

New and Re-Emerging Infectious Diseases in Sub-Saharan Africa

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1 Introduction

The great Roman philosopher Pliny the Elder famously wrote *ex Africa semper aliquid novi* [always something new out of Africa]. This quote referred to the variety of wildlife and the seemingly infinite abundance of natural resources which amazed the Romans. However, the quote could be equally applied to the proliferation and spread of infectious diseases. The two most serious epidemics of recent times emerged from African tropical forests, namely AIDS and Ebola. Every region of the world has to deal with the threat and impact of disease, but Africa has been disproportionately impacted.

Infectious diseases play a critical role with respect to demographic trends in sub-Saharan Africa. Higher mortality rates for the working-age population can create scenarios where dependency ratios are adversely impacted. In order for the continent to move forward and claim a demographic dividend, it is crucial that the impact of infectious diseases is understood and addressed.

The demographic dividend is defined by the United Nations Population Fund (UNFPA) as “the economic growth potential that can result from shifts in a population’s age structure, mainly when the share of the working-age population (15–64) is larger than the non-working-age share of the population (14 and younger, and 65 and older)” (UNFPA 2015). We argue that this was under threat in parts of Africa due to the AIDS epidemic, which primarily killed young adults. Malaria mortality is found more among children while TB is closely related to AIDS. Treatment for AIDS and TB has been a game changer, and with the proper drugs people can expect to live close to normal lives. However, while demographic impacts can be prevented or at least delayed, it is at a price.

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This chapter looks specifically at three existing diseases: malaria, AIDS, and tuberculosis and one new one Ebola. It addresses also the likelihood of new diseases emerging.

2 Global Health and Africa

In the past half century, the global health landscape has changed markedly for the better and will continue to do so. People are living longer, healthier lives, and indicators of infant, child, and maternal mortality show steady improvement. In their call for the new Sustainable Health Goal¹ to have measurable targets, Norheim and colleagues noted: ‘Throughout the world, except in countries where the effects of HIV or political disturbances predominated, mortality decreased substantially from 1970–2010, particularly in childhood’ (Norheim et al. 2015).

Sub-Saharan Africa is the region with the youngest and most rapidly growing population (IHME 2010). The United Nations Children’s Fund (UNICEF) estimates that within 35 years, one in every four people will be African—in 1950 only nine in 100 were. By 2050, around 41% of the world’s births, 40% of under-fives, and 37% of children under 18 will be African (You et al. 2014). The growth of the youthful population threatens to outpace economic development, placing a strain on institutional capacities and the delivery of social services. On the other hand, it means that there is an opportunity for a demographic dividend, as discussed elsewhere in this book. Additionally, and for some time, Africa will not see the same burden of non-communicable diseases (NCDs), resulting from an aging population, as the rest of the world is facing.

Despite these gains, the continent faces serious challenges from infectious diseases. This is put into context in Table 1, which shows the changing Burden of Disease data globally and for sub-Saharan Africa (SSA), from 1990 to 2013. Globally the main cause of loss of disability-adjusted life years (DALYs) is heart disease, which is an NCD. If we were to look at developed countries (not shown), their major burden comes from NCDs, in particular heart disease, stroke, and other lifestyle related illnesses. These are increasing in importance but only sickle cell disease makes it into the top ten ranking in SSA (stroke is number 19 and heart disease number 17 in the 2013 ranking).

¹The Sustainable Development Goals (SDGs) will replace the Millennium Development Goals that ran from 2000 to 2015.

Table 1 Global disability-adjusted life years (DALYs)^a, top 10 causes global and Sub-Saharan Africa

Rank	Global				Sub-Saharan Africa			
	1990	2013	% change	1990	2013	% change	2013	% change
1	Lower respiratory infections	Ischemic heart disease	30	Diarrheal disease	Malaria	-7		
2	Diarrheal disease	Lower respiratory infections	-44	Lower respiratory infections	HIV/AIDS	483		
3	Neonatal preterm birth	Diarrheal disease	-58	Malaria	Lower respiratory infections	-22		
4	Ischemic heart disease	Low Back Pain	63	Measles	Diarrheal disease	-48		
5	Neonatal encephalopathy	COPD	21	Protein-energy malnutrition	Neonatal preterm birth	-6		
6	Tuberculosis	Neonatal preterm birth	-47	Neonatal preterm birth	Protein-energy malnutrition	-22		
7	Malaria	Malaria	1	Neonatal encephalopathy	Neonatal encephalopathy	-3		
8	COPD	Hemorrhagic stroke	22	Tuberculosis	Tuberculosis	-8		
9	Hemorrhagic stroke	HIV/AIDS	370	Neonatal sepsis	Neonatal sepsis	30		
10	Iron-deficiency anemia	Neonatal encephalopathy	-22	Other neonatal	Sickle cell	40		

Source: IHME (2016)

^aDALYs stand for disability-adjusted life years and are a metric for quantifying the burden of disease from mortality and morbidity. One DALY can be thought of as one lost year of healthy life

3 Communicable Diseases

Malaria and AIDS are the communicable diseases that head the latest DALY table for SSA. TB has remained consistently at number eight on the African ranking. These diseases spread most easily where there are weak health systems and poor infrastructure. However, all can be brought under control. Interventions such as spraying and (often impregnated) bed nets reduce the incidence of malaria. The development and distribution of anti-retroviral therapy means symptomatic AIDS illness can be suppressed. TB can be cured (WHO 2010). The game changer for all these diseases would be the development of effective (or for TB, more effective) vaccines (PATH 2015).

Lower respiratory infections and diarrheal disease account for significant health loss in SSA, although their relative disease burdens are lower than 20 years ago. The expected improvement in living conditions and wealth will reduce incidence of diarrhea (e.g., clean water and hygiene) and respiratory infections (e.g., not using wood, coal, or paraffin for cooking and having better ventilated housing – the ventilation will also cut transmission of TB). Improvements in access to health care will reduce infant, child, and maternal mortality. Deaths from measles have fallen out of the top ten diseases. The 2015 Bill and Melinda Gates' Foundation letter reflected the optimistic view that polio would be eradicated in Africa in 2015 (this seems to be the case in 2016), and Guinea worm, elephantiasis, river blindness, and blinding trachoma will be controlled and eliminated (Gates and Gates 2015).

3.1 Malaria

Malaria is vector-borne disease caused by *plasmodium* parasites, transmitted to humans through the bites of infected female *anopheles* mosquitoes. The WHO estimates that 3.2 billion people in 96 countries are at risk of malaria infection (1.2 billion are at high risk). In 2013, over 198 million cases of malaria occurred globally, leading to approximately 584,000 deaths. The disease occurs disproportionately in Africa as Fig. 1 shows. The continent accounts for 90% of deaths, of which 78% are children under the age of 5 (WHO 2014b). Within endemic countries, the poorest and most marginalized communities are those most severely impacted by malaria, and are least likely to have access to services for prevention, diagnosis, and treatment.

The likelihood of transmission depends on factors related to the parasite, the vector (mosquito), the human host, and the environment. Mosquitoes breed in standing water and so transmission patterns are highly dependent on climate, particularly rainfall patterns, temperature, and humidity. The African vector species has shown a particularly long lifespan and higher tendency towards biting humans, a reason why the disease is rampant throughout the continent. People who move into areas

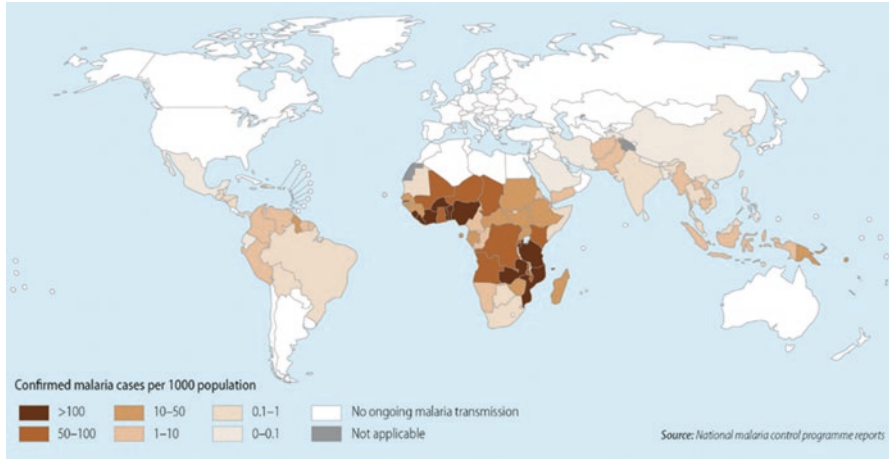


Fig. 1 Countries with ongoing malaria transmission 2014 (Source: WHO 2014b)

with high malarial transmission include migrant workers and refugees; infants and children are particularly susceptible as their immunity is low.

Unlike some other infectious diseases there are highly efficient and cost-effective interventions available. The main ones are vector control and protection. This involves managing the environment to reduce the places in which mosquitoes can breed, and using indoor residual spraying (IRS) and insecticide-treated mosquito nets (ITNs). The WHO estimates that ITNs reduce the incidence of malaria by over 50% (similar results have been documented via the use of IRS, however randomized trial data is limited) (WHO 2014b). Current treatments for malaria are effective and therefore good case management, accurate diagnosis, and the treatment of infections are crucial. The fact that malaria is still so serious in Africa is an indictment of poor health systems and a lack of political will.

The international community has implemented a strong, coordinated response to the malaria epidemic, highlighted by the creation of the Roll Back Malaria (RBM) partnership launched in 1998 by the WHO, UNICEF, UNDP, and the World Bank. The RBM Partnership, hosted by the WHO in Geneva, is a global framework of more than 500 partners. The WHO is planning a strategy for 2016–2030 with the aim of “a world free of malaria” (WHO 2014b). The Gates Letter predicts: ‘We won’t be able to completely eradicate malaria by 2030, but we will have all the tools we need to do so. These will include a vaccine that prevents people being infected with malaria... In 15 years; we’ll be poised to send malaria the way of smallpox and polio’ (Gates and Gates 2015).

3.2 *HIV and AIDS*

The human immunodeficiency virus (HIV) is a retrovirus that destroys the cells of the immune system. As the infection progresses, the immune system becomes weaker and the person is susceptible to opportunistic infections. Incidents of illness increase in frequency, duration, and severity. This can take 10–15 years, during which time the person is infected and can transmit HIV. The most advanced stage of HIV infection is acquired immunodeficiency syndrome (AIDS). If the individual is not put on treatment they will die.

The first cases were identified in 1981 among gay men in the United States. HIV was isolated and recognized as the cause of AIDS in French laboratories in 1983. The virus originated in non-human primates in Africa and was transferred to humans in the early twentieth century. The HIV-1 strain of the virus was transmitted from chimpanzees in Central Africa, while at around the same time the less virulent HIV-2 strain crossed the species barrier from sooty mangabey monkeys in West Africa. The mode of transmission is unknown. Speculation is that either hunters or people butchering the animals were first infected.

Spread occurred beyond the primary cases. HIV moved slowly out from initial infections in a core area until it reached populations where conditions were ripe for rapid transmission. This, in Western societies, was among relatively affluent gay men and intravenous drug users. In sub-Saharan Africa, it occurred in unstable central African regions, particularly the border between Uganda and Tanzania.

HIV is most efficiently transmitted through the transfusion of infected blood, but blood and blood products are now screened. The sharing of contaminated needles is the second most effective route of transmission. This can happen in health care settings (nosocomial infections), but is most common among injecting drug users. Simple measures of sterilization can reduce this, as well as providing clean needles in clinics and hospitals and to addicts.

Being HIV positive reduces the chance of a woman falling pregnant (by about 30%), carrying the fetus to term, and delivering (Chen and Walker 2010). HIV infected women experience higher maternal mortality. Even if a woman is on treatment, she is less likely to conceive, or complete the pregnancy, and still faces a higher (albeit reduced) risk of death. An infected mother can pass HIV to her child during pregnancy, childbirth, and breastfeeding. Use of anti-retroviral drugs reduces this risk from about 30% to less than 5%. The current advice is that HIV positive pregnant women remain on treatment for the rest of their lives. Infected children fail to thrive and, in the absence of treatment, most die before their fifth birthdays. Even if children are not infected, infant and child mortality rates are slightly higher among those born to infected mothers.

Globally, over 36.9 million people are living with HIV and 1.2 million die annually (UNAIDS 2015). The worst affected continent is Africa, but it is not a homogeneous epidemic. In much of North and West Africa, prevalence levels among adults (aged 15–49) are low (below 2%) and the disease is concentrated among specific populations. Many Southern African countries are experiencing hyper-endemics

Table 2 AIDS and key indicators for selected African countries

Country	HIV prevalence	Life expectancy					Infant mortality rate		
	2014	1995	2000	2005	2010	2013	1995	2005	2015
Botswana	25.2	56.2	48.7	54.6	63.4	64.4	48.9	44.8	34.8
Ethiopia	1.2	49.3	51.9	56.2	61.3	63.4	105.6	69.6	41.4
Kenya	5.3	54.5	50.8	53.5	58.7	61.0	71.9	54.3	35.5
Lesotho	23.4	56.8	47.2	43.7	47.5	49.3	76.6	88.1	69.2
Malawi	10.0	43.5	44.1	48.3	56.8	61.5	121.9	70.7	43.4
Mozambique	10.6	45.9	48.7	50.6	53.2	54.6	143.4	90.4	56.7
Nigeria	3.2	46.1	46.6	48.7	51.3	52.4	123.4	96.6	69.4
Rwanda	2.8	31.6	48.2	54.8	61.4	63.4	129.6	70.2	31.1
South Africa	18.9	61.4	55.8	51.6	54.4	56.7	48.2	51.5	33.6
Swaziland	27.7	56.4	48.7	45.9	48.3	48.9	68.7	83.0	44.5
Tanzania	5.3	48.7	50.5	55.6	61.6	64.3	95.8	58.7	35.2
Uganda	7.3	43.8	46.4	51.8	55.8	57.8	101.0	67.6	37.7
Zambia	12.4	42.0	43.5	49.4	56.4	59.2	107.8	68.7	43.3
Zimbabwe	16.7	50.2	41.7	41.8	49.6	55.6	60.1	61.0	46.6

Source: World Bank (2015)

where prevalence levels are above 15% and have remained at this level for long periods.

The AIDS epidemic in the worst affected countries has an impact on mortality levels, labor force participation and employment, food security, and life expectancy (AVERT 2014a). The effect of the disease on key indicators is shown in Table 2.

AIDS can be effectively controlled via the use of antiretroviral therapy (ART). ART consists of the combination of antiretroviral (ARV) drugs to suppress the progression of the virus. ART is effective in reducing viral load and hence prolonging life, reducing mortality rates, and increasing birth rates.

Scientific advances mean ART can be taken as one pill, once a day and different combinations are available if a patient develops resistance to some drugs. The cost of ART has plummeted dramatically, falling, at its lowest level, to US\$115 per person per year in 2013 for first-line ART therapy (AVERT 2014b). The numbers on treatment rose and at the end of 2015, it was between 14.9 and 15.8 million globally. The challenge is to reduce new infections and get people on treatment, and both are happening. Provided people can access treatment and are adherent, the burden of AIDS will continue to decrease. People on treatment are much less infectious, and so the number of new cases falls and treatment becomes prevention.

Improvements in ART quality and availability mean people infected with HIV can now live almost normal lives. This also means that the number of people living with HIV is going to increase. One of the most crucial ways of combatting the epidemic will be to maintain a reduction in the number of new infections. In this sense, we are on the right track as new infections have fallen by 35% since 2000, from 3.1 million people in 2000 to 2 million in 2014 (UNAIDS 2015).

Unfortunately, many African countries are dependent on donor funding to provide treatment and related services. This means that the sustainability of treatment is threatened. An analysis by Resch, Ryckman, and Hecht looking at 12 African countries found under their ‘maximum effort scenario’, across the countries “total average annual government expenditure on AIDS would increase by 2.5 times, reaching \$5.1 billion, which is sufficient to cover 64% of total AIDS financial needs’ and “although upper-middle-income countries, such as Botswana, Namibia, and South Africa, would become financially self-reliant, lower-income countries, such as Mozambique and Ethiopia, would remain heavily dependent on donor funds” (Resch et al. 2015).

3.3 Tuberculosis

Tuberculosis (TB) is an infectious bacterial disease commonly affecting the lungs. Coughing, sneezing or spitting can help facilitate the transfer of *mycobacterium tuberculosis* from person to person. It no longer appears in the list of the top ten causes of Global DALYs, largely because it is so linked to AIDS. TB is an AIDS related opportunistic infection and may not be recorded separately. In 2013, nine million people developed TB and over 1.5 million died, of which 300,000 were HIV+ (WHO 2014c). TB accounts for 25% of all HIV-related deaths.

The WHO estimates that about one-third of the world’s population has latent TB. These people have the TB bacteria, but are not ill, and do not infect others. On average the lifetime risk of an infected person falling ill with TB is around 10%, however this number is significantly higher for certain groups. HIV+ people are over 26% more likely to develop TB (WHO 2014d). Children and people in low- and lower-middle income countries face a heightened risk of falling ill. Africa has the greatest proportion of new TB cases with 280 falling ill per 100,000 in 2013. In North America, the rate is only 3–4 people per 100,000 annually (WHO 2014d; World Bank 2015).

TB is treatable and curable, generally with four antimicrobial drugs over a 6 month period. Over 30 million lives were saved through effective diagnosis and treatment between 2000 and 2013. Without proper supervision and technical support, adherence to the treatment can be difficult. There is also a growing concern about multidrug-resistant tuberculosis (MDR-TB), i.e., bacteria that do not respond to the most common, first-line drugs. This may be caused by ineffective treatment, either via incorrect use or low quality TB drugs and non-adherence to treatment. MDR-TB is more complex to treat, with lower cure rates, and the costs are 100 times greater than normal TB (WHO 2014e).

Preventing TB involves inoculation and public health interventions. Currently, the only available vaccine *bacillus Calmette-Guérin* (BCG) reduces the risk of getting infected by 20% and the risk of infection turning into disease by nearly 60%. It is given to children in much of the resource-poor world, but is no longer routinely used in the rich world. Intense efforts to develop new vaccines are underway. TB is

closely linked to poverty, crowding, and lack of properly ventilated accommodation. This means that public health and development interventions are critical.

Further research and development for new TB drugs is essential. Other areas for research include improving adherence to the drug regimen, which will address the danger of MDR-TB, and better diagnostics. However, the majority of global funding for TB is put into drug production and preventative vaccines, making new cures difficult to come by (Moran et al. 2013). Internationally, the Global Fund to Fight AIDS, Tuberculosis, and Malaria, provides over 80% of all support to fight TB. This has created a concern about financial dependence.

4 Emerging Diseases

One of the goals of this chapter is to speculate on the likely burden of disease up to 2050. Obviously, we cannot know what new diseases may emerge. However, we envisage that they will be zoonotic, crossing the species barrier from vertebrate animals to humans, as seen with new strains of influenza, severe acute respiratory syndrome (SARS)² or Middle East respiratory syndrome (MERS)³. Zoonoses are of concern because they are often unrecognized and may have increased virulence in human populations (Quammen 2012). The host reservoir may be difficult to identify, monitor, and control, making the prediction and prevention of outbreaks problematic. Globalization and global travel facilitate the rapid spread of such diseases.

Africa is a likely source of new diseases, and it is probable that most new illnesses will be viral hemorrhagic fevers (VHFs). Rapid economic development and population growth result in exploitation of formerly untouched natural resources and increasing contact between humans and wildlife. The potential for emergence of new diseases is increased. Subsequent urbanization, mobility, and increased human proximity create ideal conditions for diseases to spread widely and rapidly.

The key global health response must be to contain outbreaks locally and then regionally. This was well illustrated by the reaction to the 2014 Ebola epidemic. The first stage was to understand the disease: transmission and epidemiology. The second stage was to put in place the public health measures needed to stop transmission. While new diseases will emerge, experience and scientific advances, especially with AIDS and Ebola, mean that we can expect that they will be contained relatively quickly. It is unlikely that new emerging diseases will have a significant impact on African population dynamics although there are serious economic and social consequences. Compared to HIV, new epidemics may be quick to spread, but they can also be quick to control.

²SARS is a viral respiratory disease of zoonotic origin caused by the SARS coronavirus (SARS-CoV). Between November 2002 and July 2003, it originated in the livestock markets of southern China, causing about 8000 deaths.

³MERS is viral respiratory illness first reported in Saudi Arabia in 2012. It is also zoonotic and, as with Ebola, fruit bats were believed to be the reservoir.

The emergence of the 2015 Zika virus epidemic in Brazil took the global community by surprise, and is another example of the risks of a zoonotic disease. Zika was first identified in Uganda in 1947 in rhesus monkeys through a monitoring network of sylvatic yellow fever. It was subsequently identified in humans in Uganda and the United Republic of Tanzania in 1952.

It is spread to people through the bite of an infected *Aedes* mosquito. The symptoms of the virus include mild fever, skin rashes, conjunctivitis, muscle and joint pain, and malaise or headache, lasting for 2–7 days. These relatively minor symptoms make it hard to determine exactly how many people have been infected with the virus. Despite the fact that Zika itself is very rarely fatal, there has been growing concern that the virus can cause serious birth defects, primarily microcephaly. Brazilian health authorities also observed an increase in Guillain-Barré syndrome, which coincided with Zika virus infections in the general public. These concerns culminated in the WHO declaring, in February 2016, Zika “a Public Health Emergency of International Concern” (WHO 2016). This swift response may have been prompted by the failures of the WHO in responding to the 2014 Ebola outbreak.

4.1 *Ebola*

The first recorded outbreak of the acute and deadly infectious disease caused by the Ebola virus was in Southern Sudan in June 1976, where 284 people were infected, and over 50% died. A few months later, there was a second occurrence in Zaire (today the Democratic Republic of the Congo). This time, almost 90% of the 318 infected persons died. During this outbreak, Ebola was identified as a hemorrhagic fever. The disease was named after a river in the Northern area of DRC (CDC 2014). Over the next 30 years, there were sporadic, isolated outbreaks of Ebola in a number of Central African countries. All were either contained, or petered out.

Ebola is a zoonotic infection. The animal reservoir is believed to be bats. The incubation period in humans is 2–21 days. People are not infectious until they develop symptoms. Initial indications include fever, fatigue, muscle pain, headache, and a sore throat, followed by vomiting, diarrhea, rash, organ failure, and internal and external bleeding. Victims remain infectious even after death, as their blood and body fluids still contain the virus. Human-to-human transmission occurs via direct contact with contaminated fluids (WHO 2014a).

In March 2014, cases of Ebola were reported from the West African country of Guinea. Within a few days, Sierra Leone and Liberia notified the WHO that they too were seeing patients. Shortly after, for the first time, Ebola was seen in a major urban area, Conakry, the capital of Guinea. By June 2014, there had been 337 deaths, making this outbreak the worst recorded, and the death toll continued to rise. By April 2016, just over 11,000 people had died (CDC 2016). Isolated cases occurred in a number of developed countries including the United States, Spain, and the United Kingdom. Almost all were health care workers returning (or evacuated) from epidemic areas.

At the time of writing, there is a sense that the current Ebola epidemic has been brought under control. On March 29, 2016, the WHO Emergency Committee on Ebola announced that, in their view, the Ebola situation in West Africa no longer constituted a Public Health Emergency of International Concern and that the Temporary Recommendations adopted in response should be terminated. However, there are still sporadic cases.

Ebola caught the attention of the global press and resulted in a massive mobilization, including support from the international community. It is not demographically significant, however, because the numbers of casualties are too small. Nonetheless, it has been extremely costly. A WHO document estimated that the sum of US\$1536 million was needed to stop the outbreak, treat infected people, ensure essential services, preserve stability, and prevent outbreaks in countries as yet unaffected (WHO 2015a). As of May 2015, only US\$482 million had been mobilized.

5 Mortality, Morbidity, and Socio-economic Impacts

There is much reason to be optimistic when looking at health prospects in SSA. To be sure, there are challenges but overall the burden of disease has decreased significantly. Norheim et al. note: “Except where HIV or war or other major political disturbances predominate, health and longevity are better now than they were 20, 40, or more years ago, and still improving ...; a cost effective way to reduce premature death in many countries is to continue reducing child and maternal mortality, tuberculosis, HIV and malaria, partly because programs for these reductions that took years to establish are already in place and death rates are decreasing” (Norheim et al. 2015).

When AIDS first appeared there were dire predictions of hugely increased mortality, population declines, and possible socio-economic collapse. Demographers grappled with the implications and ran models to assess what might happen (Whiteside 1998). There was evidence of falling life expectancy and birth rates, changing population structures, and growing numbers of orphans. Rates of infection tended to be higher in urban areas, especially in the informal settlements or slums. What was and remains baffling is how little notice was taken of potential demographic impacts (Smith and Whiteside 2010; Whiteside 2006; de Waal 2006).

As policies and programs were put in place to combat the AIDS epidemic, the urgency seemed to diminish. However, innovative work by the RUSH Foundation is sounding warning bells (Collier et al. 2015; Atun et al. 2015; RUSH 2014). These studies looked at the moral and fiscal implications of ART and the concept of long term debt. It remains to be seen what action will be taken.

Ebola has been an additional wake-up call, but it seems that many of the previous arguments are being reshaped. An example is the issue of orphans – a major concern in the AIDS epidemic, but one where there was little action. Evans and Popova noted: “Every child who loses a parent experiences a tragedy. But many non-orphan children are experiencing significant income shocks due to the Ebola crisis, and

income differences can dwarf the differences between orphans and non-orphans. Thus, while it will be crucial to be mindful of the needs of orphans, broader attention to the needs of children in the wake of the Ebola crisis will be just as important for the long-term health and welfare of the affected countries” (Evans and Popova 2015). Still, there is no sign of action being taken.

As is reflected in other chapters in this book, sub-Saharan Africa faces unique challenges. While the region has made overall progress in reducing mortality and the burden of disease, different countries show increased instances of death within particular age groups and sexes. For example, between 1992 and 2012, Mozambique saw mortality rates among women aged 15 to 60 rising from 378 per 1000 people to 475 per 1000 people (World Bank 2014).

Much of the success is the result of the international rollout and commitment to immunization and prevention. As a result of immunization and other health care improvements (i.e., access to clean water, improved sanitation and hygiene, and educational programs), the number of deaths of children under the age of 5 fell from 9.6 million in 2000 to 7.6 million in 2010 (WHO 2012). The key will be to move toward what The Lancet describes as a health convergence where health in the poor countries gradually improves until it is similar to that in the wealthy world (Jamison et al. 2013).

6 Funding for Health

The key question is how the control of epidemics will be funded. Health funding is different in each country with a mixture of domestic resources; private financing, including insurance and out-of-pocket payments; and donor funding.

The diseases are expensive – Roll Back Malaria estimates that Africa needed US\$2.2 billion in 2015 (Roll Back Malaria 2015). In 2013, global funding for the HIV and AIDS response was an estimated US\$19.1 billion in low and middle-income countries. The need was, however, an estimated US\$22–24 billion (AVERT 2015). The funding gap for TB is estimated at US\$930 million in Africa (WHO 2015b). As mentioned, the price tag for the current Ebola outbreak was estimated at US\$1536 million. Resources slated for Ebola is being reallocated to fight the Zika virus.

Money was raised rapidly from the international community for HIV and AIDS. In 2001, Kofi Annan, Secretary General of the United Nations, called for spending on HIV/AIDS to be increased tenfold in developing countries, and the Global Fund for AIDS, TB and Malaria (GFATM) was established. In 2003, President George W. Bush pledged US\$15 billion toward the Presidential Emergency Program for AIDS Relief (PEPFAR), and WHO launched the “3 × 5” campaign to have three million people on treatment by 2005 (Whiteside and Lee 2005). The problem is that the existence of external resources means in many countries the bulk of epidemic funding comes from international sources, therefore creating an unhealthy situation of dependency.

Slow economic growth and the resulting fiscal cutbacks have left many sectors at a loss for funding. In spite of this, however, development assistance for health

(DAH) rose from 2012 to 2013 by 3.9%. We predict that DAH will remain steady or decline. There has been a push for countries in the developing world to increase their domestic funding for health. The Abuja Declaration in 2001 was an agreement by the Heads of State of African Union countries to increase government spending for health to at least 15% of their annual budget. However, only three countries have achieved their Abuja Declaration commitments thus far.

There are initiatives to increase domestic funding for health, including improving the efficiency of existing spending. The move to universal health coverage (UHC) will be significant. Malaria, HIV and AIDS, tuberculosis, and Ebola will require continuing international support in some countries. AIDS is too expensive to treat from domestic resources alone in some settings, and the withdrawal of international financing would mean people would die. However, the one constant with infectious diseases is that they can be prevented, and prevention costs less than cure. Africa's infectious disease burden can be managed.

7 Conclusions

Sub-Saharan Africa has a young and rapidly growing population. The region has seen significant health gains over the past 30 years. However, challenges still remain as a result of infectious diseases.

This chapter looked at a number of infectious diseases in Africa. Malaria, Tuberculosis, HIV and AIDS, and Ebola all may jeopardize efforts to capture a demographic dividend. High mortality and morbidity decrease the likelihood of a demographic dividend occurring, as dependency ratios worsen. As a result, increased focus must be placed on ways in which the diseases can be effectively combatted and mitigated. This includes finding sustainable funding from both domestic and international sources.

Demographic dividends can occur in Africa provided AIDS is treated. The other diseases are mainly felt in human misery rather than macroeconomic terms. Perhaps this should provide reason enough to intervene.

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