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Review Article

Prevention, Treatment and Eradication of NTDs by Concerted Efforts-Prognosis and Prediction

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Abstract: Neglected Tropical Diseases (NTDs) are diseases of poverty most prevalent in continents Africa, some parts of Asia, and the low-income regions of G20 countries. The name was given because of the neglect of the global burden of this category of diseases leading to lesser and lesser control strategies by one and all. Although medically diverse, neglected diseases share features that allow them to persist in extreme poverty. The mortality rates with these diseases are relatedly low, but morbidity rates, the main concern, are comparatively higher. This review covers the importance of the control of the NTDs at different levels of control community, national and international levels missed by many of the publications. The visual impact of most diseases is manifested in the form of disfigurement, blindness, and disabilities believed to be dreadful stigmas that people try to hide. Keeping in mind this aspect, there is an urgent need to convince most people to contribute to controlling and preventing the further spread of these diseases. Thus, motivating community-level control. The first detailed study on the global burden of these diseases and the risk factors involved was initiated by the World Bank in 1992. A follow-up study was performed in 2005. This was the basis for the start of the fight against these diseases, initially selecting the eight most affecting diseases and then gradually increasing to 13 by 2006. World Health Organization also released its first report on NTDs in 2010, compiling all the related aspects. The report was the basis for selecting diseases as targets and reached 17 diseases by 2013. Most of the reviews have not highlighted the importance of the various pharmacoeconomics and pharmacoepidemiology strategies which can be incorporated to get better results in eradicating these diseases. The main bottleneck is the inaccurate and imprecise measurement of the disease burden from the data, which does not give a clear picture of the disease. The detail of parameters selected for most of the measurement of disease burden, Disability-Adjusted Life Year (DALY), and measuring tools, which have been incorporated from time to time to meet the requirement, are also covered. The review also highlights the role played by different strata of a system for better control of these diseases.

Keywords- Neglected Tropical Diseases, NTD, DALY, Prevalence

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1. INTRODUCTION

The "Neglected Tropical Diseases" (NTD) are a group of infections prevalent in tropical regions and endemic in low-income populations in developing areas of Africa, Asia, and America. The term "Neglected Tropical Diseases", a modification of "Other diseases", was coined by Dr Kenneth Warren (1980)[1] to mark the neglect by all. The core 13 neglected tropical diseases include protozoal infections, helminths, and some bacterial and viral diseases. The neglected protozoal infections include Leishmaniasis, Human African Trypanosomiasis, and Chaga's disease. Helminth infections are soil-transmitted helminths covering ascariasis, trichuriasis, hookworm infestations, lymphatic filariasis, onchocerciasis, dracunculiasis, taeniasis, trematodia ses, and schistosomiasis. The bacterial diseases comprise Buruli ulcers, leprosy, trachoma, and yaws. Dengue and rabies are viral diseases.[2-4] NTDs are endemic in 149 countries, 100 out of those countries are endemic for more than one disease and 30 countries of these are endemic to 6 or more diseases. These diseases affect poverty-driven individuals and their families, finally spreading to the community. The people suffering from these diseases live in poor and pitiable conditions, mostly in rural backgrounds or slum areas.[5] They have little or no say in major political and administrative decisions; thus, their voice is not heard. The widespread assumption that the people at risk of NTDs are relatively less prone to morbidity and diseases have little mortality rates has been strongly refused. These diseases may cause multiple infections leading to severe pain that may or may not be followed by permanent disability and death. The disability may manifest as disfigurement, leading to social stigma, especially for females and children. The major effect on a person is the loss of productivity and further development, mainly social and economic aspects. The main neglect for all these diseases occurs at all three levels of control: the community, national, and international. The community level can include efforts like integrating NTDs with other not-so-neglected diseases like malaria, tuberculosis, etc. But at the national level, efforts are to provide the input data and to implement various policies agreed upon at the international level. The neglected approach of the scientific community has also led to ignorance in the general public, leading to less awareness, thus limiting the number of available treatment options. Therefore, the significant effort to control the diseases should also include awareness among people from all walks of life be it a medical or paramedical staff, they should be well versed with the disease manifestations, treatment options available, and measures which are there in place to control the spread of these diseases. The sequential steps are followed, first all, control, then elimination and finally, last, eradication step. This has been taken care of, and for the past years, many publications are there in peer-reviewed medical and scientific journals highlighting the degree and nature of adverse effects, treatment options and the extent of growth to achieve the goals. Further, the collaboration of the NGOs, industry, regulatory agencies and other disease-controlling authorities at national and international levels can be beneficial. Print and social network media can also play a pivotal role in eradication by giving unadulterated information. All level authorities can work hand-in-hand to achieve Vision 2030.[6,7] The Blue Marble Health concept is based on the iconic image of the Earth, which was taken on December 7, 1972, from the surface of planet earth by Apollo 17 spacecraft astronauts who were on their way to the moon.[8] Dr Peter Hotez, Dean of the National School of Tropical Medicine, proposed that even though all economies are growing, a bottom-tier of society remains in each economy, where disease burdens are comparable around the World, according to a new global health paradigm. It is a fact that neglected tropical diseases are starting to appear in prosperous countries, particularly among the underprivileged living among the wealthy.[9] This thought shifts the emphasis from the developing World to the poor population living among the wealthy G20 and Nigeria. These G20 countries and Nigeria account for half of the World's NTDs. A startling fact is that 12 million Americans have an undiagnosed parasitic infection. The measures should be in place in these countries to detect, control and eradicate these diseases. They are the poor people who live in prosperous societies. The Chagas disease prevalence and spread also support the concept which is also common in Argentina, Brazil, Mexico, and the United States, leprosy the most common disease in G-20 countries.[10]

1.1 Classification of NTD

The various organizations WHO, CDC and other organizations dealing with tropical infectious diseases have some differences in including some of the diseases in the list of NTDs. Ascariasis, Buruli ulcer, Chagas disease, dracunculiasis, hookworm infection, African human trypanosomiasis, Leishmaniasis, leprosy, lymphatic filariasis, onchocerciasis, schistosomiasis, trachoma, and trichuriasis are among the 13 core NTDs covered usually. The WHO has also included foodborne trematode, yaws, cysticercosis, dengue, rabies, echinococcosis and mycetoma, adding to give twenty diseases in total. Some diseases like scabies and other ectoparasites, Chromoblastomycosis, and snakebite envenomation were included in the list in the year 2017 in PLoS list. [2-4, 11] The initial NTDs were all severe chronic infections, the majority of which were parasitic diseases, with the additional characteristic that they primarily affected the extremely poor. Two years before PLOS Neglected Tropical Diseases launched, in 2005, an early list of 13 diseases was published in PLOS Medicine, concentrating only on the significant NTDs. WHO updated the 2005 list with additional conditions they deemed essential for global public health. Among the helminth disorders, they included were echinococcosis, foodborne trematodiases, and taeniasis/cysticercosis. Chagas is a protozoan disease, while YAWS is now a bacterial infection (endemic treponematoses). Various fungi's deep mycoses were also included. The list, which did not initially contain viral infections, was expanded by the WHO to include rabies and the arbovirus diseases dengue and chikungunya. They also had scabies, various ectoparasites, and snakebite envenomation. [2-4, 11] The classification of NTD mostly accepted in PLoS journal (PLoS,2018, PLoS) is based on, the category of organism causing the disease. They can be protozoa, bacteria, viruses, or helminths (as shown in figure 1a). The other classification, as given by Anderson et al., is based on the class names based on parasitic dimensions: microparasites or macroparasites.[13] Figures 1a, 1b and 1c show the classes with the diseases included. The two classes based on Anderson *et al* differ in the life cycle (simple or complex), replication (involvement of intermediate or reservoir host), and modes of transmission of disease (direct, indirect, or vector).[14] The difficulty in overcoming the NTDs infection arises as these parasites include a zoonotic component that is essential for their survival and transmission. This zoonotic component acts as their carrier and can cause the spread of these diseases.[15] These zoonotic components can be wild or domesticated animals involved in the transmission cycle of pathogens by culture, food, or behaviour.[15]

Fig.1: Classification of NTD[2-4, 11-14] a) PLoS b) Anderson *et al* c) WHO/CDC

1.2 PREVALENCE OF NTDs

1.2.1 Regions of the World (geographical and climatic conditions)

According to WHO[16], the major geographical regions of the World are six, which are mainly used for reporting, analyzing, and administrating. The African Region, European Region, Eastern Mediterranean Region, Region of America, South-East Asian Region, and Western Pacific Region.[17] All the regions have different climatic conditions classified as Zones.[18] The parameters considered for the determination of condition in the area are the mean annual temperature measured in the open air/mean annual partial water vapour pressure. The climatic conditions prevailing in all the regions are shown in figure 2.

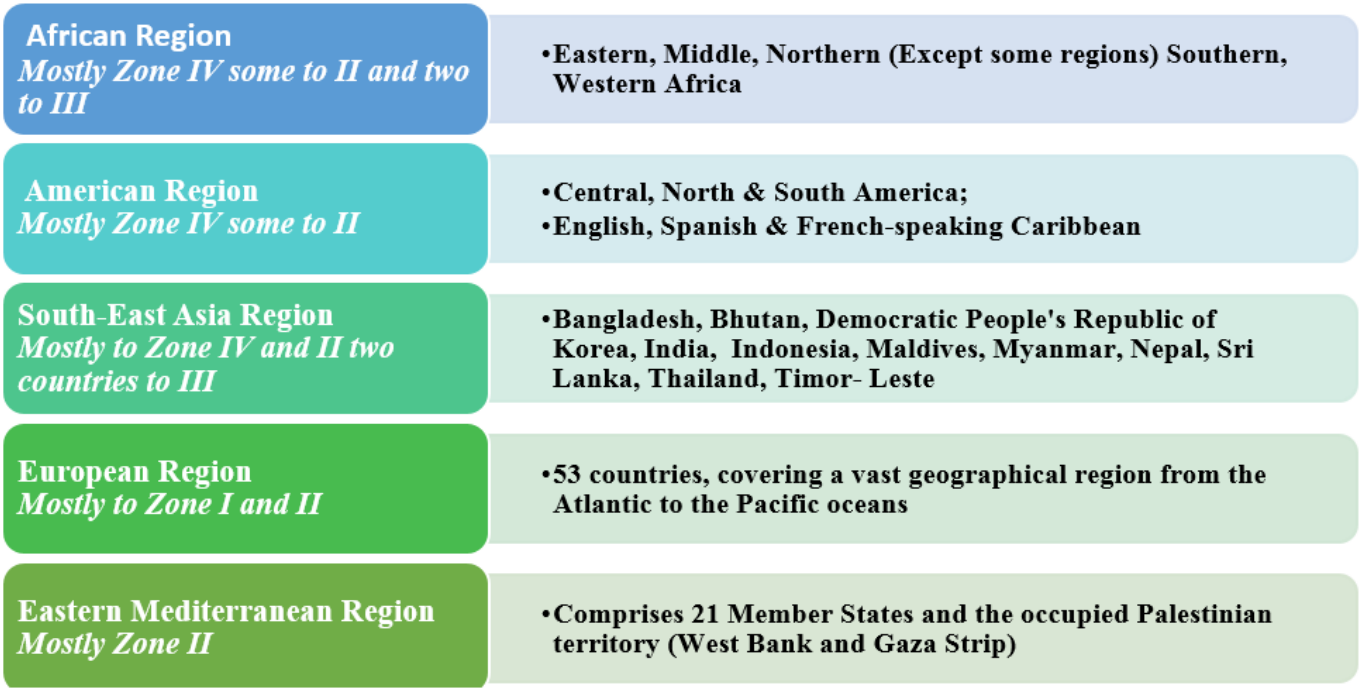


Fig 2: Regions of World according to WHO and their climatic zones. Zone I is temperate zone, Zone II is Mediterranean or subtropical zone, Zone III has hot and dry climate and Zone IV is divided into IV a having hot humid tropical climate while IV b having hot and very humid.[17-19]

1.3 Parameter for measurement of Global Burden of Disease

Initially, the global burden of disease[21,22] was mainly focused on mortality rates, which was counting the number of deaths which is an easy task. Later on, with the inclusion of physical and psychological morbidity and disability, a clearer picture was visualized with the inclusion of these parameters causing disability in a person and loss of productivity. Thus, DALY was the considered major parameter for determining the local, regional, and global burden of a disease calculated from data on prevalence. The DALY was defined as life (in years) lost due to death (premature) and life lived (in years) in less than total health. One DALY may be compared to a year lost of a "healthy" life. The population's DALYs are used to measure the variation between an ideal health condition (disease and disability-free) and the present health condition. DALY[23] is the sum of the YLL, which is the years of life lost because of premature death, and the YLD[24] is expanded as years lost due to disability.[25]

DALY = YLL + YLD

Fig 3: The relationship between YLD (Years of healthy life lost due to disability), YLL (Years of Lost Life per 100 000 population) and DALYs (Disability-adjusted life years).

The basic formula for determining YLL (for a particular disease, age, sex, and year) is the product of the number of cause-specific deaths in the population (N) and standard life expectancy (L) in years or, more precisely, the age of death. Before 2010, the YLD was estimated using incidence estimates, age-weighting, and time discounting.

$$YLL = N \times L$$

$$YLD = I \times DW \times L$$

Where YLD, as explained earlier, is years of life with disability and the first term I is the number of cases incident of a particular condition in a population while DW is disability weight associated with the condition, the last term L is the average duration of the disease until death in years. After 2010, calculations were more aptly based on prevalence estimates of the disease, taking into account disability factors also.[24] This can be summed up as the number of cases prevalent of a disease (P) and Disability weight (DW) were multiplied to get YLD.

$$YLD = P \times DW$$

1.4 Graphical Representations of Global Prevalence

The data in the graphs shows that the disease prevalence is affected by climatic conditions prevailing in the region under study. Thus, the control is to be strategically modified accordingly. The changes in climatic conditions affect global temperature and weather also[26] in turn; these factors jointly affect the spectrum of infections and their vector's growth. The significant effect of weather, as observed, is mainly on the outbreak's timing, location, and infection severity. There is also a shift in habitats leading to the introduction of diseases to areas unaffected by them earlier. The climate also affects proliferation rate, transmission season, vectors, and reservoir hosts.

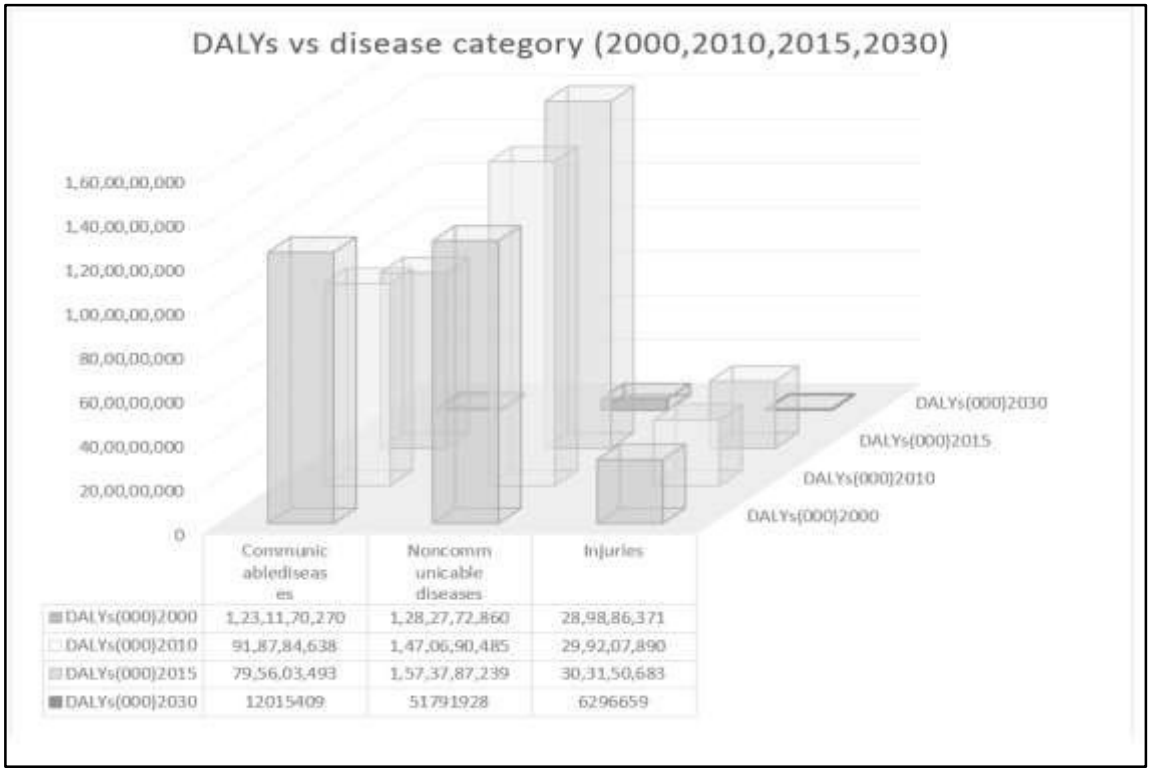
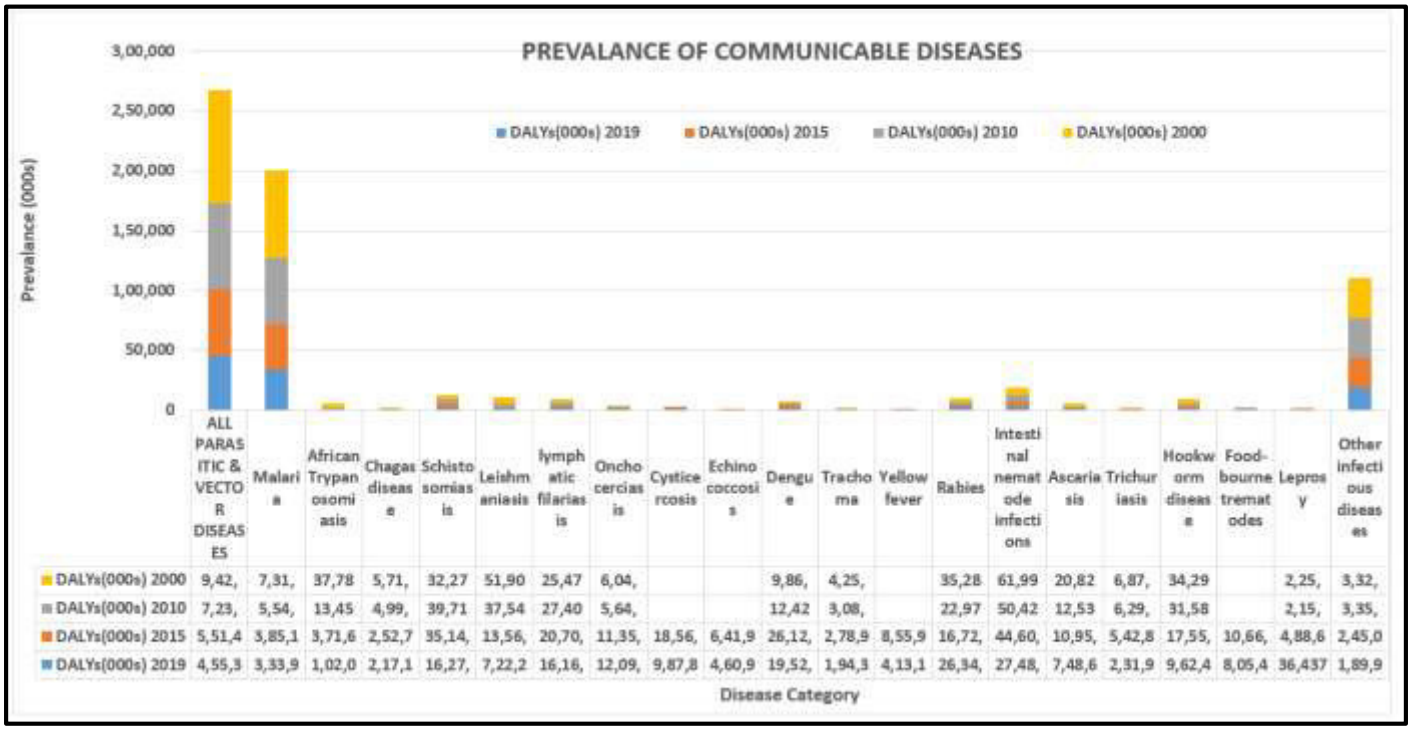


Fig.3: Showing prevalence as per WHO data (2000, 2010 and 2015) of different top 20 categories of diseases in terms of number of DALYs (000s). The data of 2030 is the projected data.[27- 29]



	ALL PARASITIC & VECTOR DISEASES	Malaria	African Trypanosomiasis	Chagas disease	Schistosomiasis	Leishmaniasis	lymphatic filariasis	Onchocerciasis	Cysticercosis	Echinococcosis	Dengue	Trachoma	Yellow fever	Rabies	Intestinal nematode infections	Ascariasis	Trichuriasis	Hookworm disease	Food-bourne trematodes	Leprosy	Other infectious diseases
DALYs(000s) 2000	9,42,	7,31,	37,78	5,71,	32,27	51,90	25,47	6,04,			9,86,	4,25,		35,28	61,99	20,82	6,87,	34,29		2,25,	3,32,
DALYs(000s) 2010	7,23,	5,54,	13,45	4,99,	39,71	37,54	27,40	5,64,			12,42	3,08,		22,97	50,42	12,53	6,29,	31,58		2,15,	3,35,
DALYs(000s) 2015	5,51,4	3,85,1	3,71,6	2,52,7	35,14,	13,56,	20,70,	11,35,	18,56,	6,41,9	26,12,	2,78,9	8,55,9	16,72,	44,60,	10,95,	5,42,8	17,55,	10,66,	4,88,6	2,45,0
DALYs(000s) 2019	4,55,3	3,33,9	1,02,0	2,17,1	16,27,	7,22,2	16,16,	12,09,	9,87,8	4,60,9	19,52,	1,94,3	4,13,1	26,34,	27,48,	7,48,6	2,31,9	9,62,4	8,05,4	36,437	1,89,9

Fig.4: Showing the prevalence of different communicable diseases in terms of the number of DALYs in different regions of WHO (Data: 2000, 2010, 2015 and 2018).[27-29]

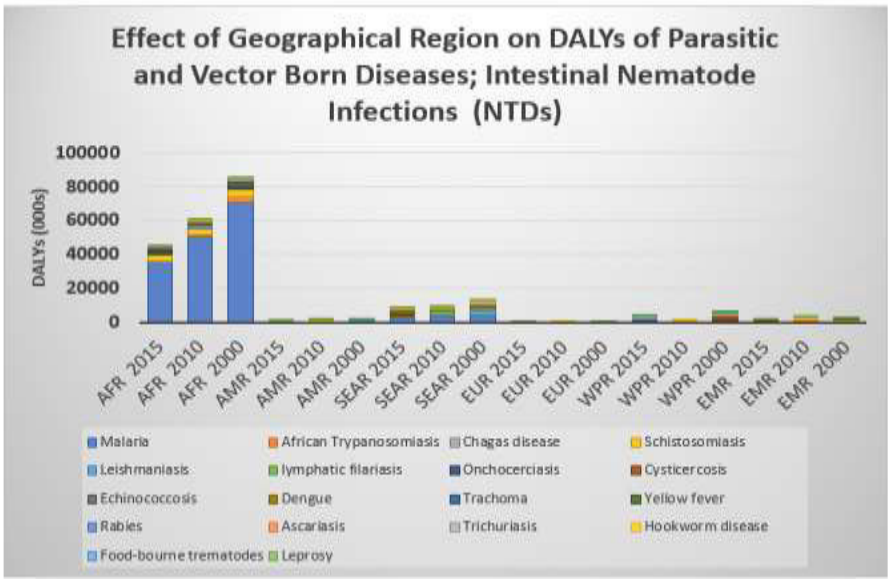


Fig.5: Showing the effect of geographical region on DALYs of parasitic and vector -borne diseases; intestinal nematode infections (NTDs). [27,28,29]

1.5 Newer approaches - Integrating Pharmacoeconomics with Pharmacoepidemiology for management of NTDs[30].

Pharmacoepidemiology[31] and pharmacoeconomics[32] represent the rational progress in medication assessment development of evidence-based, cost-effective strategies followed by their sensible use, which leads to new effective and innovative therapies. It is essential to consider quantitative measures of the therapy's economic, clinical and humanistic values during the development of effective treatment for neglected tropical diseases. The various parameters considered for pharmacoeconomics are shown in fig. 6. fig. 7 shows the parameters used for the calculation of the cost of disease, which includes the cost of detection, treatment, prevention of disability, control as well as rehabilitation.[33]

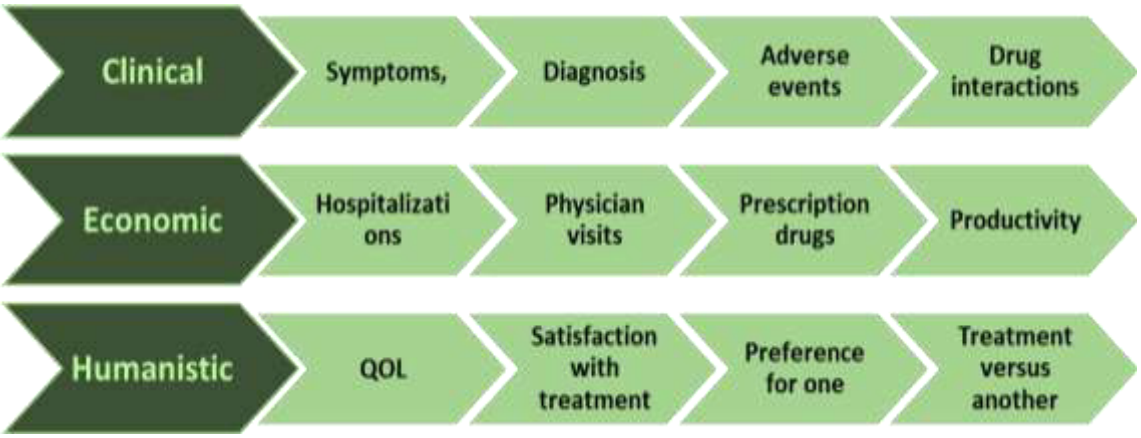


Fig.6: Parameters considered for Pharmacoeconomics.[36]

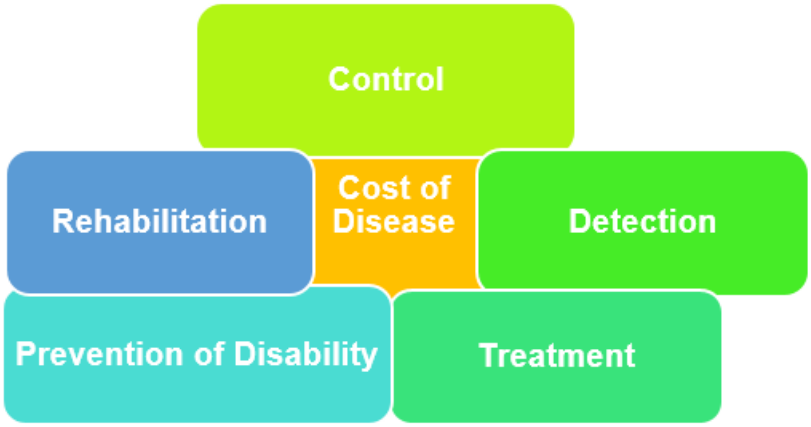


Fig.7: Showing the factors involved in compiling the Cost of Disease.[36]

Table 1: Economic burden of various NTDs DALYs converted to US dollars.[36]

NTD	Economic burden
Dengue fever	US$ 29.3 million (US$ 27.5–31.1 million) Private health sector has four times the public sector expenditures
Echinococcosis	Purchasing power parity 4.1 billion international dollars annually 46% human treatment & morbidity 54% animal-health costs
Lymphatic filariasis	Lost productivity US$ 1.7 billion US$ 1.3 billion/year in lost productivity US$ 0.05 to US$ 0.10 per person treated Cost of the DALYs averted US$ 5.90
Soil-transmitted helminthiases (deworming)	Net present value of wages up by more than US$ 40/ treated person Benefit-to-cost ratio = 100 Increase adult income by 40% US$ 0.07 per each round of drug distribution (or US$ 70 000 for 1 million school-aged children)
Schistosomiasis	Disability rate important, a total of 45.4 days off-work lost/ infected person/year
Trachoma	Lost productivity is estimated at US$ 2.9 billion annually

Table 1 gives the detail of the economic burden of various NTDs in terms of the cost of disease and also the loss of productivity in the disease-causing economic burden also.

1.6 *Principles of elimination and eradication of NTDs*

For the prevention and control of NTDs, the World Health Organization (WHO) suggests five public-health measures: preventative chemotherapy, intensive case management, vector control, the provision of clean water, sanitary conditions, and hygienic practices, as well as veterinary public health (that is, applying veterinary sciences to ensure the health and well-being of humans). The factors are highlighted in fig. 8.

For the prevention and control of NTDs[38-48], the World Health Organization (WHO) suggests five crucial public-health measures to be followed:

Fig.8: The thrust areas for the best control of NTDs. [38-48]

1.6 Preventive Chemotherapy (PC)

Treatment of at-risk populations periodically with preventive chemotherapy is an effective strategy for managing and eliminating NTDs, including trachoma, onchocerciasis, lymphatic filariasis (LF), schistosomiasis, and soil-transmitted helminthiasis (STH) (PC). Between 2016 and 2019, more than 1 billion people received PC annually, which resulted in significant decreases in morbidity, lower transmission, and, for some NTDs, regional eradication as a public health concern. This number decreased to 732 million in 2020 due to the COVID-19 pandemic, as the disease's spread was curbed. Mass drug administration provides medication to everyone within a given geographic area or the entire population (MDA). This suggests that regardless of whether a person is diagnosed, everyone who qualifies receives therapy. For instance, MDA treats schistosomiasis and STH in different parts of India, focusing on students who are enrolled in school because the disease is more common in that age group. The six NTDs-soil-transmitted helminths (STH), Dracunculiasis, Lymphatic Filariasis, Trachoma, Onchocerciasis, and Schistosomiasis, can be controlled through PC in the form of mass administration

1.7 Intensified case management

This intervention aims to manage illnesses within primary healthcare systems and, in the long run, render them unproblematic in terms of public health. This intervention is utilized when no affordable control tools are available, and devices on a broad scale are constrained.

1.8 Vector control

Managing vectors, such as mosquitoes, flies, ticks, bugs, and other pathogen-transmitting vectors, is a crucial component of vector control. Access to safe water, adequate sanitation, and good hygiene (WASH) are critical in the new WHO present road map. It is essential for the treatment and prevention of all NTDs. The most recent statistics show that 47% of schools lack handwashing facilities, 40% of people worldwide do not have access to handwashing facilities at home, and 16% of healthcare facilities do not have functional restrooms or handwashing facilities at the points of care where patients are treated. Services for veterinary public health (also known as utilizing veterinary sciences to protect human health and welfare). The interdependence between human health, animal health, and the environment in which people live is acknowledged by this intervention. Many NTDs, including rabies, are zoonotic diseases that transfer from animals to people. SAFE approach (surgery for those with trichiasis, antibiotic treatment for conjunctival infection, facial cleanliness and environmental improvement to reduce transmission). The evidence demonstrates that, even though one technique may predominate to control a particular disease or group of diseases, applying all five methods and putting them into practice locally still results in tremendous success. The consequences of permeable borders, population growth and migration, urbanization, the movement of animals and vectors, and the political and geographic effects of climate change must all be considered when creating plans for spreading and managing NTDs. Today, uncontrolled epidemics happen every three to five years.

1.10 Opportunities and Challenges for complete eradication of NTDs[49]

NTD initiatives may run into problems such as insufficient intervention targeting, limited treatment coverage among specified subgroups, and a lack of surveillance systems that can meet the sensitivity and specificity necessary for disease eradication. These issues could be resolved by developing unique solutions and using modern methods and technology effectively applied by previous health projects, such as eradicating polio, malaria and vaccination. We think there is a

chance to find and prove the viability of innovation from current advancements to meet challenges in controlling and eradicating these diseases. The mass media, whether print or social networking, can also spread knowledge, have control and finally eradicate the NTDs. With the rapid advancements in Internet access, various mobile technologies and geographical coding technologies, the collection, processing and sharing of data with different agencies is accessible. The blogs by various scientific agencies are thus allowing sharing of the latest advancements with larger masses. The main issues addressed are detecting, identifying and controlling different NTDs. Sharing one's experience or recent advances also gives us significant advantages. The detail of various blogs is given in table 3.

Table 3: Collective list of blogs on NTDs and their primary goal.

Blogs	Main Goal
"Centres for disease control and prevention" [50]	Information related to the achievement of the organization is blogged.
"Official PLOS Blog" [51]	Connecting to the wider scientific community through blogs.
"BMC'S BLOG NETWORK" [52]	A blog for the parasitic and vector diseases
"Global Health Training Centre"[53]	Sharing of Global Health Clinical Research experiences
"World Bank Blogs" [54]	Blogs related to the goal of the world bank to end extreme poverty and share prosperity, including health topics.
"Sightsavers" [55]	Mainly focussing on persons with disability.
"The Lancet Global Health Blog" [56]	Recent developments in NTD
"Sabin Vaccine Institute" [57]	Updates on NTD and vaccine as future.
"Center For Strategic And International Studies" [58]	Strategic and planning information for NTD control
"Discover Magazine" [59]	Wide range of topics NTD under body horror.
"Global Alliance to Eliminate Lymphatic Filariasis [60]**(GAELF)"**	Blogs on various issues related to NTDs.

1.11 PARTNERSHIPS TO FIGHT BACK NTDs [34, 36]

The partnerships are emerging as a platform for various; Governmental agencies, Ministries of Health and Education, Pharmaceutical companies, bilateral and multilateral agencies, foundations, implementing partners, NGOs (Non-governmental organizations), and Private sector partners to achieve the goals set to eradicate NTDs. Some of the agencies are detailed here. The list is not exhaustive but a mere effort to highlight the endeavours at all levels of the neglects being catered to. The "NTD Support Center"[61] has more than 100 partners (43 being ministries of health), and they support the research pertaining to neglected tropical diseases. The initiative "Speak Up Africa"[62] also supports the SDGs, with a significant focus on the first to sixth. The main aim is to ensure every African individual lives a long and healthy. President Bill Clinton started "Clinton Global Initiative (CGI)"[63] in 2005. CGI's main motto is "to turn ideas into action". The initiative was created to find solutions for significant challenges faced globally. The work is convoked through CGI University, CGI America, and CGI International. After its establishment in 2005 till 2016, CGI members have made more than 3,600 plans, thus improving the lives of millions of people residing in 180 different countries. The "USAID NTD" [64] Program is associated at all levels- regional, national and global- to support various NTD programs. They provide access to the cheap and more ready availability of drugs by local people, thus helping the more

Table [1]: Concluding table showing the regional prevalence of diseases with preventive measures for effectively controlling the diseases and various partnerships.[30, 70,71]

Disease	Symptoms/ Disability	Regions of Prevalence	Preventive Measures [72-79]	Sponsored
Buruli ulcers	Skin and soft tissue destruction are extensive, resulting in the formation of large ulcers.	Sub-Saharan Africa	Combined antibiotic treatment (rifampicin and streptomycin) I'm proved diagnosis	UBS Optimus Foundation, the Swiss Agency for Development and Cooperation, and the German Federal Ministry of Education and Research.
Chagas disease [66,67]	Development of damage □ Heart □ Autonomic nervous system □ Oesophagus □ Colon	US, Latin America and the Caribbean	First-line treatment with benznidazole and nifurtimox tablets. Vector control Strict observation Oral transmission control Per domiciliary infestation elimination	DNDi Eisai Co. Ltd.
Cysticercosis	□ Epileptic attacks □ Headaches □ Learning difficulties	All six WHO regions	Improvements in sanitary conditions, such as avoidance of open defecation.	Bill & Melinda Gates Foundation and the UK Government

	Convulsions		Chemotherapy for pig farming as well as humans New vaccination	
Dengue	A significant cause of hospitalization and death is a haemorrhagic fever.	First time in Europe. They are spreading further to the European and African continents.	Control the spread of the vectors New diagnostic methods Newer medicines and vaccines	Global Dengue and Aedes-transmitted Diseases Consortium (GDAC)
Dracunculiasis (guinea-worm disease)	Oedema with pain Generalized pruritus The worm emergence causes blistering and ulceration Followed by fever, nausea and vomiting.	Sub-Saharan Africa verge of eradication	Control of infection in dogs Timely Village-based active searches for disease Case-containment Improved and vigilant surveillance Easy availability of safe drinking water	UNICEF, CDC and The Carter Center
Echinococcosis	More prevalent in males. Cysts grow in CNS, head and neck region, peritoneal cavity, diaphragm and soft tissues, abdominal wall, heart, kidney, spleen, bones, spine and pelvic region.	Global distribution	Regular treatment of dogs Strict controls for the slaughter of livestock Destroying infected offal Vaccination of sheep.	Flatworm Functional Genomics Initiative (FUGI), funded by Wellcome Trust Strategic Award
Endemic treponematoses (Yaws, endemic syphilis, bejel and pinta)	Ulcerative cases Disfigurement of the face and legs	Latin America	Administration of oral azithromycin	
*Foodborne trematode infections	Cholangiocarcinoma Paragonimiasis Cerebral cases	Tropical regions	Preventive chemotherapy Strategic veterinary public-health	
Human African Trypanosomiasis	Neurological disorders Psychiatric disorders	Sub-Saharan Africa	Improved medicines accessibility (nifurtimox and eflornithine) Enhanced surveillance Early case-finding Prompt treatment	
Rabies	Respiratory, GIT, and CNS (central nervous systems) disorders. Acute stage hyperactivity is known as furious rabies or can also cause paralysis (dumb rabies)	Africa and Asia, Latin America	Vaccines Controlling the disease in dogs (vector) by cost-effective dog immunization.	Boehringer Ingelheim,
Leishmaniasis	Ulcers on the face, arms and legs Permanently disfiguring scars with most damaging on mucocutaneous	US, Southwest Asia, South and Central America, Mexico, Australia and Sub-Saharan Africa	Improvement in diagnostic tests Research for safe, effective and affordable medicines (amphotericin B, miltefosine , paromomycin) Vaccine alternative Facilitating the dissemination of research findings	DNDi
Leprosy (Hansen disease)	Permanent damage is caused to nerves, skin, eyes and limbs.	Worldwide	Case-finding and treatment leading to global control of transmission Development-specific diagnosis interventions Multidrug therapy (MDT)	DNDi, Novartis
Lymphatic filariasis	Major harm to the lymphatic system, arms, legs, kidneys, and genitals (especially in men)	Pacific Islands, East and South Asia, Sub-Saharan Africa	Mass-drug administration: antifungal ointment, Diethylcarbamazine Vector (insect) control	END7, DNDi, GlaxoSmithKline, Johnson & Johnson, Eisai

				Pharmaceuticals India Pvt. Ltd.
Onchocerciasis (Preventative Chemotherapy)	Visual impairment, including permanent blindness Skin nodules Onchocercal skin disease	Latin America, Caribbean, Sub-Saharan Africa	Stricter surveillance activities Mass-drug administration with Ivermectin.	Merck African Programme for the Control of Onchocerciasis (APOC)]
Schistosomiasis (bilharziasis)	Liver fibrosis Kidney failure Cancer of the bladder	Sub-Saharan Africa, Caribbean regions, Latin America, Sub-tropical areas of Asia	Mass treatment of high-risk population Easy availability of safe water Improved sanitation Educating people about hygiene Proper control of snails Mass-drug administration with praziquantel and albendazole or praziquantel alone.	Helen Keller International, TI Pharma, Merck KGaA, Astellas Pharma Inc. and the Swiss Tropical and Public Health Institute
Soil-transmitted Helminthiases (Intestinal Worms)				
Ascariasis	Abdominal pain Nausea, tiredness, loss of appetite. Leading to malnutrition Anaemia In children's hampered physical growth along with cognitive development	Several regions of South-East Africa, Central and South American region	Strengthening healthcare systems Prophylactic chemotherapy Provision for education on hygiene related to water and sanitation. Preschool and school-aged children were dewormed with albendazole.	END7
Hook Worm		Throughout World (Tropical and subtropical)		
Trichuriasis		Some tropical regions of Asia, Africa, Central America, South and the Caribbean islands		
Trachoma	Causes 3% of the World's blindness	Worldwide	SAFE strategy **S**urgery of the lids **A**ntibiotics to treat infection **F**acial cleanliness **E**nvironmental improvement	Sightsavers, DND*i*, Pfizer (International Trachoma Initiative)

Example of diseases is Clonorchiasis, Opisthorchiasis, Fascioliasis, Paragonimiasis

2. CONCLUSION

This is the lesson learnt the hard way: international efforts are fruitless without community and national efforts, as dissemination of help and funds mainly occurs at the community level. An appeal to the national and private sector to contribute inputs in the form of funds and critical knowledge for effective prevention and strict control of these neglected diseases. The change of name from other communicable diseases to Neglected Tropical diseases was a major step. It has drawn the attention of large masses at all three neglect levels and given an extra edge. First and foremost is controlling poverty, as it is the major cause. This will lead to well-aware individuals being more adept at controlling the spread of disease, thus causing a smaller number of cases. The other major aspect neglected is the flaws in linking precise climatic conditions with epidemiological data, thus giving a not-so-clear scenario. This may lead to wasted efforts also when plans for a particular area in a region are required. This concept has been addressed in European agencies and has led to the collaboration of the European Environment and Epidemiological network. This should be followed in other regions. This will be beneficial as there is a paradigm shift in the prevalence of many diseases under this category. The important aspects of infiltration through borders, growth in population and urbanization should also be considered while planning the strategy for controlling and managing NTDs. Many efforts have been put forward, and still much more are required.

3. AUTHOR CONTRIBUTION STATEMENT

Dr Mohini Bajaj conceptualized and designed the review, discussed it with Dr Sanju Nanda and prepared the original draft. Then the data was discussed, analyzed and review finalized.

4. CONFLICT OF INTEREST

Conflict of interest declared none.

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