

Economic outcomes of Malaria in South East Asia

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Abstract

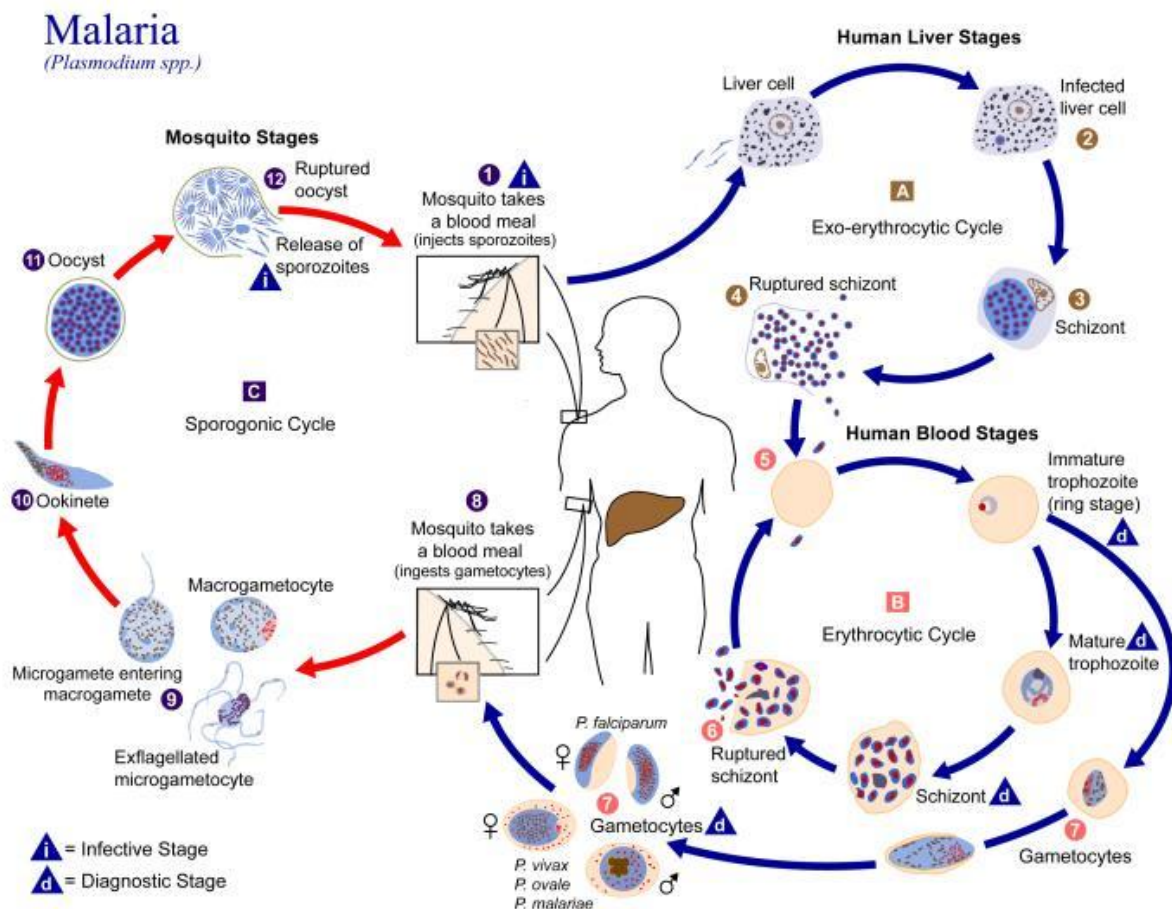
WHO statistics show that nearly 300 million people suffer from malaria on a yearly basis and over a million of them die from it. Statistically, every 40 seconds one child of all children in the world dies from malaria. In Africa, almost 90 percent of all recorded deaths are caused by malaria. Some time ago malaria was also a fatal disease in South-East Asia. Nevertheless, in the twentieth century a number of preventative actions have been undertaken and there has been a major improvement in the quality of intervention agencies' activities. However, a new strain – resistant to treatment and prevention – has started to grow there. Paper is an analysis of the economic impact of malaria in South East Asia, based on historical data. The study concentrates on economic perspective and outcomes of malaria in Asia region.

Keywords

Malaria, history, economy, impact, disease, remedies,

Dengue and malaria are two dangerous, mosquito-borne tropical diseases. Both are prevalent in equatorial regions, especially in wetlands. However, there is one principal difference between those two. In case of malaria, complications and problems increase over time. Dengue, on the other hand, has serious but short-term outcomes. In some ways malaria is more dangerous than dengue, since it requires a cure and does not pass off by its own. This is because malaria is a parasite and not a virus. Its functioning and behavior has been described by vast medical literature, which can be generally summarized to the cycle shown in Chart 1.

Chart 1. Mode of transmission of malaria



source: image taken from Wikipedia
 (https://pl.wikipedia.org/wiki/Malaria#/media/File:Plasmodium_lifecycle_PHIL_3405_lores.jpg),
 accessed 01.07.2015

The term malaria originates from Medieval Italian words “*mala aria*” that means “bad air”. Earlier, in ancient Rome, it was known as “Roman fever”. It appeared in the English literature about 1829 (Reiter 1999). It was associated with frequent fevers occurring among people travelling through wetlands. Currently, malaria, as a disease, is one of the most severe public health problems worldwide. It is a leading cause of death and disease in many developing countries, where young children and pregnant women are the groups most affected. According to the World Health Organization’s World Malaria Report (2013) and the Global Malaria Action Plan (2013):

- 3.4 billion people (half the world's population) live in areas at risk of malaria transmission in 106 countries and territories
- In 2012, malaria caused an estimated 207 million clinical episodes, and 627,000 deaths. An estimated 91% of deaths in 2010 were in the African Region.

Malaria is caused by parasitic protozoans (malaria parasites). It is transmitted by mosquitoes living in tropical and subtropical climate zones. Malaria is a serious health problem for inhabitants of developing countries and an infectious cause of death for people travelling to tropics. Among all parasitic diseases, malaria accounts for the most deaths in the world. Yearly, approximately 1–3 million people die from it. The severe course of infection impacts, most of all, little children, pregnant women and travelers from our climate zone (i.e. people who have not had a chance to develop partial resistance to malaria). The minimum incubation period for malaria is about 7 days counting from the infected mosquito bite. In this period of time, the afflicted person may not observe any changes in their state of health. The first symptoms of malaria include: fever with sweating and chills, headache and muscular pain, weakness and general indisposition, nausea and vomiting, profuse sweating. Then the temperature falls down, but not for long, as it continuously appears again. Muscles are in pain, cough or trouble with breathing can appear. Untreated malaria can lead to its cerebral form, which often ends with a coma or death. Fatality rate can reach 20% even with intensive care and treatment (Nadjm and Behrens, 2012). Therefore, rapid recognition of clinical signs and appropriate medical treatment are extremely important. Recognition of malaria is based on identifying – during a fever peak or immediately after it – typical malaria parasites in or around red cells. Treatment of malaria can be undertaken only by a doctor, as particular medicines are not without an impact on a human body. Malaria imposes substantial costs to both individuals and governments:

Economic costs to individuals and their families include purchase of drugs for treating malaria at home; expenses for travel to, and treatment at, dispensaries and clinics; lost days of work; absence from school; expenses for preventive measures; expenses for burial in case of deaths.

Economic costs to governments include maintenance, supply and staffing of health facilities; purchase of drugs and supplies; public health interventions against malaria, such as insecticide spraying or distribution of insecticide-treated bed nets; lost days of work with resulting loss of income; and lost opportunities for joint economic ventures and tourism.

While economic direct costs (for example, illness, treatment, premature death) have been estimated to be at least US\$ 12 billion per year globally (Roll Back Malaria calculations), economic costs of lost economic growth is many times more than that. Countries with intensive malaria grew

1.3% less per person per year, and a 10% reduction in malaria was associated with 0.3% higher growth (Gallup and Sachs, 2001).

Malaria might be prevented and controlled by state-imposed efficient institutions. Control is carried out through the following recommended malaria treatment and prevention interventions. The choice of interventions depends on the malaria transmission level in the area (e.g., in areas of low transmission level, intermittent preventive treatment for pregnant women is usually not recommended and expensive). There are different patterns for prevention and intervention.

Prevention

Insecticide-treated nets (ITNs)

Intermittent preventive treatment of malaria in pregnant women (IPTp)

Intermittent preventive treatment of malaria in infancy (IPTi)

Indoor residual spraying (IRS)

Health education strategy

Interventions

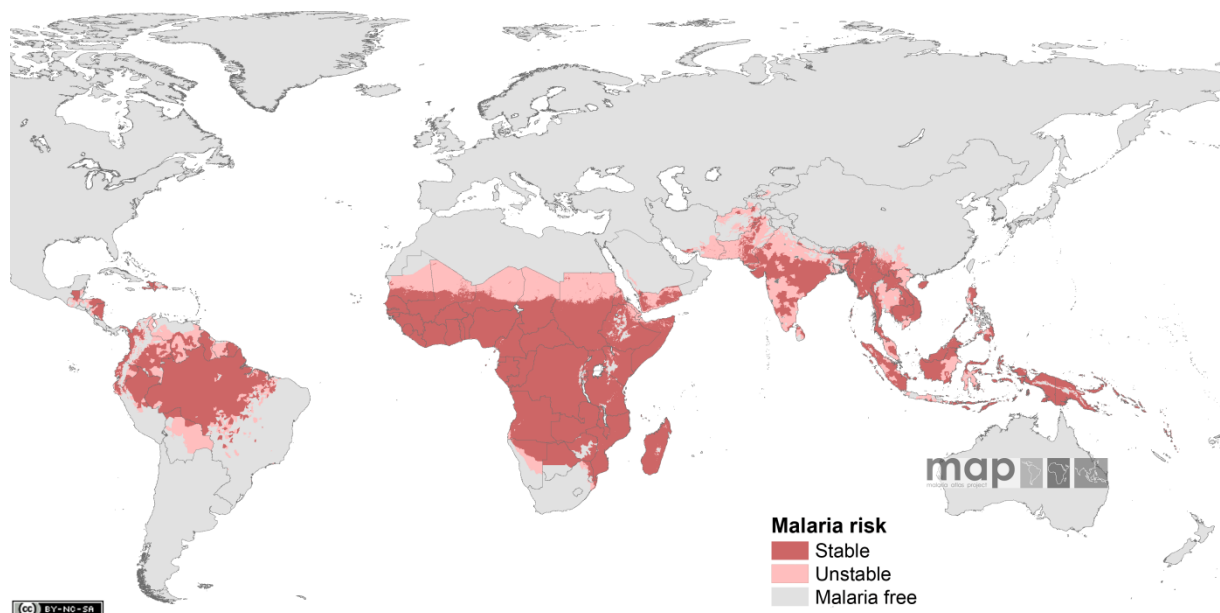
Larval control and other vector control interventions

Mass drug administration

Mass fever treatment

State health malaria programs for ill people

Chart 2. The presence of Malaria in the world



Source: Malaria Atlas Project, Oxford University (2015), (<http://www.map.ox.ac.uk/>).

Malaria and economic history – outcomes so far

In the book titled “The Fever: How Malaria Has Ruled Humankind for 500,000 Years” Sonia Shah says that malaria is a problem for mankind, present in our world for centuries (Shah 2010). If we take a closer look into historical background of malaria, it turns out the most deadly infectious disease in history. Shah claims that it is something more than just a medical problem. It is indeed a cultural problem – lack of awareness that malaria is something we should be fighting out; an economical problem – no funds for combating malaria; and a political problem – world leaders do not perceive fighting against malaria as a political target.

In fact, malaria might have influenced the economic trajectory of the world through institutions. In “The Colonial Origins of Comparative Development: An Empirical Investigation” by Daron Acemoglu, Simon Johnson and James A. Robinson they stated that the sickness environment determined the nature of settlements, which determine the nature of institutions which, in turn, determined the economic prosperity of a country. They claimed:

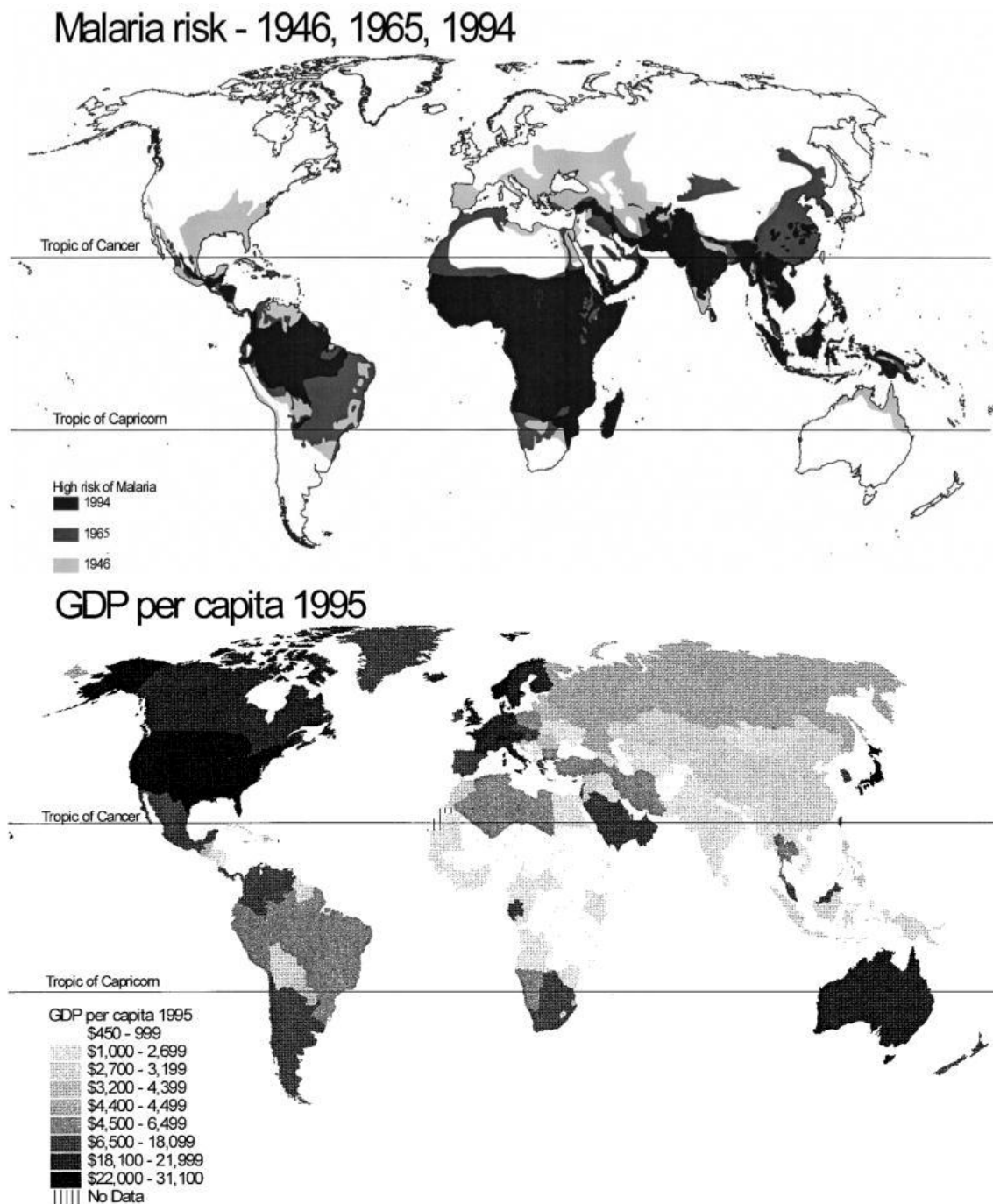
“1. There were different types of colonization policies which created different sets of institutions. At one extreme, European powers set up “extractive states,” exemplified by the Belgian colonization of the Congo. These institutions did not introduce much protection for private property, nor did they provide checks and balances against government expropriation. In fact, the main purpose of the extractive state was to transfer as much of the resources of the colony to the colonizer. At the other extreme, many Europeans migrated and settled in a number of colonies, creating what the historian Alfred Crosby (1986) calls “Neo-Europes.” The settlers tried to replicate European institutions, with strong emphasis on private property and checks against government power. Primary examples of this include Australia, New Zealand, Canada, and the United States.
2. The colonization strategy was influenced by the feasibility of settlements. In places where the disease environment was not favourable to European settlement, the cards were stacked against the creation of Neo-Europes, and the formation of the extractive state was more likely.
3. The colonial state and institutions persisted even after independence.” (Acemoglu and others, 2001):

If this assumption is right malaria always has been causing poverty and was a major hindrance to economic development for ages. Also it's curious that poverty can increase the risk of malaria, since those in poverty do not have the financial capacities to prevent or treat the disease. Economic burden is placed on poor families living outside cities, who often bear the costs from their own pockets for nets, doctors' fees, antimalaria pills and transport to health facilities. That's micro scale. Taking that into account on a macro level country economy might fall into a “malaria trap,” in which sickness begets poverty and poverty makes disease prevention unaffordable (Gollin and Zimmermann, 2007). In this point outside or state intervention may be very expensive, but desperately needed. Basically malaria causes significant economic losses, and can decrease gross domestic product (GDP) in countries with high levels of transmission (Africa) by incurring health costs of malaria. These include

both personal and public expenditures on prevention and treatment and lost-work cost. Economic costs accumulate over time, year after a year. Gallup and Sachs (2001) found that the 44 countries with intensive malaria problem had in 1995 income of 1,526 dollars per capita, compared with 8,268 dollars per capita for the 106 countries without intensive malaria burden. Malaria and poverty are well connected.

Sachs and Malaney (2002) conclude: “Where malaria prospers most, human societies have prospered least. The global distribution of per-capita gross domestic product shows a striking correlation between malaria and poverty, and malaria-endemic countries also have lower rates of economic growth. There are multiple channels by which malaria impedes development, including effects on fertility, population growth, saving and investment, worker productivity, absenteeism, premature mortality and medical costs”. The question is does malaria cause poverty, as they say, or conversely, is poverty responsible for malaria? Nevertheless, it’s obvious that fewer malaria infections will greatly improve human capacities and promote economic progress.

Chart 3. Maps showing correlation between malaria risk and GDP per capita



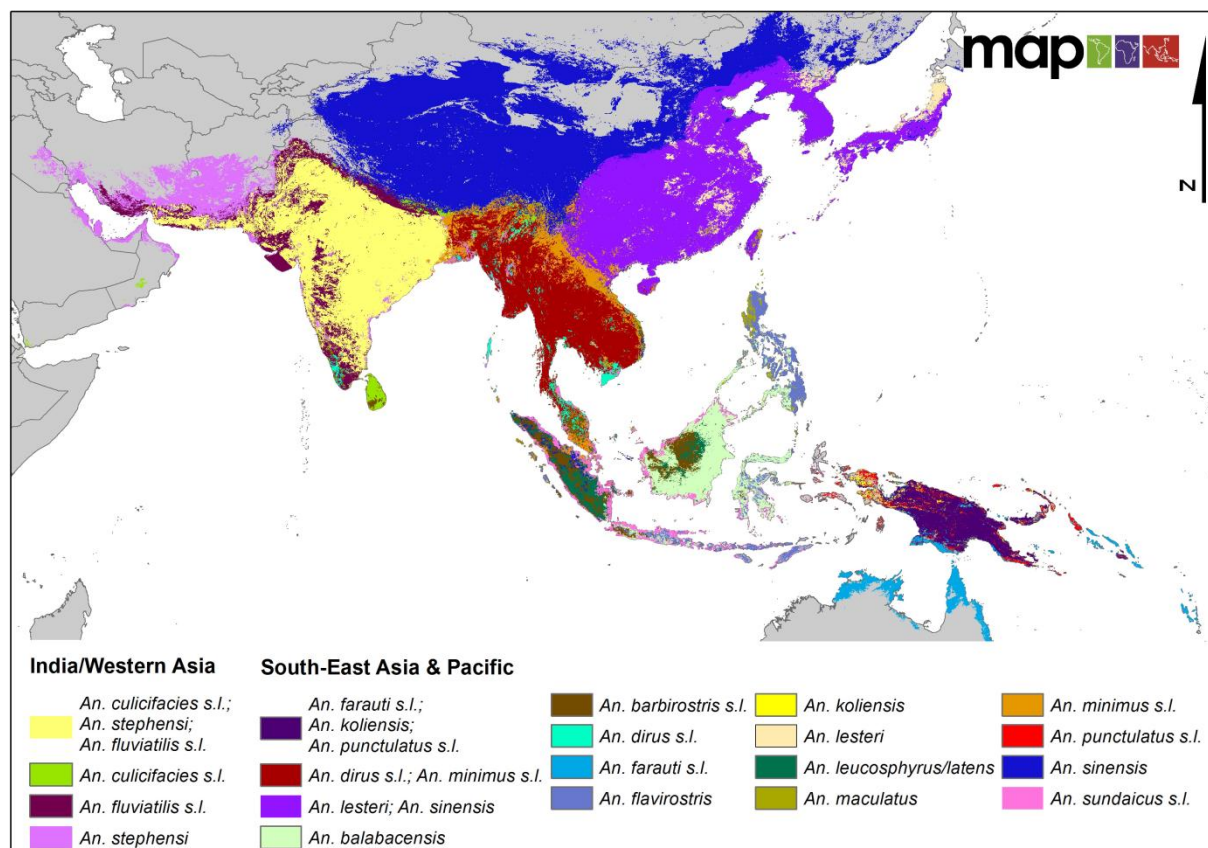
source: Gallup JL., Sachs J. (2001), *The economic burden of malaria*, "American Journal of Tropical Medical Hygiene", 64 (1,2), pp. 1-11.

Malaria eradication in South East Asia – success or first step?

In Asia-Pacific region there is a different pattern to the spread of malaria, more types of mosquitoes, with different behavior patterns. It's one of the reasons why controlling malaria is complicated. Significant progress has been made to reduce the number of malaria cases and mortality

rates since 2000, however, malaria remains a major threat in the region, with around 30 million cases and 42,000 deaths each year.

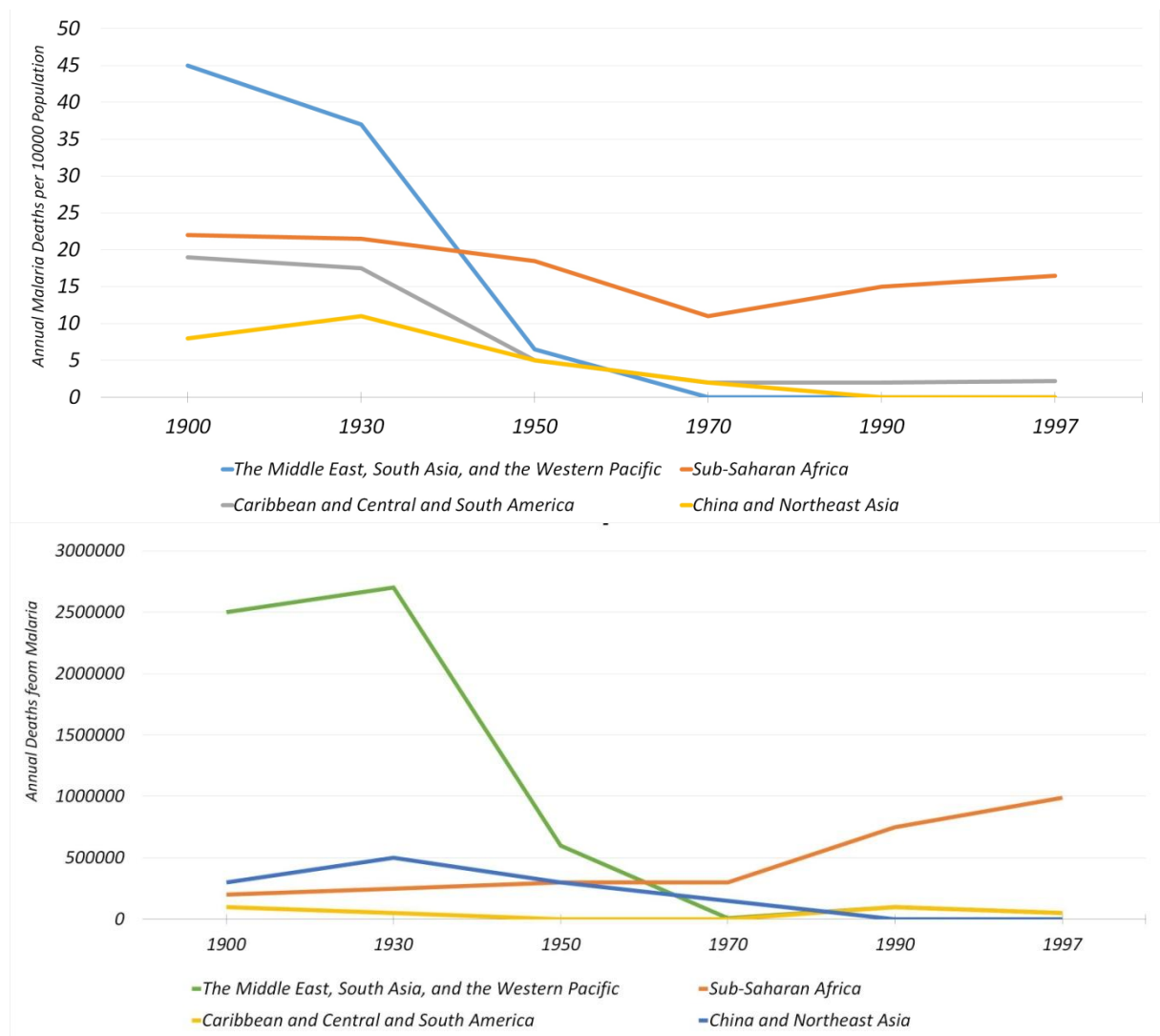
Chart 4. Dominant malaria vectors (types of mosquitoes carrying parasite) in Asia in 2010.



Source: Oxford University (2015), Malaria Atlas Project (<http://www.map.ox.ac.uk/>).

Ronald Ross, who lived in Asia, named malaria the “million murdering death” (Ross 1923). Asia used to be the “global centre” of malaria. However, this has changed. For almost two decades toward the middle of the 20th century, from the early 1930s to the late 1940s, war across Asia and the Western Pacific stirred the cauldrons of malaria. With popularization of malaria remedies in the late 1940s and early 1950s, national malaria control campaigns were established in all of the affected countries. Simultaneous deployment throughout most of the affected areas of health delivery systems providing treatment was crucial for this success (Carter and Mendis 2002). Then, in the 70s, malaria in Asia became resistant to applied medicines and mortality and morbidity from malaria slightly increased.

Chart 5. Morbidity from malaria in Asia, Africa and South America – comparative historical perspective 1990-1997



Source: own elaboration. Data taken from The World Health Report, 1999 (World Health Organization); Rolling back malaria report (2012), p 49-63.

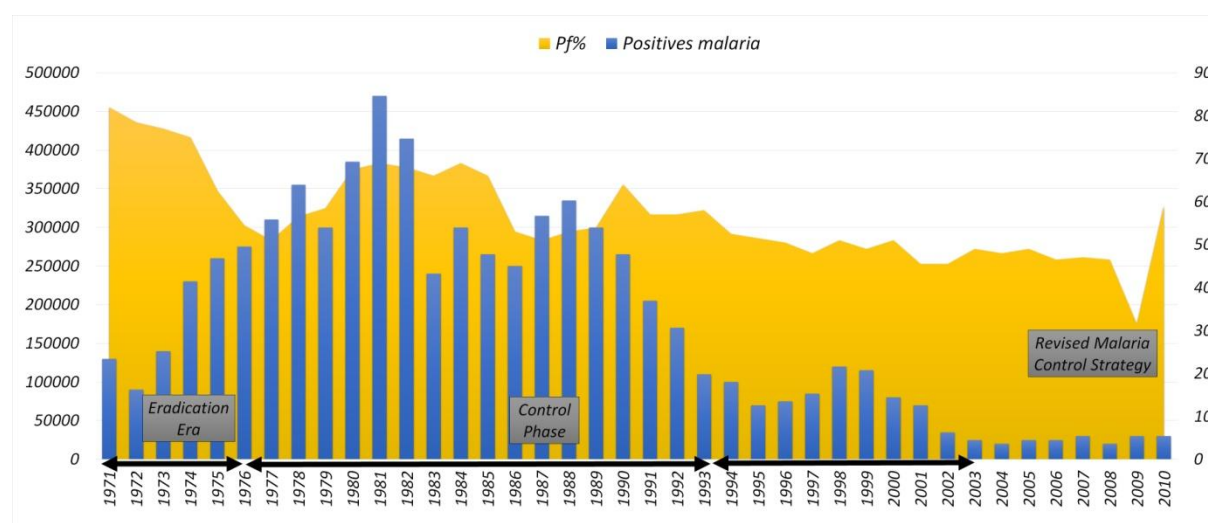
In Asia, the second most affected part of the world, India has the highest malaria burden, followed by Indonesia and Myanmar.¹ In Africa malaria is present everywhere, both in cities and rural areas (Harper and Armelagos, 2011). In Asia however, it is more common in rural areas than in cities. Cities in countries, such as Cambodia, Laos, Thailand or Vietnam are malaria-free (Cui and others, 2012). Nevertheless, the disease is prevalent in many rural regions, including along international borders and jungle. As cities are centres of growth, the elimination of malaria can be treated as a substantial success. In the 90s, Asian countries implemented a series of institutional programmes, which led to a positive outcome – i.e. reduced number of malaria sufferers and malaria deaths. The

¹ According to Levi (2012) there is no viable and proven data about North Korea, however malaria and tuberculosis are major health problems in North Korea (WHO, World Malaria Report 2011).

reported malaria deaths declined in all countries of the region. Between 2000 and 2011 the highest decline in reported malaria deaths was registered by Sri Lanka (100%) and Nepal (100%) followed by Bhutan (93.3%) Thailand (93.2%), Bangladesh (92.6%), Myanmar (78.9%), Indonesia (53.4%), and India (19.7%) (WHO, SEARO, 2013).

One example of a country that is particularly successful in fighting against malaria is Thailand. Based on recorded malaria surveillance activities in Thailand from 1971 to 2011, the peak of malaria cases was present in 1981 with the total of 473,210 infections, and has since declined thereafter despite another rise in case load seen in 1988 (349,291 infections). In general, from 1988 to 2010, malaria has declined considerably as a result of expanded programs and access to quick diagnosis and treatment in countryside areas as well as an active infection surveillance program (Suwonkerd and others, 2013). Between 25,000 and 35,000 confirmed malaria cases still occur in Thailand annually. Despite decades of success in reducing the number of cases of malaria in the country, the disease remains a major cause of morbidity and mortality (especially on borders with Burma and Cambodia).

Chart 6. Trends of malaria in Thailand between 1971 and 2010 ('Positives' refer to all malaria cases, "Pf" = *P. falciparum*, multi-drug resistant malaria, infections only)



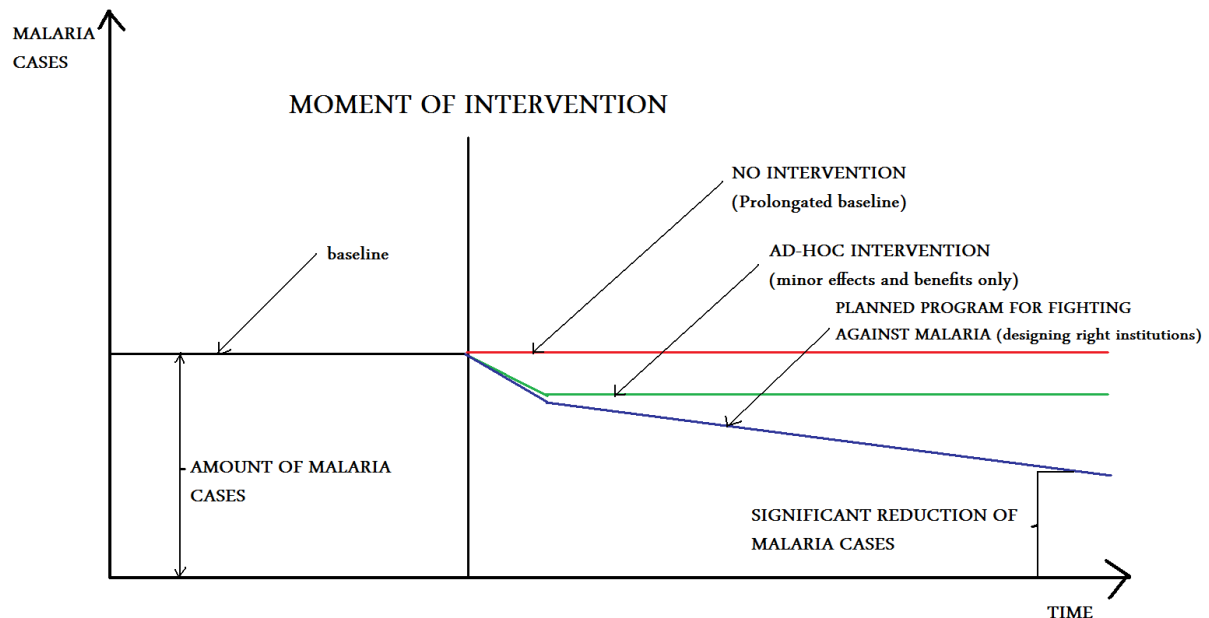
source: own elaboration based on: WHO data

(http://www.searo.who.int/en/Section10/Section21/Section340_4027.htm).

Leaving the problem of malaria to market-based solutions requires a network of effective institutions that give appropriate incentives. As malaria affects mostly countries that are poor, market institutions are usually quite ineffective. Here arises a valid question about state intervention and the scale of such intervention, with the aim to protect human capital. Chart 7 presents the model of human capital protection against malaria, which emphasizes long-term benefits resulting from establishing proper institutions. If a market is not able to establish effective institutions that could handle the

problem of malaria, the role of a country is to create educational institutions and establish standards and principles, or supportive programmes, which will help solve or facilitate dealing with the problem. That might indicate a significant role of the public sector to undertake campaigns of prevention.

Chart 7. Economical model showing the viability of programming institutions against malaria



Source: own elaboration.

The example of economical success in Asia depicts the importance and necessity of undertaking extensive activities in terms of infrastructure and financing, such as:

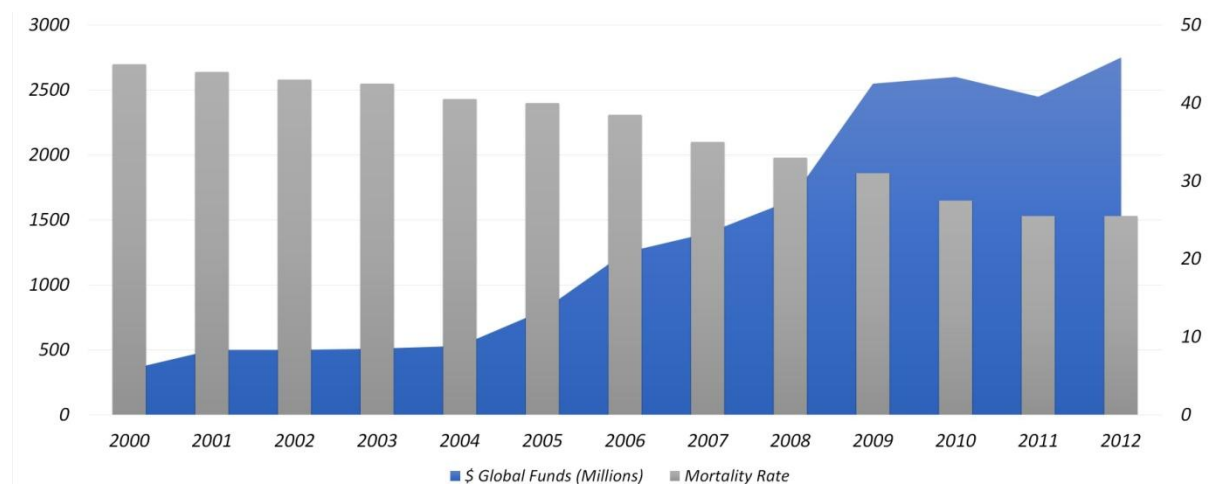
- Providing more funds and ensuring that actions against malaria are adequately represented in state and regional development programmes and budgets.
- Incorporating malaria treatment into existing healthcare systems and improving state healthcare institutions, quality and availability of services – understood in the financial and cultural sense, as well as the opening hours of healthcare facilities.
- Undertaking specific programmes of confronting and treating malaria among pregnant women and children.

The fight against malaria cannot be of an ad-hoc nature, as such interventions bring only interim benefits. Moreover, it cannot take a form of war against mosquitoes (e.g. with the use of DDT)². Against all appearances, mosquitoes play an important role in the ecosystem (Gunn 2012). Money intended for preventing and control over malaria must be centrally coordinated and accompanied by effective local activity plans. Statistics show that an increase in funding leads to a

² DDT (dichlorodiphenyltrichloroethane) has been banned all over the world, because of its harmful effects on the environment, people and animals, e.g. it led to reducing egg shell thickness, which resulted in lowering the number of mature birds. Overusing insecticides has also a negative impact on the pollination of plants.

lower number of malaria-related deaths. Between 2000 and 2012 the decrease amounted to 42% which has been presented in Chart 8.

Chart 8. Malaria - global funding and global mortality rates



Source: own elaboration based on data from website <https://www.malarianomore.org>

International strategies of fight against malaria.

World leaders have appreciated the need of dealing with malaria and conceived a Millennium Development Goal (MDG) No. 6 (“Stop and begin to reverse the spread of malaria and other major diseases”) and MDG No. 4 (“Reduce by two thirds the mortality of children under five years old”). Moreover, several international strategies of overcoming malaria have been launched. They include:

- Global Partnership “Roll Back Malaria”(1998), initiated by WHO, UN Development Program, UNICEF and the World Bank, aiming at reducing the number of infections by 50 per cent until 2010;
- Declaration in Abuja (2000); a common strategy launched by African countries, targeted at establishing solutions in terms of preventing malaria and decreasing mortality rate among children under 5 years old;
- Declaration in Maputo on HIV/AIDS, tuberculosis, malaria and other communicable diseases, which cemented the commitment of African governments to increasing financial support for the healthcare sector up to 15% of all government expenditure;
- European Alliance Against Malaria, encompassing civic associations from all over Europe, whose mission is to increase funds and improve strategies of fighting against malaria.
- In Asia, creation of APMEN (The Asia-Pacific Malaria Elimination Network), established in 2009 to work on malaria eradication through knowledge exchange, capacity building and cooperation.

Traps and obstacles on the way of fighting against malaria

It could seem that freeing a village or a town of malaria can be done quite easily: inhabitants must avoid mosquito bites and each infected person must be treated with appropriate remedies. Moreover, it is necessary to prevent the appearance of new parasites by extending care over infected travellers. Theoretically, such an approach should be enough to eliminate malaria. However, malaria is also present in gorillas, chimpanzees and monkeys (Prugnolle, 2010). An overall solution of the malaria problem is currently unachievable.

Nevertheless, there are remedies capable of treating malaria. The most effective one comes from China. For over two thousand years Chinese healers have used different leaves of fern to brew tea in order to treat fever and other health problems. In the 70s, Chinese scientists discovered that the key specific that treats malaria is almost within reach. It is *Artemisia annua* (Qing Hao) – a plant that has become an effective incarnation of the efforts undertaken in treating malaria (in some sense also Lyme disease) It contains artemisinin, a substance that has replaced quinine in fighting malaria. Today, artemisinin is present in every remedy applied in treatment of malaria. After introducing artemisinin as a cure administered together with other remedies, the mortality in Africa went down by a half. Unfortunately, this solution is expensive – the cost of artemisinin limits its scope of application to developing countries (White 2008).

Earlier, before artemisinin entered the market, malaria was treated with remedies that the parasite has become resistant to. For instance, resistance to derivatives of chloroquine spread from the late 1950s to up to 1970, which led to the recovery of malaria and caused millions of deaths. Furthermore there were derivatives of sulphadoxine-pyrimethamine, which became inefficient in 1980s and 1990s.

Although regional political and economic instability is partially blamed for the resurgence of malaria, human population expansion and mobility into forested regions, and environmental changes such as urbanization and deforestation have all contributed to the changing picture of malaria epidemiology. Perhaps, the single most important culprit responsible for the regional and global malaria resurgence is the emergence and spread of Artemisinin Resistance.

South-East Asia has a particular problem with malaria. Although the parasite is being particularly active in Africa and South America, it is in Asia, where quite recently the most deadly form of the parasite has appeared (the above-mentioned type *Plasmodium falciparum*), which has become resistant to the cure, to artemisinin. The situation concerns northern and western Cambodia, Thailand, Vietnam and eastern Burma (Myanmar) and Laos (WHO, 2013b). The increase of malaria resistance in South East Asia is particularly notable in poor regions of Cambodia, Burma and north-eastern Thailand. It's because frontiers comes through jungle (Lubina, 2014). The problem has been noted by western media. It is only the beginning, but if resistance to artemisinin goes more widespread, malaria can become a far more important problem of South East Asia than it is today. Taking into account current travel possibilities, the problem of malaria spreading grows to a larger size. What if Thai-Cambodian malaria reaches Africa? Experts (based on World Malaria Congress

2012) claim that such a case mortality will raise by 25%. Moreover, treatment is expensive. Also a vaccine against malaria is being formulated (its cost so far has reached over 500 million USD). Its effectiveness is estimated to be 30–50% (Riley and Steward, 2013). That is not much but doctors and scientists agree that it is a milestone in preventing the disease and an opportunity of freeing economical growth reserves in the countries of South America, Africa and Asia.

Conclusions

Spread of malaria not only can be stopped but also significantly reduced. Malaria has been eliminated throughout most of the developed world, including the United States in 1951 and southern Europe (Spain, Portugal, Greece, Italy) in the late 1940s. With other diseases the situation was similar. Smallpox was ultimately wiped out in the 1970s, with the last case being in Merca, Somalia in 1977. When the eradication was announced in 1980, the operation was described “a triumph of management, not medicine”. The malaria case is a bit more complicated, because it is a disease of a more cunning nature. Despite this, several successes have been achieved, especially in Asia. Nevertheless, insufficient financial support and its little effectiveness, lame healthcare infrastructure and lack of proper education, i.e. ineffective institutions, are the main obstacles standing on the way of treating and preventing malaria. Instances of effective institutions can be seen in countries, which have introduced the pre-elimination phase, limiting the severity of malaria outcomes to a minimum (e.g. Thailand, Malaysia, Sri Lanka, Taiwan). As the World Bank has noticed, „the Asian Tigers”, rapidly developing Asian countries, have within the last 30 years achieved an unprecedented economical leap accompanied by an effective modification of their institutions (World Bank, 1993). They have also achieved a huge portion of success in terms of minimizing the problem of malaria, which indicates to confirming the view that malaria is a significant barrier for economic growth in developing countries of the tropics. Facing this challenge helps achieving better economical results.

Moreover, in case of malaria, the priorities of providing support are not always clear and evident. A huge part of political and financial capital is invested in vain into regions that have least need of it. For instance, at the beginning of the 20th century, 90 countries committed themselves to launch a similar project, following the strategy outlined by the U.S. Department of State and World Health Organization. Result: malaria was overcome on several Caribbean islands and Reunion, in the wealthiest and most developed regions, while forgetting about two billion of people inhabiting the poorest areas, left at the mercy of endemic malaria, which is the most difficult to control (Harrison, 1978). Interestingly, in 2001, Bjørn Lomborg, a Danish economist, published the book titled „The Sceptical Environmentalist”, where he accused ecological activists of presenting selective results of scientific research on different types of threats (Lomborg, 2001). By doing so, they enforce particular political actions and claim money from limited resources to solve dubiously most urgent issues. Lomborg believes that one dollar invested in reducing carbon dioxide emission, being responsible for the greenhouse effect, will result in fewer benefits than one dollar invested in the fight against malaria.

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