THE WAR ON NEGLECTED TROPICAL DISEASES

How Humanity Fought Back Against a Common Enemy

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Introduction – Why Neglected Tropical Diseases?

"I've lost faith in humanity," is a phrase I find myself hearing in so many conversations with friends, family, and even strangers online. Over the past few years, from personal experience, there is an increasing trend in the number of people adopting such nihilistic views on the world. Corruption, a lack of cooperation and altruism, along with having incompetent world leaders are some of the reasons touted for said loss of faith. This is especially the case with the ongoing coronavirus disease 2019 (COVID-19) pandemic, where the ensuing lockdown has driven more people towards these negative opinions and world views (Tucker, 2020).

I understand that it is difficult to adopt positive views on humanity. When reading the news, it's often the tragedies, the disturbing and the macabre that catches the eye. We are constantly surrounded by negative news because they are the ones that get the most attention. These are the articles or videos that get clicks, views, and shares. In a world where social media and the internet are likely the only sources of information that many of us turn to, it's no wonder that people are losing faith.

I am a science student and consider myself a person of science as well. My belief in humanity is closely aligned with my belief in science, and I am a firm believer that it brings out the best in people and can aid in humanity's progress. Because of this, even as I negotiate through these trying times, I know that my faith in humanity will come out even stronger than before. Because I know, that for every article with thousands of shares about another super-spreader event due to irresponsible people, there is another about how the world is working together to beat COVID-19 (The Straits Times, 2020).

I wrote this essay to highlight the very best in science and humanity, and to hopefully inspire others to adopt a more positive view towards humanity. I believe that the topic of Neglected Tropical Diseases (NTDs) is one that isn't talked about enough. I first learnt about NTDs in polytechnic years ago, where I found it amazing how such significant acts of cooperation amongst different countries and even private companies went relatively unknown, such that even I hadn't heard of it.

Our lecture on microbes and a sustainable future, which briefly talked about the United Nation's (UN) 17 Sustainable Development Goals (SDGs), further motivated me to write about this topic. As part of the third SDG, "Good Health and Well-Being", the UN plans to largely eradicate NTDs, along with other diseases such as AIDS, tuberculosis, and malaria (UN, 2020). I strongly believe that this can be achieved if everyone settled their differences and worked together against our common enemy.

When the opportunity of an open-ended essay came up for this module, I immediately knew I had to write about this. It was also a good opportunity for me to find out more about the issue of NTDs and throughout the process of writing this essay. Throughout the process, I have certainly learnt more about public health, epidemiology as well as the difficulties faced by the affected countries.

Finally, I know that the recommended page length was about five to ten pages, but there was too much to talk about and I couldn't cover everything within the limit. Even though the essay may be a little long, I hope whoever reads this enjoys it as much as I enjoyed writing it.

The War on NTDs

NTDs: An Introduction

NTDs are a group of communicable parasitic, bacterial, viral, and protozoan diseases that target the world's most vulnerable populations. According to the World Health Organization (WHO), more than 1 billion people in nearly 150 countries are affected by NTDs every year, and it is also costing developing economies billions of dollars in lost productivity and healthcare costs (WHO, n.d.-d). Poor sanitation, frequent contact with animal vectors, as well as high population densities are some major risk factors that contribute to NTD susceptibility. As of today, the WHO lists 19 causative agents within its list of NTDs, along with snakebite envenoming. Examples include Leprosy, Dengue Fever, Buruli Ulcer and Leishmaniasis (WHO, n.d.-d). We will be focusing our attention onto the "Big Six" – Dracunculiasis (also known as Guinea Worm Disease), Lymphatic Filariasis, Human African Trypanosomiasis (HAT), Yaws, Leprosy, and Blinding Trachoma.

Dracunculiasis is a painful and often debilitating condition caused by *Drancunculus medinensis*, a nematode that infects humans by residing as larvae in water fleas. Consumption of water contaminated with infected water fleas is the primary cause of Dracunculiasis (WHO, 2020c). Upon ingestion, the larvae will attempt to penetrate the walls of the host's stomach and intestines. Infected individuals may not present with any symptoms for up to a year while the worm matures. After which, the worm would emerge from the skin (usually near the foot), causing painful blisters and burning sensations. While unlikely to cause death, dracunculiasis can cause complications such as bacterial infections at the exit sites, along with arthritis and paralysis if the worm dies in the joints or spinal cord, respectively (WHO, 2020c). In 2019, a total of 54 cases of Dracunculiasis were reported (WHO, 2020c).

Lymphatic Filariasis, is a parasitic disease caused by *Filarioidea* worms and transmitted by mosquitoes carrying the worms (WHO, 2020d). Whilst many infected individuals may present with no symptoms at all, some may develop a debilitating and disfiguring condition known as elephantiasis. Elephantiasis is characterized by painful swelling in the extremities as well as thickening of the skin near the affected areas. The condition is a result of damage to the lymphatic system caused by the infection, resulting in lymphedema. Today, the WHO estimates that 120 million individuals are infected with lymphatic filariasis (WHO, n.d.-c).

HAT, also known as African sleeping sickness, is an often-fatal disease caused by the *Trypanosoma brucei* parasite (WHO, n.d.). The parasite is insect-borne and is usually transmitted to humans through the bite of the Tsetse fly. It can also be transmitted vertically from mother to child or through sexual contact, albeit rarely (WHO, 2020e). Post-infection, the disease course usually proceeds in two stages. Initially, the parasites rapidly multiply in the infected individual, causing fever, enlarged lymph nodes and headaches. The second, fatal stage occurs when the parasites cross the blood-brain barrier. This results in sleep cycle disturbances, and other neurological symptoms such as poor coordination and behavioural changes (WHO, 2020e). In 2018, the WHO recorded a total of 977 cases (WHO, n.d.).

Yaws is a bacterial disease caused by the *Treponema pallidum pertenue* bacterium, a close relative of the bacterium that causes syphilis (WHO, 2019b). The most common route of transmission is through contact with fluids from an infected lesion. Even though it is not usually fatal, yaws is significant because it spreads rapidly amongst children in rural communities, who often interact with one another. When infected, individuals may initially present with skin lesions known as ulcers, which can progress to bone and joint problems if not treated (WHO, 2019b). In 2016, the total number of cases reported was 59,000 (WHO, 2019b).

Leprosy, commonly referred to as Hansen's disease, is a disfiguring and debilitating condition that arises due to infection by *Mycobacterium leprae* (WHO, n.d.-b). It is commonly transmitted through extensive contact with infected individuals, or the respiratory droplets of those suffering from leprosy. Majority of infected individuals do not develop symptoms, while those that do have an incubation period of about five years. Common symptoms include numbed and discoloured patches of skin caused by nerve damage, as well as loss of sensation in the extremities (WHO, n.d.-b). Left untreated, the cartilages in the body will wear over time, leading to shortening of the digits, and even flattening of the nose. In the most severe cases, leprosy can even lead to paralysis. A WHO estimate in 2018 found that there were 209,000 individuals suffering from leprosy (WHO, n.d.-b). Leprosy is the only disease in this list that has left a significant mark in Singapore. We have a leprosy relief association that provides welfare, lodging and healthcare services to ex-leprosy sufferers who have been abandoned by family members due to the stigma and fear associated with leprosy patients (Netherlands Charity Association, n.d.).

Finally, blinding trachoma, as its name suggests, is a bacterial disease caused by *Chlamydia trachomatis* that can potentially result in blindness (WHO, 2020b). It is usually transmitted by direct or indirect contact with secretions from an infected individual's eyes and nose. When infected, an individual will develop conjunctivitis, but reinfection and repeated inflammation of the eyelids can eventually result in blindness (WHO, 2020b). The disease affects a disproportionately high number of children, likely due to poor personal hygiene as well as maintained close contact with other children. A recent estimate revealed that infection by *C. trachomatis* is responsible for causing partial or complete blindness in 1.9 million individuals (WHO, 2020b).

Economic, Social and Health Impacts: Why We Should Care

So just how great of an impact do NTDs have on human society? Living in the relative comfort of a developed country such as Singapore may render us "blind" to the global burden of NTDs. We are usually only concerned with issues that might affect us, such as dengue fever, which is likely the only NTD that us Singaporeans have to worry about in our lifetimes. Therefore, it is necessary to assess how the rest of the world is being affected by NTDs, as it lets us better understand the plight that many over the world are facing today. Another reason to study the impacts of NTDs is that it also acts as an indirect measurement of the benefits of tackling this problem. We can start by looking at three main impacts: Economic, Social and Health.

We begin with the most straightforward of the three: Health. It's no wonder that diseases are going to generate health impacts, but how do we measure the extent of that? Using our "Big Six" as a reference, a simple way to measure the health impact of diseases is to look at their Disability-Adjusted-Life-Years (DALYs), which take into account how many years of life are lost due to death and disability. Table 1 lists the total DALYs for each of the diseases taken from estimates from the WHO in recent years.

Disease	Lymphatic Filariasis	Yaws	Leprosy	HAT	Trachoma	Dracunculiasis
DALYs (thousands)	2070.85 (2015)	1600 (2014)	488.64 (2015)	371.64 (2015)	278.97 (2015)	12.9 (from 1990 to 2016)

Table 1: DALYs due to "Big Six" NTDs (Mitra, A. K., & Mawson, A. R., 2017; Fitzpatrick, C., & Asiedu, K., 2014; Cromwell, E., et al., 2018)

To summarize the data from table 1, on an annual basis, these six NTDs have led to 4.8 million DALYs. In comparison, a disease that we are oh-so-familiar with, dengue, has about half that number with 2.6 million DALYs annually (Wu, Z., et al., 2018). Many of these diseases may not be fatal, but they leave sufferers with lifelong complications and scars that lead to decreased quality of life and physical impairments. Examples of such complications include partial or complete blindness caused by repeated trachoma infections, as well as disfigurement due to lymphatic filariasis.

Next, we'll move on to the economic impacts. Economic impacts can be measured in 2 scales, the microeconomic or individual level, and the macroeconomic or national level. Within these two scales, economic burden comes from two main factors: loss of productivity along with treatment and preventative costs (Conteh et al., 2010). Productivity losses occur when sufferers are absent from work or are less productive at work due to illness, which may even escalate to loss of jobs at the individual level, or a shrinking workforce at the national level (Lenk et al., 2016). Sufferers may also need to be cared for by their families, placing more economic burden on already underprivileged populations.

Costs of treatment and prevention may also perpetuate the poverty cycle (Hotez et al., 2009). Recall that NTDs affect a disproportionately high number of developing countries, and NTDs place an immense burden on the public health infrastructure of these nations, which are already underfunded to begin with. This makes it difficult for the most badly afflicted nations to deal with these diseases. At the individual level, treatment costs are so expensive that they may turn people away from seeking effective treatment. An extreme example would be in Ghana, where the cost of treatment for each patient of Buruli Ulcer is nearly three times the annual income of the bottom 25% of earners in the country (Conteh et al., 2010).

Finally, the most challenging impact to assess: Social Impacts. While health and economic impacts can be measured in terms of numbers, there exists little to no data on the social impacts of NTDs, especially in the poorest of countries. Much of the stigma and discrimination suffered by victims of NTDs is due to the disfigurement and disabilities inflicted upon them by the disease as well as fear of contracting the disease. In some cases, superstitions also contributed to the stigmatization of individuals suffering from NTDs. Leprosy patients in Singapore were shunned by society partly because the older generation believed that it was a "curse" inflicted upon them due to bad karma from wrongdoings in their previous lives (Netherlands Charity Association, 2017).

There are many factors that influence the level of stigma faced by patients. Individuals from underprivileged backgrounds, those suffering from advanced stages of disease, patients with more conspicuous physical symptoms, women, and children are all more likely to face higher levels of stigmatization and discrimination (Hofstraat K. & van Brakel W. H., 2015). Unfortunately, many of the complications caused by NTDs can be lifelong, and this can mean decreased work and educational opportunities for sufferers, sentencing them to a decreased quality of life in general. Other consequences that were reported include social isolation, refusal of treatment due to fear or embarrassment, and even serious psychological consequences such as anxiety, depression, and suicidal tendencies.

Prevention, Elimination and Eradication: What We Can Do

By now, you must be wondering about what I had mentioned in the beginning as my motivation for writing this essay. How is telling you about all these excruciating conditions supposed to "restore your faith in humanity"? If anything, I'd be surprised if I didn't already cause you to lose some of that precious faith. Lucky for you, there's a good side to this NTD fiasco, a "happy ending", if you would.

The six aforementioned diseases are special in that they have been targeted for elimination or eradication by the WHO within the next few years. For many of them, the target set was actually eradication/elimination by 2020. The WHO defines elimination as having an incidence rate of zero in a defined geographical area, and eradication as a permanent elimination worldwide. You'll be happy to hear that some NTDs are already on the verge of complete eradication, such as dracunculiasis, with annual cases dropping from upwards of millions in the 20th century to only 54 in 2019 (WHO, 2020c). How can this be? How did a disease so prevalent just decades ago get reduced to only a handful of cases in recent years?

We've already seen the why, but how do we even begin to deal with a problem that has been affecting the lives of so many for generations? The key strategy is that every single NTD, no matter how frightening, can be treated, or prevented with medications and drugs. This means that if we are able to somehow provide everybody in the world with preventative medications or treatment, we can effectively eradicate every single one of them. Of course, this is harder than it sounds. The most hardly hit areas, which require the most help, are usually also the most isolated, which can make treatment delivery challenging or even outright impossible if countries only had themselves to rely on.

Cue the London Declaration on Neglected Tropical Diseases. The London Declaration was launched in January 2012 as part of the WHO plans to eradicate or eliminate some of the NTDs by 2020. It was inaugurated at the Royal College of Physicians, with leaders from all the world's leading economies, as well as countries that are badly affected by NTDs in attendance. Also present were top officials from the WHO, Bill Gates (representing the Bill and Melinda Gates Foundation), as well as representatives from top pharmaceutical companies (WHO, 2012). The declaration pledged to eradicate dracunculiasis, and eliminate lymphatic filariasis, leprosy, HAT, and blinding trachoma by 2020. Some countries and organizations also provided hundreds of millions of dollars for research and development of novel therapeutics and interventions for NTDs. Additionally, many of the world's top pharmaceutical companies volunteered to utilize their mass manufacturing processes to produce and deliver medications to combat NTDs. By also ensuring that these lifesaving drugs actually reach the people who require them the most, the aforementioned logistical obstacles can be circumvented.

The two main methods of NTD prevention are preventive chemotherapy (PCT), and innovative and intensified disease management (IDM). NTDs which belong to the PCT group are controlled via non-specific and large-scale deployment of drugs to populations and communities which are endemic for the disease. Mass drug administration programmes have already begun in many countries with drugs donated from pharmaceutical companies. With periodic and sustained drug administration, the number of individuals infected will decrease over time, effectively preventing further transmission as well (Rosenberg et al., 2016). An example of an NTD that can be treated with preventive chemotherapy include lymphatic filariasis with donated diethylcarbamazine. As part of the London Declaration, the Japanese pharmaceuticals company Eisai pledged to donate around 2.2 billion tablets of diethylcarbamazine from 2014 to 2020 (Bill & Melinda Gates Foundation, 2012). By casting a wide net, made possible with the London declaration, countries can effectively prevent cases from arising in at-risk populations. By keeping cases low, the rates of transmission will naturally fall as well (WHO, 2019a).

For NTDs that belong to the IDM group, there is a current lack of the necessary resources or tools that can be used to combat them, due to challenges associated with diagnosis and treatment. As such, they may be costlier and more challenging to manage compared to the PCT group. An example of an NTD from the IDM group is HAT. It is difficult to manage due to the nature of the parasite itself. There exist vast animal reservoirs for *T. brucei Rhodesiense* in areas that are endemic for the disease. This means that even if we were to deliver treatment to everyone, a tsetse fly could still potentially transmit the disease from an infected animal to humans again (Aksoy et al., 2017). For IDM NTDs, the WHO recommends a multi-pronged approach. The goal is to facilitate ease of management by the country's very own primary health-care system by providing them with the tools and knowledge necessary. This can be achieved by improving the country's own public health infrastructure and conducting more focused research on the NTDs itself to come up with new and more effective methods of control, diagnosis, and monitoring (WHO, n.d.-a).

Successes and Setbacks: Are We Winning the Fight?

But just how much are we doing? We've seen how methods such as PCT and IDM can help lower transmission rates, but what do the numbers look like? How many people are actually receiving the help that they need, and are we effectively keeping the numbers down? Fortunately for us, the organisations and countries that came together in 2012 also formed the Uniting to Combat NTDs partnership in order to track progress as well as to ensure that their plans are being carried out properly. They have been releasing regular progress reports outlining key figures such as the progress they have made in certain countries as well as future directions.

Let us begin by looking at the scale at which this operation has been carried out. In 2016 alone, there were 1 billion individuals who received treatment for at least one NTD. Additionally, from 2012 to 2018, more than 10 billion doses of drugs were donated by pharmaceutical companies for use in PCT and IDM. To puts things into perspective, prior to the London Declaration, in 2011, less than a billion doses of NTD drugs were donated by pharmaceutical companies; In 2016, it was nearly double that, at a staggering 1.8 billion doses donated in total (Uniting to Combat NTDs, 2020a). Finally, due to the combined efforts of all parties involved, the number of individuals requiring interventions against NTDs have fallen from highs of more than 2 billion in 2011, to about 1.5 billion in 2018.

We will now move on to how "the war on NTDs" have impacted rates of transmission and number of cases over the years, as well as go over some of the challenges that are currently being faced when tackling the disease. Let us begin with what will most likely be the next disease, as well as the first parasite that we eradicate for good, dracunculiasis. Dracunculiasis itself is an IDM NTD, as it can also persist in animal vectors such as dogs. This makes it inherently difficult to manage, as can be seen in the nation of Chad, where persistent infections in dogs have made it difficult to reduce the number of cases of human infections to zero, due to cross infections. As such, a unique approach was taken in controlling the disease. On top of treating active cases, as well as preventing consumption of contaminated water, which are known to prevent further transmission of disease, the Guinea worm eradication programme encouraged tethering of dogs to prevent further transmission by offering a cash incentive of US$20. These efforts have led to a very significant drop in the number of cases annually, from 1060 in 2011 to just 26 in 2017 (Uniting to Combat NTDs, 2017).

The next disease that we'll be looking at is lymphatic filariasis. Lymphatic filariasis is under the PCT group, as there are relatively inexpensive drugs available for treatment which when paired with rapid and accurate diagnosis, can be deployed easily in many populations. Since the start of lymphatic filariasis programmes in 2012, a lot of progress has been made. The disease is considered to have been eliminated in 10 countries, including Thailand, Cambodia, and Sri Lanka. In addition, as a result of the combined efforts of everyone involved, nearly 500 million people are considered to be in the clear, no longer requiring treatment (Uniting to Combat NTDs, 2017). Unfortunately, despite the progress that has been made, there is still room for improvement. Only 58% of individuals who require treatment actually receive it, due to difficulties in reaching the most isolated of populations. Countries like Gabon and Equatorial Guinea have also yet to begin mass administration of PCT drugs.

HAT also looks to be on track for elimination in most of the affected countries within the next few years. The total number of cases fell from more than 7,000 in 2012 to less than 1000 in 2018. The success of the programme was attributed to mass testing, as well as ensuring that treatment is delivered to the people who need them, even in the most remote of villages. In 2016, more than 2.3 million at risk individuals were screened, meaning that is unlikely that the low number of cases if due to undertesting. At the start of the programme, there were 36 countries surveyed as endemic for HAT. In 2019, 10 of these countries reported no new cases of infection, while 12 reported less than 50 cases (Uniting to Combat NTDs, 2020b). In some countries, control of Tsetse fly vector populations has also been used in an attempt to reduce transmission.

Next, we focus on a disease that primarily affects children, yaws. Unlike some of the other diseases that we have talked about, yaws eradication has been a hot topic ever since the 1950s, when the WHO and the United Nations Children's Fund (UNICEF) worked together to provide mass treatment programmes in more than 40 countries. This resulted in a decrease of disease burden by 95%. The effectiveness of the campaign was due in part to the development of penicillin, which was an effective treatment method for infection by *T. pallidum pertenue* (WHO, 2017). After the initial success, progress on yaws eradication stagnated for the following half a century, until 2012, when oral Azithromycin was discovered to be an effective alternative in place of penicillin injections. The discovery sparked renewed interest in yaws eradication, as the disease could now be classified under the PCT group, and mass drug administration could potentially be used to reduce transmission (Marks, 2016). As a result of these efforts, India was declared yaws-free in 2016, and the plan is to eradicate the infection in the remaining 14 countries still endemic for yaws (WHO, 2017). Challenges faced by the yaws eradication programme are often logistical in nature, such the inaccessibility of vulnerable populations which require Azithromycin.

Trachoma is another disease classed under the PCT group of NTDs. The trachoma programme focused on four main pillars: surgery for inturned eyelashes, antibiotic treatment for the infected, facial cleanliness, as well as environmental improvements (Uniting to Combat NTDs, 2017). In 2018, nearly 90 million individuals suffering from eye infections by *Chlamydia trachomatis* received antibiotic treatment. The number of sufferers who require sight-saving surgical intervention also doubled from 2014 to 2016. During the programme's launch in 2012, a significant problem was the lack of antibiotics, but support from the pharmaceutical company Pfizer helped. Due to all these factors, significant progress has been made: The number of people who require PCT has fallen from 300 million in 2011 to less than 180 million in 2018; Trachoma has also been eliminated in Cambodia, Laos, Mexico, Morocco, and Oman (Uniting to Combat NTDs, 2017). Despite the best efforts of everyone involved, trachoma remains a big problem in many countries, with less than 50% of people who require treatment actually receiving it. This was attributed to the inability to reach all affected communities due to a lack of funding.

Finally, we move on to the final disease on our list, leprosy, which falls under the IDM category of NTDs. Leprosy is likely the most challenging disease to eliminate out of our "Big Six", and this is due to a lack of a rapid diagnostic tool, complicated treatment programme (a combination of drugs are required), as well as social isolation of sufferers, which only facilitates further transmission by delaying treatment. Beginning in 2015, the leprosy elimination programme has not made a lot of progress in terms of reducing the number of cases. From 2015 to 2019, the number of new cases fell by a mere 4000, from 212,000 cases to 208,000 cases. There is definitely still hope however, with pharmaceutical companies pledging to provide the necessary drugs from 2015 to 2020. Additionally, the programme has also made headway in preventing social isolation of sufferers by educating the public about leprosy and opening up community rehabilitation centres (Uniting to Combat NTDs, 2017).

For many of these diseases, the WHO and Uniting to Combat NTDs had hoped to put them under control in all affected countries by this year. Despite the promising progress over the past few years, we have come across perhaps our biggest challenge yet in the fight against NTDs and ironically, it comes in the form of another disease, which certainly needs no introduction – COVID-19. A quick google search tells us the kind of chaos and havoc it has been wreaking throughout countries and societies all over the world. Since the pandemic was declared public enemy number one, programs related to NTDs were put on hold, and this can have many dire consequences. Spikes in new cases across the board, along with decreased funding are just some of the issues faced by the elimination programs today (Chaumont et al., 2020).

Looking Ahead to the Future.

While the numbers do look promising, there is definitely still room for improvement. Even though more than a billion individuals received PCT treatment in 2018, there is still an estimated 600 million people who require treatment but currently have no access to them (Uniting to Combat NTDs, 2020a). The diseases within the PCT group also fall short in terms of their coverage targets, and they all face the common problem of accessibility. This can be due to a lack of funding, poor public health infrastructure within a country, or the lack of manpower necessary for distribution (Uniting to Combat NTDs, 2017). Going forward, more funding, along with stronger cooperation with countries which are affected to develop new methods of delivery, will be needed in order to meet the coverage targets deemed necessary to keep the diseases under control. This is important as PCT can only be effective if there is sustained use in affected populations until they are considered disease-free.

Recall that IDM NTDs are inherently a bigger challenge to manage due to a lack of available resources which can be used to tackle the disease. The most obvious and straightforward way to tackle this issue, would be by upgrading our current arsenal of deployable weapons by investing more into research towards new treatment regimens and novel diagnostic methods. In the past, the discovery of new treatment methods which are much easier to implement have drastically improved success rates of elimination programs (such as the example of Azithromycin and yaws), while accurate and rapid diagnosis can be crucial both in case detection as well as post-implementation monitoring (Chaumont et al., 2020).

Finally, I would like to end off my essay with a case study which serves as a warning and reminder that we cannot afford to let up until complete elimination is achieved. One of the diseases that we have looked at today, HAT, was actually brought under control in the mid-20th century due to the numerous successful control measures that were implemented, helped by the discovery of suramin, a drug used to treat the disease that is still currently in use today. Unfortunately, a long period of political instability and increased poverty in the latter half of the 20th century, along with persistently low numbers of new cases, led to the cessation of elimination programmes (Steverding, 2008). This had devastating consequences over the next few decades, and there was a resurgence in the number of cases, peaking in the late 1990s with over 35,000 new cases annually (WHO, 2020a).

We must make sure never to repeat such a mistake, as doing so would mean that all our efforts over the last decade would have gone to waste. As we have seen from the example above, until the disease has been completely eliminated, the possibility of resurgence cannot be ruled out. For successful elimination programs, this momentum must continue, and this can only be accomplished by continued research into the diseases, development of new tools which can help in our fight, and, most importantly, by making sure that the funds needed to run these programs do not dry up (Uniting to Combat NTDs, 2017).

Reflections

This essay was actually really interesting to write, and even though I was initially introduced to this topic years ago, there was still so much to learn as I would come to realize. One of my biggest takeaways from the assignment is that the problem of NTDs is much more complex than simply the diseases themselves. My initial plan was to actually write about the diseases in a more general manner rather than focusing on the "Big Six", as I had thought that the elimination programs for individual NTDs were more or less the same, and they faced somewhat similar success rates as well as challenges. Soon after I started researching for the essay, and looking into the different NTDs, I realised that this was clearly not the case. With so many elimination programs which employ different methods and face different challenges, it was clear that I had to look at them individually, as not doing so would be doing this topic an injustice.

This was also the first time I've looked so deeply into epidemiology and disease management at a macro scale. My biomedical science background meant that I've only really explored infectious diseases at a surface level (i.e. pathogenesis, treatment, and prognosis etc.), and this was definitely a nice change of pace. Reading up on the challenges faced by the different countries when implementing elimination programmes taught me lots about the importance of public health research and epidemiology: We can come up with as many treatments as we want through scientific research, but if we do not tackle the problem at its roots, then we will never be able to truly solve the problem.

Studying the economic and social impacts of NTDs was also pretty eye-opening. People often fixate on the health impacts of diseases, which is evident when I was conducting my research for this essay. A quick google search on any of the diseases brings up the signs and symptoms, mortality rates, and prognosis of the disease, but almost nothing about the social and economic difficulties faced by vulnerable populations. I feel that if more people knew about the many different ways in which the world is affected by such diseases, there would be more support for such elimination programmes.

While this essay was just a quick school project, I truly hope that it had the intended impact on anyone who reads it. As the world battles this pandemic, the social isolation and constant negative press makes it challenging to think positively, whether it be about global issues or personal struggles. The story of how so many stakeholders, including those who did not suffer directly from NTDs, settled their differences, and rallied themselves in the War Against NTDs is an inspiring one, and by bringing more people's attention to this, I hope to inspire positivity, along with future acts of cooperation.

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