

Epidemiology projects

In all of these projects, it will be important to get a good understanding of the pathogen being studied. What are its characteristics, how is it spread? A good way to find some synthetic and up to date information is often to look for reviews in journals like The Lancet or The Lancet Infectious Diseases, BMJ or other medical journals. The [US CDC](#) also has extensive online resources that could be useful.

Giving the context, i.e., the incidence/prevalence in whatever country/region you are considering is also important. The NICD pages linked to in the projects have some important information about policies in South Africa, if you choose to use South Africa as the country under consideration.

HIV

(See some information here <https://www.nicd.ac.za/diseases-a-z-index/hiv/>.)

HIV (human immunodeficiency virus) is a virus spread through certain body fluids that attacks the body's immune system, specifically the CD4 cells, often called T cells. Over time, HIV can destroy so many of these cells that the body can't fight off infections and disease. These special cells help the immune system fight off infections. Untreated, HIV reduces the number of CD4 cells (T cells) in the body. This damage to the immune system makes it harder and harder for the body to fight off infections and some other diseases. Opportunistic infections or cancers take advantage of a very weak immune system and signal that the person has AIDS.

Read the part of the document [on prevention of mother-to-child transmission](#) (on the NICD website linked above) relative to antiretroviral therapy (ART) use to prevent mother-to-child transmission of HIV, during breastfeeding and in infants (Sections 6.1 to 6.3) and write a model for HIV propagation that informs the number of HIV+ infants based on the use/successful use of ART as described in the report.

Malaria in border areas

(This uses information from <https://dx.doi.org/10.1111/j.1708-8305.1999.tb00858.x> and <https://www.nicd.ac.za/diseases-a-z-index/malaria/>.)

The Mpumalanga and KwaZulu-Natal provinces are endemic for falciparum malaria. Chloroquine-resistant Plasmodium falciparum has been reported in these areas. Malaria is a notifiable disease and in 1996, 27,035 cases and 163 deaths were reported, while 23,120 cases and 104 deaths were reported in 1997. Over 90% of cases were Plasmodium falciparum. The annual number of cases varies according to the amount of rain.

The highest risk areas are the Northern and Eastern border areas, which indicates the importance of imported malaria. The majority of cases originate from Mozambique. It is estimated that up to 18% of malaria cases are imported.

Write a model to investigate transmission of malaria in a border region where two countries with different health policies, living conditions, etc., come into contact. As malaria is a notifiable disease, you can find reports on numbers of cases on the [NICD website](https://www.nicd.ac.za/diseases-a-z-index/malaria/) and could try to incorporate some of that information in your work.

Schistosomiasis

(This uses information from <https://dx.doi.org/10.1111/j.1708-8305.1999.tb00858.x> and <https://www.nicd.ac.za/diseases-a-z-index/schistosomiasis-bilharzia/>.)

Schistosomiasis, also known as bilharzia, is a disease caused by parasitic worms. There are two forms of the disease, namely intestinal schistosomiasis caused by *Schistosoma mansoni* and *S. japonicum*, and urinary schistosomiasis caused by *S. haematobium*. Less commonly, *S. mekongi* and *S. intercalatum* also cause disease in humans. Infection with Schistosomes may present as an acute infection or as a chronic disease. Schistosomiasis ranks second to malaria as the most common parasitic disease in Africa.

In 1999, Schistosomiasis was endemic in large parts of South Africa, with *haematobium* and *mansoni* being the commonest species involved. A survey undertaken by Gear et al. in 1980 delineated endemic areas and snails known to be vectors of the disease. It is estimated that 3 million people are infected and many more are at risk. A study of Northern KwaZulu-Natal in 1991 placed the prevalence of infection as high as 60% in most areas, reaching 98 - 100% in some localities. A recent study in the Port St Johns district in the eastern Cape showed an overall prevalence of 42%, ranging from 0% to 89%.

Write a model to investigate schistosomiasis transmission. Investigate in particular control mechanisms.

Measles

(This uses information from <https://www.nicd.ac.za/diseases-a-z-index/measles/>.)

Measles is a highly contagious disease caused by a virus. Patients with measles present with fever and with a rash. The rash looks like small, red, flat spots over the body. The rash does not form blisters, nor is it itchy or painful. Other signs include cough, conjunctivitis (red eyes) and coryza (running nose). Complications of measles can include diarrhoea, dehydration, brain infection (encephalitis), blindness and death. Complications are more serious in those who catch measles as young infants (under 2 years of age) and in children who are malnourished.

Using the [Prevention of secondary cases](#) document on the NICD page, write a measles transmission model that considers these different intervention mechanisms. You should probably distinguish between age groups in order to do that. As measles is a notifiable disease, you can find reports on numbers of cases on the [NICD website](https://www.nicd.ac.za/diseases-a-z-index/measles/) and could try to incorporate some of that information in your work.

Rabies

(This uses information from <https://www.nicd.ac.za/diseases-a-z-index/rabies/>.)

Rabies is a viral infection of the nervous system. The disease is reported in different wild and domestic animal species, but most cases of rabies in South Africa involve domestic dogs. Human rabies cases are rare in South Africa but cases are still confirmed annually. Humans are exposed to rabies through bites (and other wounds) inflicted by rabid animals. The virus is contained in the saliva of a rabid animal. Most human rabies cases in South Africa are associated with domestic dog exposures. Although a fatal infection, rabies can be controlled through vaccination of domestic dogs (and cats) and the use of rabies post-exposure prophylaxis in exposed human cases.

Write a rabies model, where rabies is present in animal populations and is sometimes transmitted to humans. In particular, incorporate some of the mechanisms of prevention detailed in the NICD [National Guidelines for the Prevention of Rabies in Humans, South Africa](#) document.

As rabies is a notifiable disease, you can find reports on numbers of cases on the [NICD website](#) and could try to incorporate some of that information in your work.