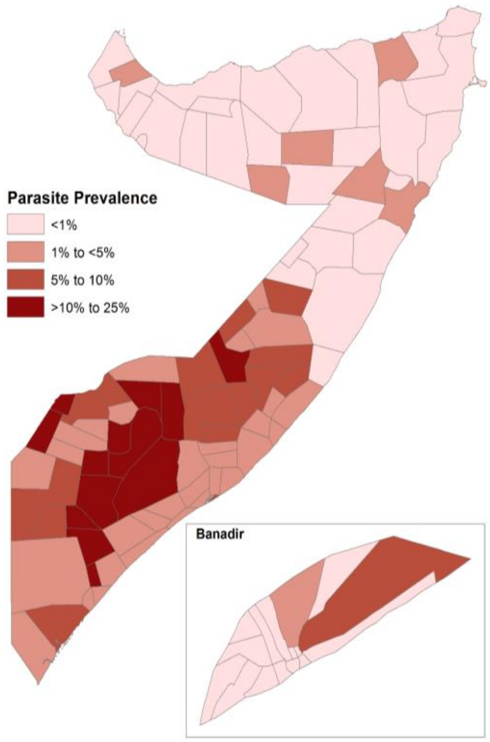


Figure 4 shows a map of villages by level of epidemic risk demonstrating the inverse relationship between malaria epidemicity and endemicity. Figure 5 is a map of districts by epidemic risks drawn from the proportion of villages by different levels of epidemic risks.

Villages were defined on the basis of transmission ≤10% *Pf*PR_{2-10} and the number of 3 blocks of months with 40% or more rainfall compared to average expected rainfall [Noor et al 2014]. Most villages had a set of such blocks of three months and these were ranked into quintiles of epidemic risk as shown on the map. This map shows that most districts in northern Somalia and a few in the south have moderate to high risk of epidemics. The focus of vector control interventions, in a situation of limited resources, should be on those in the high to highest risk of epidemics. These districts in high to highest epidemic risk areas cover 48% of the estimated population of Somalia in 2014.

Figure 4 The level of epidemic risk by settlements in Somalia defined using a combination of eco-climate zone, transmission intensity and rainfall anomaly [Noor et al 2014]. Most parts of Somalia are at risk of epidemics but the highest risk villages are located in northern parts Somaliland and Puntland. Villages in Central and South are also at high risk mainly around the Juba and Shabelle rivers.

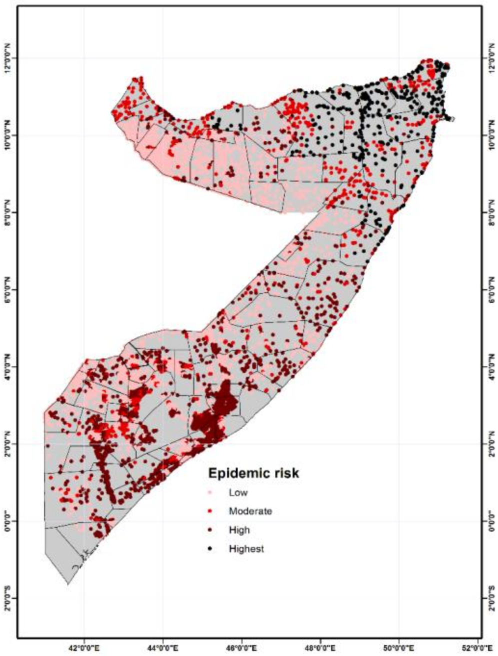
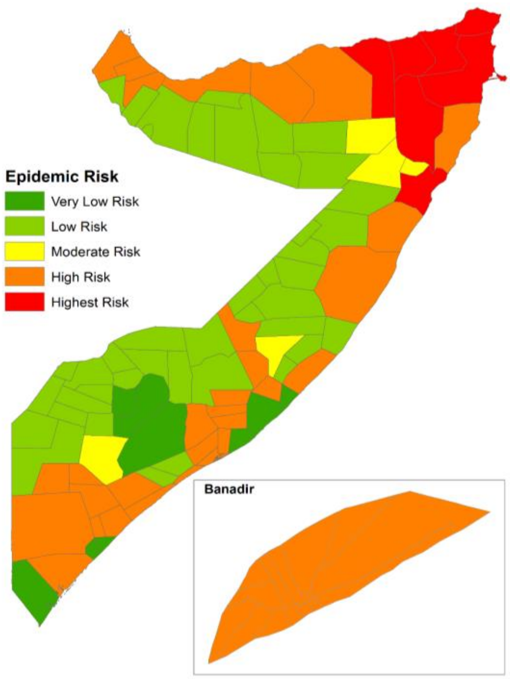


Figure 5 The level of epidemic risk by districts in Somalia defined from the proportion of villages in each epidemic risk class. The northern districts of Somaliland and Puntland some of eastern parts of Central and South are of highest epidemic risks. These are districts with high frequency of rainfall anomalies and where malaria transmission ins unstable and hypoendemic.



9. EPIDEMIC MONITORING AND SURVEILLANCE

9.1 Forecasting and Early Warning System

An early warning system for malaria epidemics relies on a real-time systems that reports on indicators such as malaria cases, prevalence, rainfall and temperature changes. It also requires a mechanism to interpret these indicators to make a decision on the probability of an epidemic.

9.1.2 Vulnerability risk indicators

Regular monitoring of the following risk indicators are required:

- Neglect/breakdown of control activities
- Levels of insecticide and drug resistance
- Prolonged drought that is likely to reduce transmission and consequent natural immunity
- Malnutrition rates – increased malnutrition makes individuals susceptible to more adverse consequences of an epidemic
- Migration of non-immune populations to high malaria endemic areas or migration of infected populations to susceptible areas for example through resettlement programmes, migration of labour forces or displaced population due to war or civil unrest
- Large infrastructure developments such as irrigation, dams, roads etc which may increase risk of transmission

Such information can be obtained from routine M&E systems and in collaboration of various sectors in the country.

9.1.3 Meteorological Indicators

The main driver of malaria epidemics in Somalia are changes in climactic indicators, especially rainfall and its association with changes in temperature and humidity. Direct measurements of these indicators can be obtained from meteorological departments. Where such weather data are not available, online resources can be used to produce satellite derived estimates of climatic indices.

Amount and distribution of rainfall (through space and time), mean minimum and mean maximum air temperature, and relative humidity will be monitored from time to time. Special attention should be paid to:

- Development of collection of stagnant water after rains
- Drying riverbeds which transform into stagnant water ponds
- Increasing rainfall coupled with increasing temperature that provide ideal ambient conditions for breeding
- Increasing humidity in favorable temperature conditions that increase longevity of the vector

It is advisable that rainfall, temperature (minimum, maximum and mean) and humidity are interpreted together and not separately. However, in most of Somalia where temperatures are generally favourable for transmission, rainfall is most important indicator for transmission and should be closely monitored. In cooler highland areas, temperature is a more suitable indicator. A continuously updated database of climatic indicators should be established for accurate early detection of epidemics. Graphs of weather anomalies (deviation from the mean) can be calculated to provide a signal for potential epidemics. Where possible such as system should be implemented in each region.

9.1.4 Entomological Indicators

Different entomological information will be gathered when and where possible and appropriate. Routine regular monitoring of entomological data in all epidemic-prone areas may be costly, but investigations such as monitoring the larval densities in selected areas (when there are indications for the likelihood of mosquito breeding from meteorological data) can be undertaken with minimum cost and staff. To this end, all field staff may be given practical training in simple mosquito larval collection and preservation techniques. Identification of anophelines from other larvae is simple and can be performed by all community health workers and other health staff at the periphery with minimum training. In the absence of species identification, action should be taken in all breeding sites where anopheline larvae have been collected. Specialized entomological staff as necessary may gather other entomological data such as resting and biting densities of adult anopheles. Usually, a high density of *An. gambiae s.l.* larvae and adults in an area is a very good indication that there is a likelihood of a malaria epidemic.

9.2 EPIDEMIC PREPAREDNESS

Although epidemics occur occasionally, preparedness for epidemics is a continuous process. Ideally, there must be contingency funding set aside for epidemic response in addition to usual funding required for control. Funding and resources should be available at regional levels determined based on careful determination of regional need. . resources and the proportion of these contingency supplies to be kept at each level has to be determined and transported to the specific levels well in advance. Overall, the following resources should be available for epidemic preparedness.

1. Trained human resource
2. Drugs for uncomplicated & complicated malaria cases based on national treatment guidelines
3. Supportive drugs based on National treatment guidelines.
4. Rapid Diagnostic Tests (RDTs)
5. Microscope
6. Microscopy Slides + slide boxes
7. Lancets
8. Giemsa stock solution
9. Buffer tablets (Ph7.2)
10. Immersion oil
11. Cotton wool
12. alcohols swabs
13. Alcohol, (Methanol)
14. Insecticide for spraying (type to be decided by the resistance mitigation plan in place)
15. LLINs
16. Transportation and logistics

9.3 EPIDEMIC PREVENTION

To prevent malaria epidemic the first step is to identify areas and population at risk. For Somalia these are now defined (see Figure 4 and 5). Appropriately timed and targeted indoor residual insecticide spraying (IRS) is the most effective preventive measure in epidemic prone areas. In some cases, larval control operations can be used to supplement IRS efforts.

In Somalia, seasonal epidemics can occur across all regions, and in areas where there is substantial intrinsic transmission, mass distribution of ITNs in advance can be considered as preventive measure for malaria epidemics. ITNs can also be used in areas where refugees and IDPs are being resettled, development areas with labor forces, and areas under complex emergency situations.

9.4 EARLY DETECTION SYSTEM

Malaria early warning systems (MEWS) are designed with the aim of providing information on the probable timing, location, magnitude and severity of an epidemic and a signal of its actual occurrence [Najera 1998; RBM 2001]. The three main components of a MEWS are: measures of the risk of malaria epidemics; the level of vulnerability to the epidemics; and early detection system (EDS) [WHO 2005]. These require reliable information on changes in climatic and environmental drivers of malaria transmission, spatial distribution of intrinsic malaria and other risk factors and an effectively functioning EDS with clearly defined thresholds for epidemic alert and response [Najera et al 1998; Connor et al 1999; Cox et al 1999; Worrall et al 2000; RBM 2001; WHO 2005; Guintran et al 2006].

A well-functioning epidemic early warning system is one that detect, verify and notify the occurrence of epidemic within two weeks of the onset. The main source of epidemic alert data are confirmed malaria cases from the surveillance system and case fatality rates. These required a surveillance system and data with the following qualities:

- Accurate, complete and representative
- Timely (weekly reporting is appropriate)
- Rapid analysis and feedback

The backbone of the an EDS is the data collection at the health facilities aggregated and reported weekly. Data collected by community health workers can sometimes serve as a useful signal for epidemics. At the health facility, data should be interpreted weekly. Health workers at the periphery must therefore the necessary training to do this. Where a health facility does not have confirmatory diagnosis, clinically diagnosed cases can be used. However, one should note that current WHO recommendation requires that all cases are diagnosed with RDTs or microscopy before treatment.

Typically a malaria epidemic of malaria is defined as a situation when the number of malaria cases are in excess of the normal number at a specific period of time and place. The normal expected cases at a given time point and location are defined from weekly data across five years for the same location and period above normal can be detected through graphical plotting of the data.

Once a malaria epidemic is detected at a health facility, this must be reported immediately to higher service levels and preferably directly to the district health office and the national malaria programme. At the district level, data from health facilities should not be combined to allow for proper identification of health facilities that have detected an epidemic. The following information should be provided from each health facility the total numbers of:

1. Out-patients
2. Suspected malaria
3. RDT/microscopically examined cases
4. RDT/microscopy positive malaria cases
5. Admissions
6. Malaria in-patients in hospitals and health centers, and
7. Malaria-specific deaths among in-patients

9.4.1 Identifying epidemics using surveillance data

The following steps are required to manipulate data to identify epidemics using weekly surveillance data.

Step 1. Develop an epidemic monitoring table (Table 2) from the weekly malaria data from the surveillance system for the past five years.

Step 2. Compute median, the 3rd quartile or the 75th percentile of the number of cases by week from the weekly data of the past five years

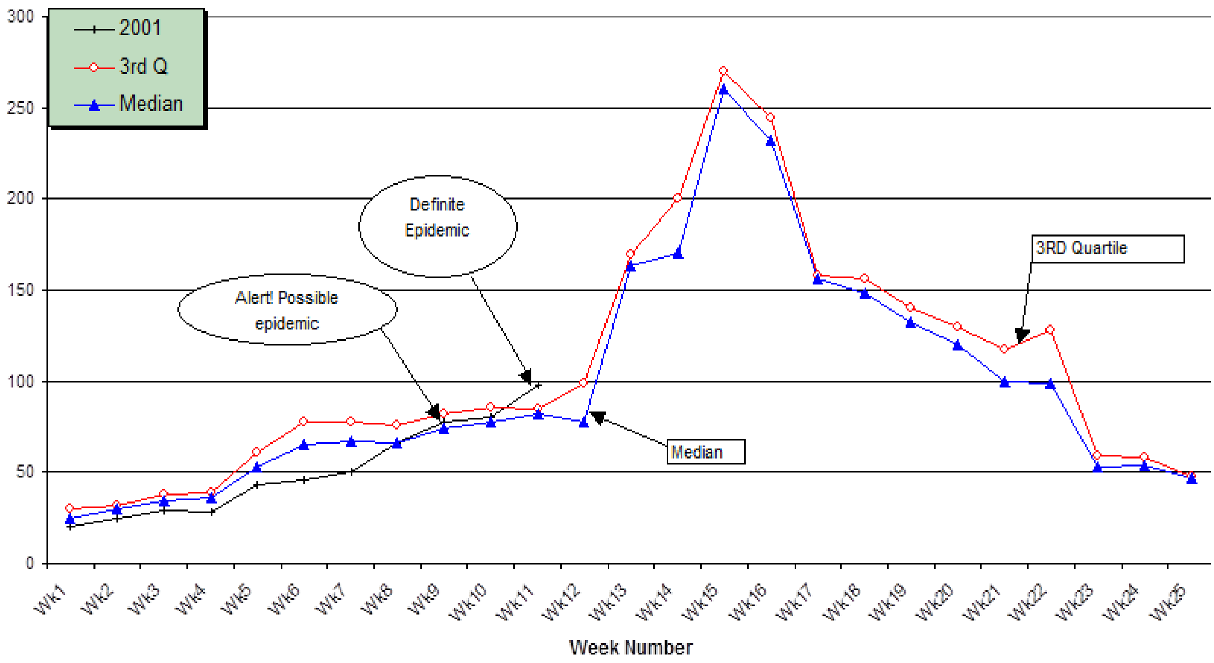
Step 3. Plot the median, the 3rd quartile and the reported weekly number of cases on the same graph (Figure 6)

Step 4. Use this graph to identify epidemics. Where the weekly cases exceed the median, this is an alert for an epidemic. When the weekly cases match or exceed the 3rd quartile then suggests an overt epidemic. The following table and graph are presented to provide a better understanding on the use of the weekly data for monitoring malaria epidemics.

Table 2. Weekly Malaria Cases Compilation Table in Health Facility "X" 1996-2001 (Adopted from Namibia EPR, 2005)

Year	Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	Wk8	Wk9	Wk10	Wk11	Wk12	Wk13	Wk14	Wk15	Wk16	Wk17	Wk18	Wk19	Wk20	Wk21	Wk22	Wk23	Wk24	Wk25
1996	20	28	30	33	45	52	56	56	66	70	88	120	157	230	250	220	160	140	124	110	83	70	65	50	49
1997	25	30	34	36	53	65	67	66	74	78	85	99	163	200	260	232	158	148	132	120	100	99	59	54	48
1998	30	32	38	39	61	78	78	76	82	86	82	78	169	170	270	244	156	156	140	130	117	128	53	58	47
1999	18	23	22	28	33	34	41	48	49	55	62	67	85	96	103	95	78	74	63	56	51	43	42	39	35
2000	40	36	46	45	77	104	100	96	98	102	76	36	181	110	290	268	152	172	156	150	151	186	41	66	45
2001	20	25	29	28	43	46	50	66	78	80	98														
3rd Q	30	32	38	39	61	78	78	76	82	86	85	99	169	200	270	244	158	156	140	130	117	128	59	58	48
Median	25	30	34	36	53	65	67	66	74	78	82	78	163	170	260	232	156	148	132	120	100	99	53	54	47

Figure 6. Weekly Malaria Cases Compilation chart in Health Facility "X" 1996-2001 (Adopted from Namibia EPR, 2005)



Step 5. Once an epidemic has been identified from the weekly surveillance data the next step is to undertake a breakdown of cases by village. This will help identify the affected villages and guide implementation of response. The following form can be used for tallying of cases by village. This exercise should be implemented until epidemic is considered controlled.

Tally Sheet for Breakdown of Malaria Data by Village

Region: Lower Shabelle District: Afgooye

Name of Health Facility: Garasweyn MCH Month: May Year: 2002

Week No. 2 Date: From 13.05.02 to 19.05.02

Name of Village	Tally	No. of cases
Village X	~~////~~ ~~////~~ ~~////~~ ~~////~~ ~~////~~ ///	28
Village Y	~~////~~ ~~////~~ ~~////~~ ////	19
Village Z	~~////~~~~////~~//	12

9.5 EPIDEMIC RESPONSE

9.5.1 Rapid Assessment

Following an epidemic signal, a rapid assessment process should be initiated for verification purposes while at the same a response initiative is developed. During the rapid assessment it is necessary to do as follows:

a) Confirm that an epidemic exists or could happen soon
b) Investigate and establish possible cause of epidemic
c) Define geographic extent of the epidemic
d) Estimate the potential impact in terms of cases expected and fatality rates
e) Assess local capacity to respond and control the epidemic.

Care must be taken that the assessment process does not take too long and that health facilities are well stocked to respond to case load at the time of the assessment.

The rapid assessment team should consist of health workers, laboratory experts, representative from the national programme, epidemiologists and where possible entomologists. Where diagnostic capacity does not exist in the field, the team should be equipped with the necessary diagnostic equipment. Some simple entomological surveys may be undertaken in order to confirm the presence of efficient vectors.

Rapid assessment should include visits to health facilities, markets, villages and other areas of population concentration. Rapid increase in school absenteeism could be a signal of increased illness among pupils. Schools should therefore also be visited. Identification of new graves in a village and consultation with village chiefs, elders and other well informed individuals should be part of the rapid assessment. Where there are conflicting responses an rapid survey may be necessary.

9.5.2 Epidemic control

If the presence of an epidemic is confirmed (malaia case definition) through the rapid assessment, immediate response plans should be put in place. This plan should be one that is operationally efficient so that epidemic areas can be reached quickly at minimum cost and logistical outlay.

The control measures that are implemented should depend on the epidemiological characteristics of the area, the nature and magnitude of the epidemic and the available resources. The main measures after confirmation of the outbrak include

- Mass treatment of all febrile cases
- Focal spraying of residual insecticides
- Rapid distribution of insecticide treated nets **<u>if the population is manageable in size</u>** and LLINs critera is applicable so as to bring impact on reduction of the incidence of transmission, especially if the epidemic is in the early stages.
- Larval control activities (eg.; Mechanical) where breeding sites are few, focal and findable
- Appropriate management of all malaria cases (uncomplicated & severe)

9.6 POST-EPIDEMIC EVALUATION

Post-epidemic evaluation should be used to assess the challenges across the whole process of forecasting, prevention, detection, preparedness and control. This information will provide lessons that are useful for the strengthening the whole system.

A series of indicators should be developed for each stage of the process on which the evaluation is based. Weaknesses and inefficiencies during this process should be rectified in preparation for the next potential epidemic.
It is critical to identify who and which level of health administration is responsible for each stage of the process. Typically, these include community, health facility, district and regional health offices and the central ministry of health. Their specific responsibilities depend on the organization of the health system structures in each country. Generally they are:

9.6.1 Community level

The active involvement of the community in all control activities will be very crucial. Appropriate and intensive health education should be given so that communities will participate with a sense of ownership in the program. The community's role is:

- Selection and supporting community health workers who will provide early diagnosis and treatment of patients.
- Undertaking environmental control (source reduction activities).
- Participation in other vector control activities such as residual house spraying, especially through cooperation during spray operations and by protecting sprayed surfaces from being re-plastered.
- Participation in prevention and personal protection measures including increased use of insecticide-impregnated bed-nets, selection of settlement sites, etc.
- Early detection of epidemics and reporting malaria situations from time to time to health service units. The community and village health workers have also a very important role of detecting epidemics early and reporting on time to health institutions and all other concerned parties. Wherever there are village health workers, the trend in the number of febrile patients treated as malaria cases should be monitored and abnormal situations detected as early as possible, in order to take timely actions.

9.6.2 Health facility level

These have very important role especially in disease management, epidemic detection and control, as well as health education to clinic attendants. In particular, the health posts/stations have high coverage in rural areas than the other health service units; hence their involvement in epidemic detection using monitoring chart and control is essential. The active participation and ownership of these health service units in the malaria control program in their catchment areas and their collaboration is important.

The proper management of severe and complicated malaria cases in hospitals will help to reduce the incidence of mortality. Hospitals have also important roles in reporting the trend in malaria-specific mortality and morbidity (especially admissions).

9.6.3 District health offices

District health departments have a very important role of collection and analysis of data from community health workers, health stations, health centers, hospitals and other private health service units. They are responsible for the overall co-ordination of epidemic prevention and control activities in their respective districts. They will identify and list villages and populations prone to repeated attacks of malaria epidemic and further stratify malarious villages in different groups based on similarities and differences in epidemic risks. Sketch maps of villages will also be made at this level. The wereda health office also will have a separate files for each health facility data and monitoring chart

9.6.4 Regional health offices

Due to the unstable nature of malaria transmission in, prevention and interruption of transmission through vector control activities are considered as extremely important control measures. Unless such control measures are carried out effectively by trained and specialized personnel, they may not have the desired impact on the transmission of the disease. Measures such as residual house spraying and epidemic control operations require a relatively high standard efficiency and organization of work. Therefore, malaria control offices especially at the peripheral levels (currently sector offices) have to be strengthened by the regional malaria control departments with respect to manpower, material and financial resources.

The main responsibilities of the regional malaria and other vector-borne diseases control departments include the following:

- Coordinating all malaria control activities in the region.
- Planning various malaria control measures (on the basis of the national guidelines) specific to the different eco-epidemiological types in the region.
- Training of junior technical personnel (diagnostics, and vector biology and control technicians) and community health workers.
- Organizing on-the-job training courses for health staff at all levels of the health service system who are involved in the malaria control program.
- Production of materials for health education of the public relevant to malaria control.
- Monitoring and evaluation of disease management (chemotherapy), vector biology and control and other components of the malaria control program according to the procedures set by the Ministry of Health. Employment of corrective measures as found necessary and/or notification of problems to the center.
- Devising procedures on information flow between all health institutions and malaria control units in the region; analysis of data, identification of problems and provision of timely feedback, as well as forwarding regular and emergency reports to the Ministry of Health.
- Mobilization of manpower and logistics in the region in the case of the occurrence of epidemics.
- Coordination of activities and provision of technical assistance in detection, prevention and control of malaria epidemics.
- Follow-up of meteorological information for representative stations and use of such information for epidemic forecasting.
- Follow up of administrative and financial matters for procurement of supplies, and operational activities at all levels.

9.6.5 Central Ministry of Health

The responsibilities of the Malaria and other Vector-borne Diseases Control Unit include the following:

- Development of national guidelines and plans for malaria control in general and epidemic control in particular.
- Overall regional capacity building in manpower, logistics and finance, so that the control of malaria can be effectively implemented at all levels.
- Monitoring, evaluation and follow up of the implementation of the national malaria control strategies and guidelines.
- Dissemination of new knowledge derived from operational research and routine monitoring and evaluation of control activities by organizing and conducting of training of trainers and developing a system for training and supervision at regional levels.
- Organization of financial, material and technical assistance to the regions.
- Provision of technical and material assistance for epidemic control, as deemed necessary, to regions.
- Dissemination of meteorological information to regional levels and assistance in epidemic forecasting.
- Promotion of inter-sectoral collaboration and the involvement of governmental, non-governmental and international organizations in the control of malaria.
- Training of trainers regarding epidemic prevention and control.
- Procurement of supplies including insecticides and drugs.

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