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**Prompt:**

**Review Article**

**Neglected Tropical Diseases (NTDs) - A Snapshot of Research**

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**ABSTRACT**

More than a billion people-one-sixth of the earth’s population is infected with one or more neglected tropical diseases (NTDs) in developing countries. Over the past decade, interests in NTDs have resurfaced as these are a barrier to achieving broader human development outcomes (e.g., improved newborn, child and maternal health, food, and nutritional safety). Several national and international organizations (such as the WHO, USAID, CDC, and others) concentrate on NTDs and fighting to control or prevent them. This review describes a brief introduction to NTDs, the global burden of the diseases in terms of disability-adjusted life years (DALYs), years lived with disability (YLDs) and years of life lost (YLLs). This paper also reviews the negative impact of these diseases on global economies and discusses strategies for public health to prevent and eliminate these diseases, the achievements and challenges that can be achieved to address adversity there.

**KEYWORDS:** neglected tropical diseases, ascariasis, trichuriasis, schistosomiasis, lymphatic filariasis (LF)

**INTRODUCTION**

NTDs are diseases that affect many subtropical and tropical regions, such as Asia, Africa, and the Americas, where the most impoverished people live. According to a World Bank study, 51 percent of the people of sub-Saharan Africa (SSA), a prime focus for NTDs, lives on less than US$1.25 a day, and 73% of the people lives on less than US$2 a day (Chen & Ravallion, 2008). In relation to their outcome on health, NTDs lead to an immense economic and social burden arising from physical disabilities, loss of social status, social stigma, discrimination, blindness, disfigurement, growth failure, malnutrition, and impaired cognitive development. Such interrelated outcomes perpetuate the cycle of poverty by stopping people from leading productive lives and influencing households, communities, and countries as a whole negatively.

In the 2010 study, NTDs responsible for 26.06 million disability-adjusted life years (DALYs) (95 percent confidence interval: 20.30, 35.12), i.e., years of healthy life lost due to disability or premature life (Hotez et al., 2014). The DALY metric quantifies the burden of a disease as the number of healthy years of life lost to morbidity and mortality and is an internationally recognized summary measure of population health. It facilitates comparing the relative impact of diseases and risk factors over time (Devleesschauwer et al., 2014, Murray & Acharya, 1997). NTDs are also referred to as disablers rather than killers, and that’s why DALY metric is used as it has a direct co-relationship with morbidity rather than mortality. The biodiversity of NTDs indicates that the strategies for control or elimination are also very diverse. Several NTDs can be managed by drug treatment (preventive chemotherapy), on a nation or community scale, via mass drug administration (MDA) campaigns. Other NTDs require different control or elimination approaches and strategies, including specialized drugs and/or vector control (limiting or eradicating insects (pathogens transmitting flies and bugs) (Molyneux, 2013). Despite a range of strategies, several organizations, including the World Bank, Bill & Belinda Gates Foundation, United Kingdom Department for International Development, pharmaceutical companies, and government officials from donor and endemic countries chat together at an event entitled “Uniting to Combat NTDs: Ending the Neglect...
and Reaching the 2020 Goals”, and set targeted goals for NTDs (Molyneux, 2012).

**Epidemiology and Global Burden Scenario**

NTDs are biologically diverse, so they are found in regions with favorable conditions, such as poor hygienic conditions and sanitation. It is reckoned that 1.6 billion people worldwide are affected by NTDs, and 149 countries are endemic for at least one NTD (The Lancet Global Health, 2020). Bacteria, viruses, protozoa, and helminth parasites are the infectious agents responsible for NTDs. These agents are transmitted primarily through various vectors (flies, mosquitoes, sandflies, blackflies, etc.) and may cause NTDs when these vectors contact individuals. The major NTDs, their causative agents, and endemic regions are mentioned in table 1 (Hossain et al., 2017).

The Global Burden of Disease (GBD) study launched in 1990 as a single World Bank-commissioned analysis, now known as the GBD project, quantified the health impacts of more than 100 diseases and injuries for eight regions of the world, providing estimates of morbidity and mortality by region, age, and sex. NTDs are among the world’s most familiar conditions, with over 2 billion cases, according to the 2013 GBD study (Table 2).

Since 1990, GBD 2013 shows some important and noteworthy changes in the incidence or prevalence of these diseases. The most remarkable is a 610 percent rise in the incidence of dengue fever, consistent with the extensive occurrence of this disease in the Americas, Asia, and Africa above what would be predicted due to shifts in population demographics. GBD 2013 showed that in prevalent cases of lymphatic filariasis, onchocerciasis, and vision loss attributable to trachoma, there were substantial reductions (approximately 30%-40%) (de Vlas et al., 2016). A 71% decrease in the number of cases of human African trypanosomiasis (HAT) infection is also included in the study (Steinmann et al., 2015).

The burden of NTD is represented by DALYs lost, which corresponds to the years of healthy life lost due to early death, ill-health or disability. Seventeen NTDs together forming the fourth largest disease burden of all communicable diseases, accounting for almost 46-57 million DALYs lost. When assessed using DALYs, NTDs become second only to HIV/AIDS and before malaria and tuberculosis in DALYs lost (WHO, 2004). Seven of these 17 diseases are the most prevalent and are liable for most of the burden of NTD disease, affecting 1.4 billion people globally. Infections with three soil-transmitted helminths (hookworm, ascariasis, and trichuriasis), lymphatic filariasis, onchocerciasis, trachoma, and schistosomiasis are all seven of these diseases (Norris et al., 2012). This burden is because these 17 neglected diseases are not killers but make people disable, leading them to become a burden on the earth.

The major NTD burden is represented in table 3 by DALYs (Vos et al., 2015; Murray et al., 2015; Abubakar et al., 2015). The years of disability (YLD) and the years of life lost (YLL), the main component of DALYs, are both assessed in this table. For most neglected tropical diseases, YLDs contribute to a higher proportion of disability-adjusted life years than do YLLs, and the most common diseases (see Table 3) are also the ones that affect the most disability. In total, 8 million YLLs and 17 million YLDs were liable for NTDs in 2013 (Herricks et al., 2017). The GBD 2013 study compares the variation in DALYs since 2005 (Table 3), and the change in percentage shows the small effort made to reduce the amount of DALYs.

In addition to the NTDs mentioned above, chikungunya has posed a threat to public health in recent years. The burden of chikungunya in India during the 2006 epidemic was calculated to be 25,588 DALYs lost, with a cumulative burden of 45.26 DALYs per a one million-person population (Krishnamoorthy et al., 2009). The estimated total disability-adjusted life years lost for the 2014 Colombian epidemic was 40.44 to 45.14 per 100k population (Cardona-Ospina et al., 2015). However, even DALYs do not reveal the entire story of the adverse consequences of NTDs. Some of the unique and potential shortcomings of Global Burden of Diseases Study 2010 have been outlined elsewhere (Byass et al., 2013). In addition, DALYs only assess direct health loss and, for instance, do not take into account the economic influence of the NTDs that results from adverse effects on child development and school attendance, agriculture (particularly zoonotic NTDs), and overall economic productivity (Miguel et al., 2004; Hotez et al., 2009). Nor do disability-adjusted life years account for specific costs of surveillance, treatment, and prevention measures. Yet, economic influence has risen as an important feature of the neglected tropical diseases, which may trap people in a cycle of poverty and illness (Miguel et al., 2004; Hotez et al., 2009; King, 2010). Additional aspects not taken into account by the DALY metrics are the essential stigmatization components for many of the neglected tropical diseases and the spillover impacts to community and family members (Perera et al., 2007; Weiss, 2008), loss of tourism (Mavalankar et al., 2009), and health system overloads (e.g., during dengue outbreaks). Ultimately, efforts to control and eliminate NTDs could generate economic and social benefits that are not necessarily reflected in the DALY metrics, particularly among the poor communities who are most affected (Hotez et al., 2009).

**Public Health Strategies**

The WHO proposes a mixture of five approaches for the control and prevention of NTDs, which are implemented as per the epidemiology of the specific NTD. Intensified disease management (IDM), preventive chemotherapy (PCT), vector control, hygiene and sanitation, safe water, and public veterinary health are the strategies. The unprecedented decision by some pharmaceutical companies to donate ‘as many drugs as needed for as long as needed’ to help eradicate NTDs has changed the landscape of NTDs by trying to make the drugs available to the poorest nations, with PCT becoming the most common approach to treating the five major diseases (Samuels & Pose, 2013).

- PCT includes a single dose of medication once or twice a year, typically given by the distribution of medicines on
Table 1: List of NTDs, their causative agent(s), and the potential endemic areas of these NTDs (Hossain et al., 2017)

| NTDs                  | Causative agent(s)                                      | Bacterial infections                                                                 | Endemic areas                                                                 |
|-----------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Buruli ulcer          | Mycobacterium ulcerans                                 | Australia, Guyana, Malaysia, Mexico, Peru, Sri Lanka, Papua New Guinea, West, and Central Africa |
| Bartonellosis          | Bartonella henselae, other Bartonella spp.             | Globally distributed                                                                 | Africa, a small part of Central and Southern America                           |
| Bovine tuberculosis   | Mycobacterium bovis                                    | Globally distributed (highest rates in developing countries)                         | Caribbean, Central and South America, Sub-Saharan Africa                         |
| Cholera               | Vibrio cholera                                         | South America, Central Africa, Dominican Republic, Haiti, Cambodia, Papua New Guinea, Thailand, Malaysia, Indian subcontinent |
| ETEC infection        | Enterotoxigenic Escherichia coli (ETEC)                 | Globally distributed (highest rates in developing countries)                         | Brazil, China, Mozambique, Myanmar, Madagascar, Indonesia, India, Nepal, Philippines, Vietnam, Sudan, and other tropical and subtropical regions |
| Salmonellosis          | Salmonella enteric serovars, S. enteritidis, S. typhimurium, S. typhi, S. paratyphi | Globally distributed (highest rates in developing countries)                         | Africa, Middle East, part of Asia, Australia, Mexico, South America              |
| Shigellosis            | Shigella dysenteriae, S. boydii, S. flexneri, S. sonnei | Globally distributed (highest rates in developing countries)                         | Africa, Southeast Asia, the Indian subcontinent, Pacific Region, and most probably in the (sub) tropical regions of the Americas |
| Leprosy                | Mycobacterium leprae                                   | Africa (highest rates), parts of Americas, Asia, Europe                              |                                                                                 |
| Leptospirosis          | Leptospira interrogans                                 | Globally distributed (highest rates in developing countries)                         | China, Israel, India, Pakistan, Turkey, Russia                                  |
| Trachoma               | Chlamydia trachomatis                                  | Africa, Middle East, part of Asia, Australia, Mexico, South America                   |                                                                                 |
| Treponematoses         | Treponema pallidum                                     | Africa (highest rates in tropical regions)                                           |                                                                                 |
| Relapsing fever        | Borrelia recurrentis, B. duttoni, other Borrelia spp.  | India, Subcontinent, South-East Asia, Pacific Islands, Central and South America, Parts of Africa and Northern Australia |
| Dengue                 | Dengue fever virus (genus: Flavivirus)                 | Indian subcontinent, South-East Asia, Pacific Islands, Central and South America, Parts of Africa and Northern Australia |
| Yellow fever           | Yellow fever virus (genus: Flavivirus)                 | South America, West, and Central Africa, occasionally in East Africa and Central America |
| Japanese encephalitis  | Japanese encephalitis virus (genus: Flavivirus)        | Indian subcontinent, South-East Asia, occasionally in East Africa and Central America |
| Chikungunya            | Chikungunya virus                                      | Africa, Southeast Asia, the Indian subcontinent, Pacific Region, and most probably in the (sub) tropical regions of the Americas |
| Rabies                 | Rabies virus (genus: Lyssavirus)                       | Globally distributed                                                                | Asia, China, South Korea, Taiwan, India, Pakistan, Nepal, Sri Lanka, Malaysia, Thailand, Vietnam, Laos, Philippines, Taiwan, China, South Korea, Japan, Cameroon, Nigeria, Liberia, Costa Rica, Ecuador, Guatemala, Gabon, Peru, Panama, Mexico, Thailand, Vietnam, Laos, Ukraine, Siberia, Kazakhstan, Russia, Africa, Asia, Central and Southern America, Central and West Africa, Caribbean, Central and South America, Sub-Saharan Africa, Sub-Saharan Africa, Parts of Central and West Africa, some Caribbean islands, China, Indonesia, Philippines, Cambodia, Laos |
| Rift Valley fever      | Rift Valley fever virus (genus: Phlebovirus)           | Africa and Arabian Peninsula                                                         |                                                                                 |
| Viral haemorrhagic fever| Arenaviridae: Lassa virus, Chapare virus, Guanarito virus, Junin virus, Machupo virus, Sabia virus | Certain viruses are endemic in certain areas. Lassa virus: |                                                                                 |
| Dracunculiasis         | Dracunculus medinensis                                 | Guinea, Liberia, Nigeria, Sierra Leone                                               |                                                                                 |
| Cysticercosis/taeniasis| Taenia solium, T. saginata, Diphyllobothrium latum      | Guinea, Liberia, Nigeria, Sierra Leone                                               |                                                                                 |
| Enterobiasis           | Enterobius vermicularis                                | Guinea, Liberia, Nigeria, Sierra Leone                                               |                                                                                 |
| Echinococciosis        | Echinococcus granulosus, E. multilocularis             | Guinea, Liberia, Nigeria, Sierra Leone                                               |                                                                                 |
| Intestinal fluke infection| Echinococcus granulosus, E. multilocularis             |_main   |                                                                                 |
| Fascioliasis           | Fasciola gigantica, F. hepatica                        | Bolivia, Cuba, Chile, Ecuador, Egypt, Iran, France, Portugal, Peru, Spain             |                                                                                 |
| Clonorchiasis          | Clonorchis sinensis                                    | China, South Korea, Taiwan                                                          |                                                                                 |
| Paragonimiasis         | Paragonimus spp.                                       | India, Pakistan, Nepal, Sri Lanka, Malaysia, Thailand, Vietnam, Laos, Philippines, Taiwan, China, South Korea, Japan, Cameroon, Nigeria, Liberia, Costa Rica, Ecuador, Guatemala, Gabon, Peru, Panama, Mexico, Thailand, Vietnam, Laos, Ukraine, Siberia, Kazakhstan, Russia, Africa, Asia, Central and Southern America, Central and West Africa, Caribbean, Central and South America, Sub-Saharan Africa, Sub-Saharan Africa, Parts of Central and West Africa, some Caribbean islands, China, Indonesia, Philippines, Cambodia, Laos |
| Opisthorchiasis        | Opisthorchis felineus, O. viverrini                    | Africa, Asia, Central and Southern America                                           |                                                                                 |
| Lymphatic filariasis   | Wuchereria bancrofti, Brugia malayi, B. timori         | Africa, Asia, Central and Southern America                                           |                                                                                 |
| Loiasis                | Loa loa                                                | Central and West Africa                                                             |                                                                                 |
| Mansonellosis          | Mansonella persians, M. streptocerca, M. ozzardi       | Sub-Saharan Africa, Parts of Central and West Africa, some Caribbean islands, China, Indonesia, Philippines, Cambodia, Laos |
| Schistosomiasis        | Schistosoma haematobium, S. guineensis, S. intercalatum, S. japonicum, S. mansoni, S. mekongi | Sub-Saharan Africa, Parts of Central and West Africa, some Caribbean islands, China, Indonesia, Philippines, Cambodia, Laos |
| Onchocerciasis         | Onchocerca volvulus                                    | Africa, a small part of Central and Southern America                                |                                                                                 |
| Ascarasis              | Ascaris lumbricoides                                   | Africa, Asia, Central and Southern America                                           |                                                                                 |
| Hookworm infection     | Ascaris lumbricoides                                   | Africa, Asia, Central and Southern America                                           |                                                                                 |
| Strongyloidiasis       | Strongyloides stercoralis                              | Africa, Asia, Central and Southern America                                           |                                                                                 |
| (Contd...)             |                                                        |                                                        |                                                                                 |
Table 1: (Continued)

| NTDs                  | Causative agent(s)                                                                 | Endemic areas                                                                 |
|-----------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Trichuriasis          | *Trichuris trichiura*                                                              | Globally distributed                                                          |
| Toxocariasis          | *Toxocara canis, T. cati*                                                          | Globally distributed                                                          |
| Trichinellosis        | *Trichinella spiralis, other Trichinella spp.*                                     | Globally distributed                                                          |
| Ectoparasitic infections |                                                                                   |                                                                               |
| Scabies               | *Sarcoptes scabiei*                                                                | Globally distributed (highest rates in tropical and subtropical regions)      |
| Myiasis               | *Parasitic fly larvae (Calliphoridae Oestridae, Sarcophagidae and others)*        | Globally distributed (highest rates in tropical and subtropical regions)      |
| Fungal infections     |                                                                                   |                                                                               |
| Mycetoma (Madura foot) | *Various fungi (eumycetoma and bacteria (actinomycetoma, pseudomyocetoma)*         | Africa, India, Central, and South America                                       |
| Paracoccidiomycosis   | *Paracoccidioides brasiliensis*                                                    | Argentinia, highest rates in Brazil (80%), Colombia, Ecuador, Mexico, parts of Central America, Venezuela |
| Protozoal infections  |                                                                                   |                                                                               |
| Chagas disease        | *Trypanosoma cruzi*                                                               | Latin America                                                                 |
| Human African trypanosomiasis | *Trypanosoma brucei gambiense, T. brucei rhodesiense*                              | Africa                                                                        |
| Amoebiasis            | *Entamoeba histolytica*                                                            | Globally distributed (highest rates in developing countries)                  |
| Giardiasis            | *Giardia intestinalis*                                                             | Globally distributed (highest rates in developing countries)                  |
| Leishmaniasis         | *Visceral leishmaniasis: Leishmania donovani, L. chagasi, L. infantum Mucocutaneous leishmaniasis: L. major, L. tropica, L. mexicana, L. braziliensis* | Indian subcontinent, Asia, Africa, South Africa, Mediterranean basin           |

Table 2: Prevalent cases of NTDs in 2013 and percent change from 1990 to 2013 according to the Global Burden of Disease Study (GBD) 2013 (Vos et al., 2015)

| Disease                                         | Prevalent cases (in millions) in 2013 | Percent change since 1990 |
|------------------------------------------------|--------------------------------------|---------------------------|
| Ascariasis                                      | 804.4                                | −25.5%                    |
| Trichuriasis                                    | 477.4                                | −11.6%                    |
| Hookworm                                        | 471.8                                | −5.1%                     |
| Schistosomiasis                                 | 290.6                                | 30.9%                     |
| Foodborne trematodias                           | 80.2                                 | 51.1%                     |
| Dengue†                                         | 58.4                                 | 610.9%                    |
| Lymphatic filariasis                            | 43.9                                 | −32.1%                    |
| Onchocerciasis                                  | 17.0                                 | −31.2%                    |
| Chagas disease                                 | 9.4                                  | 22.4%                     |
| Cutaneous/mucocutaneous leishmaniasis           | 3.9                                  | 174.2%                    |
| Trachoma†                                       | 2.4                                  | −39.2%                    |
| Cysticercosis‡                                   | 1.0                                  | −26.3%                    |
| Cystic echinococcosis‡                          | 0.8                                  | −15.4%                    |
| Leprosy                                         | 0.7                                  | 61.3%                     |
| Visceral leishmaniasis                          | 0.1                                  | 35.1%                     |
| Rabies‡                                         | 0.02                                 | −40.4%                    |
| African trypanosomiasis                         | 0.02                                 | −71.1%                    |
| Other NTDs                                      | 59.7                                 | −5.0%                     |
| Total cases                                     | 2,322                                | NA                        |

Additional NTDs

| Disease                                         | Prevalent cases (in millions) in 2013 | Percent change since 1990 |
|------------------------------------------------|--------------------------------------|---------------------------|
| Trichomoniasis                                  | 67.1                                 | 45.6%                     |
| Scabies                                         | 66.1                                 | 24.8%                     |
| Typhoid fever*                                  | 11.0                                 | −19.9%                    |
| Paratyphoid fever*                              | 6.4                                  | −27.9%                    |
| Venous animal contact*                          | 5.5                                  | −2.7%                     |
| Cholera*                                        | 2.3                                  | 6.1%                      |
| Cryptosporidiosis*                              | 1.4                                  | −19.4%                    |
| Amoebiasis*                                     | 0.4                                  | 17.0%                     |
| Total cases of additional neglected diseases    | 160.2                                | NA                        |

*Incident cases in 2013 rather than prevalent cases, †Symptomatic cases only.
See GBD 2013 capstone manuscript on prevalence, incidence, and years lived with a disability (YLDs) for detail on percent (%) change calculations (Vos et al., 2015). All data provided in this table (exception of cholera, rabies, amoebiasis and cryptosporidiosis) are also obtainable on the website of the Institute for Health Indicators and Evaluation (IHME) and have been previously published in Vos et al. (2015). Abbreviations: NA, non-applicable.

A wide scale, known as mass drug administration (MDA). Not fewer than 65%-80% of the total population living in endemic areas must take the medication for MDA to be effective. As such, it is oftentimes administered by teachers...
Table 3: Leading causes of disability-adjusted life years (DALYs) resulting from the NTDs according to the Global Burden of Diseases Study (GBD) 2013 with attributing years lived with disability (YLDs) and years of life lost (YLLs) (Vos et al., 2015; Murray et al., 2015; Abubakar et al., 2015)

| NTDs                                  | DALYs (in millions) in 2013 | Percent change for DALYs 2005‑2013 | YLDs (in millions) in 2013 | YLLs (in millions) in 2013 |
|----------------------------------------|----------------------------|-----------------------------------|---------------------------|---------------------------|
| Visceral leishmaniasis                 | 4.24                       | 8.7%                              | 0.008                     | 4.23                      |
| Foodborne trematodiases                | 3.63                       | 14.6%                             | 3.63                      | 0                         |
| Schistosomiasis                        | 3.06                       | −13.9%                            | 2.86                      | 0.2                       |
| Hookworm                               | 2.18                       | −0.5%                             | 2.18                      | 0                         |
| Lymphatic filariasis                   | 2.02                       | −14.3%                            | 2.02                      | 0                         |
| Ascarias                               | 1.27                       | −29.0%                            | 0.93                      | 0.34                      |
| Rabies                                 | 1.24                       | −14.6%                            | 0.0001                    | 1.24                      |
| Onchocerciasis                         | 1.18                       | −19.4%                            | 1.18                      | 0*                        |
| Dengue                                 | 1.14                       | 17.0%                             | 0.56                      | 0.58                      |
| Trichuriasis                           | 0.58                       | −12.3%                            | 0.58                      | 0                         |
| African trypanosomiasis               | 0.39                       | −54.3%                            | 0.005                     | 0.38                      |
| Chagas disease                         | 0.34                       | 4.6%                              | 0.10                      | 0.24                      |
| Cysticercosis                          | 0.34                       | −16.4%                            | 0.31                      | 0.03                      |
| Cystic echinococcosis                  | 0.18                       | −14.1%                            | 0.08                      | 0.1                       |
| Trachoma                               | 0.17                       | −18.1%                            | 0.17                      | 0                         |
| Cutaneous and mucocutaneous leishmanias| 0.04                      | 35.9%                             | 0.04                      | 0                         |
| Leprosy                                | 0.04                       | 8.6%                              | 0.04                      | 0                         |
| Other NTDs                             | 3.13                       | −11.8%                            | 2.26                      | 0.87                      |
| Total NTDs                             | 25.17                      | NA                                | 16.95                     | 8.21                      |

| Additional neglected diseases         | DALYs (in millions) in 2013 | Percent change for DALYs 2005‑2013 | YLDs (in millions) in 2013 | YLLs (in millions) in 2013 |
|---------------------------------------|----------------------------|-----------------------------------|---------------------------|---------------------------|
| Typhoid fever                         | 11.13                      | −13.7%                            | 0.16                      | 10.97                     |
| Cholera                               | 5.17                       | −20.1%                            | 0.04                      | 5.13                      |
| Paratyphoid fever                     | 3.82                       | −8.0%                             | 0.04                      | 3.78                      |
| Cryptosporidiosis                     | 3.46                       | −29.6%                            | 0.19                      | 3.27                      |
| Venous animal contact                 | 3.00                       | −3.4%                             | 0.15                      | 2.85                      |
| Scabies                               | 1.71                       | 4.8%                              | 1.71                      | 0                         |
| Amoebiasis                            | 0.38                       | −23.8%                            | 0.04                      | 0.34                      |
| Trichomoniasis                        | 0.11                       | 8.2%                              | 0.11                      | 0                         |
| Total deaths from additional neglected diseases | 28.78 | NA                                | 2.44                      | 26.34                     |

See GBD 2013 capstone manuscript on DALYs for detail on percent (%) change calculations (Murray et al., 2015). The estimates presented in this table are also obtainable on the website of the Institute for Health Metrics and Evaluation (IHME) and were previously published in (Vos et al., 2015; Murray et al., 2015; Abubakar et al., 2015). Information on YLDs and DALYs for Cryptosporidiosis, Cholera, and Amoebiasis is not obtainable from the website of IHME or capstone papers. Abbreviations: NA, non-applicable.

The major NTDs and intervention strategies are listed in table 4. These strategies can control or eliminate the adversity of neglected tropical diseases by 2020 if properly implemented, although some challenges need to be overcome to achieve the goal by 2020.

Achievements

WHO has recorded incredible achievements in combating neglected tropical diseases since 2007. An estimated 1 billion people received treatment in 2015 alone. The WHO report, Integrating NTDs in global health and development, reveals how generous donations of medicines, strong political support, and improvements in living standards have guided to sustained expansion of disease control programmes in countries where these diseases are most prevalent (WHO, 2017).

Since 2007, when a group of global collaborators met to agree to tackle neglected tropical diseases, a number of international and community volunteers, facilitating delivery to vast numbers of people in rural areas as well. Some individuals are not eligible to receive these drugs—children under the age of two or five years, the very sick, or pregnant women (Samuels & Pose, 2013).

• IDM includes care for infected persons and those at risk of infection. This intervention is the prime strategy for the control of NTDs for which no preventive medicines are obtainable, such as Chagas disease, Buruli ulcer, leishmaniasis, human African trypanosomiasis, leprosy, and yaws (Samuels & Pose, 2013).

• The use of pesticides is also needed to combat vector-borne diseases transmitted by snails, insects, or crustaceans (Samuels & Pose, 2013).

• Management of vectors is strengthened by the provision of sanitation, hygiene, and safe water and close cooperation within sectors responsible for health, agriculture, irrigation and environment (Samuels & Pose, 2013).

• Finally, veterinary public-health interventions are also crucial in tackling neglected tropical diseases because zoonotic diseases (e.g., anthrax, bovine tuberculosis, cysticercosis, brucellosis, echinococcosis, zoonotic trypanosomiasis, and rabies) are responsible for much of the mortality and morbidity arising from NTDs (Samuels & Pose, 2013).
local partners have partnered alongside ministries of health in endemic nations to provide quality-assured medicines, and offer people with care and long-term management. In 2012, Partners endorsed a WHO NTD roadmap, contributing additional assistance and resources to eliminate 10 of the most prevalent NTDs (WHO, 2017).

Key achievements of this roadmap of the WHO NTD include (WHO, 2017):
- In 2015 alone, at least 1000 million people were treated for NTD.
- 0.556 billion individuals obtained preventive treatment for lymphatic filariasis (elephantiasis).
- More than 0.114 billion individuals received treatment for a disease caused by the filarial nematode Onchocerca volvulus (onchocerciasis, or river blindness: 62% of those needing it).
- In 2016, only 25 human Guinea-worm disease cases were recorded, placing eradication within reach.
- HAT (sleeping sickness) cases have been lowered from 37,000 new cases in 1999 to well below 3000 in 2015.
- Trachoma – the world’s top infectious cause of blindness – has been eliminated as a public health issue in Morocco, Mexico, and Oman. More than 185 million trachoma patients had surgery worldwide for trichiasis and antibiotics had been received by 56 million individuals in 2015 alone.
- Visceral leishmaniasis: 100% of Nepal’s districts, 97% of Bangladesh’s sub-districts, and 82% of India’s sub-districts reached the elimination target in 2015.
- Only 12 confirmed human deaths were due to rabies in the WHO Region of the Americas in 2015, putting the region close to the goal of eliminating rabies in humans by 2015.

**CHALLENGES**

Despite all the success achieved, NTDs remain worrying in many third-world people who is still live below the poverty line and are deprived of all the facilities necessary to lead a healthy life. WHO reports that there are still about 2.4 billion people without adequate sanitation facilities, such as toilets and latrines (Hutton et al., 2017), while more than 660 million people still drink water from “unimproved” sources such as surface water (UNICEF & WHO, 2015). Reports also suggest that millions of people do not have access to NTD drugs, and prevention programs remain inadequately funded.

Failure to distribute drugs adequately is also a major challenge in this term. A better method of delivering and distributing drugs should need to be introduced. There are still some NTDs such as dengue fever, chikungunya which cause havoc in populations, and the recent outbreaks of zika virus and its complications create a massive concern to the associated authorities to reconsider and introduce new diagnostic tools, medicines, and insecticides to improve its control.

To overcome these challenges, strengthening joint efforts between stakeholders, along with increased support, is a prerequisite for ensuring the success of NTD programs in achieving the goal. It is now imperative to develop the best possible tools to defeat these diseases and make them accessible to workers on the ground.

**CONCLUSION**

The main goals of this review are to learn about the various neglected tropical diseases and how they are distributed which results in harming our socio-economic development and global economy. NTDs are more common in regions where living standards are not acceptable and where sources of pure drinking water and foods are not commonly available. Though these diseases are not considered as lethal but can lead a life to disability. Moreover, a lot of burdens are created each year by those NTDs which have a bad impact on the global economy. A must need attention is required to prevent them and basic treatments will be focused on preventive measures rather than medication. If we desire to get rid of these diseases, need to have better living conditions and ensuring of proper food and drink sources. Vector control is also a prerequisite since most NTDs are spread by vectors. Finally and foremost, what we need to do is to introduce new diagnostic tools and a better method of delivering drugs and improve the living conditions of people.

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Table 4: The intervention strategies of the major neglected tropical diseases, where elimination refers to elimination as a public health problem (Hollingsworth et al., 2015)

| Disease | Interventions | WHO target for 2020 |
|---------|---------------|---------------------|
| Lympathic filariasis (elephantiasis) | Annual/annual MDA (ivermectin, albendazole and DEC), vector control through insecticide-treated bed nets or spraying | Global elimination |
| Onchocerciasis (river blindness) | MDA (ivermectin) and vector control | Country elimination |
| Schistosomiasis (bilharziasis) | MDA (praziquantel) to school-age children and high-risk adults, along with WASH and possible snail control | Regional and country elimination |
| Soil-transmitted helminthiasis (roundworm, whipworm, hookworm) | MDA (albendazole, mebendazole) treatment of school-aged children. | 75% coverage (bi) annual PCT recommended |
| Blinding trachoma | MDA (azithromycin) and surgery, along with improved hygiene | Global elimination |
| Intensified disease management (IDM) diseases, controlled by increased diagnosis and management of cases | | |
| Chagas disease | Spraying with indoor residual insecticides, housing improvements | Regional elimination |
| HAT (sleeping sickness), Gambian form | Treatment, active/mass screening and vector control with tsetse targets | Global elimination |
| Leprosy | Early diagnosis and treatment | Global elimination |
| Visceral leishmaniasis (kala-azar) in the Indian sub-continent | Indoor residual spraying of insecticides, insecticide-treated bed nets, active case detection, rapid diagnosis and treatment | Regional elimination |
CONFLICT OF INTERESTS

The authors declare that they have no competing interests.

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