Biotechnology

Neglected tropical diseases: a brief review on Indian perspectives

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Abstract
Neglected Tropical Disease (NTDs) is a group of different infectious diseases in their spread, epidemiology, outcome and control. Combined with being the most common disease worldwide, the World Health Organization (WHO) estimates that billions of people and the growing economic costs of billions of greenbacks annually. They are common in tropical and subtropical areas and 149 countries suffer from NTDs. India is home to a large number of poor people who live in poverty, and as a result, they are infected. India is the second most populous country in the world (18% of the world's population). Neglected tropical diseases (NTDs) are more commonly found; we can rely on India to bear the brunt of NTD, with a population of over 1.3 billion. Twenty untreated tropical diseases (NTDs) are identified through the World Health Organization (WHO), which affects more than 1.7 billion people worldwide. Visceral Leishmaniasis (VL), Lymphatic filariasis (LF), Leptospirosis, Rabies, Dengue and Soil-Transmitted Helminthic Infections (STH) are most common in India. NTDs vary greatly in their appearance and disease burden in terms of their local presence and proximity. Such diseases are more prevalent in rural areas and in a few suburban areas of low-income countries such as Asia, Latin America and sub-Saharan Africa. The current article reviews the typical NTDs in India, their level, current state of governance involvement, and the challenges and opportunities for the elimination of NTDs.

Keywords: neglected tropical diseases, visceral leishmaniasis, dengue, India

Introduction

Neglected tropical diseases are a group of chronic illnesses that carry viruses, viruses, bacteria and fungi that may infect economically poor people regardless of the state of the world income. Their infection prevents people (adults and children) from going to popular destinations and their involvement in public life. More than a billion people are affected and it costs economic development billions of dollars every year from these NTDs. "People who live in poverty, without proper sanitation and who are very close to infectious diseases and domestic animals and livestock are the most affected," (WHO 2020) [78]. India is the second most populous country in the world and in itself makes up 18% of the world's population. Therefore, we can expect to bear the brunt of the NTD burden. However, India additionally has the seventh largest financial system in terms of gross domestic product (GDP), and many diseases stand out for their unwavering impact on India's fitness. Neglected tropical diseases (NTDs) are 17 or more chronic infectious diseases and related diseases that cause the most common diseases in the world's poorest people (WHO, 2010) [83]. An important aspect of NTDs is their effectiveness in selling poverty due to its effect on child development, end-stage pregnancy outcomes, and employee eligibility (Hotez et. Al., 2009) [36]. Another distinguishing feature is how they differ in their etiology, distribution, and load disturbance primarily based on their geographical spread.

A. Protozoan NTDs

Visceral leishmaniasis

Leishmaniasis is a neglected vector-borne disease considered a disease of the poor (WHO, 2014) [76]. It is the second most important protozoan disease medically (in human life) after malaria. 350 million people are at risk in high-risk areas, and 14 million people are immediately affected by (disorder) disorder (illness) (Pace, 2014) [57].

Visceral leishmaniasis or kala-azar is found in 75 locations worldwide in Asia, Africa and the Americas. India alone makes up 25% of the global burden (problem) of kala-azar. It is a public health problem in the country with the spread of the area in 54 districts in 4 districts - Bihar (33 of 38 districts), Jharkhand (4 of 24 districts), Uttar Pradesh (6 out of 75 districts) and West Bengal. (11 of 23 districts). The well-known Micro-stratification shows that there are 633 blocks in 4 regions that could be problematic.

Rare times come from various provinces in addition to Assam, Gujarat, Himachal Pradesh, Jammu & Kashmir, Kerala, Madhya Pradesh, Haryana, Puducherry, Sikkim, Tamil Nadu and Uttaranchal. Leishmaniasis is not always the most effective (appropriate) disease left out, and it is the first health problem worldwide. It produces different groups of scientific syndromes ranging from self-healing (visible) skin lesions to fatal visceral disease. It is mainly about a zoonotic disease that affects dogs, foxes, foxes and mice. Animal dams play a key role in transmission. Many of the dangers associated with Leishmania's distribution have been affected (associated); these include, socio-economic conditions, malnutrition, human migration and environmental and climate change. Prevention and deception are based entirely on early analysis and treatment, monitoring of vector management disorder and public awareness (Daniella, 2015) [17]. Parasitological diagnosis is made on the basis of biopsy results, and the treatment requires potentially toxic and costly pills. The variety

of such drugs is inaccessible. Spraying homes with residual pesticides is difficult to support, as is the control of animal dams (e.g., puppies, VL). Recent research has led to the development of pesticides, bed nets, miltefosine, and cheap and reliable serological tests for leishmaniasis (Guerin *et al*., 2002; Davies *et al*., 2003) [31, 21].

Typical preventive measures, alongside N, N-diethyl-meta-toluidine (DEET) - are completely based on repelling pesticides and permethrin or various insecticides applied to clothing and insect repellents with well-placed containers all provide protection against flies when used. well (Soto *et al*., 2006) [67]. Vector management and reservoir management are powerful. Even if there is no commercial vaccine available right now, there are plans to look forward to it in the future. The automatic choice of human infection is associated with high level of protection from competition with homologous infecting Leishmania spp. Phlebotomus is not said to fly overhead and is miles away at night in a residential area. Therefore, falling asleep in a pinnacle flooring or on beds above the floor can save the infection. Early treatment in all cases is very important.

Symptoms and signs often appear weeks or months after inflammation and include fever, weight loss, and increased liver function. Extremely untreated visceral leishmaniasis can be fatal, especially if different pre-modern conditions include tuberculosis, pneumonia, and diarrhea.

Prevent keep away from outdoor activities from dusk until sunrise. If you must have it, immerse it in front or spray the outer garment and gear with permetrin. Use a spray containing 20%-30% DEET or 20% Picaridin on the exposed pores and skin. Exercise again in accordance with the manufacturer's instructions. Sleep under the bed internet with permetrin or in a room with air conditioning. Flies are very small, 2-3 mm, and can penetrate with standard monitors and nets. Signs treated with pesticides and nets can reduce the risk of access.

There is no preventive vaccine or remedy directed at Leishmaniasis. Treatment options depend on identifying the type of infectious leishmania and the number of infections, however it includes antifungal pills and antibiotics.

Animal shelter plays the main function of transmission. Many opportunities related to Leishmania's distribution have been involved; those include, socio-economic conditions, malnutrition, human migration, and environmental and climate change. Prevention and management are based entirely on early analysis and treatment, vector manipulate, problem management, and community education (Daniella, 2015) [18]. perhaps because the new NTD technology is not considered profitable, India has not fully planned and directed its own biotechnology engine to build gears against its automatic NTDs. If this is a flexible need for exchange, it could produce one among India's largest contributions to international health and development.

B. Helminthic NTDs

The most common NTD in helminthic are ground-based helminthiases, schistosomiasis, fascioliasis, and echinococcosis. Lymphatic filariasis (LF) is a local removal procedure due to the administration of multiple drugs.

Helminths (STH) - Ascaris lumbricoides, hookworms (Ancylostoma duodenale and Necator americanus) and *Trichuris trichiura* - are the most common (common) diseases in the world, and India is thought to have a fine style. most of the cases (375 million) step in the global burden of disease estimates, 2013 (Murray *et al*. 2015) [54]. The largest discounts worldwide for Ascaris cases (-25.5% since 1990) were considered, but the reduced ones were smaller in Trichuris (-eleven.6%) or smaller hookworm (-five.1%) (Herricks et in 2017) [34]. In today's large estimates (2015), 258 million people (or one in 5) in India are expected to develop STH, 148 million Ascaris, 109 million hookworms and 40 million Trichuris diseases, indicating the decline of Ascaris. and Trichuris, but a higher incidence of hookworm than previous reports (Lai *et al*. 2019) [44].

This contamination is due to Ascaris lumbricoides worms and is commonly found in tropical and subtropical climates. Men and women with mild infections will not show any signs and symptoms. Those who develop symptoms begin with persistent cough, shortness of breath, shortening within 1 week of exposure to worms migrating to the lungs and throat. A second set of symptoms, including abdominal pain, nausea, vomiting, diarrhea, blood or worms in the stool, fatigue, weight loss appear a few weeks (up to two or three months) later because the worms are adult and females lay eggs that may be secreted by feces. The parasite can live in humans for up to 2 years. Adolescents are more likely to suffer from this disorder because they are more prone to play and eat dirt. Treatment includes taking anthelmintic pills.

C. Soil and mode transmission diseases

Infection with four types of nematodes - roundworm (Ascaris lumbricoides), whipworm (*Trichuris trichiura*), and hookworms (Necator americanus and Ancylostoma duodenale), collectively called Soil-Transmitted Helminthes (STH), is among the most common neglected areas. diseases worldwide (WHO, 2011) [80]. STHs are still widely distributed in tropical and subtropical climates, and are common (common) where sanitation and hygiene are poor. The sector Fitness corporation (WHO) estimates that 880 million children are infected with STH infection worldwide and need treatment (WHO, 2017) [81], of which 241 million are in India (WHO, 2010) [84].

Dracunculiosis or guinea worm disease

Ascariasis

The infection is caused by worms called Ascaris lumbricoides and is usually confined to tropical and subtropical areas. Parents with moderate illness may not show any symptoms. People who develop signs and symptoms after a severe infection start with a persistent cough, shortness of breath, shortness of breath within 1 week of exposure to worms that migrate to the lungs and throat. second set of symptoms abdominal pain, nausea, vomiting, diarrhea, blood or worms in the stool, fatigue, weight loss appear a few weeks to two or

three months, later due to worms becoming adults and females laying eggs. it can be emptied of feces. The parasite can live in humans for up to two years. Children especially have the disease because they often play and swallow the dust. Remedy includes taking anthelmintic pills.

Hookworm | Ancylostomiasis

This intestinal contamination is all caused by Necator americanus, seen with Ancylostoma duodenale, and small volume with the help of Ancylostoma ceylanicum and mites commonly seen in tropical and subtropical climates. People with minor infections will not show any signs and symptoms. Those who develop the symptoms first experience skin rashes where the larvae enter the pores and skin. Abdominal pain, diarrhea, loss of appetite, weight loss, and fatigue stand up because migrating larvae change into adults and fit inside the intestinal tract. Eggs produced by females are disposed of in the feces. Remember that Ancylostoma duodenale hookworm can also be detected with the help of eating soil or sand with dirty arms or dirty fruits and vegetables. A common symptom of this disease is anemia (iron deficiency). Remedy includes taking anthelmintic pills. This intestinal infection is caused by Necator americanus, followed by Ancylostoma duodenale, and slightly by Ancylostoma ceylanicum and mites commonly found in tropical and subtropical climates. People with mild infections may not show any symptoms. Those who show signs of growing symptoms first develop skin rashes when the larvae enter holes and holes in the skin. Abdominal pain, diarrhea, loss of appetite, weight loss, and fatigue rise as migratory larvae grow into adults and are balanced within the digestive system. The eggs produced by the females are shed.

Trichuriasis

Infection is caused by Trichuris trichuria whipworm and occurs internationally, especially in areas where there is no proper sanitation. People with minor ailments may not show any symptoms. those who show symptoms have diarrhea, consisting of blood, mucus, and fluid as a result of swallowed eggs hatched in the caecum (an area similar to the large intestine sac) followed by larvae that migrate to the colon to grow into adults and mates. Eggs produced by girls are excreted in the faeces. Extreme conditions include abdominal pain, chronic diarrhea, and rectal prolapse. Worms can live on people for years. Children especially suffer from this disease because they are used to playing and eating dust. Remedy includes taking anthelmintic pills.

Typically, South Asia is responsible for almost one-fourth of the world's cases of helminthiases transmitted to the ground, with the highest cases in India, followed by Bangladesh. Ascariasis (Ascaris lumbricoides infection) is the most common helminth disease in Southeast Asia, with more than 200 million cases, diagnosed using more than 100 million cases of trichuriasis (*Trichuris trichiura*) and worms, respectively. While Necator americanus debts are the highest number of cases of human worm infection in Uttar Pradesh and the West Bengal States, and elsewhere in India, mixed diseases with N. americanus and Ancylostoma duodenale also appear (Yadla *et al* 2003) [85]. Because of their significant impact on child growth and development, in 2001 the 54th International Fitness Conference set a goal of reducing the height and depth of soil-borne helminth infections by 50% and achieving a permanent goal. worm infestation of at least 75% of college teens at risk. The most important approach is based on several times each year on multidrug-based administration (MDA) the use of the drug mebendazole or albendazole as a single dose, and the drug delivery device depends largely on schools and school teachers in charge of medicine (WHO, 2017) [81].

Helminthiases form the top 3 rare NTDs in South Asia. Ascariasis (Ascaris lumbricoides infection) is the most common infection of helminth and NTD in the area, with more than 200 million cases, occurring in more than 100 million cases of trichuriasis (*Trichuris trichiura*) and worms, respectively. Although Necator americanus is a debt owed to many of the world's most common human-to-worm infections, in Uttar Pradesh and West Bengal States in India, and possibly in a few other places in India, mixed diseases are both N. americanus and Ancylostoma duodenale appear, moreover. in natural diseases A. duodenal (Yadla *et al* 2003) [85]. A. duodenale was additionally diagnosed as a cause of pediatric hookworm (Bhatia *et al*.2010) [7]. In Pakistan, polluted water used in agriculture is considered a high risk hookorm (Ensink *et al*. 2005) [28]. Overall, South Asian debts accounted for about a quarter of all land transfusion cases, and most cases in India, are tracked with the help of a Bangladesh road. These numbers are based on statistics posted in 2003 (Bethony, *et al*. 2006) [6]; additional fashion records from Atlas International Helminth Infections (Brooker *et al*, 2010) [8] are not available in South Asia. As a result of the positive impact on the growth and development of children, in 2001 the 54th World Health Organization established a goal to reduce the spread and prevalence of contagious helminth infections in all parts of the world by 50% and to achieve the goal of eradicating the worms at least 75% of school-age youth. (WHO, 2010) [84]. The most important method is that twice a year the Mass Drug Administration (MDA) uses the drug mebendazole or albendazole as a single dose, and the drug delivery device depends on the skills of school drug administrators. Among Bhutan-only children who have achieved this goal so far, although almost half of Sri Lanka now receive deworming drugs in national control campaigns, however, a high percentage of preschool children receive deworming, especially in Bangladesh, India, Nepal, and Sri Lanka, probably because they received a single dose of albendazole as part of efforts to eradicate lymphatic filariasis (LF) that combines MDA with this drug in combination with diethylcarbamazine citrate (DEC). Similarly, Nepal focuses on helminth management, as well as LF and efforts to eradicate trachoma, through a U.S.-sponsored NTD software program (Linehan, *et al* 2011) [48], as in Sri Lanka a general case of helminth infections transmitted to the ground among school children falls below the WHO recommended degree required for the annual killing of worms Pathmeswaran *et al*. 2005 [60]. The human worm vaccine is also under development to introduce post-treatment re-infection (Hotez *et al* 2010) [35].

Filarial diseases

Lymphatic Filariasis and Onchocerciasis.

Lymphatic filariasis

LF is found in countries with significant economic challenges. W. bancrofti is a very important form of human filariasis. It is often identified as an urban disease that is devoid of animal dams. It has also been reported in rural areas. Parasite starts only in humans and mosquitoes. But older worms can also live for eight to ten years and bring Microfilaraemia (MF) very often. That is actually a real connection that contains (includes) illness. The World Health Organization (WHO) predicts that LF is found in 81 tropical and subtropical regions worldwide with an estimated 120 million infected people and one billion at risk; Nine hundred and forty-seven million people were threatened, while 40 million people were harmed by this threat. Four countries in the world India, Indonesia, Bangladesh (all Asian countries) and Nigeria (Africa) contribute about 70% of LF pollution internationally (WHO, 2020) [78].

There are eight parasites with filarial diseases, of which three are parasites - Wuchereria bancrofti (Cobbold 1877) [15], Brugia malayi (Brug 1927) [9] and B. timori (Partono *et al*. 1977) [58] cause lymphatic filariasis (LF) that disrupts lymphatic filariasis (LF) a major lymphatic gadget in severe organ defects leading to social discrimination (poverty) (Cobbold 1877, Brug 1927, Partono *et al* 1977) [15, 9, 58]. In India, the first type of W. bancrofti and B. malayi is seen. W. bancrofti provides 99.4% of the total load. It is a group of round diseases with tode parasitic helminthiasis under the Filarioidea type of infection. The most affected organs are the legs and genitals that cause ‘elephant’ and hydrocele in adult males and breast filariasis in women followed by chronic disability that results in social stigma. In the Indian language the disease is called ‘Hathipaon’ (elephant feet). In India, LF is the second leading cause of malaria in animals and is second only to malaria and tuberculosis worldwide.

LF is considered one of the leading NTDs in the world. India offers a major global responsibility, which is why the first attempt was to set a vision to control the disease. India has made great strides in its completion of international programs. In India, LF is due to the round worm nematode parasites. W. bancrofti and B. malaria and is transmitted by the mosquitoes Culex quinquefasciatus, *Mansonia annulifera* and *M. uniformis*. B. Malayi donates to a neglected and existing base in Kerala, Andhra Pradesh, Odisha, Madhya Pradesh, Assam and West Bengal. Optionally, the Bihar region has the highest quality at the same time as the lowest Goa (Michael *et al*. 1996) [53]. Most people with the disease are undiagnosed - people no longer show signs and symptoms-despite the fact that worms can damage the kidneys and lymph nodes for a long time without symptoms and signs. Excessive infection, which may not be seen for years, causes swelling inside the genitals, breasts, legs and arms and may progress to lung damage. Treatment includes taking anthelmintic pills.

It is recommended to use a spray containing 20% -30% DEET or 20% Picaridin on the pores and skin. Re-apply as manufacturer's instructions. Wear clothes that are neutral (beige, medium gray). If possible, wear long sleeves, cotton clothes. If available, first immerse or spray the outer layer of clothing and wash with permetrin. Remove water containers around living areas and make sure that door and window screws work properly. Apply sunscreen first and apply a repellent (preferably 20 minutes in advance).

Onchocerciasis

Onchocerciasis - or "river blindness" - is an infectious disease caused by the filarial worm Onchocerca volvulus which is spread by frequent bites of infected flies (Simulium spp.). These flies breed near fast-moving rivers and streams, near villages near fertile land where people depend on agriculture for their livelihood. Onchocerciasis is an eye and skin disease. Symptoms are caused by microfilariae, which travel throughout the human body to the subcutaneous tissue and cause severe inflammatory responses when they die. People with the virus may also show signs of itching and various skin diseases. Some people with inflammation develop eye ulcers that can lead to visual impairment and permanent blindness. In most cases, nodules under pores and skin build up near mature caterpillars (WHO, 2019).

It is a rare infectious disease caused by spirurid and toxins Onchocerca volvulus from the large family Filaroidiae, the family Onchocerchiadae (Turner, 2014) [73]. It is most commonly seen in Sub Saharan Africa, Yemen and Central and South America (Dunn et. Al. 2015) [23] Onchocerciasis is transmitted through repeated bites of the black female female genus Simulium (Datta, 1974) [20]. People are one sure host. The medium host, a black fly, needs stagnant water in hot humidity to reproduce; hence it is also referred to as “river blindness,” the second most common cause of infectious cause of blindness after trachoma. The life cycle of the black fly ranges from two to three weeks and six to twelve months in humans (Barua *et al*. 2011) [4]. Onchocerciasis is characterized by pruritus, skin rashes, and permanent blindness due to the immune response implanted in the host (Ali *et al*. 2003) [3]. Wolbachia species of the microorganism were identified as Onchocerca endosymbionts and are significantly responsible for Onchocerca disease (Tamarozzi *et al* 2011) [70].

Recognition of the manifestations of the various Onchocerca volvulus infestation and the reporting of all possible conditions from India may be important in estimating the appropriate epidemic and disease burden in this part of the field.

Platyhelminth diseases: schistosomiasis, fascioliasis and echinococcosis

Schistosomiasis

It is one of the oldest diagnostic parasitic diseases described in ancient records. It affects an estimated 200 million people worldwide. The Indian subcontinent has long been considered a low-risk area for human schistosomiasis. Many types have been described in India that may have been associated with human infection and cervical cancer. The tool for poor health care and lack of awareness in rural and tribal areas are important factors that prevent the prevalence of schistosomiasis outbreaks in humans over animals.

The abundance of waterways such as rivers, lakes, dams and irrigated fields in India provides an ideal environment for freshwater snails. In addition, pollution of human and animal feces and urine, improper handling of river or lake water for lack of absorption and domestic energy and sanitation and lack of vector exploitation measures provide an additional opportunity to spread schistosomiasis in India. There are a number of factors that can help the disease to continue to be isolated. Due to its uncommon, diagnosing human schistosomiasis in India is difficult and requires a high degree of suspicion while clinically comparable patients. Schistosomiasis is a disease of poor and poor people who have no knowledge of society and medical services. Because of the incurable and unexplained symptoms associated with intestinal schistosomiasis or urine, it is possible that patients in rural India do not usually seek medical help. For that reason, the actual incident is expected to be subject to evidence. Importantly, the migration of population from epidemic areas associated with the risk of the creation of the human schistosome continues to be a major threat in India. Pure water snails are considered an important biological factor in schistosomal pollution in India. Absence of Bulinus sp. it is believed that the main cause is urinary schistosomiasis due to S. haematobium was unable to reach India even after repeated exposure to this type of infection within the world epidemic with the help of troops during the first and second world wars (Baugh 1978) [5].

The Indian subcontinent has seven types of schistosome novels that infect animals. Among them, S. indicum, S. spindalis and S. bomfordi was first described by Montgomery in 1906, followed by the discovery of S. incognitum by Chandler, S. and left with the help of Rao, S. nairi by Mudaliar *et al*., and the Orientobilharziadattai of Dutt *et al*. (Agrawal & Rao, 2011, Dutt & Srivastava 1955) [2, 24]. In addition, O. turkestanicum and O. harinasutai has also been described as buffalo in India (Agrawal & Rao, 2011) [2]. Dutt and Srivastava contributed to the development of schistosomiasis in India by identifying O. turkestanicum from a deadly disease site in Srinagar, describing its life cycle and snail host Lymnaea auricularia (Dutt & Srivastava 1964) [25]. Even as the S. indicum, S. spindalis and S. and are still members of S. indicum clade, S. incognitum and O. turkestanicum by Proto - S. mansoni clade (Lawton *et al*. 2011) [45]. The financial and health consequences of schistosomiasis are huge and the debilitating illness is more than just fatal. Newer, schistosomiasis can cause anemia, depression and reduced chance of being considered, despite the fact that the effects are often reversible with treatment. Chronic schistosomiasis can also affect people's ability to function and in a few cases can lead to death. The mortality rate due to schistosomiasis is difficult to quantify due to underlying diseases including liver and kidney failure, bladder cancer and ectopic pregnancy due to schistosomiasis of female genitals.

A new mortality test is needed for schistosomiasis, as it varies between 24,072 and 200,000 worldwide annually. In 2000, the WHO expected the annual death toll to be 200,000 worldwide. This should have been significantly reduced due to the impact of the increase in major chemical monitoring campaigns over the past decade.

Schistosomiasis is detected by the detection of parasite eggs in a stool or urinary tract. Antibodies and / or antigens found in blood or urine samples are also warning signs of infection. WHO's strategies for controlling schistosomiasis are focused on reducing intermittent illness, with Praziquantel focused on intensive care (preventive chemotherapy) for affected individuals. It involves the day-to-day management of all vulnerable groups. In a few parts of the world, where there is likely to be a small number of infections, interruptions in the transmission of the disease should be targeted.

Treatment-focused groups are: Preschoolers-adults, adolescents in remote areas, adults who are considered vulnerable in desert areas, and people who engage in activities related to contact with full water, for example fishermen, farmers, irrigation. workers, and women their domestic chores deliver them full water. All groups live in easily accessible areas (WHO, 2021) [76].

Fascioliasis

It is a water-and-food zoonotic disease caused by parasites of sophistication, class Trematoda, genus Fasciola; especially Fasciola hepatica and *F. gigantica* (Lalrinkima *et al* 2021). Fasciolosis, a food-borne infection caused by Fasciola hepatica and *F. gigantica* has been a major economic loss in the livestock sector. In India, cattle fasciolosis is a major concern for the project due to the fact that these animals are the source of the laws of milk and dairy products in humans. It is talked about worldwide (WHO, 2006) [79]. FH is a flat, hermaphroditic leaf-shaped animal, and it desires the two visitors to complete their life cycle. Green mammals. People are unintentional / accidental recipients who collect waste by using raw cooked vegetables or by absorbing water. Six Medium hosts are freshwater snails. Fasciola fluke resides within the hepatic glands of their host directly and the eggs overflow with the host's feces. Eggs hatch into ciliated miracidia when they come in contact with water and infect freshwater snails. Free cercaria leaves the snail, interacts with the life of aquatic plants such as watercress and becomes metacercarial cysts. Infection of the host host directly has two stages, hepatic and biliary phase. After ingestion, the metacercaria ex-cyst inside the duodenum and moves through the intestinal wall into the peritoneum, and with the Glisson tablet to the liver. The larvae then travel through the hepatic parenchyma. This hepatic stage lasts for 4 months and the affected person develops fever, nausea, vomiting, urticaria, right hypochondriac pain, hepatomegaly, hypergamma-globulinemia, anemia and significant eosinophilia. All patients usually experience hypochondriac pain and significant eosinophilia.

A progressive biliary diploma takes place during the months following a meal when the old flukes mature in the biliary tract and begin to lay eggs. This will result in occasional hypochondriac pain, with or without cholangitis or cholestasis due to progressive bile duct infection. The eggs appear to be inside the chair during this stage. Demonstrating eggs with a chair pattern may require repeating samples with attention-

grabbing techniques. Because we have not tried this would provide an explanation for the horrific sewage test in all our confirmed cases.

Control of fasciolosis is done with a solution for infected animals using anthelmintic pills and controlling the number of snails that is not always an effective idea about the reproductive ability of a snail. Veterinary treatment for fasciolosis is usually performed after medical and coprological tests on the eggs of sensitive insects that lead to indiscriminate anthelmintic use. In the treatment of fasciolosis the use of triclabendazole has shown variable efficacy in recent years as evidenced by the use of the emergence of a drug-resistant parasite highlighting the need for immunological control (Brockwell *et al*., 2014). There is strong evidence that vaccination against fasciolosis in animals is possible based on vaccine trials in specific international areas. however, the appropriate safety level has not yet been reached which may be discussed in more detail about Fasciola acquired antimicrobial resistance, parasite attacks and methods of preservation in keepers, reproduction of immunization vaccines and use of appropriate adjuvants (Toet *et al*., 2014; Molina-Hernández *et al*., 2015; Beesley *et al*., 2018).

Echinococcosis

An undetectable zoonotic virus due to the larval level of the tapeworm parasite of the genus Echinococcus. The cycle of the existence of this virus continues between puppies (vertical host) and green predators (central host). Humans can also exacerbate the disease by eating dog feces. Echinococcus granulosus motives cystic echinococcosis (CE) while Echinococcus multilocularis is responsible for alveolar echinococcosis (AE). AE is not found in India and the facts about its duration of treatment, occurrence and epidemiology are limited (Madhusudhan *et al*., 2016) [50]. However, CE is a serious zoonosis disease in many parts of the world including India. The larvae of E. granulosus can kill the liver, lungs, lungs and other human organs, livestock, buffalo, sheep, pigs and various animals (Haridy *et al*., 2006) [33]. Echinococcosis is usually an undiagnosed zoonotic parasitic disease due to the diploma of the tapeworm parasite of the Echinococcus genus. The life cycle of this scheme is supported between dogs (direct host) and green predators (central host). The value of Indian agriculture relies on cattle for their livelihood (Singh *et al*., 2011) where livestock and buffalo production facilities form the backbone of the cattle business. Hydatid cysts have been found in many Indian food producing animals including farm animals, buffalo, sheep, goats and pigs. The presence of stray animals including puppies and cattle, wild slaughter, free access of dogs for littering, reduced number of vultures, sewage irrigation, and improper waste disposal strategies increase the risk of disease transmission to humans (Singh *et al*., 2002). Echinococcosis particularly persists in the domestic cycle associated with pet dogs as a direct host and a few species of pets as intermediate hosts. Eggs E. granulosus can survive to inform the myth under warm, humid and cold climates for weeks to months, although it is sensitive to exhaustion (Eckert *et al*., 2003) [26].

Although it is a major zoonotic problem, not much research has been done in India to diagnose an epidemic or to estimate financial loss due to illness. As a result, no programs have been developed or implemented at the national level to control or eliminate disease. This is the first formal analysis of CE losses due to CE in India. Such research is needed to help develop strategies to prevent and control diseases in India and other developing countries. CE is an important zoonosis that affects a large number of food-producing animals and males in India. The audit found significant CE-related losses within the dairy industry. Incidents of illnesses within farm animals and buffalo were rated as significant financial losses. The loss of population is likely to be lower due to poor reporting of illness in the country. Monitoring of cystic echinococcosis in animals severe infections are not seen in farm animals and dogs. Surveillance is no longer identified or prioritized with a useful resource for nearby groups or animal resources.

Cystic echinococcosis is a preventable disease because it involves a variety of pets such as direct and medium-sized insects. Occasional worm infestation of dogs with praziquantel (at least 4 times a year), improved hygiene of livestock (including proper destruction of burning offal), and public education campaigns appear to be declining, and earning high incomes. nations, denying transmission and increasing the burden of human diseases.

An estimated 12% of CE global cases come from India due to favorable weather conditions including hot and humid climate, the presence of large numbers of middle-aged tourists depending on pasture activities, lack of understanding and poor collaboration between veterinary science and medicine. in India.

NTD infections

Trachoma

Causes a common blind spot for eye diseases in key parts of the world including India. Trachoma is also known as "Rohe", "Kukre", "Khil" or "Dane" in various parts of India, in local languages, a disease as old as the ancient texts and is mentioned among a few books by Charak and Susruta. Trachoma is a disease that is the result of poor hygiene and inadequate access to water and sanitation. It affects the conjunctiva that traces the inside of the eyelids. Chlamydia trachomatis of the family Chlamydiaceae, Gram-bad obligate intracellular bacterium is a causative agent of trachoma and conjunctivitis included with urogenital infections (Mariotti, 2004) [52]. C. trachomatis is transmitted by direct or oblique contact using fomites, fingers, bedding, flies, and dirty towels, etc. (Polack *et al*. 2005) [61]. Relatives of relatives and schools are the places to transfer. In healthy people, the immune system is effective enough to clear one piece of chlamydial contamination; but, after a few episodes of infection, it fails to fight the infection. In permanent societies, the recurrence of chlamydial contamination takes place within a short period of time leading to serious illnesses, inflammation, and visual problems (Lietman *et al*. 1998) [47]. Symptoms of conjunctivitis in the newborn, in particular, ocular discharge, conjunctival congestion and swollen eyelids from the first 15 days of birth. Signs and symptoms of

conjunctivitis in adults include unstable mucopurulent unilateral, external sensation, redness, photophobia, sadness, hypermea of the tarsal conjunctiva rather than bulbar conjunctiva, and the appearance of swollen lymph nodes in all eyes (Khanduja *et al* 2009) [43]. Facial washing can also cause trachoma with the help of reducing the secretion of infected flies and fingers that are thought to carry contagious mucus; in the form of flies that attract both flies but still swollen faces; or by removing the non-chlamydia secretions that may provide live access directly to the modern eye. Similarly, hand washing may reduce the transmission of trachoma if the hands provide a way to carry chlamydiae from inflammation to new / infected eyes.

The WHO has approved a four-step application to control trachoma in epidemic areas. This software is called SAFE:

- Surgery is an accurate degeneration of the eyelid (eg, entropion and trichiasis) which puts patients at risk of blindness.
- Antiretroviral drugs to treat individual patients and substance abuse in order to reduce the burden on the community
- Facial hygiene to reduce the risk of infection in people
- Environmental improvements (eg access to access to drinking water and improved sanitation) to reduce disease transmission and re-infection of patients.

Leprosy

Leprosy is an infectious disease caused by Mycobacterium leprae, an acid-fast, stick-like bacillus. The disease mainly affects the skin of the eyes, the peripheral nerves and the mucosa of the upper respiratory tract. It is also called Hanson's illness and is not contagious. It is caused when a person comes in close contact and repeats drops in the nose and mouth that come out of a leper. Children are more likely to develop leprosy than adults. These days, about 208,000 people worldwide have leprosy, most of them in Africa and Asia, according to WHO. About 100 people were diagnosed with leprosy in the U.S. every 12 months, usually within Southern California, Hawaii, and a few places in the U.S.

Brucellosis: An important regenerative zoonosis with a global spread. Yet it is a major public health problem that can be controlled in many developing countries including India. Brucellosis in India is very common but a neglected disease. Currently, Brucella melitensis is responsible for the highest recorded cases worldwide with farm animals rising as an important lake with fewer cases of B. suis.

Brucellosis is an important and progressive animal and public health problem in India. In India 80% of the population lives in about 575000 cities and a host of small towns; be able to have close access to pets / wildlife according to their work. As a result, the population is at greater risk of developing zoonotic diseases and brucellosis. The disease has even greater significance in nations such as India, where conditions are promoting globalization due to unsanitary conditions and poverty. The most common types of conditions in India are B. melitensis, and B. abortus. B. Melitensis is a very serious and common burden on a person and causes extreme illness and increased risk of incontinence. B. abortus is a prominent species in livestock. Bovine brucellosis is widespread in India and seems to be on the rise these days, perhaps due to the extended and rapid movement of farm animals (Renukaradhya *et al*. 2002) [62]. The prevalence of bullfighting in rural India, especially buffalo, is probably another sensitive issue for the preservation and spread of pollution. Free grazing and movement with normal herd mix also contributes to the high prevalence of brucellosis in these animals. Prevention depends on raising public awareness of health awareness programs and safe practices for cattle. Effective cooperation between health and animal services should be encouraged. This study compares international literature with its impact on the discovery, classification and diagnosis and epidemiology and control methods adopted in the Indian context. Because the cure for animal brucellosis is expensive, encourage mass vaccination of cattle should be done. Pet owners should be trained about the importance of vaccinating their animals. In addition to the medical efficacy and effectiveness of vaccine rates, limited availability of vaccines and immunizations has brought about the persistence of brucellosis in many areas especially in India. This has led to the testing and slaughter of infected animals which is an economic burden. Prevention of human brucellosis depends on the control of the disease in domestic animals especially in mass vaccination (Nicoletti 2001). In many countries, the use of B vaccine. abortus strain in livestock and vaccine B. melitensis stress Rev1 in goats and sheep has resulted in removal or removal of brucellosis in these cattle.

Viral NTDs

Dengue

Dengue is a serious viral infection that can lead to death. In a Chinese-language medical encyclopedia 992 from the Jin Dynasty (advertisement 265-420), Dengue fever came to be called "water poisoning" associated with flying insects. The word "dengue" is derived from the Swahili word Ka-dinga pepo, which means "cramp-like seizure". The epidemiology of dengue fever on the Indian subcontinent has been very complex and has changed dramatically in the last sixty decades of the most common complications, affected areas and the severity of the disease. The first case of dengue fever in India was as early as 1946. Aedes aegypti is the most common VV vector in India, determined by A. albopictus. The caterpillar references suggest that A. aegypti is well established in the vicinity of the city and is beginning to remove A. Albopictus. Vessels that hold water, that is. plastic, metal drums and cement tanks facilitate A-breeding. aegypti (Shriram *et al* 2009) [65]. Growing in a high-risk environment for urban migration, transportation development and residential transformation is a major concern (Fulmali *et al* 2008) [29].

Vector control is considered to be the best way to prevent animal-borne diseases. There are several criticisms from India that have confirmed the vector resistance of mosquitoes with anti-worm agents such as DDT and dieldrin however malathione infection has been reported (Dash *et al* 2001) [19]. Temephos is relatively strong in control of A. aegypti, followed

by fenthion, Malathion and DDT (Tikar *et al* 2008) [72]. Occasionally hot fog reduced rest and biting for three days after treatment, and internal fog pressed adults for five days (Mani *et al* 2005) [51].

Japanese encephalitis

The Japanese encephalitis (JE) virus is the leading target of vaccinated encephalitis in Asia and the western Pacific. Japanese encephalitis is a mosquito-borne disease, caused by the Japanese encephalitis virus (JEV). The JE virus is transmitted to humans through the bite of Culex mosquitoes, especially Culex tritaeniorhynchus. The virus is kept in a cycle between mosquitoes and invertebrates, usually birds and pigs. Humans are not immune to danger or death, since they usually do not overprotect the JE virus in their bloodstream to contaminate eating mosquitoes. The transmission of the JE virus occurs in many cases in rural agricultural areas, often associated with rice production and flood irrigation. These conditions can occur near urban centers in some parts of Asia. In cooler parts of Asia, the transmission of the JE virus occurs over a period of time. People's illnesses are usually severe during the summer and autumn. In tropical and subtropical areas, the transmission of the virus can be stopped year-round, with a high degree of peak season during the wet season.

JE is a major child health problem and epidemics have been reported in many places since 1955 in India. The first evidence of JEV in India changed from a study conducted in 1952 (Smithburn *et al*. 1954) [66]. A major outbreak occurred within the Banura region of West Bengal in 1973 (Chakravarty *et al*. 1975) [12]. Considered at the time, the virus was formed all over India and outbreaks were frequently reported. The worst-affected provinces are Andhra Pradesh, Assam, Bihar, Haryana, Karnataka, Kerala, Maharashtra, Manipur, Tamil Nadu, Orissa, Uttar Pradesh and West Bengal. From the union areas of Goa and Pondicherry epidemics are also reported (Kabilan *et al*. 2004) [40].

JE is India's leading public health problem due to its complex eco-epidemiology. The conditions of JE for that reason represent the subject of ice in the study of a wide variety of small diseases. For this reason, the occurrence of JEV cases is not always a real indicator of people at risk. Considering the severity of the AES and JE crisis within the United States of America, the Indian government has developed a different approach to reducing the burden of disease in addition to preventing death, illness and disability. The strategy includes vaccinating the JE in the affected districts and strengthening the monitoring applications. In addition, vector control, case control, timely transfer of complex and complex situations is also performed. Proper sanitation facilities, as well as access to clean drinking water, are also targeted at this approach. Provision, clinic, emotional, physical and social rehabilitation are integrated to balance the burden of inefficiency due to JE. In addition, improvements in the nutritional status of vulnerable children have also been planned (nvbdcp).

Mosquito control was not found to be effective. There is a great need for modern green pesticides to effectively control vectors. Swine vaccination in addition to avoiding the public outbreak of swollen mosquitoes seems to work but a temporary solution in the most dangerous areas. Therefore, vaccination is the only effective way to control JE pollution. The above-mentioned indicators help our preparedness for JEV-related risks. Later administration of JEV is a possible goal and may reduce the incidence of illness.

Rabies

Rabies is a devastating mammal disease that causes encephalitis and further death. It is most prevalent in India, with an estimated 20,000 annual deaths (1/3 of the global rabies burden) (Jackson & Wunner 2007) [38]. Rabies is caused by a dangerous virus that is transmitted to humans through the saliva of many animals. But a large number of deaths are learned to bite, or to be exposed to a swollen dog. Rabies causes serious diseases and deaths in India. The disease is found all over the country except for Andaman & Nicobar and the Lakshadweep Islands. Human cases of rabies are reported in all parts of the United States of America (Hampson K. *et al*. (2015). It is estimated that India owes 35% of the global burden of rabies. Ninety-five percent of all deaths are in Africa and Asia where the disease causes fifty-nine thousand deaths annually, more than a third of the world's cases.

The Integrated Disease Surveillance Mission (IDSP, 2020) of the Indian Department of Health and Family Welfare does not include India in standard rabies surveillance.

In parts of Africa and Asia, domesticated dogs are rabies virus reservoirs (Suraweera *et al*. 2012) [69]. Although the rabies vaccine was developed by Louis Pasteur in 1885, rabies remains a neglected disease among humans and animals, especially among the poor and marginalized in low-income areas, where it is most commonly found. It is estimated that canine rabies is dangerous to more than three and three billion people worldwide.

Rabies in dogs can be classified as 'living' or 'disabled' groups. Rabies cats have been reported to be more aggressive than grinding dogs (Greene *et al* 1990) [30]. In tests, signs and symptoms in bovine include behavioral fluctuations, excessive salivation, vomiting, and pharyngeal paresis (Hudson *et al*. 1996) [37]. The disease is incurable and causes the deaths of infected animals.

Chikungunya

Chikungunya fever (CHIKF) is an arbovirus infection caused by the chikungunya virus (CHIKV), an alpha virus belonging to the Togaviridae family. The infection follows the cycle of the mosquito and the person starting with the mosquito bite. Over time, symptoms increase after 2-6 days of incubation, as well as mild fever and severe arthralgia. The disease is self-limiting and lasts for 2 weeks, but chronic illness can last for several years with progressive polyarthralgia (Schwartz and Albert, 2010) [64]. Chikungunya and Dengue have the same vector and suggest the same scientific presentation; as a result of the final compilation of letters is also reported in several studies / research (Saswat *et al*., 2015; Londhey *et al*., 2016; Jain *et al*., 2017; Kaur *et al*., 2017) [63, 49, 39, 42]. Severe arthritis, short-term fever, rash, myalgia / arthralgia, and conjunctivitis

are more common in CHIKF, with abdominal pain, leukopenia, neutropenia, and thrombocytopenia seen in dengue fever (DF). The Chikungunya virus is mainly transmitted by the Aedes mosquito. Mosquitoes infect CHIKV while biting a person inflamed with viremia. During this time of outbreak in mosquitoes, CHIKV multiplies within the midgut, circulates through the body cavity, reaches the esophagus, creates infections, and exits saliva. CHIKV reaches a new stage where mosquitoes feed on their blood. The virus grows as the transmission cycle continues inside the new facility and is picked up by mosquitoes during the event when you eat from an infected person and the transmission cycle continues.

There is no specific type of antiviral or type of treatment that should be treated with Chikungunya and symptomatic treatment is a key aspect of patient management. Usually, the affected person is encouraged to rest and drink plenty of water to prevent dehydration. Non-steroidal anti-inflammatory drugs are avoided until dengue infection is eliminated. Acetaminophen or paracetamol is given to reduce pain and fever (NVBDCP, 2014-15; CDC, 2018) [56, 11]. The Chikungunya outbreak is a major public health problem in India. Twenty-four Indian counties and 6 union areas are common in CHIKV. Despite causing serious illness and limited morbidity, CHIKF is a challenge for people due to the traumatic course of infection and long-term follow-up that contributes to the high quality of life. Therefore, it is important to ensure its prevention and control measures.

Mosquito control was not found to be effective. There is a great need for modern green pesticides to effectively control vectors. Swine vaccination in addition to avoiding the public outbreak of swollen mosquitoes seems to work but a temporary solution in the most dangerous areas. Therefore, vaccination is the only effective way to control JE pollution. The above-mentioned indicators help our preparedness for JEV-related risks. Later administration of JEV is a possible goal and may reduce the incidence of illness.

Modern guidelines for the study of neglected diseases in India

Since these diseases are often overlooked and are often seen in the complex parasite life cycles, there is restricted information about their epidemiology and the biology of the people who infect them.

- The Science, Technology and Innovation Policy (2013) does not currently reflect research into neglected diseases.
- The National Biotechnology Development Plan (2015-2020) aims to promote early development and treatment of vaccines for rotavirus, cholera, typhoid, rabies (human-based DNA (DNA), malaria, dengue, tuberculosis, and Japanese encephalitis.
- The National Intellectual Property Rights Policy (2016) states that it will encourage community-funded R&D institutions and businesses to increase the number of over-the-counter diseases for now but it does not say how. There is nothing enthusiastic about this.
- Gadgets of the National Health Policy (2017) and the desire to revitalize revenues to meet health needs and to ensure that new medicines are less expensive for people who need them most, but no longer deal directly with neglected diseases.
- The National Medicines Policy Framework (2017) states that one of its goals is to create an environment that allows for the growth and development of new medicines, yet its availability no longer produces tropical drugs for tropical diseases.
- The National Policy on the Treatment of Common Diseases (2018) contains tropical diseases and identifies the desire to support research into the treatment of rare diseases. It does not prioritize diseases and funding areas for research or how innovation can be supported.

The open source drug discovery program has become an integral part of the useful tool of the Council for Scientific and Industrial Research (CSIR) to develop new high-quality materials for the prevention, analysis, and treatment of common diseases in India. This program is not currently supported. It could serve as a platform for finding targeted therapies and treatments for infectious and non-communicable diseases.

Discussion neglected tropical disease tropical diseases are a threat to regions that have exceeded their normal local boundaries due to international travel, the possible spread of climate change, mosquitoes, and urbanization, spreading to irrational people. Managing NTD is therefore difficult because of its complex eco-epidemiology. Neglected tropical diseases are important public health problems, strongly controlled by community participation. The need is to organize health training programs on dengue to improve community technology and to sensitize the public to participate in embedded vector control programs. Many NTDs can be disabled. It is therefore very important to increase the focus on NTD packages to integrate with renewal, as this will help improve the quality of life of the people living there and NTD. People with disabilities make up 15% of the local population so the key to NTD applications is to ensure that they include people with disabilities so that the best half of the population is achieved and the goal of NTD programs is achieved. Strengthening the current momentum behind each and every NTD will strengthen both sectors and ensure that no one is left behind as we go on controlling the NTD.

Table 1: The Major Neglected Tropical Diseases Ranked by Prevalence

Disease	Caused by	Global Prevalence (millions)	Population at Risk	Regions of Highest Prevalence	Source
Leishmaniasis	*Leishmania donovani*	12	350 million	India, South Sudan, Sudan, Brazil, Ethiopia, and Somalia	PAHO/WHO, 2017
Ascariasis	*Ascaris lumbricoides*	807	4.2 billion	East Asia and Pacific Islands, sub-Saharan Africa, India, South Asia, China, Latin America and Caribbean	Bethony *et al*.,6 de Silva *et al*.7
Ancyclostomiasis	*Ancylostoma duodenale*	740	1.5 billion	Middle East, North Africa, and northern India	Aziz & Ramphul 2021
Trichuriasis	*Trichuris trichiura*	604	3.2 billion	Sub-Saharan Africa, East Asia and Pacific Islands, Latin America and Caribbean, India, South Asia	Bethony *et al*.,6 de Silva *et al*.7
Lymphatic filariasis	*Wuchereria bancrofti.*	120	1.3 billion	India, South Asia, East Asia and Pacific Islands, sub-Saharan Africa	Ottesen,9 WHO10
Onchocerciasis	*Onchocerca volvulus*	37	90 million	Sub-Saharan Africa, Latin America and Caribbean	Basanez *et al*.13
Schistosomiasis	*S. mansoni, S. intercalatum, S. haematobium, S. japonicum, and S. mekongi*	207	779 million	Sub-Saharan Africa, Latin America and Caribbean	Steinmann *et al*.8
Fascioliasis	*Fasciola hepatica, F. gigantica*	2.4	17 million	China, India, Taiwan, Vietnam, Korea and Thailand	Lalrinkima *et al* 2021
Echinococcosis	*Echinococcus granulosus and E. multilocularis*	1	9.7	India, South America, North Africa, China, and the Middle East and Iran	Grakh *et al* 2020
Trachoma	*Chlamydia trachomatis*	84	590 million	Sub-Saharan Africa, Middle East and North Africa	International Trachoma Initiative,11 Medecins sans Frontieres12
Leprosy	*Mycobacterium leprae*	0.4	ND	India, sub-Saharan Africa, Latin America and Caribbean	International Federation of Anti-Leprosy Associations16
Brucellosis	*Brucella melitensis Brucella abortus,*	0.5	5 million	Middle East and subSaharan Africa, China, India, Peru, and Mexico	Alkahtani *et al*. (2020)
Dengue	*DENV-1, DENV-2, DENV-3 DENV-4*	96	3.9 billion	Americas, Africa, the Middle East, Asia, and the Pacific Islands	Ong *et al* (2021)
Japanese Encephalitis	*Japanese encephalitis virus (JEV)*	0.67	3 billion	Bangladesh, China, India, Indonesia, Philippines, and Vietnam	Deng *et al*. (2020)
Rabies	*Lyssavirus Rabies virus (RABV)*	1.8	3.3 billion	World wide	Radhakrishnan *et al* (2020)
Chikungunya	*Chikungunya virus (CHIKV)*	1.8	1·3 billion	Africa, Asia and the Indian subcontinent	Nsoesie *et al*. 2016

* ND denotes not determined

Conclusion

India has already eliminated many other NTDs, in conjunction with guinea virus virus, trachoma etc. Persistence of concurrent transmission as infection degrees were reduced by intervention depends largely on transmission, immunology processes, parasite integration, and end-of-transmission. This is very difficult to measure, even in epidemiological studies, however it may be very important in achieving the long-term goals of NTD programs. In animal-borne diseases, as well as onchocerciasis and visceral leishmaniasis, human/vector mixing styles play a role in local transmission variability. For this reason, data for those styles can monitor local integration height, assortative (unconventional) mixing and social variability considering improved regional level spread and regional-focused interventions (De Vos *et al*. 2018, Hamley *et al*. 2019, Chapman *et al* 2018, Chapman *et al*. 2020) [22, 32, 13, 14]. Furthermore, with visceral leishmaniasis, records of immune responses and contamination associated with the presence or absence of symptoms can inform the timing of immunizations and understand the symptoms of infection (Bulstra *et al*. 2018, Le Rutte *et al*. 2019) [10, 46]. Note that we are focusing on visceral leishmaniasis on the Indian subcontinent as it is believed to be completely anthroponotic there (i.e., humans are an easy pool for pollution) (De Vos *et al*. 2018) [22]. Water intervention, sanitation, and sanitation (WASH) did the job during most of the NTDs. however, WASH charging has been difficult to assess with criticism primarily based on modern evidence showing conflicting results (Stocks *et al* 2014, Vaz Nery *et al* 2019, Ejere *et al*. 2015) [68, 74, 27]. In order to better identify and predict increased value of WASH, certain facts about WASH-related behaviors are needed, although this will be difficult to construct (Coffeng *et al* 2018) [16].

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