

# Malaria's economic effects

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*What follows is a general and non-systematic summary of some research evidence related to malaria's effect on student absenteeism, student economic achievement, worker absenteeism, and general economic outcomes*

## General burden

The burden of malaria is extremely high in Mozambique, even by regional standards [Brundtland, 1999]. With a prevalence as high as 40%, malaria accounts for 29% of all deaths, and 42% of deaths among children under five [USAID, 2011]. Nearly a quarter of maternal deaths are due to malaria [Singh et al., 2014]. Along with HIV/AIDS [Berg et al., 2014], malaria is one of the greatest threats to public health in southern Mozambique.

## Student absenteeism

A study in rural Kenya found that malaria was one of the chief determinants of primary school dropout and absenteeism, and that female and orphans were most affected. The same study found that 39.6% of total days missed were attributed to malaria, a far greater burden than any other cause of absenteeism [King et al., 2015].

A study in Mali also showed malaria as the greatest determinant of absenteeism. Additionally, the researchers found that even asymptomatic infection (which should not affect absences) had a direct correlation with education achievement [Thuilliez et al., 2010].

A study in Cameroun found that children lost an average of 1.53 school days per month due to malaria infection [Kimbi et al., 2005].

A Brazilian study found that one malaria episode nearly doubled the likelihood of poor school performance among students, even after adjusting for age, mother's education, time in study area and school absenteeism [Vitor-Silva et al., 2009].

Though uncomplicated malaria appears not to have a major effect on school outcomes (once you adjust for other factors) in lower-endemicity contexts [Vorasan et al., 2015]

Collecting data on student absenteeism is an important and useful component of general health surveillance; even if not relevant to monitoring malaria epidemics, it serves as a baseline, and can help detect and monitor the severity of other disease outbreaks [Ashton et al., 2015].

A Gambian study found that in government schools, intermittent preventive treatment for malaria reduced the odds of drop out by two thirds [Zuilkowski and Jukes, 2014].

## General economic outcomes

Children who survive malaria face hurdles which can have life-long economic repercussions, particularly those related to intellectual development (such as cerebral malaria) [Idro et al., 2010] and general growth anemia [Mabunda et al., 2008].

Their families also pay economically - 32-34% of households incur malaria-related costs which rise to the level of “catastrophic” per the World Health Organization’s standards (ie, 10% of household income or 40% of non-food income) [Castillo-Riquelme et al., 2008].

A Sri Lankan study suggested that 5.6% of all working days were lost due to malaria-caused absenteeism during the malaria season (in the same population, 10% of all school days were lost to malaria-caused absenteeism) [Konradsen et al., 1997].

It is estimated that countries with malaria grow at a rate 1.3% slower than those without malaria, even after adjustment for relevant confounders [Sachs and Malaney, 2002].

Many people don’t realize that the direct costs of malaria (treatment, etc.) make up only a small part of the overall cost to those effected (24%). Far greater are the indirect costs to the patient (44%) and the indirect costs to the household (32%) due to things like loss of wages, decreased productivity, increased caretaking responsibilities, etc. [Attanayake et al., 2000].

Households absorb the majority of malaria-related costs, with 46% - 85% of these costs being indirect [Sicuri et al., 2013].

Even when low transmission is achieved, the direct costs of malaria can still be very high [Bôtto-Menezes et al., 2016].

Treating and preventing malaria, particularly when the right populations are targeted (such as pregnant women), can be extremely cost-effective [Ross et al., 2011]. A Study in southern Mozambique showed that the incremental cost-effectiveness ratio per DALY (disability-adjusted life year, a measure commonly used by epidemiologists to assess the value of an intervention in health terms) averted was \$1.02 by providing intermittent preventive treatment to pregnant women. Even if the treatment costs were 11 times greater, it would still represent a cost-effective intervention [Sicuri et al., 2010].

## References

- [Ashton et al., 2015] Ashton, R. A., Kefyalew, T., Batisso, E., Awano, T., Kebede, Z., Tesfaye, G., Mesele, T., Chibsa, S., Reithinger, R., and Brooker, S. J. (2015). The usefulness of school-based syndromic surveillance for detecting malaria epidemics: experiences from a pilot project in ethiopia. *BMC Public Health*, 16(1).
- [Attanayake et al., 2000] Attanayake, N., Fox-Rushby, J., and Mills, A. (2000). Household costs of 'malaria' morbidity: a study in matale district, sri lanka. *Trop Med Int Health*, 5(9):595–606.
- [Berg et al., 2014] Berg, A., Patel, S., Aukrust, P., David, C., Gonca, M., Berg, E. S., Dalen, I., and Langeland, N. (2014). Increased severity and mortality in adults co-infected with malaria and HIV in maputo, mozambique: A prospective cross-sectional study. *PLoS ONE*, 9(2):e88257.
- [Bôtto-Menezes et al., 2016] Bôtto-Menezes, C., Bardají, A., dos Santos Campos, G., Fernandes, S., Hanson, K., Martínez-Espinosa, F. E., Menéndez, C., and Sicuri, E. (2016). Costs associated with malaria in pregnancy in the brazilian amazon, a low endemic area where plasmodium vivax predominates. *PLoS Negl Trop Dis*, 10(3):e0004494.
- [Brundtland, 1999] Brundtland, G. H. (1999). WHO on Health and Economic Productivity. 25(2):396–402.

- [Castillo-Riquelme et al., 2008] Castillo-Riquelme, M., McIntyre, D., and Barnes, K. (2008). Household burden of malaria in south africa and mozambique: is there a catastrophic impact? *Tropical Medicine & International Health*, 13(1):108–122.
- [Idro et al., 2010] Idro, R., Marsh, K., John, C. C., and Newton, C. R. J. (2010). Cerebral malaria: Mechanisms of brain injury and strategies for improved neurocognitive outcome. *Pediatr Res*, 68(4):267–274.
- [Kimbi et al., 2005] Kimbi, H., Awah, N., Ndamukong, K., and Mbuh, J. (2005). Malaria infection and its consequences in school children. *E Af Med Jrnl*, 82(2).
- [King et al., 2015] King, N., Dewey, C., and Borish, D. (2015). Determinants of primary school non-enrollment and absenteeism: Results from a retrospective, convergent mixed methods, cohort study in rural western kenya. *PLOS ONE*, 10(9):e0138362.
- [Konradsen et al., 1997] Konradsen, F., Hoek, P. W. V. D., Priyane, H., and Amsersainghe, F. (1997). Measuring the economic cost of malaria to households in sri lanka. *American Journal of Tropica Medicine and Hygiene*, 56(6):656–660.
- [Mabunda et al., 2008] Mabunda, S., Casimiro, S., Quinto, L., and Alonso, P. (2008). A country-wide malaria survey in mozambique. i. plasmodium falciparum infection in children in different epidemiological settings. *Malar J*, 7(1):216.
- [Ross et al., 2011] Ross, A., Maire, N., Sicuri, E., Smith, T., and Conteh, L. (2011). Determinants of the cost-effectiveness of intermittent preventive treatment for malaria in infants and children. *PLoS ONE*, 6(4):e18391.
- [Sachs and Malaney, 2002] Sachs, J. and Malaney, P. (2002). The economic and social burden of malaria. *Nature*, 415(6872):680–685.
- [Sicuri et al., 2010] Sicuri, E., Bardaji, A., Nhampossa, T., Maixenchs, M., Nhacolo, A., Nhalungo, D., Alonso, P. L., and Menéndez, C. (2010). Cost-effectiveness of intermittent preventive treatment of malaria in pregnancy in southern mozambique. *PLoS ONE*, 5(10):e13407.
- [Sicuri et al., 2013] Sicuri, E., Vieta, A., Lindner, L., Constenla, D., and Sauboin, C. (2013). The economic costs of malaria in children in three sub-saharan countries: Ghana, tanzania and kenya. *Malar J*, 12(1):307.
- [Singh et al., 2014] Singh, K., Moran, A., Story, W., Bailey, P., and Chavane, L. (2014). Acknowledging HIV and malaria as major causes of maternal mortality in mozambique. *International Journal of Gynecology & Obstetrics*, 127(1):35–40.
- [Thuilliez et al., 2010] Thuilliez, J., Sissoko, M. S., Toure, O. B., Kamate, P., Berthélemy, J.-C., and Doumbo, O. K. (2010). Malaria and primary education in mali: A longitudinal study in the village of donéguébougou. *Social Science & Medicine*, 71(2):324–334.
- [USAID, 2011] USAID (2011). Demographic and Health Survey in Mozambique.
- [Vitor-Silva et al., 2009] Vitor-Silva, S., Reyes-Lecca, R. C., Pinheiro, T. R., and Lacerda, M. V. (2009). Malaria is associated with poor school performance in an endemic area of the brazilian amazon. *Malar J*, 8(1):230.

- [Vorasan et al., 2015] Vorasan, N., Pan-Ngum, W., Jittamala, P., Maneeboonyang, W., Rukmanee, P., and Lawpoolsri, S. (2015). Long-term impact of childhood malaria infection on school performance among school children in a malaria endemic area along the thai–myanmar border. *Malar J*, 14(1).
- [Zuilkowski and Jukes, 2014] Zuilkowski, S. S. and Jukes, M. C. H. (2014). Early childhood malaria prevention and children's patterns of school leaving in the gambia. *Br J Educ Psychol*, 84(3):483–501.