Malaria & Vector-Borne

Malaria is a large-scale cause of illness, with over 90% of deaths occurring among children in tropical regions, in particular in Africa and the Pacific.

Malaria and other vector-borne diseases have declined over the last decade, as a result of poverty reduction and anti-malaria programmes.

Vector-borne diseases are sensitive to climate; as climate becomes warmer and wetter, changes to their prevalence will slow and complicate efforts aimed at eradication.

Fighting vector-borne diseases is highly cost effective; minimizing vulnerability requires action to reduce or eradicate prevalence and increase the resilience of populations affected.

2010 EFFECT TODAY
20,000
DEATHS PER YEAR

2030 EFFECT TOMORROW
20,000
DEATHS PER YEAR

MORTALITY IMPACT

42% 15% 44%

RELATIVE IMPACT

HOTSPOTS

2010 2030

DR CONGO
MOZAMBIQUE
TANZANIA

2010
2030

6,000
5,750

1,750
1,750

1,500
UGANDA
2,250
NIGERIA

586 2

410 4

GEOPOLITICAL VULNERABILITY

LDCs BRIC
G8 SIDSs G20

Estimates Global Climate Impact

Confidence Indicative

Severity
Affected
Injustice
Priority
MDG Effect

Change in relation to overall global population and/or GDP

Deaths
Developing Country Low Emitters
Developing Country High Emitters
Developed
Other Industrialized

Deaths per 10 million
A major cause of illness in developing countries, climate change will worsen the burden of vector-borne diseases, although it is difficult to predict with any precision the areas that will be worst affected (IPCC, 2007). Countries that already have serious malaria burdens should expect to see an aggravation of these diseases, due to increasing temperatures and other climate-related phenomena. Such aggravations will be offset to some degree through anticipated socio-economic development in the predominantly lower-income countries in which these diseases are most prevalent (Mathers and Loncar, 2005). But vector-borne outbreaks are also re-occurring in places where they have long been absent: a yellow fever epidemic in Uganda in 2010 was the first in 20 years (Rosenberg and Beard, 2011). As climate change brings warmer weather to colder places, the range of vector-borne disease is also shifting from the tropics, and to higher altitudes, as insects and other vectors roam further afield. In the US for instance, Leishmaniasis, a vector-borne disease originating in Mexico and Texas has begun to shift further north (González et al., 2010). Communities now linked by globalization are also becoming exposed to higher risks, as illustrated for instance by a colony of yellow fever mosquitoes recently found in Holland (Enserink, 2010). Successful international programmes fighting these diseases should be reinforced in areas of particular risk, in order to safeguard against set-backs due to climate change in the fight to eradicate malaria and control other deadly vector-borne diseases (WHO and RBMP, 2010).

CLIMATE MECHANISM
Climate change is understood to enable the shift in vector-borne diseases like malaria, dengue, and yellow fever in several ways. As mountainous areas warm up for instance, vectors, such as mosquitoes, would reach higher altitudes and increase exposure to disease in zones adjacent to affected areas; the same can be said of higher latitudes at the boundaries of current areas of infection. Transmission conditions and seasons are likely to expand in warm areas where rainfall used to be too low to support vectors, but now will increase. Temperature changes affect incubation rates and, together with range changes, increase the amount of time people are exposed to insect bites (Jetten and Focks, 1997). However, transmission could also decline, due either to a drop in rainfall and temperature peaks—beyond which diseases like malaria cannot thrive—or due to very high rainfall that washes away insect larvae (WHO, 2004 and 2011). At a smaller scale, temperatures also influence the survival rates of mosquitoes (Martens et al., 1999). As was pointed out in the Ghana country study in this report, climate change also affects human behaviour, as, for instance, when people sleep outside on the hottest nights without mosquito net protection, significantly increasing their risk of contracting vector-borne diseases.

IMPACTS
The impact of climate change on the key vector-borne diseases of malaria, dengue fever and yellow fever is estimated to be over 20,000 deaths a year today, with 6 million people affected. Fourteen African and Pacific island countries are estimated to suffer Acute and Severe levels of vulnerability to the effects of climate change on vector-borne disease; most of these countries are land-locked developing countries, such as the Central African Republic or Zambia, or small island developing states, such as the Solomon Islands. The greatest total effects are estimated to occur in the DR Congo, with nearly 6,000 additional deaths due to vector-borne diseases in 2010. Five other countries also suffer large scale effects in the thousands: Nigeria, Mozambique, Tanzania, Uganda, and Côte d’Ivoire. By 2030, the effect of climate change on malaria is expected not to change since it is expected that there will be continued large-scale reductions in the prevalence of malaria, due mainly to economic growth over this 20-year period. In fact, as a proportion of population, malaria is estimated to decrease as a concern under these assumptions.

THE BROADER CONTEXT
According to the World Health Organization, malaria has undergone a major reduction in its overall prevalence in the last decade, falling from 1.2 million deaths in 2000 to 0.8 million deaths in 2008. However, most of the reduction occurred in the first years of the decade: over the four-year period between 2004 and 2008, there was a reduction of only 60,000 deaths (WHO BDD, 2000 and 2011). However, even at lowered rates of death, malaria...
is considered one of the largest global contributors to sickness. Interpretations of the scale of the disease also vary dramatically, with some estimating more than 5 billion clinical episodes that resemble, and could be characterized as, malaria occurring in endemic areas annually (DCPP, 2006). Other factors, such as economic growth, will likely compensate for increased risks due to climate change, but they will also slow efforts to eradicate these diseases (Reiter, 2001).

Given that climate-aggravated malaria is highly prevalent in impoverished rural communities, delaying efforts to eradicate the disease will also delay development progress. As people in the affected communities also have a high propensity to migrate, malaria could also be carried to new areas, generating epidemics (Haleset al., 2000).

VULNERABILITIES AND WIDER OUTCOMES

Experts have identified various determinants of malaria and vector-borne diseases. Environmental conditions play an important role, such as high temperatures, high rainfall, and humidity, together with pools of still, sun-drenched water (WHO, 2009). Social vulnerabilities include the level of education enabling people to take preventative measures, such as draining mosquito ponds, or address environmental predispositions to disease (Garg et al., 2009). Finally, poverty seriously inhibits access to medicine, vaccines, and preventative measures, such as insecticides and bed nets (Brennan, 2001). Given that some 6 million people are affected, the economic productivity of those worst hit communities is jeopardized. For example, when members of rural, subsistence families lose working hours because of illness, their already minimal disposable income will be threatened further. The Ghana country study in this report illustrated how in malaria-infested areas, people lose working hours because of illness, and awareness can also help to raise the level of preventative responses and encourage health services to be sought soon after the onset of symptoms. Aside from civil infrastructure projects, vector-borne disease control is considered to be highly cost effective (DCPP, 2006).

RESPONSES

Responses are numerous and comprise preventative and treatment-type actions. Drugs and vaccines through national or region-specific immunization programmes (for dengue and yellow fever, not malaria), insecticide-treated bed nets, use of pesticides outdoors, insecticide for personal use and indoors, and civil engineering projects to drain malaria breeding sites are all key components of the anti-malaria and vector-borne response toolkit. Access to affordable health services, including through low-cost health insurance, is also critical for the speedy diagnosis and treatment of disease. Education and awareness can also help to raise the level of preventative responses and encourage health services to be sought soon after the onset of symptoms. The indicator measures the effect of climate change on malaria, dengue fever, and yellow fever, based on World Health Organization research and data (WHO, 2004; WHO BDD, 2011). The climate change effect on malaria is used as a proxy for dengue and yellow fever, since research suggests similar mechanisms apply (Epstein, 2001; Hales et al., 2002). Uncertainties in climate parameters, particularly rainfall, environmental, and socio-economic factors call into question the reliability of all estimations. The indicator is also conservative from the perspective that it does not take into account a variety of other vector-borne diseases, whose prevalence may also be significantly influenced by climate change, such as viral encephalitis, schistosomiasis, leishmaniasis, Lyme disease, and onchocerciasis (WHO, 2003).
CLIMATE VULNERABILITY

- Acute
- Severe
- High
- Moderate
- Low

Vulnerability measure: comparative mortality as a share of population (national)

CLIMATE UNCERTAINTY

- Limited
- Partial
- Considerable

LOW

Malaria & Vector-Borne Vulnerability measure:
comparative mortality as a share of population (national)