

CLIMATE CHANGE AND MALARIA IN SUB SAHARAN AFRICA

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Introduction

Sub-Saharan Africa consists of all African countries that are fully or partially located south of the Sahara desert, excluding Sudan and contrasting North Africa, which is considered a part of the Arab World. These sub-Saharan countries form the bulk of the African, Caribbean, and Pacific Group of states, formed by the Georgetown Agreement with the objectives of poverty reduction, sustainable development, and deeper market integration. Malaria is a chronic impediment to this development, predicted to slow growth by 1.3% annually, in time and monetary costs. According to the World Bank, the region's GDP would have been 32% higher in 2003 had the disease been eradicated in 1960. Sub-Saharan Africa also has a high child mortality rate, with malaria as the leading cause of death¹.

Additionally, sub-Saharan populations face a multiplicity of issues in engaging with malaria eradication, such as the region is over-populated in terms of how many resources and people it can support, features a high dependency ratio, and large percentage of the population lives in poverty and has little access to affordable health care.

Most of the poor in sub-Saharan Africa are engaged in agricultural work as a primary source of income, but this sector is characterized by poor irrigation, lack of inputs, and lack of market access. Given the major population boom and expected decreases in agricultural production due to climate change, food will become more scarce, and malnutrition will rise. Malaria will also be able to expand into climates that had previously been too cold, dry, or high in altitude and affect new populations. Thus, the threat of climate change will exacerbate the burden of malaria by increasing their vulnerabilities.

¹ World Bank Database. Data taken from 2012. The World Bank Group.

RELEVANT STATISTICS

The Global Context of Malaria



The Current Impact of Malaria

Malaria, meaning bad air in medieval Italian, is a mosquito borne protozoa transmitted to humans through the salivary glands of female mosquitoes. No vaccine exists, and current treatments are beginning to develop resistances in certain malaria species. The WHO estimates that in 2010 there were 219 million cases of malaria resulting in 660,000 deaths.² Though Asia has the largest population at risk, the disease burden is highest in sub-Saharan Africa where 85–90% of malaria fatalities occur.³

The disproportionate disease burden can be attributed to the vulnerabilities populations in sub-Saharan Africa face. Though there is a high degree of demographic variance among African populations, there are common vulnerabilities. Approximately 48.5% live in extreme poverty (less than \$1.25 daily PPP), with 78-91% without access to improved sanitation and child malnourishment reaching 58% in some areas.⁴ Poverty can increase the risk of malaria, since those in poverty do not have the financial capacities to prevent or treat the disease, invest in health care, or afford medical services. Those in poverty may lack financial means to invest in risk reduction or coping mechanisms. In its entirety, the economic impact of malaria has been estimated to cost Africa \$12 billion USD every year. The economic impact includes costs of health care, working days lost due to sickness, days lost in education, decreased productivity due to brain damage from cerebral malaria, and loss of investment and tourism.⁵

2 World Malaria Report 2012 (Report). World Health Organization. http://www.who.int/malaria/publications/world_malaria_report_2012/wmr2012_no_profiles.pdf

3 Layne SP. "Principles of Infectious Disease Epidemiology" (PDF). EPI 220. UCLA Department of Epidemiology. <http://web.archive.org/web/20060220083223/http://www.ph.ucla.edu/epi/layne/Epidemiology+220/07.malaria.pdf>

4 World Bank Database. Data taken from 2012. The World Bank Group.

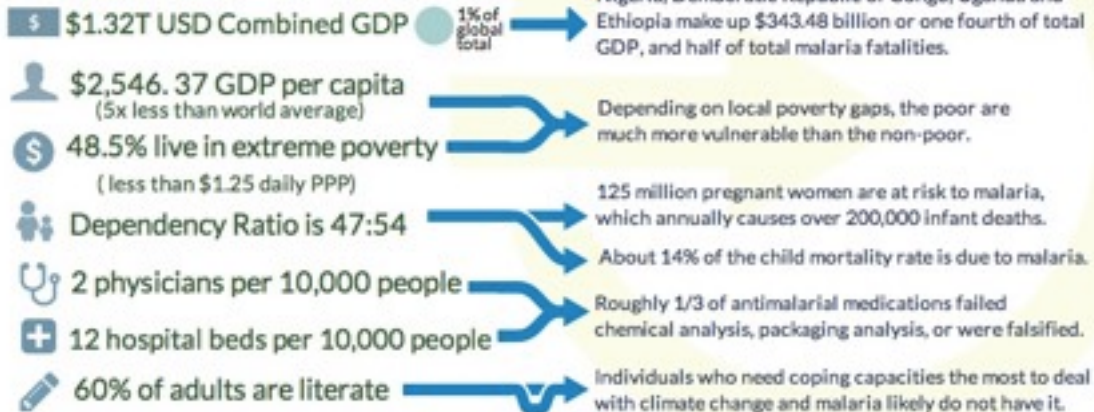
5 Greenwood BM, Bojang K, Whitty CJ, Targett GA (2005). "Malaria". *Lancet* 365 (9469): 1487–98.

RELEVANT STATISTICS

Sub-Saharan Vulnerability Profile

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of the top 15 most vulnerable countries are in sub-Saharan Africa



Malaria is still a major cause of death in sub-Saharan Africa, causing about 14% of under-five deaths in the region. Cerebral malaria is one of the leading causes of neurological disabilities in African children. Studies comparing cognitive functions before and after treatment for severe malarial illness continued to show significantly impaired school performance and cognitive abilities even after recovery.⁶ Malaria in expectant mothers is a major cause of stillbirths, infant mortality, and low birth weight. About 125 million pregnant women are at risk of infection each year; in Sub-Saharan Africa, maternal malaria is associated with up to 200,000 estimated infant deaths yearly.⁷ Consequently, severe and cerebral malaria have far-reaching socioeconomic consequences that extend beyond the immediate effects of the disease.⁸

Another clinical and public health concern is the proliferation of substandard antimalarial medicines resulting from inappropriate concentration of ingredients, contamination with other drugs or toxic impurities, poor quality ingredients, poor stability and inadequate packaging. This concern is exacerbated since there is no way to test for counterfeits without access to a laboratory, hindering access to health in poorer communities. A 2012 study demonstrated that roughly one-third of antimalarial medications in Southeast Asia and Sub-Saharan Africa failed chemical analysis, packaging analysis, or were falsified.⁹

6 Fernando SD, Rodrigo C, Rajapakse S (2010). "The 'hidden' burden of malaria: Cognitive impairment following infection". *Malaria Journal* 9: 366. <http://www.malariajournal.com/content/9/1/366>

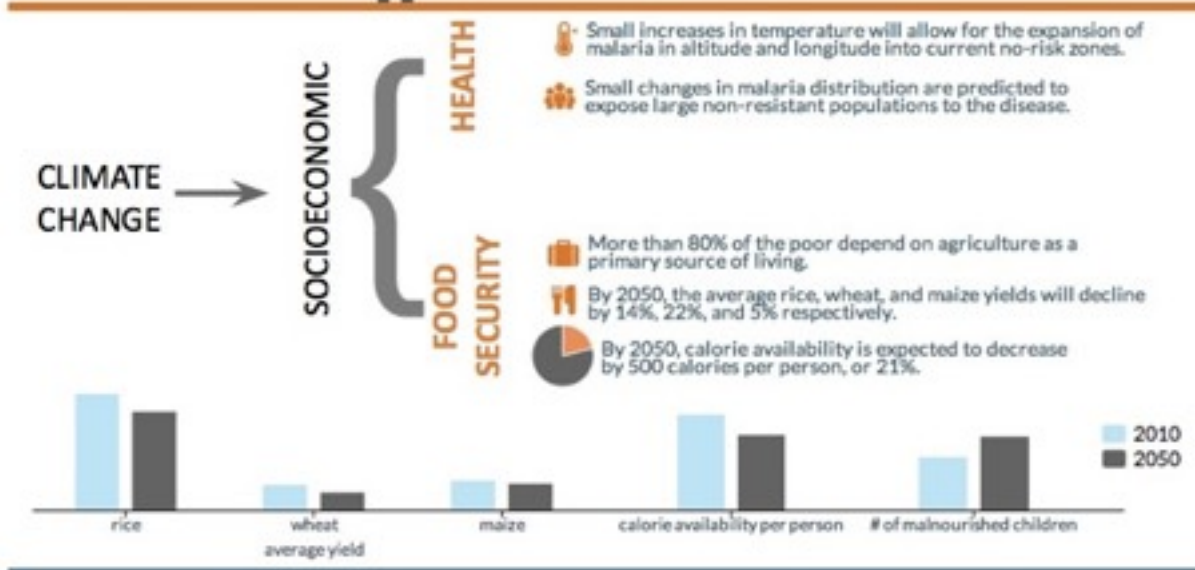
7 Hartman TK, Rogerson SJ, Fischer PR (2010). "The impact of maternal malaria on newborns". *Annals of Tropical Paediatrics* 30 (4): 271–82.

8 Ricci F (2012). "Social implications of malaria and their relationships with poverty". *Mediterranean Journal of Hematology and Infectious Diseases* 4(1): e2012048. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435125>

9 Nayar GML, Breman JG, Newton PN, Herrington J (2012). "Poor-quality antimalarial drugs in southeast Asia and sub-Saharan Africa". *Lancet Infectious Diseases* 12 (6): 488–96. doi:10.1016/S1473-3099(12)70064-6. PMID 22632187.

RELEVANT STATISTICS

The Potential Impact of Climate Change



Climate Change & Malaria Transmission

Climate change poses a threat to reducing malaria incidence, as warming temperatures and changing environments will allow mosquitoes to migrate to new areas that were once inhospitable to malaria transmission. The majority of additional populations at risk in climate change models occurs in areas where the potential transmission of malaria increases from zero to a few months annually, i.e. the expansion of malaria into current no-risk zones.¹⁰ East and south Africa are regions expected to see the greatest increases of risk, as small temperature increases will allow malaria to be spread more longitudinally and in altitude. West Africa is expected to experience higher risks as changes in precipitation will increase the potential for stagnant water as breeding pools for mosquitos, in climates where this currently limits transmission.¹¹ Climate modeling predicts small increases in temperature will allow malaria to affect populations it had previously been limited in, such as the densely populated highlands of East Africa.¹² Small changes in malaria distribution may expose large numbers of people to infection.

Climate Change & Increasing Vulnerabilities.

A model by the International Food Policy Research Institute indicates that in 2050 in Sub-Saharan Africa, average rice, wheat, and maize yields will decline by up to 14 percent, 22 percent, and 5 percent, respectively, as a result of climate change¹³. Without climate change, calorie availability is expected to increase in Sub-Saharan Africa between 2000 and 2050. With climate change, however,

¹⁰ IPCC. Climate Change 2001. Impacts, Adaptations and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press.

¹¹ Bomblies A. 2012. Modeling the role of rainfall patterns in seasonal malaria transmission. *Clim Change* 112(3-4):673-685.

¹² Martens W, Niessen L, Rotmans J, Jetten T, McMichael A. 1995. Potential impact of global climate change on malaria risk. *Environ Health Perspect* 103:458-464.

¹³ IFPRI. "Setting Priorities for Public Spending for Agricultural and Rural Development in Africa." International Food Policy Research Institute. 2009

food availability in the region will average 500 calories less per person in 2050, a 21 percent decline. In a no-climate change scenario, only Sub-Saharan Africa (of the 6 regional groupings of developing countries studied in the report) sees an increase in the number of malnourished children between 2000 and 2050, from 33 to 42 million. Climate change will further increase this number by over 10 million, resulting in 52 million malnourished children in 2050.¹⁴

¹⁴ IFPRI. "Climate Change: Impact on Agriculture and Costs of Adaptation". International Food Policy Research Institute. 2009

STAKEHOLDER ANALYSIS

Risk, Roles, and Responsibility



To accurately and efficiently combat this deadly disease, we must first examine the stakeholders in this plan, first and foremost being low income populations in areas most affected by malaria. Rapid urbanization in states have left many destitute, with no choice but to seek out slums and poorer outskirts of cities with less opportunity for education and health

care. These dwellings have no means of proper sanitation, drinkable water, electricity or drainage, meaning fertile ground for disease, germs, and misinformation about vaccines and aid workers to spread. As climate change becomes a more pressing issue, with flooding providing breeding grounds for carrier mosquitoes and loss of sustainable farm land, many more of these people will suffer.

Stepping back, it is important to take into account the state government's role in fighting malaria. Without proper clearance, non-governmental organizations cannot function in any facet of humanitarian work, and without the government's approval, vital resources could be delayed in deployment. Governments refusing to acknowledge the growing crisis or divert resources to local medical aid programs run the risk of alienating their people and discontent, which could lead to violence and unfavorable outcomes. According to Transparency International's Corruption Perceptions Index, many sub-Saharan country governments rank as the highest corrupt institutions, Botswana being the most corrupt. With money changing hands so often and illegally, foreign investors are wary of creating partnerships with African nations. Though many of these countries are still in the developmental stage of their economy, it is important to create preventative measures. Resources and funding should be allocated to research departments to work in tandem with local organizations to study communities prone to yearly flooding and create toolkits that make the transition back to normal life post-flood easier and more convenient. Though politician terms are relatively short, legislation should be drafted during that time to build on support for NGOs and clearing corruption.

Internationally, a large outbreak of malaria left unchecked would reflect poorly on the United Nations and other unions of nation states. The United Nations, with it's plethora of humanitarian aid programs has an immense stake in the containment of malaria. Being one of the most well funded organizations in the world, lending a hand to local organizations would only benefit them as an entity, and improve diplomatic relations worldwide. Since NGOs like UNICEF or Doctors Without Borders operate under time and financial constraints, they often rely heavily on governmental support to enter the country in question and begin outreach to local organizations.

LOGICAL FRAMEWORK

GOAL: To improve risk management by 2015 in relation to malaria rates and climate change impacts in sub-Saharan Africa



OBJECTIVE: By understanding, producing, and disseminating relevant data and facts on climate change and risk management possibilities, malaria and climate change will be highlighted as priority issues with an emphasis on how non-climatic-dimensions of vulnerability determines the adaptation to climate change.



INDICATORS:

- Percentage of districts reporting monthly numbers of suspected malaria cases
- Percent change in malaria incidence
- Percentage of cases receiving a diagnostic test
- Improved sanitation in treating facilities (measured by sterile supplies per doctor divided by patients seen per doctor)
- household person-to-mosquito-net ratio
- Percent change in poverty rate (at \$1.25 PPP in 2010 USD)
- Percent change in total malaria mortality rate
- Percent change in child mortality due to malaria
- Percent change in efficacy of anti-malarial medication



ACTIVITIES:

- Educating the government/community about the CRM-TASP¹⁴ of the UNDP¹⁵ "designed to support developing countries in managing the changing nature of climate risk"¹⁶ through media and workshop, so that they can compare and contrast similar cases, and provide recommendations and solutions to reduce the possible impacts
- Hold meeting with stakeholders and government in the name of human health to promote and more unified goal that can be reached together
- Increase quality of prenatal care by increasing access to antimalarial medication for pregnant women
- Conducting chemical analysis/ packaging analysis
- Provide mosquito nets to the community at a low cost

¹⁴ World Malaria Report 2012 (Report). World Health Organization. http://www.who.int/malaria/publications/world_malaria_report_2012/wmr2012_no_profiles.pdf

¹⁵ Climate Risk Management Technical Assistance Support Project

¹⁶ United Nations Development Programme

Conclusion

There is an urgent need for a collaborative effort of both government and stakeholders to support infrastructural development, community outreach programs, preventative approaches, agricultural development, risk management systems, and professional agencies with climate change technology to combat non-climatic conditions to avoid long-range consequences of malaria in the context of climate change. The tasks ahead are immense as these solutions must be implemented in the face of a multitude of problems, such as conflicts, lack of leadership, economic corruption, discrimination, unstable governments, pandemics, lack of infrastructure, low education, poverty, and public health. Without preventative approaches, these affected communities through rising temperatures will become even more vulnerable, and eventually the nation state will grow societally impatient of always bailing out those who live at risk, thus their response will become increasingly indifferent and ineffective, furthering the vulnerability conditions of the affected communities.

WORKS CITED

- Greenwood BM, Bojang K, Whitty CJ, Targett GA (2005). "Malaria". *Lancet* 365 (9469): 1487–98. World Malaria Report 2012 (Report). World Health Organization. http://www.who.int/malaria/publications/world_malaria_report_2012/wmr2012_no_profiles.pdf
- Hartman TK, Rogerson SJ, Fischer PR (2010). "The impact of maternal malaria on newborns". *Annals of Tropical Paediatrics* 30 (4): 271–82.
- IFPRI (2009). "Climate Change: Impact on Agriculture and Costs of Adaptation". International Food Policy Research Institute.
- IPPC. Climate Change 2001. "Impacts, Adaptations and Vulnerability. Contribution of Working Group II to the Third Assessment Report." Intergovernmental Panel on Climate Change, Cambridge University Press.
- Layne SP (2007). "Principles of Infectious Disease Epidemiology" (PDF). EPI 220. UCLA Department of Epidemiology. <http://web.archive.org/web/20060220083223/http://www.ph.ucla.edu/epi/layne/Epidemiology+220/07.malaria.pdf>
- Nayyar GML, Breman JG, Newton PN, Herrington J (2012). "Poor-quality antimalarial drugs in southeast Asia and sub-Saharan Africa". *Lancet Infectious Diseases* 12 (6): 488–96. doi:10.1016/S1473-3099(12)70064-6. PMID 22632187.
- World Bank Database.(2012). Data taken from 2012. The World Bank Group.
- Ricci F (2012). "Social implications of malaria and their relationships with poverty". *Mediterranean Journal of Hematology and Infectious Diseases* 4(1): e2012048. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435125>
- IFPRI (2009). "Setting Priorities for Public Spending for Agricultural and Rural Development in Africa," International Food Policy Research Institute.