



Children dancing in HIV-prevalent region



## Infectious Diseases

**Abstract** This chapter introduces infectious diseases faced by many populations in the world. The role of the environment and how and why these diseases are transmitted as well as prevention strategies are also discussed. The story takes place at a disco funeral in Kenya, where HIV prevalence is high and risky sexual behavior takes place.

**Keywords** Infectious disease • HIV/AIDS • TB • Malaria • Prevention • Kenya

Microorganisms capable of causing disease are called pathogens, though not all microorganisms cause disease [1]. Many microorganisms can provide immunological protection by creating direct competition against other harmful organisms [1]. A true pathogen is a microorganism that causes disease in any susceptible host, while an opportunistic pathogen only causes disease in immune-compromised individuals [1]. An infection occurs when a pathogen invades a host and begins to grow, which ultimately results in the disease—or the consequence of tissue or cell impairment [1]. Finally, an infectious disease is caused by a microorganism, specifically bacteria, viruses, parasites, or fungi, that are directly or indirectly spread between people [1].

Once a person contracts an infectious disease, health effects vary and symptoms can be chronic or acute and can range from mild to severe or

even death. Some infectious pathogens are less contagious, while others are easily transmitted [1]. Some pathogens are virulent and cause disease and other ones rarely cause disease [1]. For example, polio infects most people who come in contact with it, but only 5–10% develop symptoms, which range from flu-like symptoms for a couple of days to meningitis and paralysis [1, 2]. Alternatively, if someone comes into contact with virulent Ebola virus disease, their survival rate is only 10–50% and patients can suffer from fever, abdominal pain, and hemorrhaging, although Ebola is not as easily transmitted [1, 3]. Thus, the worst infectious diseases are easily transmitted or contagious and are extremely virulent [1]. The combination of virulence and contagiousness in infectious diseases has caused a myriad of outbreaks and epidemics in history.

Some of the worst infectious diseases in the world are tuberculosis (TB), human immunodeficiency virus or acquired immunodeficiency syndrome (HIV/AIDS), and malaria, although lower respiratory tract infections (e.g. pneumonia) are currently the most deadly in the world, causing around 3.2 million deaths [4]. There are other infectious diseases that have made visible marks in history books by killing millions of people; these outbreaks included the bubonic plague, influenza (flu), and smallpox. Then, there are more infamous diseases that become known for their alarming symptoms or disfigurement, such as Ebola virus disease, leprosy, and rabies. The list of infectious diseases is wide-ranging and has the potential to affect nearly every single person.

These diseases are labeled under various classifications, such as emerging infectious pathogens or diseases, emerging and re-emerging tropical diseases, neglected tropical diseases, or communicable diseases. There is some confusion regarding these terms. A communicable disease is caused by a harmful agent or toxin through direct or indirect transmission of the infectious agent by the infected person, animal, vector, or inanimate environment that can act as a host [5]. Most infectious diseases are communicable diseases, but not all communicable diseases are infectious diseases. Lyme disease, a disease caused by ticks, is an example of a communicable disease that is not contagious or spread person to person. HIV/AIDS is an infectious disease that is also a communicable disease, as it is transmitted person to person. Tetanus is the final example of a disease that is non-communicable, but is an infectious disease, and is caused by toxins in the environment. Separately, tropical diseases encompass all diseases that occur in hot, humid conditions. This list includes malaria, leishmaniasis, schistosomiasis, onchocerciasis (river blindness), lymphatic filariasis,

Chagas disease, African trypanosomiasis, and dengue hemorrhagic fever [5]. Neglected tropical diseases have become a more widely accepted global health term that also describes the diverse group of diseases in tropical and subtropical conditions that are largely neglected in terms of their worldwide attention; this list includes the aforementioned diseases as well as ascariasis, hookworm, leprosy, trachoma, yaws, dracunculiasis (guinea-worm disease), Buruli ulcer, and more [6].

Despite the vast nomenclature, the environment has a significant role in the transmission of each and every one of these diseases [7]. Water supply, sanitation, food, and climate change are all environmental factors that influence the spread of these diseases [8]. Poor water and sanitation or contaminated food can contribute to diarrheal disease outbreaks, such as cholera, while climate change can affect the distribution and population of disease vectors; for example, flooding and standing water wetlands can cause malaria outbreaks [8]. Public health strategies focus on understanding how to control environmental drivers of infectious diseases, which contributes to disease prevention [7]. Because infectious disease traits and outcomes are so varied, the collaboration between health policy, access to healthcare, and the environment are important in order to determine how these efforts can best be aligned to make a difference in counteracting these diseases [7]. The interaction needed between these types of efforts alongside an understanding of the culture can create positive interventions and curb disease rates; however, if unheeded, adverse consequences can arise and contribute to disease transmission, as was the case with HIV/AIDS in Western Kenya.

## KENYA

In Kenya, the most significant cause of death by broad group is HIV/AIDS, malaria, and TB [9]. HIV/AIDS was the leading cause of death in Kenya in 2012, contributing to 54,400 deaths or 14.4% of all death country-wide [9]. Malaria caused 12,000 deaths (3.2%), while TB caused 9400 deaths (2.5%) [9]. Diarrheal diseases also contributed to 23,400 deaths (6.5%) in Kenya [9]. These mortality rates of infectious diseases in Kenya suggest that these types of diseases are of critical concern in the country. Unfortunately, in addition to these diseases, there are also many neglected tropical diseases. This list of diseases includes non-typhoidal salmonella, lymphatic filariasis, leishmaniasis, and trachoma [10, 11]. To put this into perspective, 29 million people in Kenya are at risk for lymphatic

filariasis, and two million are at risk for trachoma [11]. There are also infectious diseases that are specifically waterborne and foodborne that occur in Kenya due to population displacement, crowding, poor access to safe water and sanitation, and unsafe food handling and preparation (e.g. unpasteurized milk) [12]. These diseases include cholera, typhoid, hepatitis A and E, *Entamoeba histolytica*, *Shigella dysenteriae* type 1, and brucellosis [12]. Malaria is a priority vector-borne disease concern in Kenya, but there are also other vector-borne diseases dispersed throughout Kenya. These diseases often occur from standing water or unprotected water containers, overcrowding, inadequate shelter, and significant climatic and temperature variation [12]. This list of diseases in Kenya includes Rift Valley fever, yellow fever, plague, dengue fever, chikungunya fever, human African trypanosomiasis, relapsing fever, and Marburg hemorrhagic fever [12]. Finally, there are certain infectious diseases that occur specifically from overcrowding—hygiene and sanitation—which frequently happen in refugee camps or slums. Diseases of overcrowding and subsequent inadequate shelter in Kenya include measles, ARI, diphtheria, meningococcal disease, pertussis, and TB [12].

Fortunately, for certain diseases, vaccines are available and readily dispersed throughout the country. Vaccine coverage consists of approximately 80% of the population and includes the following vaccines: BCG for tuberculosis; diphtheria, pertussis, tetanus; and hepatitis B; MCV for measles and polio; and Hib3 for influenza [12, 13]. Other vaccines have been recently introduced and disseminated in Kenyan populations, but have lower coverage rates of approximately 60–70%; these include RotaC for rotavirus and PcV3 for streptococcus pneumonia [13]. However, for HIV/AIDS and malaria in Kenya, the only current options are prevention and, if contracted, some level of treatment, if available.

### INFECTIOUS DISEASES IN KENYA

Around 11 p.m., the group and I drove 30 min into the bush where we met with two local boys on a motorcycle. We were secretly led to a *disco matanga* located approximately 30 minutes deeper into the bush. At this point, we were approximately an hour away from Busia, Kenya, in a direction that crossed back and forth between the Kenyan and Ugandan border, but we would never be able to retrace the trail. The only light came from the motorcycle headlights in front of us and our only trail disappeared as soon as the dust settled. I had no idea what a *disco matanga* was,

even up until the point where I exited the parked vehicle. I quickly learned. A *disco matanga* is a cultural funeral practice of the Luo in the Nyanza province [14].

Nyanza province is the most severely affected area in Kenya with HIV rates up to 15% [15, 16]. Disco funerals create an environment and provide opportunities for adolescents to engage in risky sex and promote HIV/STI transmission [17–20]. Wife inheritance also occurs at these events [21]; the purpose of a disco funeral was personally described to me as the combination of wife inheritance and a funeral into one event. Because the infection and mortality rate from AIDS is so high in the region, it has become custom that if a husband dies, the brother of the husband takes the wife as his own [21]. The culture in the region is accepting of polygamy, so having more than one wife or multiple relationships is condoned [20]; unfortunately, practicing polygamy in an area with significant rates of HIV/AIDS may be unsafe and may increase the risk of HIV transmission. For example, if the brother practices unsafe sexual intercourse with his newly inherited wife, who may have contracted HIV from her former husband, then he has an increased risk of contracting HIV.

The purpose of the *disco matanga* or disco funeral is to help raise money in order to give the deceased husband a proper burial [7]. There is usually a specific way to raise money at these events. At the event that I attended, fund raising began with music playing and an MC who started the party, “If you are sitting, you either have to pay 20 bop or go out and dance.” Those who want to continue sitting on the bench have to pay 20 Kenyan Shilling (KSh), while those who do not want to pay get off the bench and dance. This trend continues throughout the night. The microphone also gets passed to a person who would pay for a dance or suggest for a named individual to dance with them for one song.

Disco funerals are held in rural settings. The event I attended took place in desolate forest where there was no electricity, running water, and only limited phone service. It began very late at night and continued until daylight morning hours; in response to the extreme darkness, two single generator-run light bulbs were set near the MC table and provided lighting. The attendees included primarily adolescent and adult men (around 16–37 years of age), a few children, the inherited/widowed wife, and a handful of adolescent girls. The men drank home-brewed “moonshine” hour after hour and became intoxicated. Many of the men also smoked marijuana and were chewing miraa (an amphetamine-like stimulant). The consumption of local-brewed alcohol and drugs, including khat, cannabis,

and tobacco/betel quid, is common among individuals at disco funerals [20]. I was told the mixture of alcohol and miraa increases sexual aggressiveness or tendencies.

While dancing was not a big deal to me at the event, I questioned the intent of the dance and did not realize until later the actual purpose of the dance. Bidding on dances not only provides alone time with the selected partner of the bidder but is traditionally used to decide on later transactional sex [20]. One study provided evidence of this, as an interviewed participant stated, "Once he has bought the girl then he dances with her, so during the dance with her is when they talk and come to an understanding or they agree on where they are going to meet and they just finish their business [have sex] there and there" [20]. While I was cautious, I was still naïve and unaware the dance would be used in this manner.

Because the attendees kept calling on me to dance, I openly participated in dancing. At first, I didn't mind it, but one guy started petting my arm as he danced alongside me trying to converse with me in Swahili, so I exited the dance floor and walked to a few members of my group. He followed me, grabbed my arm, yanked me back to face him and said in Swahili, "I *paid* to dance with you!" He stood right next to me and continued even after a guy in my group told him to stop harassing me; finally, as it was starting to cause a scene, a family member of the inherited/widowed wife approached our group and told him to leave me alone and let me be with my friends. He finally moved to a dark corner, but continued watching me for the remainder of the night.

This experience provided insight to a cultural practice that has a presence in Western Kenya and continues to exist. Disco funerals are held up to three times a week and a single event may be celebrated up to a week long [20]. Community members attend because they are a cheap form of entertainment and an opportunity to meet the other sex; unfortunately, casual, forced, and transactional sex are often facilitated by the intense atmosphere at the funerals [20]. I experienced how and why these rapes may occur. The attending men are generally intoxicated, high from marijuana or miraa, and typically exude aggressive behavior. It was explained to me by the members of my group that children as young as 8 years old get raped at these events. Based on the parlous state of the environment, I was able to see how this situation could arise. According to current literature, a successful intervention addressing wife inheritance and disco funeral events, including the rapes, risky sexual behavior, and the spread of HIV/AIDS, does not exist [22, 23]. This cultural event in Kenya shows how the



transmission of one of the most significant infectious diseases in the world can and does occur.

## INFECTIOUS DISEASES IN THE WORLD

There are many infectious diseases in the world. These diseases can virtually occur at any moment in time. Unfortunately, some populations are more exposed than others. Individuals living in low socioeconomic conditions inherit a predisposition to infectious disease exposure. The world's highest concentration of poverty is in sub-Saharan Africa, where studies have confirmed many of the world's neglected tropical diseases occur and affect at-risk populations [11, 24–27]. Common diseases include helminth infections, schistosomiasis, lymphatic filariasis, trachoma, and onchocerciasis, which impacts more than 500 million people [24, 27, 28]. Additionally, HIV/AIDS remains another major disease threat not only in Kenya, but throughout sub-Saharan Africa.

The environment exacerbates this risk. Poor sanitation and water and insufficient hygiene practices can contribute to various waterborne diseases, such as cholera. Inadequate housing structures can allow vectors greater access to exposed skin, aptly providing mosquitos or other bugs with an open invitation to transmit malaria or other vector-borne diseases. Poverty is also associated with small housing structures and overcrowding, which can heighten the risk for airborne disease transmission, such as tuberculosis. These conditions are the root of many prevention programs or interventions.

Efforts used to control and eliminate the risk of contracting infectious diseases are ongoing. Perhaps the most noteworthy are the Sustainable Development Goals—world targets initiated by the United Nations used to create guidelines to decrease or eliminate the global burden of disease. These objectives help to indirectly and directly abate infectious disease rates through various key points outlined in the following goals: no poverty (SDG 1), good health and well-being (SDG 3), quality education (SDG 4), clean water and sanitation (SDG 6), reduced inequalities (SDG 10), sustainable cities and communities (SDG 11), climate action (SDG 13).

It is unmistakable that infectious diseases and the surrounding environment perpetuate the disease lifecycle, as these attributes are current items highlighted by many international agendas. Thus, changes are taking place to address these concerns, although many of these diseases have been

around for centuries and continue to have a stronghold in many populations. That said, it is also exciting to note the progress made in altering these disease rates. Here are some examples of some long-standing infectious diseases in the world, their origin, morbidity and mortality rates, and some current agendas aiding in their elimination strategies:

- Malaria is a vector-borne disease caused by parasites that pass onto humans through infected mosquitoes. There are 3.2 billion people living in 106 countries that have high risk to malaria exposure [29]. Symptoms of malaria range from flu-like illness to death; if not treated in 24 hours, malaria often progresses to severe and fatal illness [30]. The World Health Organization estimates that there are 212 million cases annually of malaria, resulting in 429,000 deaths [30]. Africa has the majority of the global burden of malaria, with 90% of cases occurring there, along with 92% of deaths due to malaria [30]. Malaria is preventable and curable; to date, efforts underway include many vector control interventions such as insecticide-treated bed nets, indoor spraying with insecticide, antimalarial drugs as prophylaxis, detection of insecticide and antimalarial drug resistance, surveillance efforts, and proper diagnosis and treatment [30]. Malaria has been eradicated from many countries, but the World Health Organization's goals are to reduce malaria incidence and mortality rates by 90% [30].
- HIV is a virus that is transmitted person to person through body fluids (e.g. blood). The virus attacks CD4 cells, which help maintain our immune system. HIV eventually destroys so many of these cells that the body cannot fight off other infections. Once opportunistic infections or cancers occur in this weakened immune system, the person develops AIDS [31]. Since the beginning of the AIDS epidemic, more than 70 million people have been infected with HIV, and 35 million have died from it [32]. Sub-Saharan Africa carries the burden of disease with nearly 70% of cases occurring there [32]. In 2015, there were 36.7 million people living with HIV; of this number, 2.1 were newly infected and 1.1 million died from AIDS [33]. But, progress has been made: HIV is no longer on the top ten causes of deaths in the world [4]. The primary way to reduce the spread of HIV is for infected individuals to take antiretroviral therapy (ART), which slows the progression of the disease and helps protect the immune system. Current prevention efforts besides ART availability

- and adherence include education, contraceptive dispersal (e.g. condoms), and HIV testing and counseling [34].
- Tuberculosis (TB) is one of the top ten causes of death in the world [4]. The disease is caused by bacteria that generally attack the lungs, but can also affect other parts of the body (e.g. kidney, spine, brain) [35, 36]. There are two types of conditions: latent TB and TB. It is only the development of the latter that can contribute to the contagious disease, as people with latent TB cannot spread the disease. TB is an ancient disease in which sanatoriums were historically used to quarantine infected individuals in hopes of halting the spread and curing the person [37]. The disease remains rampant, with 10.4 million cases and 1.8 million deaths, including being the leading cause of death for HIV-positive people [36]. More than 95% of TB occurs in low- and middle-income countries [36]. However, prevention efforts over the last couple decades have been effective and are believed to have saved approximately 49 million lives through diagnosis and treatment [36]. The BCG vaccine has helped prevent TB, though effectiveness is questionable [38]. If active drug susceptible TB is contracted, proper receipt and usage of antimicrobial medication typically cures the disease [36].

However, despite the progress made against infectious diseases, socioeconomic, environmental, and ecological factors are contributing to new microbial pathogens and the emergence of new infectious diseases [39]. Emerging infectious diseases are infectious diseases that are newly appearing or have existed, but are increasing geographically [40]. Population growth, urbanization and overcrowding in cities, unsanitary food preparation, ecological changes, and changing social behaviors are some direct factors contributing to the increased incidence rates of emerging or re-emerging infectious diseases [41]. These diseases happen in different origins. Some emerging infections are caused by microbes in nonhuman vertebrates, such as hantavirus pulmonary syndrome, which originates in deer mice, and HIV and SARS, which are from primates [41]. Other diseases are re-emergent microbes were historically controlled in selected regions of the world. The dengue virus of 1903 was eliminated in Central and South America, but was located in Southeast Asia 50 years later as dengue hemorrhagic fever; however, because eradication programs had ended in Central and South America, the disease eventually became reintroduced [41]. Lastly, drug-resistant pathogens can also become

threatening emerging infectious diseases. Chloroquine was effective in preventing malaria, but due to the resistance of the mosquito to the medication, malaria has resurged as a global threat [41]. Again, strategies for preventing emerging and re-emerging infectious diseases are collaborative efforts between state, local, government, academic, non-profit, and research agencies that improve surveillance and response, research, infrastructure, training, and control [42].

## THE FUTURE

Without addressing disco funerals in Kenya, many people will continue to be exposed to potential disease threats. While these types of events certainly exist throughout the world, many countries currently employ regulations to help protect population health against infectious disease outbreaks [1]. Most measures seek to terminate the pathogen from the route of transmission or from its reservoir [1]. Moreover, instead of tackling individual diseases, infectious diseases can be grouped by environmental similarities, which allows for a more comprehensive approach to addressing problems. For example, instead of just tackling cholera, public health efforts can provide people with access to quality water, proper sanitation, and educational information on correct hygiene practices. These solutions can not only improve overall population health, but also eliminate the whole host of potential problems associated with not having these basic human rights.

Ongoing efforts occur worldwide at various levels. For example, the typhoid vaccination is not on the list of standard immunizations for children in the United States. Alternatively, this same vaccine along with other preventative measures (e.g. hand washing) may be frequently used in typhoid endemic regions, such as India, or during typhoid outbreaks. Besides these types of specific program needs associated with individual countries, a comprehensive approach for infectious disease control would include:

- Water and sanitation. Pathogens can be easily transmitted in water. The World Health Organization recommends that each person have access to at least 15–20 liters of clean water a day [6]. Gastrointestinal pathogens are spread through feces, so proper sanitation is also necessary to avoid water-to-sewage contamination. Minimal sanitation facilities must include wash water, designated defecation areas,

collection of sedimentation of sewage, and separated and properly disposed sludge [6, 7].

- Shelter and site planning. With appropriate shelters, diseases related to overcrowding can be avoided [6]. Additionally, these sites should have food safety programs that encourage standards, inspection plans, and regulations regarding food and milk preparation, handling, and distribution, which can help populations evade contaminated food diseases [7].
- Management of malnutrition. Malnourished individuals can have weakened immune systems and significantly suffer from bacterial infections that may have otherwise been cleared. Breastfeeding in babies should be encouraged to avoid diseases associated with food or water contamination [6]. Adequate nutrition should also be maintained in child and adult populations.
- Case management. Early and appropriate treatment ensures effective diagnoses and treatment of diseases and inhibits the spread of the disease [7].
- Surveillance warning and response systems. These early warning symptoms can promptly detect outbreaks and ensure rapid control. Effective procedures can include outbreak response, investigation kits and supplies, surveillance structures, laboratories for rapid diagnosis and confirmation of disease threats, and active communication response between key public health actors [6].
- Immunizations. Vaccinations are not only important for individual health, but public health as well [7]. A proportion of the population that is vaccinated ensures that a disease-causing pathogen will be unable to reproduce itself at high enough levels to maintain itself in the population [7]. Once the infected host is cured or dies, there will not be enough susceptible hosts to supplement the pathogens, thus eliminating further spread of the disease [7].
- Vector and animal control and personal protection. Both animals and vectors are carriers of many diseases that affect humans. Inspecting domestic animals can eliminate the threat of pathogens from milk or meat [7]. Vector-borne diseases can be controlled by eliminating breeding grounds or stagnant water in containers and by using pesticides and bed nets [6, 7].
- Health education. Education can help relay messages to the public in order to avoid infectious diseases. Some messages can include using safe water, avoiding mosquito bites, having safe sex or no sex,

promoting proper hygiene, covering one's mouth when coughing, having good hygiene practices, eating safe food, and getting treatment early if necessary [6].

Various items from this list are being implemented in every single country. While there are continuous new diseases that are arising, it is encouraging to know that public health outreach focuses on helping populations avoid infectious diseases. Infectious diseases will likely always affect humanity, but through advances in science, technology, and communication, future diseases and outbreaks will optimistically be lessened.

## REFERENCES

1. National Institutes of Health. Understanding emerging and reemerging disease. 2017. <https://science.education.nih.gov/supplements/nih1/diseases/guide/understanding1.html>
2. Centers for Disease Control and Prevention. What is polio? 2017. <https://www.cdc.gov/polio/about/>
3. Centers for Disease Control and Prevention. Signs and symptoms. 2017. <https://www.cdc.gov/vhf/ebola/symptoms/>
4. World Health Organization. Top 10 causes of death. 2017. <http://www.who.int/mediacentre/factsheets/fs310/en>
5. CDC. Definitions for consideration. 2012. <https://www.cdc.gov/tb/programs/laws/menu/definitions.htm>
6. World Health Organization. Neglected diseases. 2017. [http://www.who.int/neglected\\_diseases/resources/en/](http://www.who.int/neglected_diseases/resources/en/)
7. World Health Organization. Special training for research and training in tropical diseases. Environment; 2017. <http://www.who.int/tdr/diseases-topics/environment/en/>
8. World Health Organization. Environmental factors influencing the spread of communicable diseases. 2017. [http://www.who.int/environmental\\_health\\_emergencies/disease\\_outbreaks/communicable\\_diseases/en/](http://www.who.int/environmental_health_emergencies/disease_outbreaks/communicable_diseases/en/)
9. World Health Organization. Kenya: statistical profile. 2015. <http://www.who.int/gho/countries/ken.pdf?ua=1>
10. Feasey NA, Dougan G, Kingsley RA, Heyderman RS, Gordon MA. Invasive non-typhoidal salmonella disease: an emerging and neglected tropical disease in Africa. *Lancet*. 2012;379(9835):2489–99.
11. Hotez PJ, Kamath A. Neglected tropical diseases in sub-Saharan Africa: review of their prevalence, distribution, and disease burden. *PLoS Negl Trop Dis*. 2009;3(8):e412.

12. World Health Organization. 2008. [http://www.who.int/neglected\\_diseases/diseasecontrol\\_emergencies/EPR\\_DCE\\_2008\\_1rr%20.pdf](http://www.who.int/neglected_diseases/diseasecontrol_emergencies/EPR_DCE_2008_1rr%20.pdf)
13. World Health Organization. Kenya: WHO and UNICEF estimates of immunization coverage: 2015 revision. 2016. [http://www.who.int/immunization/monitoring\\_surveillance/data/ken.pdf](http://www.who.int/immunization/monitoring_surveillance/data/ken.pdf)
14. Juma M, Alaii J, Askew I, et al. Risky sexual behavior among orphan and non-orphan adolescents in Nyanza Province, Western Kenya. *AIDS Behav.* 2012;17(3):1–10.
15. National AIDS/STI Control Programme. 2007 Kenya AIDS indicator survey: final report. Nairobi, National AIDS/STI Control Programme. Nairobi: National AIDS Council Control (NACC); 2009.
16. National AIDS Control Council and the National AIDS and STD Control Programme. Sentinel surveillance of HIV and AIDS in Kenya report 2006. Nairobi: National AIDS Council Control (NACC); 2007.
17. Buve A, Carael M, Hayews RJ, et al. Multicentre study on factors determining difference in rate of spread of HIV in sub-Saharan Africa: methods and prevalence of HIV infection. *AIDS.* 2001;15(Suppl 4):s5–14.
18. Glynn JR, Carael M, Auvert B, et al. Why do young women have a much higher prevalence of HIV than young men? A study in Kisumu, Kenya and Ndola, Zambia. *AIDS.* 2001;15(Suppl 4):s51–60.
19. Laga M, Schwarlander B, Pisani E, et al. To stem HIV in Africa, prevent transmission to young women. *AIDS.* 2001;15:931–60.
20. Njue C, Voeten HACM, Remes P. Disco funerals, a risk situation for HIV infection among youth in Kisumu, Kenya. *AIDS.* 2009;23(4):505.
21. Potash B. Wives of the grave: Widows in a rural Luo community. In: Potash B, editor. *Widows in African Societies*. Stanford: Stanford University Press; 1986. p. 44–65.
22. Agot EK. HIV/AIDS interventions and the politics of the African woman's body. In: Nelson L, Sieger J, editors. *A companion to feminist geography*. Malden, Massachusetts: Blackwell Publishers; 2005. p. 363–78.
23. Government of Networks. Sessional Paper No. 4 of 1997 on AIDS in Kenya. Nairobi: Government Printers; 1997.
24. Molyneux DH, Hotez PJ, Fenwick A. “Rapid-impact interventions”: how a policy of integrated control for Africa's neglected tropical diseases could benefit the poor. *PLoS Med.* 2005;2(11):e336.
25. Brooker S, Clements AC, Bundy DA. Global epidemiology, ecology and control of soil-transmitted helminth infections. *Adv Parasitol.* 2006;62:221–61. [https://doi.org/10.1016/S0065-308X\(05\)62007-6](https://doi.org/10.1016/S0065-308X(05)62007-6).
26. Brooker S, Clements AC, Hotez PJ, Hay SI, Tatem AJ, et al. The co-distribution of plasmodium falciparum and hookworm among African schoolchildren. *Malar.* 2006;J5:J599. <https://doi.org/10.1186/1475-2875-5-99>.

27. Fenwick A. New initiatives against Africa's worms. *Trans R Soc Trop Med Hyg.* 2006;100:200–7.
28. Fenwick A, Molyneux D, Nantulya V. Achieving the millennium development goals. *Lancet.* 2005;365(9464):1029–30. [https://doi.org/10.1016/0140-6736\(05\)71134-X](https://doi.org/10.1016/0140-6736(05)71134-X).
29. Centers for Disease Control and Prevention. Malaria facts. 2017. <https://www.cdc.gov/malaria/about/facts.html>
30. World Health Organization. Malaria. 2017. <http://www.who.int/mediacentre/factsheets/fs094/en/>
31. Centers for Disease Control and Prevention. What is AIDS. 2017. <https://www.cdc.gov/hiv/basics/whatishiv.html>
32. World Health Organization. HIV/AIDS. 2017. <http://www.who.int/gho/hiv/en/>
33. World Health Organization. Global summary of the AIDS epidemic. 2015. [http://www.who.int/hiv/data/epi\\_core\\_2016.png?ua=1](http://www.who.int/hiv/data/epi_core_2016.png?ua=1)
34. World Health organization. HIV/AIDS response. 2017. [http://www.who.int/gho/hiv/epidemic\\_response/en/](http://www.who.int/gho/hiv/epidemic_response/en/)
35. Center for Disease Control and Prevention. Basic TB facts. 2016. <https://www.cdc.gov/tb/topic/basics/default.htm>
36. World Health Organization. Tuberculosis. 2017. <http://www.who.int/mediacentre/factsheets/fs104/en/>
37. Daniel TM. The history of tuberculosis. *Respir Med.* 2006;100(11):1862–70.
38. Center for Disease Control and Prevention. BCG vaccine. 2016. <https://www.cdc.gov/tb/publications/factsheets/prevention/bcg.htm>
39. Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, Daszak P. Global trends in emerging infectious diseases. *Nature.* 2008;451(7181):990–3.
40. National Institute of Allergy and Infectious Diseases (NIAID). Emerging infectious disease pathogens. 2016. <https://www.niaid.nih.gov/research/emerging-infectious-diseases-pathogens>
41. Racaniello VR. Emerging infectious diseases. *J Clin Invest.* 2004;113(6):796–8.
42. Center for Disease Control and Prevention. Preventing emerging infectious diseases: a strategy for the 21st century overview of the updated CDC plan. 2001. <https://www.cdc.gov/mmwr/preview/mmwrhtml/00054779.htm>