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Outbreaks and Epidemics of Malaria in SADC – Cycles of Frustration in Preventive Action

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INTRODUCTION – THE ONGOING RISK OF MALARIA IN THE SADC REGION

The World Malaria Report (WHO, 2017a) revealed that while the rate of new cases of malaria had declined overall since 2014, the trend of reversals of malaria outbreaks and epidemics had been levelling off. In some world regions it had reversed. In 2017 around 216 million people contracted malaria (in 91 countries) compared with the 211 million in 2016. The estimated global number of deaths from malaria rose from 445,000 in 2016 to 446,000 in 2017. It was overwhelmingly Africa that was affected. Roughly 90 per cent of all malaria cases and deaths worldwide were in Africa (WHO, 2016). As WHO (2017a) pointed out, 15 countries (only one of them, India, not in sub-Saharan Africa)

continued to bear 80 per cent globally of the malaria death burden.

These trends contrast with the objectives of the control and eradication, or elimination, of malaria. The words elimination, eradication, and control are often used loosely, which results in misunderstanding (Maharaj et al., 2016). Previously, eradication was used to describe what we now call elimination (Hemingway et al., 2016). Eradication is used with reference to the 'permanent reduction to zero of the worldwide incidence of infection caused by a specific agent as a result of deliberate efforts; interventions measures are no longer needed' (Dowdle, 1999)[i]. As the bottom line, eradication means that follow-up measures are no longer required. For malaria, however, follow-up measures remain essential. WHO (2004) therefore defines malaria elimination with reference to 'interrupting local mosquito-borne malaria transmission in a defined geographical area'; there will be zero incidence of locally contracted cases (although imported cases will still occur), and continued intervention measures remain necessary. In Africa, estimates of the population at risk of malaria epidemics[ii] range

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i Control refers to the reduction of disease incidence, prevalence, morbidity, or mortality to a locally acceptable level as a result of deliberate efforts, and continued intervention measures are required to maintain the reduction (e.g. diarrhoeal diseases). Elimination of disease denotes the reduction to zero of the incidence of a specified disease in a defined geographical area as a result of deliberate efforts, and continued intervention measures are required (e.g. neonatal tetanus). Elimination of infections, in comparison, refers to reduction to zero of the incidence of infection caused by a specific agent in a defined geographical area as a result of deliberate efforts, and ongoing measures to prevent re-establishment of transmission are required (e.g. measles and poliomyelitis). Eradication, in contrast, has a bearing on the permanent reduction to zero of the worldwide incidence of infection caused by a specific agent as a result of deliberate efforts, and intervention measures are no longer needed (e.g. smallpox) (Dowdle, 1999).

ii Malaria epidemic is defined as a sharp increase in the incidence among populations in which the disease is rare or a seasonal increase in areas of low to moderate transmission beyond the normal pattern. However, the definition of 'normal' occurrence can only be defined for a particular population in a specific area and time. Therefore, malaria epidemics can generally be considered as a disturbance of a previously existing epidemiological equilibrium. The term 'true epidemics' refers to infrequent/cyclical outbreaks in relatively non-immune populations related to climatic anomalies. There can also be strongly seasonal outbreaks. This phrase, in turn, refers to variable

from 52 million to 144 million (Delacollette, 2004). WHO estimates that 23 countries on the continent are known to be epidemic prone. This includes all the Southern African Development Community (SADC) countries, except malaria-free Lesotho and the islands of Mauritius and Seychelles. There have been marked improvements in the rate of malaria outbreaks and deaths since 2000, yet a range of factors continue to trigger new occurrences. Such trigger factors relate to environment and climate, politics, governance, and demographics; and healthcare-health system factors both prompt outbreaks and affect the processes of countering, controlling, and eradicating these occurrences. Malaria epidemics usually affect populations that live in the highlands or in arid and semi-arid areas, where rainfall and/or higher temperatures play a big role in causing an epidemic, usually after an extended period of drought, thereby increasing general population vulnerability. Devastating epidemics[iii] have been recorded due to large-scale movements of non-immune populations to endemic regions as a result of the political displacement that accompanies civil wars or local conflicts. The regions or districts at risk are usually not sufficiently prepared to cope with the sudden increase of malaria transmission in which 30–50 per cent of at-risk people may develop the disease, with a mortality rate of 1–5 per cent, depending on the rapidity and the effectiveness of the response (WHO, 2009; 2012).

The 2017 WHO World Malaria Report highlighted that there has been recent stagnation in the progress towards reducing the global malaria burden: there was an unexpected upsurge in the number of cases and deaths, after significant gains in the preceding period. A

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but relatively predictable transmission influenced by variation in climate, e.g. southern region of Africa and highland fringe areas. Neglected control or the breakdown of control refers to the re-emergence of malaria in receptive areas, e.g. areas affected by civil unrest, internally displaced populations, refugees, population migration, complacence, insecticide/drug resistance, poor coverage/inappropriate intervention etc. A pandemic is an outbreak of a disease that occurs over a wide geographic area and affects an exceptionally high proportion of the population.

iii An epidemic is a widespread occurrence of an infectious disease in a community at a particular time; an outbreak carries the same definition as epidemic but is often used for a more limited geographic area.

situational analysis suggested that the resurgent outbreaks were caused by (Elimination 8, 2017: 6):

- weakening of the malaria control programme – caused by funding shortages, complacency, poor strategy execution and cessation of control activities;
- increases in the intrinsic potential for malaria transmission – due to movement of humans or mosquitoes, development and land-use changes, and changes in climate and weather patterns; and
- technical problems, including drug and insecticide resistance – as manifested in vector and drug resistance.

Funding problems contributed adversely to the ability to get effective coverage with vector control interventions, such as indoor residual spraying (IRS), long-lasting insecticide-treated bed nets (LLINs), and larval source management (LSM). There were also delays in procurement of malaria commodities such as insecticides and rapid diagnostic test kits (RDTs), and artemisinin-based combination therapy (ACT) was constrained.

In SADC's 16 member states[iv], as the SADC Malaria Report (2017) indicated, the burden of malaria was approximately 47 million cases in 2016, a rate therefore of 17 per cent in the SADC population of 277 million. Since 2014, several SADC countries have been affected by outbreaks. In 2016–2017 most SADC member states experienced malaria outbreaks. A comparison of the 2013 and 2016 levels of incidence and mortality (Table 1) reveals the variations among low- and high-transmission countries. The year 2017 proved to be the worst of these recent years in terms of malaria outbreaks in the SADC region (SADC, 2017). For example, Botswana had 9,478 cases and 76 deaths by March–April 2017, compared to 6,385 cases and 58 deaths for the same period in 2016. South Africa in comparison had 4,092 cases and 33 deaths in 2017, against the 1,543 cases and 18 deaths of 2016 (SADC, 2017). The SADC countries experienced significant increases in the numbers of malaria cases and deaths in the 2016–2017 season

iv Angola, Botswana, Comoros, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, United Republic of Tanzania, Zambia, and Zimbabwe.

over those in the 2015–2016 season, when drought conditions had prevailed. In fact, there were peaks in March–April 2015, 2016, and 2017 in all high-transmission countries.

Table 1: Trends in malaria incidence and mortality in SADC, 2013–2016

Transmission rate – high/moderate or low	Trend	Malaria incidence	Malaria mortality
In countries with moderate to high transmission rates	**Up**	Malawi, Mozambique, DRC, Angola, Madagascar	Angola, DRC
	Stable	Zimbabwe, Zambia	Madagascar, Malawi, Mozambique
	Down	United Republic of Tanzania (Mainland)	United Republic of Tanzania (Mainland), Zambia
In countries with low transmission rates	**Up**	Namibia, Eswatini	Namibia
	Stable	Botswana	United Republic of Tanzania (Zanzibar)
	Down	United Republic of Tanzania (Zanzibar), South Africa	Botswana, South Africa, Eswatini

Source: Compiled from various data sets in SADC Malaria Report, 2017: 1–2
Note: In 2016 there were a total of 60,414 malaria-related deaths in SADC countries, which was 4 per cent higher than in 2013. Angola (27 per cent of total) and DRC (56 per cent of total) were the two SADC countries with the highest mortality rates. On incidence, DRC, Malawi, Mozambique, and Zambia are the four countries with the highest incidence by far.

The trends in Table 1 demonstrate the heterogeneous nature of malaria transmission in SADC (WHO, 2017b; SADC, 2007a; SADC, 2017), making it difficult to mobilise a whole-region response. There is a risk in countries that no longer report local transmission (Lesotho, Mauritius, and Seychelles) that if this upsurge continues, they will be unprepared. In the high-transmission national areas (Angola,

the Democratic Republic of Congo (DRC), Madagascar, Malawi, Mozambique, United Republic of Tanzania (Mainland), Zambia, and Zimbabwe) the incidence in 2016 ranged from 11 to 381 malaria cases per 1,000 population, with corresponding mortality rates of 1.5–39 malaria deaths per 100,000 population. In the medium- and low-transmission areas (Botswana, Namibia, South Africa, and Eswatini), the incidence ranged from 0.3 to 9.7 cases per 1,000 population, with mortality rates of 0.1–2.4 per 100,000 population. In Mauritius, where there is no local malaria transmission, there were 25 malaria cases and no malaria-related deaths. Mozambique had increasing numbers of cases over the period, with a lower peak in 2015 than in 2017, while in Malawi and Zambia, the peak in 2016 was higher than those in 2015 and 2017. Thus, Angola, Malawi, and Zambia had lower peaks in 2017 than Mozambique. Angola recorded the largest number of cases to date (4.2 million) in 2016, with a peak in April of that year (583,000 cases), followed by a steady downward trend from May to September 2016.

Against this background of malaria incidence and mortality, the rest of this chapter reviews the overall levels of progress in the control and elimination of malaria in SADC. It draws on the observations by and participatory experiences of the author, as well as on research and reports generated by the WHO, structures of the SADC regions, and in particular on data and strategic programming generated by the SADC platform of Elimination 8 (E8). It also recognises and uses other scholarly contributions in the field. The chapter explores in depth the complexities, including constraints thereon, of the multiple interventions that have helped SADC progress in countering malaria in the region. In the final section it reviews the lessons learned from past actions and offers proposals for further strategic action.

PROGRESS IN FIGHTING THE ENCUMBRANCE OF MALARIA

Despite the high ongoing SADC burden of malaria, since 2000 the region has made remarkable progress in the fight to control malaria. This emanated from the SADC countries' scaling-up of interventions, which included surveillance, diagnosis and treatment, vector control,

health promotion, and communication for behaviour change. This whole-system approach, rather than just a curative approach, has yielded positive results for the region.

These efforts have resulted in increased access to malaria prevention and treatment, associated with a 30 per cent increase in domestic financing for malaria between 2014 and 2015, as well as strong partnerships with other stakeholders. The 2017 SADC Malaria Report showed that in 2016 the case confirmation rate[v] was 85 per cent in 10 of the 11 countries in which this is measured, and in seven countries 95 per cent of uncomplicated cases received ACT, all contributing to constraining rates of incidence and mortality. All countries achieved a rate of reporting of cases by health facilities of 80 per cent (SADC, 2017: 9). However, the report highlighted that coverage with vector control did not meet the target of 80 per cent of the population – this was only achieved by six of the nine countries that reported IRS coverage and only three of the nine countries and areas that distribute LLINs (WHO, 2017b). Cross-border and regional initiatives have been established in the SADC region to address malaria transmission among mobile and migrant populations (Elimination 8, 2015; 2016). These include the:

- E8 SADC platform,[vi] an initiative for elimination of malaria in four countries (Botswana, Namibia, South Africa, and Eswatini) and pre-elimination in an additional four countries (Angola, Mozambique, Zambia, and Zimbabwe).
- Mozambique–South Africa–Eswatini (MOSASWA) cross-border initiative for elimination in South Africa and Eswatini and pre-elimination in Mozambique (for details, see section on cross-border transmission and control).

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v Confirmation of suspected malaria cases that had a parasitological test; see SADC, 2017: 4.

vi Key SADC frameworks form the foundation of the E8 Strategic Plan. They include the SADC Protocol for Health, the SADC Malaria Strategic Framework 2007–2015, the SADC Malaria Elimination Framework, the SADC Protocol on Health Implementation Plan, and the SADC Malaria Advocacy and Communication Framework. The E8 vision is to have a malaria-free Southern Africa, and its goal is to enable and accelerate zero local transmission in the four frontline countries by 2020 through the provision of a platform for collaboration and joint strategic programming.

These initiatives are complementary. It is anticipated that as those E8 countries with low transmission progress to eliminating malaria, the four second-line countries (Angola, Mozambique, Zambia, and Zimbabwe) as well as Madagascar, the DRC, and the United Republic of Tanzania (Mainland) will transition to elimination,[vii] which is anticipated to be achieved by 2030 (see also Delacollette & Rietveld, 2006).

To prevent outbreaks or epidemics, countries need to ensure that all communities receive health education aimed at behaviour change. This should go hand in hand with ensuring universal access to all interventions. Behaviour change should be mostly related to climatic conditions conducive to malaria transmission, to prepare the population to take precautions. Countries also need to establish strong malaria surveillance systems because countering malaria depends on the accurate and complete identification of and reaction to outbreaks.

Malaria forms part of the United Nations Sustainable Development Goals (SDGs). The SDG are supported by the WHO Global Technical Strategy for Malaria 2016–2030 (GTS), WHO's Framework for Malaria Elimination and the Roll Back Malaria Partnership's Action and Investment to defeat Malaria 2016–2030 (AIM) (Roll Back Malaria Partnership, 2015). These activities are highly dependent on the availability of funding/resources through sustained domestic financing and innovative solutions to fill in gaps in countries receiving donor funding. Significantly, slow responses to outbreaks and epidemics have often been because of inadequate government funding, which in turn was due to over-reliance on international financing (Roll Back Malaria Partnership, 2015).

RISK FACTORS IN HEALTH SYSTEMS AND IMPLEMENTATION OF MALARIA INTERVENTIONS

In order to understand the forward momentum in the control and elimination of malaria, along with the setbacks and the conditions that need to prevail in order to avert relapses (see Feachem & Sabot, 2008, for example), it is essential to assess the quality and regularity of the

vii For the comparative definitions of elimination and eradication see, for example, Cohen et al., 2010; Dowdle, 1999.

initiatives to combat malaria. While the current section provides an overview of a selection of risk factors, much of the rest of the chapter presents detailed explorations of these risks, paired with deeper assessments of the success factors.

Important risk factors that are associated with malaria outbreaks and epidemics in the SADC region include (see also Figure 1):

Insufficient tracking and data recording:
The causes of malaria epidemics are multiple and may vary from one country to the next. There is general agreement that inadequate annual forecasting of the risks for malaria epidemics and emergencies at national level remains a challenge. This is compounded by inadequate flow of communication of the information to districts to allow for timely mitigation through targeted prevention. Information sources include:

- national surveillance systems (dealt with separately below)
- meteorological offices for climate updates
- population movements and displacements from local authorities
- development ministries
- the private sector
- humanitarian agencies

Weak surveillance systems:
Observation across country borders indicates that national malaria control/elimination programmes are not carrying out weekly tracking of malaria cases, which would enable the detection of abnormal rates of transmission, which would in turn lead to appropriate response measures (Elimination 8, 2015; 2016; Elimination 8 TWG, 2018; WHO, 2004). Some countries do not have updated thresholds for weekly reporting, and those that do may find that the given thresholds are no longer appropriate for the stratification zones (Elimination 8 TWG, 2018; Teklehaimanot et al., 2004; WHO, 2004).

Weak planning and preparedness:
During the rainy season, although programmes and associated staff

may be aware that an unusually heavy rainy season is highly probable they often do not strengthen their epidemic and preparedness response at all levels, including the lowest level possible (Elimination 8, 2016; WHO, 2004; 2013; 2017b). Failure to put these systems in place may result in failure to detect and respond to outbreaks in a timely manner. Most countries have also failed to trigger an adequate response to malaria epidemics and emergencies due to lack of emergency stocks of the essential malaria commodities (insecticides, RDTs, ACTs, etc.) (Elimination 8 TWG, 2018; WHO, 2017a; 2013; 2004). This risk factor results from internal factors of planning by health system staff, and from environmental constraints of funding (see below), and 'natural' factors such as occasionally unpredictable weather change (Figure 1).

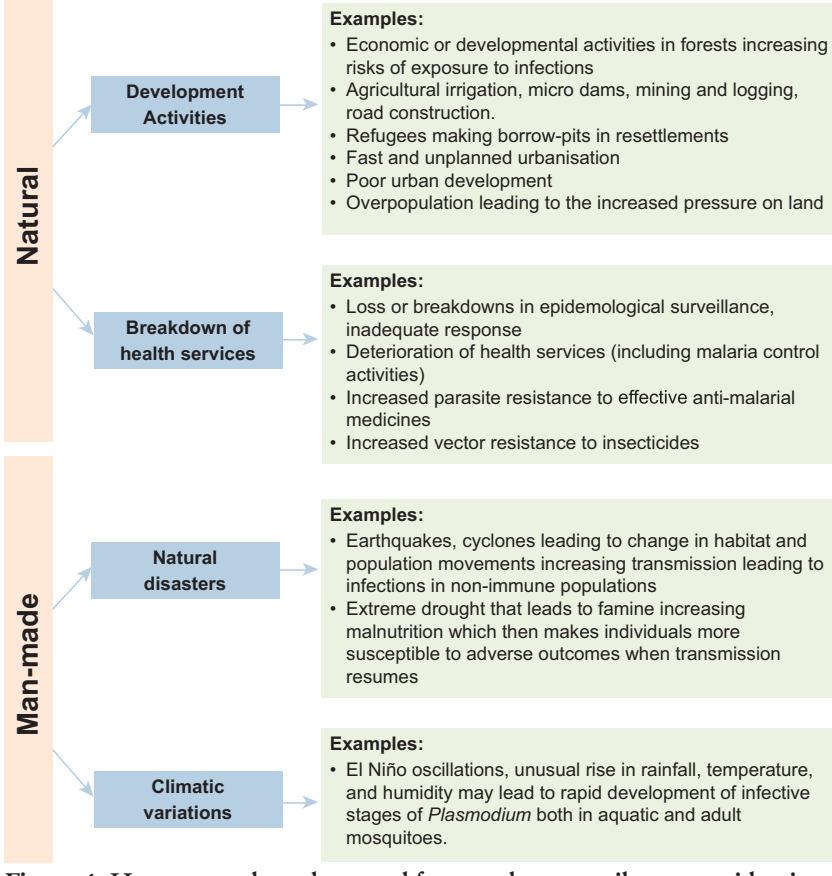

Figure 1: Human-made and natural factors that contribute to epidemics

Source: WHO, 2018a

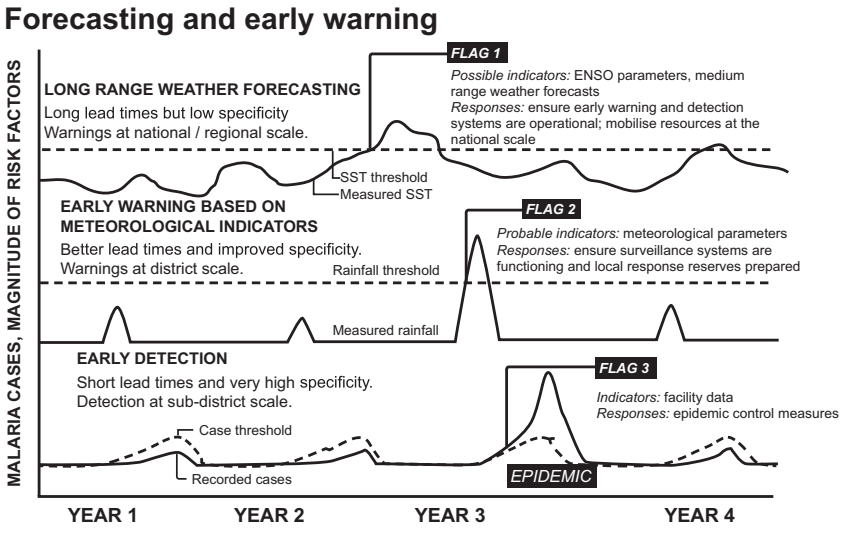

Figure 2: Survellance system for epidemics
Source: WHO, 2018a

Delayed response and disbursement:
When a malaria epidemic is verified, early management of patients that report high fever cases by health workers and clinicians is the key to reducing the case fatality rate. As part of case management in non-immune people sick with malaria, it is particularly vital to use, and quickly make available, highly efficacious and safe drugs at village level through mobile clinics. Most countries rely on external resources to fund malaria efforts, and when disbursement is delayed, there is also delayed response to outbreaks (see also the risk factor of weak planning systems). Limited human, financial, and infrastructure capacity has been noted for impeding active case investigation in countries conducting elimination of malaria. There is no tool for assessing the efficacy of and responses to case investigations (WHO, 2018a).

Health system risk factors:
The countries often lack designated malaria and integrated disease outbreak and emergency teams at district level. Country data shown in the 2017 SADC Malaria Report showed that countries were failing to meet the 85+ per cent IRS target. The low IRS coverage reported

in several countries has been attributed to factors such as delayed procurement of commodities such as insecticides, protective equipment, and spray pumps, along with insufficient recruitment of spraying teams, and inadequate capacity for supervision and microplanning of these operations. Poor or suboptimal supervision of IRS teams has affected the quality of spraying, which may be compromised further by late deployment of commodities, the delayed start of campaigns, and late payment of seasonal spray operators. Therefore, the strength of a health system outside of the malaria space also has a bearing on a country's ability to respond effectively.

Biological risk factors:
Epidemics are influenced, among other things, by emerging insecticide resistance and changing mosquito behaviour (issues that emerge in combination with favourable climatic and environmental factors). Resistance to pyrethroids, for example, is widespread in the SADC region, even though a large proportion of house structures are still sprayed with pyrethroids (Hemingway et al., 2016; Mpofu et al., 2016). In the past decade, use of pyrethroid insecticides in malaria vector control has increased dramatically through scale-up of the distribution of LLINs and IRS (see, for example, Ranson et al., 2011). In the process, major malaria vectors have developed resistance to pyrethroids, resulting in the decreased efficacy of the most commonly used insecticide class of pyrethroids. This decreased efficacy has increased mosquito survival, which signals the rising incidence of malaria morbidity and mortality. There is an urgent need for a key multisectoral approach to combat the threat of resistance, with research and development going into the creation of new and more effective pesticides.

Climate and environmental risk factors:
Unusually heavy rainfall leads to flooding, which creates favourable environmental conditions for malaria transmission (increased vector density and competence) and also leads to increased population displacement and limited delivery and access to health services. This requires countries to plan accordingly. Areas that are malaria prone

display common characteristics of being in tropical and subtropical areas, relatively close to the equator, where it is warmer, with temperate climatic factors: temperature, humidity, and rainfall; also more frequently in areas where there are lapses in economic development and public health measures (CDC, 2017). All of these factors are important for outbreak anticipation and for taking timely preventive action.

In conditions where the natural ecology supports low levels of seasonal transmission, amidst limited immunity in the population, exceptions to this pattern (rebounds) may occur where (WHO, 2018a):

- Anomalous climatic or epidemiological conditions lead to increased transmission that extends beyond the typical pattern. This may be in highlands, arid, and semi-arid areas.
- Rates of parasite infections have been reduced over time due to interventions, but receptivity remains high. This is likely in conditions where coverage has reduced, the health system has suffered breakdown, efficacy of interventions has suffered, and importation levels have gone up.
- Sudden large-scale movements of infected populations happen due to conflicts or complex emergencies. They move into non-immune populations in receptive areas, or into areas of ongoing transmission.
- Areas undergoing rapid ecological (including human) changes in immunologically-naive populations start posing conditions receptive to malaria outbreaks. Deforestation, irrigation, construction of dams and roads, flooding, mining, and earthquakes may be some of the changing conditions.

The rest of the chapter explores in depth SADC country experiences and initiatives to counter risk factors through planning, action, and reaction on the ground.

STRATIFICATION FOR TARGETED INTERVENTIONS

Stratification in the context of malaria control refers to a dynamic and ongoing process involving research, diagnosis, analysis, and interpretation of the information, which serves as a basis for

comprehensive and methodological classification of geo-ecological areas and population groups according to *malaria risk factors*, as was put forward by Castillo-Salgado (2009). In the control of malaria outbreaks, stratification is a vital analytic step to determine epidemiological differences and socio-economic aspects such as conflict, population movement, human behaviour, poverty, and access to health services (see Figure 3). A stratum that will be identified for an intervention is a population or social group located in a well-defined geographical area that shares similar principal risk factors – consequently, the measures or interventions undertaken are to modify the risk factors.

In order to provide a tailored intervention, it is vital to determine epidemiological differences (such as spatial, vector, ecology, resistance) and socio-economic factors (including conflict, population movement, human behaviour, poverty, and access to health services). The purpose of stratification is therefore to be able to employ different and appropriate interventions in diverse geographical places or populations. The choices and actions to be determined could be, for example, IRS vs LLIN or LSM[viii], or the choice to use mobile clinics in mobile populations.

The determinants for stratification and deployment of interventions against malaria are twofold, namely in epidemiology (with reference to receptivity, vulnerability, vector, and parasite species) and capacity (considering especially resources and health systems). When such interventions are undertaken one can foresee one of two scenarios: a rapid or a gradual decrease. A gradual decrease, the second scenario, entails protecting the same fraction of population in sub-regions with different baselines of receptivity to transmission. A rapid decrease, the first scenario, means achieving reductions to the same low level in all sub-regions – it requires protecting a greater fraction of the at-risk population in sub-regions that have a higher baseline.

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viii Larval source management (LSM) refers to the targeted management of mosquito breeding sites. The goal is to reduce the number of mosquito larvae and pupae. LSM can help reduce the numbers of both indoor and outdoor biting mosquitoes, and in the malaria elimination phase it can be a useful addition to programme tools to reduce the mosquito population in remaining malaria hotspots (see WHO, 2013).

Early detection remains the obvious basis on which the decisions of stratified interventions against malaria epidemics rest (see WHO, 2004). Epidemic threshold is a critical level at which the reported counts of cases or deaths, in a given space and time, are beyond what would be considered 'normal'. For operational purposes (see, for example, Teklehaimanot et al., 2004), four relatively simple statistical methods are recommended to determine thresholds.[ix]

MONITORING TRANSMISSIONS AND OUTBREAKS – SADC CONSTRUCTING SURVEILLANCE AND DATA SYSTEMS

Much of the ongoing challenge in moving from the control to elimination of malaria in Africa and SADC relates to surveillance, and specifically the recording and activation of information to counter transmission. In this respect we find that the main challenges experienced during the 2016–2017 SADC malaria season included (beside other factors, like insufficient emergency stocks and staff to give effect to operations):

- inadequate annual forecasting of the risks for malaria epidemics and emergencies at national level and communication of the information to districts to allow for timely, targeted prevention and mitigation; and
- insufficient weekly tracking of malaria cases in most programmes in the region to allow detection of abnormal rates in time for an appropriate response.

In its reflections on best practice (see also Figure 4), SADC refers to the case of Zimbabwe, noting that in 2016 Zimbabwe experienced a year free from outbreaks (ESARN, 2017; WHO, 2017b). It reflects specifically on aspects of surveillance and data systems. One of the strategic objectives of Zimbabwe's National Strategic Plan is to detect 100 per cent of epidemics within one week of onset and effectively

ix These four methods are constant case count thresholds; mean + 2SD; medium + upper 3rd quartile; and the cumulative sum (C-SUM).

to manage 100 per cent of malaria epidemics within two weeks of detection.

Although no epidemics were reported in Zimbabwe in 2016, epidemic preparedness was continued, including weekly monitoring of surveillance data. Training in integrated disease surveillance and response was given in some epidemic-prone districts, and alert and epidemic thresholds were updated based on recent data. In keeping with epidemic preparedness and response protocols, rapid response teams were given updated information, epidemic preparedness and response in provinces and districts were assessed, and partnerships and epidemic control funds were mobilised to support logistics for early outbreak response (SADC, 2017: 16). Although Zimbabwe experienced malaria epidemics in 2017, it was able to identify epidemic districts and health facilities through its weekly surveillance system and mounted a strong response with its preparedness and response plan (WHO, 2017a; ESARN, 2017). Consequently, their incidence occurrence per 100,000 population was at a low peak of 2 per cent in 2016 (compared with 9 per cent in 2015 and 7 per cent in 2017) (SADC, 2017: 14, 15).

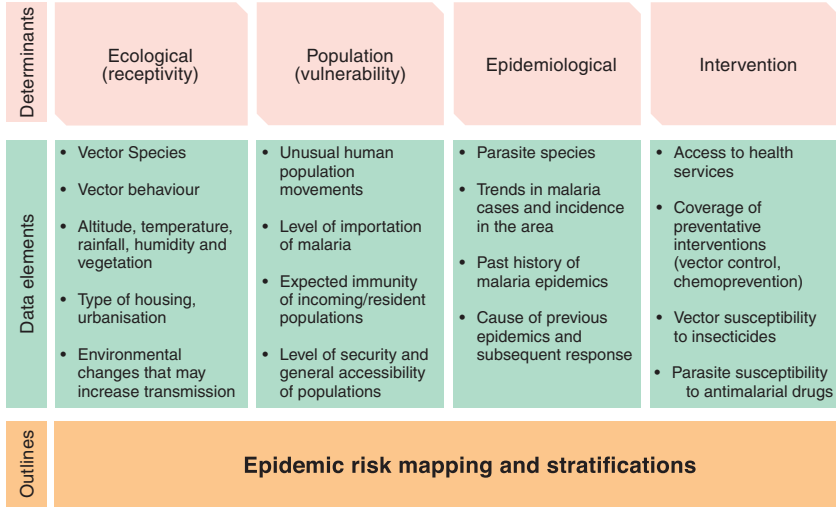

Figure 3: Defining areas that are prone to epidemics – the role of stratification

Source: WHO, 2018a

EPIDEMIC PREPAREDNESS AND RESPONSE PLANNING CHECKLIST					
KEY ACTIVITY	SUB-ACTIVITY	COUNTRY			
		South Africa	Swaziland	Zambia	Zimbabwe
	Weekly data are generated accurately at all reporting levels	UNDERWAY	YES		YES
MONITORING, SURVEILLANCE AND EARLY WARNING	A reporting rate of 100% on a weekly basis from all health facilities.	N/A	NO		YES
	Routine (weekly) analysis of surveillance data for decision making	UNDERWAY	YES		YES
	Health facility plot trend lines of the number of cases and deaths of malaria	NO	NO		YES
	National level notifiies district health facilities of possible increases in	YES	YES		YES
	Private health facilities are included in national malaria surveillance system	YES	YES		UNDERWAY
	Annual health worker training on malaria surveillance and outbreak	YES	YES		YES
	Early malaria outbreak detection system (alert threshold) predefined and	NO	YES		YES
	Key drivers of malaria epidemics identified in different areas	UNDERWAY	YES		YES
	Health facility or district data reported on monthly / weekly basis	YES	YES		YES
	Malaria risk map for transmission areas generated routinely	NO	YES		YES
	Team regularly reviews data and provides evidence of malaria events	YES			YES
		YES	YES		

Figure 4: Development of a checklist for epidemic preparedness – a means to identify priority areas for funding and/or partner support

EPIDEMIC PREPAREDNESS AND RESPONSE PLANNING CHECKLIST					
KEY ACTIVITY	SUB-ACTIVITY	COUNTRY			
		Angola	Botswana	Mozambique	Namibia
	Weekly data are generated accurately at all reporting levels		YES	YES	YES
MONITORING, SURVEILLANCE AND EARLY WARNING	A reporting rate of 100% on a weekly basis from all health facilities.		UNDERWAY	YES	NO
	Routine (weekly) analysis of surveillance data for decision making		YES	YES	YES
	Health facility plot trend lines of the number of cases and deaths of malaria		YES	YES	YES
	National level notifiies district health facilities of possible increases in		YES	UNDERWAY	YES
	Private health facilities are included in national malaria surveillance system		YES	NO	UNDERWAY
	Annual health worker training on malaria surveillance and outbreak		YES	NO	YES
	Early malaria outbreak detection system (alert threshold) predefined and		YES	UNDERWAY	YES

Figure 4: Continued

EPIDEMIC PREPAREDNESS AND RESPONSE PLANNING CHECKLIST					
KEY ACTIVITY	SUB-ACTIVITY	COUNTRY			
		Angola	Botswana	Mozambique	Namibia
	Key drivers of malaria epidemics identified in different areas		UNDERWAY	UNDERWAY	UNDERWAY
	Health facility or district data reported on monthly / weekly basis		YES	YES	YES
	Malaria risk map for transmission areas generated routinely		UNDERWAY	YES	YES
	Team regularly reviews data and provides evidence of malaria events		YES	YES	YES
				YES	

Critical questions on the checklist by Member States:

User guide for checklist?

List of tracked indicators for EPR and their relevance?

Frequency of updating E8 Situation Rwoom checklist?

Time taken for situation to change in countries and the region?

Source: SADC, 2014

In addition, the African Leaders Malaria Alliance (ALMA) – a coalition of 49 African heads of government – adopted a malaria elimination agenda and the ALMA 2030 scorecard towards malaria elimination to monitor and encourage progress (ALMA, 2016; SADC, 2014). The scorecard has a set of indicators on which each country's achievements are scored.

COMPLICATING FACTORS OF HUMAN RESOURCES AND FUNDING IN NATIONAL MALARIA CONTROL PROGRAMMES

SADC countries face multiple challenges in their fight against malaria. The main challenges relate to inadequate human resources, inadequate funding, and insufficient resources to accelerate interventions.

Most national malaria control programmes (NMCPs) encounter a combination of limiting factors. NMCPs are often understaffed, due to poor remuneration and working conditions, and the attrition rates in the NMCPs are high (Elimination 8, 2015; 2016; Maharaj et al., 2016; WHO, 2017a). The main beneficiaries of the drainage of malaria workers from the control programmes are the private sector,

NGOs, foundations, universities, and UN agents, who are constantly on the lookout for high-calibre experts, a situation that is probably comparable across a range of epidemics.

NMCPs also face challenges in the procurement supply management (PSM) chain as a result of bureaucracy within the government system where approvals take a long time, leading to delayed procurement and slow arrival/supply of malaria commodities (Elimination 8, 2015; 2016; Maharaj et al., 2016; WHO, 2017a). This is compounded by a lack of transport – much needed to deliver commodities to targeted communities and also for rapid response to outbreaks. This leads to poor delivery and stockouts of essential malaria commodities, especially at health facility and community levels.

Funding shortages also delay the launch of operations, especially of spraying campaigns (Elimination 8, 2015; 2016; Maharaj et al., 2016; WHO, 2017a). Spraying campaigns require precise timing and include the training of spray operators and the start of the actual spraying. Very often programmes have no funds to hire spray operators. At times they also do not have the requisite protective clothing, spray pumps, and insecticide (due to delays in procurement and delivery). The structure of some NMCPs is not well defined – for example, when it comes to the malaria posts and where the programme manager is below the level of director, these persons do not have the authority to carry out certain functions and have to go through several stages to reach the permanent secretary (PS) or director general (DG) (Elimination 8, 2015; 2016; Maharaj et al., 2016).

EPIDEMIC RESPONSE – ACCESS TO EARLY DIAGNOSIS AND EFFECTIVE TREATMENT

Access to early diagnosis and effective treatment are essential in reducing the forward transmission of malaria (see Figure 5). The factors crucial to this enablement are, foremost, the use of a drug that has gametocytocidal effect, mass drug administration (MDA) (see, for example, Kobylinski et al., 2011) where feasible, and radical cure in the case of epidemics of P. vivax. In addition, and to reduce mortality, it is

essential to have mass fever treatment if access is an issue and MDA is not feasible. In remote areas with low access to health care, temporary or mobile clinics are essential. Dealing with drug resistance is among the complicating factors. Other factors that affect effective treatment include the management of complex emergency situations, and the management of malnutrition and other comorbidities that increase susceptibility to malaria.

Dealing with insecticide resistance is an added complicating factor in preventing or countering malaria epidemics. There have in recent times been challenges with regard to the type of insecticide to deploy. Problems related to the manufacturers have been compounding these issues: manufacturers at times do not have adequate stocks of malaria commodities, which situation results in delayed supply. The high costs of the commodities, especially insecticides, also makes it difficult for countries to withstand the financial impact of prevention and early diagnosis, even though it is cheaper than dealing with an epidemic. High costs lead to the programmes reducing the quantities that are needed to attain the geographical coverage targets that will meet WHO standards. As indicated before, failure to attain high spraying rates leads to malaria outbreaks and consequently a rebound and loss of the ground gained in the fight against malaria. This was one of the main causes of the 2016–2017 malaria outbreaks in the SADC region. The shortages also mean that the programmes have no buffer stock, which is much needed for mounting rapid response to outbreaks and preventing the spread of the cases to other districts or communities.

Implementation of intermittent preventative treatment in pregnancy (IPTp) (WHO, 2018b) – which is the chemoprophylaxis given to pregnant women[x] (usually at each antenatal care visit) – remains a challenge because of failure to achieve the 60 per cent target. Very few countries in the SADC have attained a level of above 65 per cent. The WHO proposes currently that each woman should get this treatment more than three times in the course of a pregnancy. Birth complications in cases of malaria infection include premature deliveries

x A full therapeutic course of anti-malarial medicine which is administered to pregnant women at their routine antenatal care visits, irrespective of whether they are infected with malaria or not.

and low birth weight (also infants being born laden with parasites). The WHO (2018c) reports that recent progress in Africa in adherence to this policy has increased only marginally: among the 23 countries that reported in 2016, an estimated 19 per cent of eligible pregnant women received three or more doses of IPTp, compared with 18 per cent in 2015 (and 13 per cent in 2014). The WHO believes that uncertainty among health workers pertaining to the exact administration protocols played a role, and hence it advocates for simplified IPTp messages and health worker training.

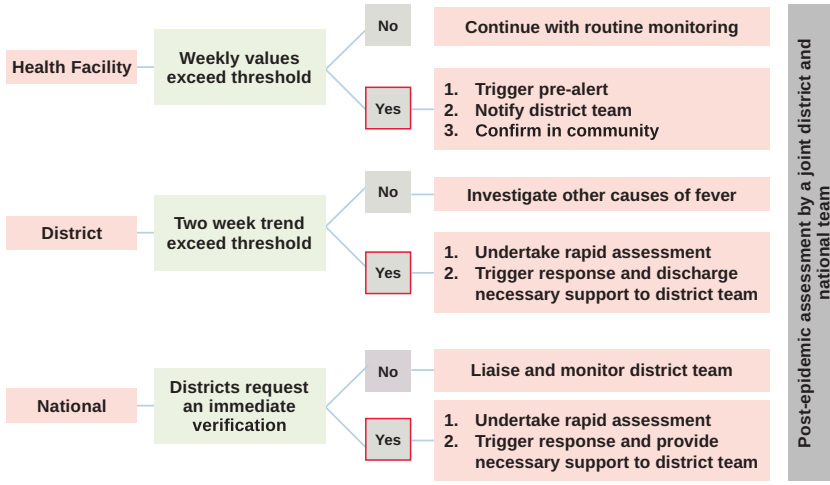

Figure 5: Early detection, verification, response and post-epidemic assessment process

Source: WHO, 2018a

CROSS-BORDER MOVEMENTS AND TRANSMISSION – AND INITIATIVES TO COUNTER MALARIA

Countries of the SADC region are also fighting to minimise both the importation of malaria from one district to another within the same country, and from one border district to another, including those coming from endemic regions such as East, Central, and West Africa (see Figure 6). The E8[xi] countries have recorded cases of transfer from

xi The countries which constitute the E8 are Angola, Botswana, Mozambique,

as spread out as Ghana, Nigeria, Ivory Coast, Gambia, Somalia, South Sudan, Uganda, Burundi, Rwanda, Ethiopia, and Eritrea and, within SADC, from the DRC, Angola, Mozambique, Malawi, Zambia, and Tanzania. It is important to acknowledge that as long as there exist high endemic countries, importation will also always exist. Nevertheless it is important for the countries to eliminate at least the local transmission of malaria; by doing so this will decrease the risk of exportation.

One of the threats related to the importation of malaria concerns the military or uniformed forces involved in the SADC, African Union (AU), and UN Peacekeeping enforcement forces that operate within and outside the SADC region. The danger is that when returning from external deployment missions, soldiers often bring malaria parasites with them. Among them cases of Plasmodium vivax (Pv), P. malariae (Pm) and P. ovale (Po) (see Burrows et al., 2017) have been observed – these are either not found or exist on a very limited scale south of the Zambezi River (the northern boundary of Zimbabwe). Thus, there is the risk of spreading these in receptive areas. Because these strains are not common in some SADC countries, there is the added challenge of diagnosis and treatment. The malaria RDT used in countries like Botswana, Eswatini, Namibia, South Africa, and Zimbabwe is only sensitive to Plasmodium falciparum (Pf) and so Pv, Pm and Po are not detected. Therefore, there is the need for countries to have some RDTs that are able to detect these other forms as well, especially at border posts. There is no economic sense to provide them country-wide, where they will be under-utilised, as most cases are Pf.

Heavy and frequent population movement through several crossing points between the E8 countries (both formal and informal) for reasons of trade, migrant work, and education – combined with the fact that many borders in the region are artificial boundaries that cut across communities – further fuels the importation of malaria across countries. Work needs to be intensified, therefore, to optimise the containment and elimination of transmission across border regions. Preventing the importation of parasites from one country to another is central to the ability to achieve elimination (Elimination 8, 2015;

Namibia, South Africa, Eswatini, Zambia, and Zimbabwe.

2016). Increasing avenues for surveillance through the establishment of border posts where testing and treatment can be carried out, and the availability of ongoing information for informed decision-making and planning are just two of the many important contributions that can be made.

Several initiatives to control and eliminate malaria unfold at regional level, given that nationally targeted efforts cannot address the interconnected nature of malaria transmission and importation across borders. The cross-border malaria control initiatives in the SADC region operate with varying levels of success. Within the E8, there are three operational cross-border malaria initiatives:

- MOSASWA: Malawi, Mozambique, and Zambia; and Mozambique, South Africa, and Eswatini (MOSASWA was formerly the Lubombo Spatial Development Initiative).
- the Trans-Kunene Malaria Initiative between Angola and Namibia.
- ZAM-ZIM (Zambia and Zimbabwe), a subset of the Trans-Zambezi Malaria Initiative.

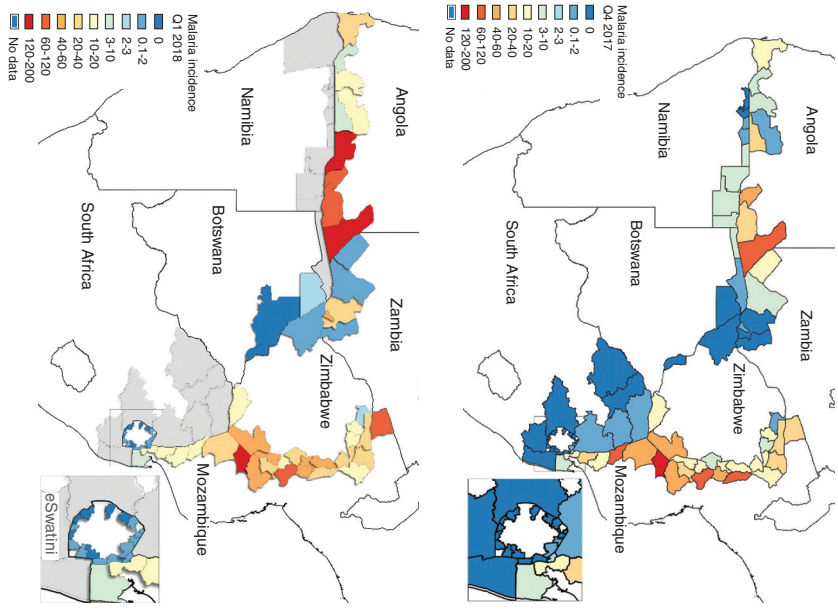

Figure 6: Informed decision-making through the use of data – 2017/18 Border District updated by month and during weekly calls

Source: Elimination 8 TWG, 2018

Further cases are the Trans-Zambezi Malaria Initiative, comprising Angola, Botswana, Namibia, Zambia, and Zimbabwe, and the Botswana, Mozambique, South Africa, and Zimbabwe Malaria Initiative (formerly the Trans-Limpopo Malaria Initiative). These regional initiatives could advance malaria elimination through greater collaboration, the sharing of lessons to tackle common challenges, and direct cooperation with neighbouring countries on specific border issues. They are, however, limited by insufficient financial resources (Maharaj et al., 2016; WHO, 2017b). The Lubombo Spatial Development Initiative was reckoned to have been an example of success in cross-border malaria control. The goal of the malaria component of the project (to decrease the transmission of malaria in the region) was met and it was deemed to have been successful. However, upon project termination there was an upsurge of malaria cases in the sub-region, resulting from migration from high transmission to low transmission areas (see Maharaj et al., 2016). Clearly, the movement of people across borders in Southern Africa remains a challenge in sustaining malaria control and elimination.

The establishment of the E8 Regional Situation Room (Figures 7 and 8) is another pertinent regional initiative. It enables attempts at countering outbreaks of epidemics to focus on cross-country measures. The Epidemic Preparedness and Response (EPR) teams and situation rooms were established at regional and country levels to be able to monitor and track the occurrence of malaria epidemics and guide the responses. The EPR body is required to be endorsed by the Minister of Health at country level, and the ministerial committee at regional level. These bodies work within the framework of what is known as a situation room. The situation room becomes the SADC body for regional outbreaks, while the countries concerned also adopt the national-level situation room model. Specifically, the E8 Situation Room is a multisectoral partner body which, at regional level (the E8 level), comprises a host of partners: SADC Secretariat, E8 Secretariat, Country M/E focal points (for all participating countries), WHO, RBM-SARN, Africa CDC, SADC Military Health Services, Global Public Health, ALMA, and the Clinton Health Access Initiative. The Situation Room is headed by a chair selected by consensus, while the

E8 Secretariat EPR Focal Point is the Secretary to the Situation Room. The Secretary is responsible for the coordination of weekly meetings, the writing, distribution and publication of meeting minutes, and any other business that may be required. The Situation Room meets via teleconference once every week to deliberate on a variety of matters: updates of the current malaria situation in each country; status of malaria commodities (insecticides, spray pumps, protective materials, ACTs, RDTs, LLINs); status of preparedness, especially at the start of the season, with regard to launching spraying campaigns, LLIN distribution and buffer stocks and support needs (whether the country needs additional insecticides, ACTs, RDTs etc.).

At country level it is made up of the NMCP M/E focal points, partners and EPR focal points from provinces and districts. The country level Situation Room feeds into the regional body and, in this way, both the country and regional bodies are able to access real-time weekly information that is much needed for informed decision-making and planning, in particular for immediate response in situations where increases are being observed.[xii] Figure 7 illustrates the E8 Situation Room and how it was established, approved, endorsed, and funded.

xii Further background information to situation rooms, which indicate the high level of planning and coordination that is required, includes:

- Terms of Reference (ToR): The Situation Room should develop ToRs that are approved by the Technical Committee and it operates within the parameters of the ToRs.
- EPR planning checklist: The Situation Room should develop an EPR planning checklist which has components of monitoring, surveillance, and early warning activities, along with sub-activities, a user guide for the checklist, a list of tracked indicators and frequency of updating the checklist.
- Budget/resource allocation: For the Situation Room to be operational and have the capacity to organise responses to malaria epidemics in the region, it should have an approved budget allocated at regional and country level.

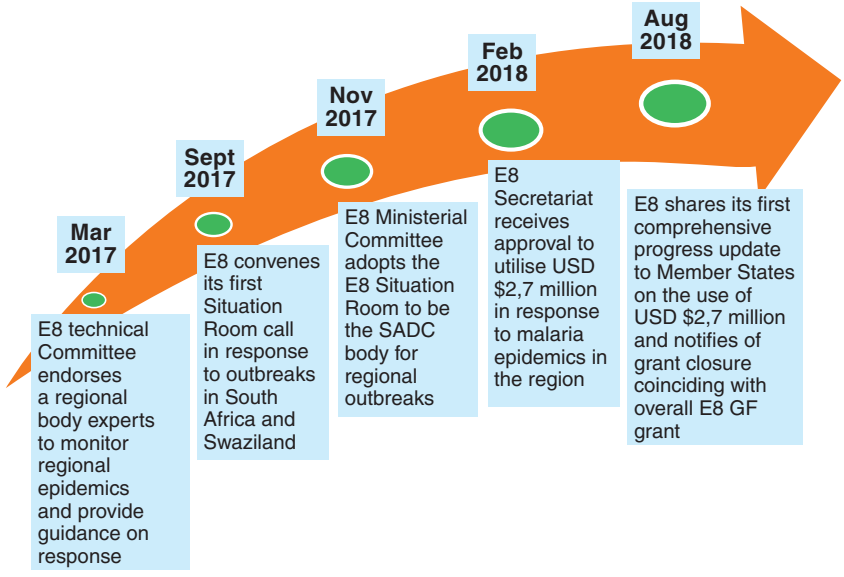

Figure 7 [xiii]: Establishing the E8 Regional Situation Room – milestones and successes

Source: Elimination 8 TWG, 2018

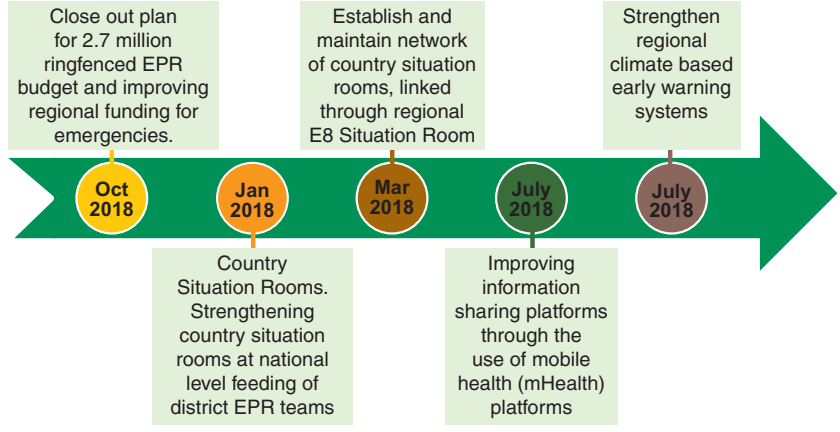

Figure 8: Future plans for the E8 Situation Room – 2018–2019 Implementation E8 Acceleration Plan

Source: Elimination 8 TWG, 2018

xiii Figure constructed prior to the former Kingdom of Swaziland's name being changed to Eswatini.

EARLY WARNING ALERT AND RESPONSE NETWORK (EWARN)

The figures on malaria outbreaks and epidemics reveal the re-emergence of malaria in areas where zero status had been achieved previously (where elimination targets appeared to have been met). This places immunologically naive populations at a very high risk (WHO, 2012; 2018a). In such humanitarian emergencies or disasters, national malaria control or elimination programmes should ensure availability of appropriate rapid diagnostic tests (RDTs). Here the Early Warning Alert and Response Network (EWARN) plays a central role in the early detection of outbreaks that require action (see WHO, 2009). The main condition for including malaria in EWARN is that it has been confirmed by RDT or microscopy. EWARN therefore is an adjunct, not a substitute, for the national disease surveillance system. Once the acute emergency phase is over, it should be reintegrated into the national surveillance system.

It is well known that humanitarian emergencies increase the risk of transmission of communicable diseases and conditions that have the potential of becoming epidemic (epidemic-prone diseases), thereby increasing morbidity (disease) and mortality (deaths) (WHO, 2012; 2018a). Conditions that result from such emergencies often involve the displacement of large numbers of people, mostly of those settled in temporary, highly crowded locations (WHO, 2012). Due to high population density there is usually inadequate food and shelter, unsafe water, poor sanitation, and lack of infrastructure. Because of the breakdown of the health systems, surveillance systems will be under-performing, disrupted, or non-existent, or they may quickly become overwhelmed.

Because the surveillance systems are unable to provide the required surveillance information associated with humanitarian emergency (including timeliness and high data quality), setting up an EWARN will temporarily fill this gap. This will be the case especially during the acute phase of an emergency and will also allow time for the routine systems to recover from the effects of the disaster.

To ensure functionality, an EWARN structure is to be made up of a

network of people who collect information that will be fed into the next reporting level so that the set control measures will be implemented.

The EWARN setup has two main components: an immediate alert component (which signals the early stages of an outbreak), and a weekly reporting component (which reports weekly data aggregated by health facilities) needed for timely detection and verification of outbreaks, and effective monitoring of morbidity patterns.

The following aspects of the structure and operations need to be functional:

- To be effective, the EWARN should have management coordinated by a public health specialist or epidemiologist who has wide experience in disease surveillance, disease control in emergencies in particular, and knowledge of surveillance systems. The coordinator will ensure the operation of provincial and district focal points (one per province/district/health facility level).
- If well coordinated, this surveillance network takes over the assessment of the occurrence of epidemic-prone diseases. This network of people is responsible for collection, investigation, reporting, analysis, and dissemination of information from the facilities/field through the reporting chain to the central level. The whole package should include adequate training and resources to ensure complete, reliable, and regular reporting. Based on information collected, alerts can be generated using alert thresholds.
- Thus, data collection and alerts should be reported in the quickest way possible, using weekly aggregated data. The data should include case definition, universal coverage, links with existing vertical surveillance programmes, and minimal data requirements.
- Data reporting and transmission methods and alert information, irrespective of their source, should be reported through the quickest means possible for verification and outbreak investigation. The coordinator and focal points should monitor the frequency of reporting (immediate, daily, or weekly) and reporting of mortality data.
- Another important function is the establishment of an outbreak preparedness system made up of a multisectoral outbreak control

team (OCT) that is capable of responding effectively to outbreaks. It is essential to be prepared by arranging items such as an outbreak response plan, standard line-list forms for data collection, and standard treatment protocols for key diseases.

- Once an alert has been received by the EWARN district focal point or higher levels, a systematic alert verification process, starting at the field level, should be initiated within 24 hours. A standardised process should be used to verify the alert and, if an outbreak is confirmed, an on-site investigation should be started.
- An outbreak investigation involves determining the cause of an outbreak and who is at risk so that control measures can be implemented, thus reducing morbidity and mortality. It should begin as soon as an alert detected by surveillance has been verified. In the initial stage of an outbreak, the causative agent may not be known, and general control measures must be taken, based on the best available data. Once the cause has been confirmed, specific measures to control the disease can be undertaken.
- It is important, therefore, to get laboratory support (WHO, 2008a). Although normal routine reporting of EWARN syndromes does not require laboratory confirmation, diseases such as malaria require confirmation through RDTs or microscopy. Such confirmation is mandatory before treatment can be started. Complex tests such as antimicrobial sensitivity validation or RDT validation need to be referred to a regional or international reference laboratory. This process is important because malaria at its onset has symptoms similar to other diseases such as chikungunya, dengue, and others. Hence the need for a proper case definition and confirmation through data analysis and interpretation.

SADC TAKING FORWARD THE LESSONS LEARNED

The lessons learned from preceding and ongoing engagement with countering malaria outbreaks and epidemics in the SADC region range in scope from specific medical diagnosis and treatment to procurement and delivery of malaria commodities, specifically targeted and capacitated systems on the ground, and management of cross-border

movements – and many interventions in between. As the bottom line, the challenges are ongoing and the conditions and capacitation of the anti-malaria fight remain sub-optimal. There have been breakthroughs and improvements, but simultaneously relapses and recurrent problems are observed. This section provides an overview, summarising and interpreting the lessons highlighted in the preceding analysis. The lessons concern, in the main, joint regional surveillance and action on the occurrence of outbreaks or epidemics by developing coordinated plans of action and sharing best practices. These include innovative cross-border strategies, diagnostic methods and tools, community case management, vector control, entomological surveillance, and mass drug administration.

The Elimination 8 (2015) initiative is central to Southern Africa's endeavours to advance from control to elimination of malaria, and multiple lessons learned from past experiences have been, and continue to be, taken on board. The E8 countries recognise the need to plan pre-emptively. Sustainability of financing is a key component in driving the region's elimination agenda. It is essential to help ensure the switch from reorientation and control to the labour-intensive project of elimination. It requires, for example, sophisticated and comprehensive case detection and investigation (see Elimination 8, 2015). There is a need for stable and sustained flows of financing to prevent breaks in the chain of prevention and elimination. One of the key challenges facing the E8 is therefore the attainment of resources to achieve elimination in the medium to short term, and to sustain the gains in the long term. Innovative, donor-independent financing is critical to the long-term sustainability of the E8's malaria programming, helping to ensure that once elimination is achieved, it will also be sustained.

To sustain momentum towards achieving the vision of a malaria-free SADC, regional and multi-country funding mechanisms, mainly from governments and their public or private partners, need to be developed. According to Elimination 8 (2015), a regional public fund could contribute to accelerating progress to elimination throughout the region and help to reduce the importation of malaria into malaria-free zones. It is also stated as one of the Elimination 8 programme goals to see public-private partnerships playing a central role in

malaria elimination, especially with a view to leveraging short-term financing, financial sustainability planning, usage of information and communication technology applications, laboratory services, and commodity availability.

On the ground, SADC countries continue to face challenges in malaria case management due to ongoing stockouts of essential malaria diagnostics (RDTs shortages) and treatment for both uncomplicated and complicated or severe malaria. Delays and challenges in the procurement and supply management (PSM) systems result in the delayed supply of anti-malaria medicines (and stockouts on the ground). The stockouts in anti-malaria commodities (medicines, RDTs, insecticides) have contributed to the failure to achieve targets: deaths due to malaria increased by 4 per cent in the SADC region between 2013 and 2016. An essential part of recommended best practice moving forward, SADC noted, is the need to define and establish minimum stockpiles of malaria commodities at SADC level. In collaboration with member states, it is necessary to pursue pooled procurement and warehousing of insecticides, RDTs, malaria medicines, and other relevant commodities in order to reduce prices and secure supplies for malaria outbreaks in the region.

Vector control using IRS is the main intervention in countries that are moving towards elimination of malaria, mainly Botswana, Eswatini, Namibia, South Africa, Zambia, United Republic of Tanzania-Zanzibar, Mozambique, and Zimbabwe. However, a host of issues contribute to ongoing malaria outbreaks in the region. The problems include issues of environmental compliance, insecticide resistance, inadequate funding to procure insecticide, and delays in the PSM chain (including delayed delivery by the manufacturers). It is recommended, therefore, that the SADC communicable diseases centre should include malaria outbreaks in their mandate. Countries are encouraged to strengthen vector control, especially in areas of entomological surveillance. They should also strengthen malaria surveillance, when possible in integrated systems, and rigorously investigate potential drivers of transmission to ensure the completeness and timeliness of data.

Quality-assured diagnosis is a crucial component of malaria control and elimination programmes moving forward, and further advances

build on this capacity. Every national malaria control/elimination programme has to ensure, therefore, its functional capacity for quality-assured diagnosis. WHO has trained certified microscopists (level one) to help ensure harmonisation of policies, standardisation of practices, and inter-operability in the SADC region. WHO countries have benefited from the regional programme for improving diagnosis, which includes capacity building, specialised testing, and a microscope slide bank (see, for example WHO, 2008b).

Other government and regulatory measures and factors contribute to the initiatives to eliminate malaria from Southern Africa by 2030, but difficulties remain. The movement of malaria commodities across borders is an example, as these materials are governed by regulatory restrictions. The impact of procurement and supply management challenges is that countries often lack buffer stocks and, consequently, cannot respond effectively or timeously to malaria outbreaks or epidemics. Delays in some countries in the registration of some medicines (primaquine, for example, which is a transmission-blocking medicine) have adverse implications for achieving the planned malaria elimination targets.

Only joint and concerted efforts can help the SADC countries reach the goal of ending cross-border transmissions. To facilitate the reduction of cross-border malaria transmission, the E8 provide technical support and operational guidance to control and end cross-border transmission. They recognise that a regionally coordinated approach is critical. It is recognised that 72 per cent, 79 per cent, and 48 per cent of cases in Eswatini, South Africa, and Botswana, respectively, are imported from the countries' more endemic neighbours. To aid joint surveillance and monitoring of the cross-border movement of people with malaria parasites, the E8 has facilitated the establishment of border posts, which extend access to diagnosis and treatment of malaria to mobile and migrant populations and the under-served border communities (see Elimination 8 Strategic Plan 2015). Furthermore, the E8 advocates for the strengthening of communication for behaviour change in cross-border areas through the use of targeted messages and by empowering and engaging local communities to support the initiatives. This includes the use of data, information, and predictions

provided by meteorological institutions to strengthen public communication appropriate for specific risk groups and for health workers (see Elimination 8, 2015).

Due to the ongoing instability of malaria in the SADC region it is crucial, in terms of climatic monitoring and associated planning, to be part of a network of systems that link the health sector to weather bureaus. The SADC Secretariat's SADC Climate Services Centre (see SADC, undated) provides regional operational services for monitoring and predicting extreme climate conditions. Every year it hosts a meeting of the Southern Africa Regional Climate Outlook Forum where a weather outlook for the coming season is analysed. This SADC centre collaborates with the United States National Oceanic and Atmospheric Administration to help get accurate forecasts as to pending malaria-conducive conditions. The weather forecasting infrastructure needs to link closely with health institutional infrastructure in the region. Hence, as proposed by SADC (WHO, 2004), malaria programme managers and directors should also work closely with the SADC Regional Communicable Diseases Centre in Lusaka, Zambia, to establish a thematic group on malaria outbreaks and emergencies, initiate a proactive approach to malaria surveillance, and strengthen the development and use of alert and epidemic thresholds for weekly reporting of malaria cases and deaths and surveillance of active foci (Elimination 8 TWG, 2018; SADC, 2007a; Teklehaimanot et al., 2004; WHO, 2004)

While there has been much progress in the SADC and E8 initiatives to control and advance towards the elimination of malaria in the region, further advances are required. These depend on systematic coordination and cooperation (see Elimination 8, 2016: 2). As stressed in SADC's Elimination 8 (2015) initiative, for E8 member states to move towards elimination, they need concertedly to deliberate on policies and the strategic and operational issues that affect their malaria elimination programmes. A collective effort is needed in order to eliminate malaria (Elimination 8, 2015). Such efforts to harmonise policies will support national programmes and regional actors to design and execute strategies that complement and reinforce one another. It is crucial equally for malaria control and elimination policies (see Feachem, 2009; Feachem

et al., 2009) to be renewed suitably and be aligned across the SADC region. For example, the five-year Malaria Strategic Plan (SADC, 2007a; SADC, 2014) needs to undergo a mid-term review and end-term review. The Malaria Elimination Strategic Plan (SADC, 2007b; SADC, 2014), which is aimed at accelerating 'Zero Local Transmission' in all districts leading to country-wide Local Zero Transmission through the provision of a mechanism for collaboration and joint strategic programming needs to be evaluated. These documents should be aligned with the SADC Malaria Strategic Framework (2015, to be updated) and the SADC Malaria Elimination Framework. The document should also be aligned with the SDGs, GTS, and AIM.

CONCLUSION

Certain and important strides forward have been made in the campaign to consolidate Southern Africa's transition from malaria control to malaria elimination. The campaign has been carried powerfully by a set of international and regional organisations and platforms to these organisations. The analysis showed the important impact that was leveraged by the network in which the WHO, SADC, and its platform Elimination 8 have been powerful players. The E8 Technical Committee is an illustration of the already-existing network operations that will help sustain SADC programmes in future.

The analysis also articulated these organisations' goals and advocacy programmes moving towards elimination. It emphasised that multiple obstacles remain before elimination will be achieved. The battle against malaria in SADC continues, but the benchmarks achieved to date offer significant pointers to actors countering Africa's epidemics, particularly malaria. At the heart of these lessons is evidence of holistic approaches, multi-, inter- and trans-disciplinary, coming together to record the levels of success we continue to witness.

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