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Review Article

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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 resurged 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.

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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 helminth (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)	Endemic areas
	Bacterial infections	
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
Bovine tuberculosis	*Mycobacterium bovis*	Globally distributed (highest rates in developing countries)
Cholera	*Vibrio cholerae*	Southern and 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)
Salmonellosis	*Salmonella enteric serovars, S. enteritidis, S. typhimurium, S. typhi, S. paratyphi*	Globally distributed (highest rates in developing countries)
Shigellosis	*Shigella dysenteriae, S. boydii, S. flexneri, S. sonnei*	Globally distributed (highest rates in developing countries)
Leprosy	*Mycobacterium leprae*	Brazil, China, Mozambique, Myanmar, Madagascar, Indonesia, India, Nepal, Philippines, Vietnam, Sudan, and other tropical and subtropical regions
Leptospirosis	*Leptospira interrogans*	Globally distributed (highest rates in developing countries)
Trachoma	*Chlamydia trachomatis*	Africa, Middle East, part of Asia, Australia, Mexico, South America
Treponematoses	*Treponema pallidum*	Globally distributed (highest rates in tropical regions)
Relapsing fever	*Borrelia recurrentis, B. duttoni,* other *Borrelia spp.*	Africa (highest rates), parts of Americas, Asia, Europe
	Viral infections	
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, intermittently in Northern Australia, and the Western Pacific
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
Rift Valley fever	Rift Valley fever virus (genus: *Phlebovirus*)	Africa and Arabian Peninsula
Viral haemorrhagic fevers	*Arenaviridae: Lassa virus, Chapare virus, Guanarito virus, Junin virus, Machupo virus, Sabia virus* *Bunyaviridae: Crimean-Congo haemorrhagic fever virus (HFV), Hantaviruses, Puumala virus,* *Filoviridae: Ebola virus, Marburg virus Flaviviridae: Omsk HFV, Kyasanur forest disease virus*	Certain viruses are endemic in certain areas. Lassa virus: Guinea, Liberia, Nigeria, Sierra Leone Crimean-Congo HFV: Africa, Arabian Peninsula, Bulgaria, Central Asia, Turkey, South-West Russia Hantavirus: Globally distributed; Filoviridae: Angola, Congo, Gabon, Kenya, Sudan, Uganda Omsk HFV: West Siberia Kyasanur forest disease virus: India
	Helminth infections	
Dracunculiasis	*Dracunculus medinensis*	Mali, South Sudan, Ethiopia
Cysticercosis/taeniasis	*Taenia solium, T. saginata, Diphyllobothrium latum*	Globally distributed
Enterobiasis	*Enterobius vermicularis*	Globally distributed (highest rates in developing countries)
Echinococcosis	*Echinococcus granulosus, E. multilocularis*	Globally distributed
Intestinal fluke infection	*Echinosoma spp. Fasciolopsis buski, Metagonimus spp.*	Bangladesh, India, Malaysia, Indonesia, Taiwan, China, Philippines, Vietnam, Thailand, Cambodia
Fascioliasis	*Fasciola gigantic, 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, Guinea, Guatemala, Gabon, Peru, Panama, Mexico
Opisthorchiasis	*Opisthorchis felineus, O. viverrini*	Thailand, Vietnam, Laos, Ukraine, Siberia, Kazakhstan, Russia
Lymphatic filariasis	*Wuchereria bancrofti, Brugia malayi, B. timori*	Africa, Asia, Central and Southern America
Loiasis	*Loa loa*	Central and West Africa
Mansonellosis	*Mansonella perstans, M. streptocerca, M. ozzardi*	Caribbean, Central and South America, Sub-Saharan Africa
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
Ascariasis	*Ascaris lumbricoides*	Globally distributed
Hookworm infection	*Ancylostoma duodenale, Necator americanus*	Globally distributed
Strongyloidiasis	*Strongyloides stercoralis*	**Globally distributed**

(*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, pseudomycetoma)	Africa, India, Central, and South America
Paracoccidiomycosis	Paracoccidioides brasiliensis	Argentina, 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 trematodiases	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 leishamaniasis	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	**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%
Venomous 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
Ascariasis	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 leishmaniasis	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
Venomous 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

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).

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

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
Preventive chemotherapy (PCT) diseases, controlled by mass drug administration (MDA) programmes		
Lymphatic filariasis (elephantiasis)	Annual/biannual 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 (bilharzia)	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. Treatment of pre-school aged children and women of childbearing age is also recommended	75% coverage with (bi) annual PCT
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

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.

CONFLICT OF INTERESTS

The authors declare that they have no competing interests.

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