UNITING EFFORTS
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Making the Case for Investing in Neglected Tropical Diseases in Ghana

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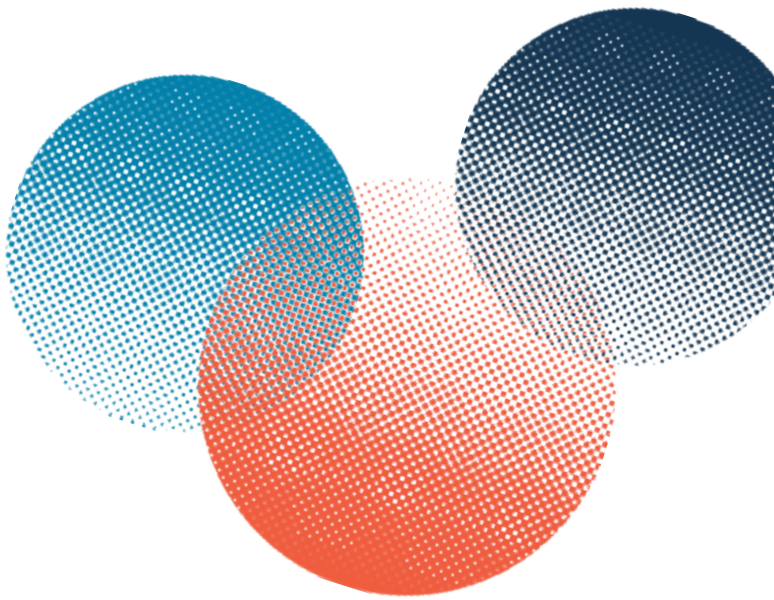


Executive summary

Overview

Neglected tropical diseases (NTDs) represent a significant threat to health and development. They affect more than 1.5 billion people globally, with 39 percent of the burden occurring in Africa [1]. In addition to the 200,000 lives and 19 million disability-adjusted life years (DALYs) lost each year, delayed treatment of NTDs can cause debilitating and disfiguring disabilities, leading to stigmatization, social exclusion, discrimination, and increased financial pressures on individuals and their families [2][1]. The importance of tackling NTDs has been recognized in the Sustainable Development Goals (SDGs), with Goal 3 on health and well-being including a specific Target (3.3) to end the epidemic of NTDs [3][2].

This report provides an estimate of the burden of three NTDs in Ghana: **lymphatic filariasis**, **onchocerciasis** and **leprosy**. It also explores the potential impact of scaling up a comprehensive set of health interventions aimed at reducing the prevalence of these NTDs. These interventions are: (1) increasing the **frequency of mass drug administration** (MDA); (2) enhancing leprosy **contact tracing**; and (3) introducing **targeted treatment** for common debilitating symptoms**.**

Main findings of the investment case

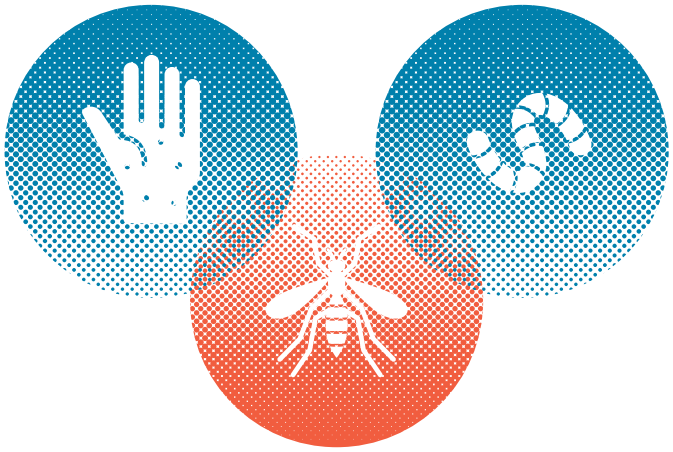
- The three NTDs modelled cause around **US$38 million in economic losses** every year in Ghana, equivalent to **0.05 percent of the country's gross domestic product (GDP)** in 2020.
- In 2020, **256,000 people** in Ghana were affected by at least one of these three NTDs.
- By acting now, the Government of Ghana can reduce the national health and economic burden of these NTDs. The investment case demonstrates that scaling up key measures would, **over the next 30 years**, bring the following **additional benefits**:
  - Reduce the **prevalence** of the three NTDs by over **4.66 million cases** and reduce **health complications** by nearly **2.30 million cases**
  - **Avert US$164 million** in economic losses
  - Provide a **positive return on investment** (ROI) of 4.2 for lymphatic filariasis, 1.1 for onchocerciasis and 28 for leprosy. This means that the **economic benefits** (**US$366 million**) would significantly **outweigh the costs** of the interventions (**US$203 million**), with a combined ROI of **1.8**
  - In an alternative scenario where medicines for MDA are donated to the Government of Ghana, the ROI would be 10.7 for lymphatic filariasis, 5.2 for onchocerciasis and 38 for leprosy. The **economic benefits** (**US$366 million**) would further outweigh the **costs** of the combined programme (**US$51 million**), with a combined ROI of **7.2**.

Recommendations

Based on the findings of the economic modelling and institutional and context analysis conducted as part of this investment case, these key actions may help protect public health and realize the benefits of strengthening NTD response as an accelerator for sustainable development:

- **Increase investment in NTDs, including investing in and fully implementing the modelled interventions:**
  - increasing the frequency of MDA
  - Increasing leprosy contact tracing
  - Introducing targeted treatment for common debilitating symptoms.
- **Strengthen data, surveillance, monitoring and evaluation systems.**
- **Strengthen community engagement and increase public awareness.**
- **Integrate and mainstream NTDs into existing programmes, services and structures.**
- **Strengthen multisectoral engagement for NTDs in Ghana and promote a whole-of-government and whole-of-society approach.**

Making the Case for Investing in Neglected Tropical Diseases in Ghana



Every year, more than

250,000

people in Ghana are affected by at least one of the three NTDs – lymphatic filariasis, onchocerciasis and leprosy

They cause

US$38 million

in economic losses every year

By acting now, the Government of Ghana can, over the next 30 years:

Reduce the **prevalence** of the three selected NTDs by over 4.6 million cases

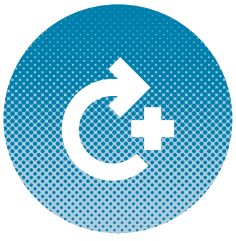
(an average of 153,000 cases annually)

Reduce **health complications** by nearly 2.3 million cases

(an average of 77,000 cases annually)

Avert **US$164 million** in economic losses.

(an average of US$5.45 million annually)



Provide a **positive return on investment** of 4.2 for lymphatic filariasis, 1.1 for onchocerciasis and 28 for leprosy.

1. Introduction

Neglected tropical diseases (NTDs) are a diverse group of more than 21 conditions that are mainly prevalent in tropical areas. They affect more than 1.5 billion people globally, with 39 percent of the burden occurring in Africa [1]. NTDs disproportionately impact impoverished communities and have devastating health, social and economic impacts. They result in 200,000 deaths and 19 million disability-adjusted life years (DALYs) each year. Alongside significant mortality and morbidity, delayed treatment of NTDs can cause debilitating and disfiguring disabilities, leading to stigmatization, social exclusion, discrimination, and increased financial pressures on people living with NTDs and their families [2]. It is estimated that NTDs result in lost household income totalling at least $33 billion each year due to lost wages and out-of-pocket health expenditures [4].

NTDs are often overlooked in the global health agenda, and their prevention and control are under-resourced despite their prevalence. New therapeutics and novel products for NTDs have been comparatively limited, suggesting a persistent gap in innovation, with just 66 novel products entering Phase I clinical trials between 2000 and 2014, equivalent to just 1.7 percent of total Phase 1 clinical trials [5]. However, NTD interventions are one of the World Health Organization (WHO) 'best buys' in global public health, and control of NTDs will contribute substantially towards achieving universal health coverage [4]. NTDs disproportionately impact the most marginalized individuals, trapping them in cycles of poverty and impeding sustainable development. By implementing NTD interventions, countries can strengthen their health services and capacity to deliver comprehensive health care while reducing the burden of disease and improving the health of their population [6].

The importance of tackling NTDs has been recognized in the Sustainable Development Goals (SDGs), with Goal 3 on health and well-being including a specific target (3.3) to end the epidemic of NTDs. Tackling NTDs also contributes to the achievement of other SDGs, including alleviating poverty (SDG 1), ending hunger (SDG 2), improving access to education (SDG 4), achieving gender equality (SDG 5), promoting decent work (SDG 8) and reducing inequalities (SDG 10) [2].

In 2012, the WHO published its first road map on NTD prevention and control. Substantial progress on NTDs has been achieved since its publication, including a reduction in the number of people requiring interventions against NTDs by 600 million over 10 years (26 percent reduction) [4]. In 2021, the WHO launched the 'Road Map for Neglected Tropical Diseases 2021–2030' [4], which strives to move away from vertical disease programmes to integrated cross-cutting approaches and to ensure that NTDs have a prominent position on the global health agenda [4]. As of December 2023, 50 countries had successfully eliminated at least one NTD [7].

Ghana has made significant progress in tackling NTDs, successfully eliminating guinea-worm disease in 2015, trachoma in 2018 [8] and human African trypanosomiasis (gambiense) in 2023 [9][8], and establishing its NTD Master Plan in 2014. Significant challenges remain, however, with insufficient funding for programmes, human resource constraints, a lack of political attention and commitment to NTDs, and inequities in programme delivery hindering progress [10][11][12].

Given the need to quantify the current health and economic burden of NTDs and estimate the benefit of scaled-up action, Uniting Efforts for Innovation, Access and Delivery,[1] in collaboration with the WHO,[2] developed a prototype toolkit for national investment cases for NTD programmes. Investment cases are an essential tool used by governments to better understand the economic impact of a given disease and the return on investment of scaled-up action. This information can be used to inform evidence-based dialogue and decision-making, encourage increased government spending on NTDs, and make spending more effective.

The Ghana Health Service's strong NTD programme, its willingness to support the investment case development process and the availability of data made it a strong candidate for this prototype modelling framework and, subsequently, this investment case pilot. Toolkit development partners agreed that onchocerciasis, lymphatic filariasis and leprosy would be included in this investment case, based on their wide prevalence and the availability of epidemiological data on these three diseases. Ghana's NTD Master Plan 2021–2025 reports that onchocerciasis is endemic and requires treatment in 140 of the country's 261 districts, lymphatic filariasis in 116 and leprosy in 212 [12].

[1] Uniting Efforts for Innovation, Access and Delivery is a global platform co-convened by the Government of Japan, the UNDP-led Access and Delivery Partnership and the Global Health Innovative Technologies (GHIT) Fund, aiming to promote dialogue and partnerships among key stakeholders involved in innovation and access to and delivery of health technologies for unmet needs in low- and middle-income countries. See www.unitingeffortsforhealth.org/ for more information.

[2] For more information on the WHO's work on NTDs, see www.who.int/teams/control-of-neglected-tropical-diseases/overview.

2. NTDs in Ghana: Status and context

2.1 Epidemiology

Many NTDs are endemic in Ghana, including lymphatic filariasis, onchocerciasis, schistosomiasis, soil-transmitted helminthiasis, Buruli ulcer, yaws, leprosy, cutaneous leishmaniasis and rabies [13]. Factors that contribute to NTD transmission include poor sanitation, limited access to health care infrastructure, and limited knowledge of risk factors and prevention methods. As a result, prevalence varies across regions based on socio-economic factors and environmental conditions; it is typically higher in rural communities and impoverished populations living in urban slums [14].

Ghana has made commendable progress in tackling NTDs, which have notably declined in the past decades, due to both economic development and disease control efforts. This has led to the certification of free of transmission of dracunculiasis and validation of elimination of trachoma and human African trypanosomiasis (gambiense) as a public health problem. However, NTDs still represent a significant public health challenge in the country [15].

In 2021, more than 15.8 million people in Ghana required preventive chemoprophylaxis for at least one NTD,[3] while only 19 percent of districts achieved effective coverage for all NTDs [16]. According to the Global Burden of Disease (GBD) Study, in 2020, NTDs[4] in Ghana were estimated to affect approximately 12 million people and killed an estimated 1,300 people [17]. Notably, the collective prevalence of NTDs exceeded that of malaria, which reached 3.3 million cases in 2020 [17]. NTDs also led to 190,000 DALYs, which reflect the years of full health lost due to ill-health, disability or premature death as a result of an NTD [17].

The following sections provide detailed insights into the status and context of the three NTDs modelled in this investment case, namely: lymphatic filariasis, onchocerciasis and leprosy.

2.1.1 Lymphatic filariasis

Lymphatic filariasis is a debilitating parasitic infection caused by worms and transmitted through the bites of infected mosquitoes. The disease is characterized by chronic lymphatic dysfunction, leading to severe swelling and deformity of the limbs (lymphoedema and its more advanced form, elephantiasis) and genitals (hydrocele) [18].

Lymphatic filariasis is endemic in 116 of the 261 districts in Ghana [12]. While prevalence drastically decreased after 2000 following more than a decade of control and elimination efforts, including MDA [15], reaching its lowest in 2015 at 866 per 100,000 [17], the disease was found to persist in several districts [19]. In 2020,

[3] The WHO defines preventive chemoprophylaxis "large-scale delivery of safe, quality-assured medicines, either alone or in combination, at regular intervals to entire population groups". WHO recommends preventive chemoprophylaxis for five NTDs: lymphatic filariasis, onchocerciasis, schistosomiasis, soil-transmitted helminthiases (STH) and trachoma.

[4] Based on the Institute for Health Metrics and Evaluation GBD classification, 'NTDs' include: Chagas disease, leishmaniasis, African trypanosomiasis, schistosomiasis, cysticercosis, cystic echinococcosis, lymphatic filariasis, onchocerciasis, trachoma, dengue, yellow fever, rabies, leprosy, Ebola, Zika virus, Guinea worm disease, intestinal nematode infections, food-borne trematodiases and other NTDs.

it was estimated that it contributed to over 250,000 cases and resulted in the loss of 8,900 DALYs [17]. Moreover, according to Ghana's NTD Master Plan 2021–2025, around 1 million people are expected to require preventive chemoprophylaxis for lymphatic filariasis by 2025 [12].

2.1.2 Onchocerciasis

Onchocerciasis is a parasitic disease caused by a filarial worm and transmitted through the bites of infected black flies. The disease primarily affects the skin and eyes, leading to severe itching, skin lesions, visual impairment and blindness if left untreated [20].

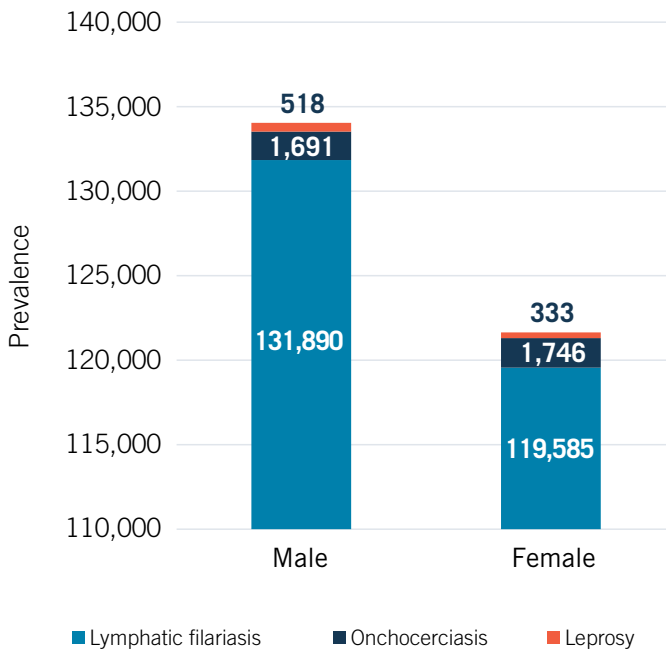
In Ghana, onchocerciasis is endemic in 140 districts, 3 of which are also endemic for lymphatic filariasis. In 2020, more than 3,400 cases of onchocerciasis were recorded in the country [17]. Moreover, according to Ghana's NTD Master Plan 2021–2025, more than 6.5 million people are estimated to require preventive chemoprophylaxis for onchocerciasis by 2025 [12].

2.1.3 Leprosy

Leprosy is a chronic bacterial infectious disease that primarily affects the skin, peripheral nerves and mucosal surfaces, leading to skin lesions, nerve damage and various deformities if left untreated. The disease is transmitted through prolonged close contact with people who have active leprosy lesions and are untreated. Factors such as poverty, overcrowding and limited access to health care services contribute to the transmission and persistence of leprosy [21].

Although Ghana has reached the WHO national elimination target (end-of-year prevalence of <1 case per 10,000 population) for leprosy, new cases continue to be reported, suggesting ongoing local transmission. According to the GBD, there were an estimated 852 cases of leprosy in Ghana in 2020 (see Figure 1) [22].

Figure 1. Number of cases of lymphatic filariasis, onchocerciasis and leprosy in Ghana, by gender, 2020



In 2020, an estimated 256,000 people in Ghana – nearly 1 percent of the total population – were afflicted with at least one of the three NTDs, with 52 percent of cases affecting males and 48 percent affecting females. Notably, leprosy has the most pronounced gender disparity of the three NTDs, with 61 percent of cases occurring among males and 39 percent among females (see Figure 1).

2.2 NTD-related harms

Although onchocerciasis is the only NTD modelled in this investment case with a higher prevalence among women than men, the intersection of sex, gender and the social determinants of health mean that women and girls have unique vulnerabilities to NTDs and their consequences[5] (see Box 1). Considering gender dimensions while strengthening its NTD response can help Ghana achieve the objectives set out in its Long-term National Development Plan, including Objective 2 to achieve gender equality and empower all women and girls, and Objective 6 to ensure healthy lives and promote well-being for all ages.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NTDs in Ghana have a substantial impact on the economy and the population's health and social welfare. NTD-attributable health care expenditures strain already limited financial resources, while the loss of productivity and labour due to disability, severe pain and impaired physical and cognitive capacities caused by NTDs further exacerbate economic hardships, often contributing to a vicious cycle of poverty [23]. For example, a study conducted in northern Ghana found that chronic lymphatic filariasis was responsible for a loss of over 7 percent of potential male labour [24].

NTDs are also associated with other health risks, including increased maternal health risks [4] and the progression of other diseases such as HIV, TB and malaria [25]. Moreover, NTDs detrimentally affect mental well-being due to social stigma and discrimination, which can in turn hinder help-seeking behaviour and treatment adherence, leading to worse health outcomes [26]. Various studies in Ghana show that people who exhibit noticeable clinical manifestations of lymphatic filariasis (such as hydrocele or elephantiasis), and people affected by leprosy often experience discrimination, stigmatization and social isolation [27][28][29].

[5] For more information on the gender dimensions of NTDs, see Access and Delivery Partnership, 'The Gender Dimensions of Neglected Tropical Diseases', Discussion Paper, United Nations Development Programme, Bangkok, 2019, https://adphealth.org/upload/resource/2523_ADP_Discussion_Paper_NTDs_211119_web.pdf; and Access and Delivery Partnership, 'The Gender Dimensions of Neglected Tropical Diseases', Factsheet, United Nations Development Programme, Bangkok, 2019, https://countdown.lstmed.ac.uk/sites/default/files/centre/NTDs%20and%20gender%20factsheet.pdf.

Box 1. Gender and NTDs

While NTDs have significant health, social and economic consequences for both men and women, women and girls may bear a disproportionate burden of infection and consequences of the disease [30]. In addition to increased biological vulnerabilities to some NTD-associated morbidities [30], women also face higher risk of acquiring certain NTDs and NTD-related complications due to traditional gender roles and cultural norms [31]. Traditional gender roles that assign women certain responsibilities, such as fetching water and/or firewood, caregiving for the family, rearing animals, cooking and cleaning, increase women's exposure to disease vectors and contaminated environments. Moreover, due to cultural norms, women may face additional financial and time challenges accessing health care due to limited economic resources and autonomy [31]. In Ghana, studies from endemic districts found that more filarial attacks and lymphoedema cases were reported among women than men [32][33][34]. Various studies also suggest that women affected by leprosy are at higher risk of severe deformities compared to men [35].

NTDs may also affect women's social and economic welfare and worsen educational disparities among girls. For instance, onchocerciasis has been found to dampen marital prospects, with the potential to affect women's psychological, social and economic well-being [36]. Moreover, girls from households affected by NTDs, such as onchocerciasis, often bear the burden of reduced educational opportunities. Frequently, girls are tasked with caregiving responsibilities for afflicted family members, hindering their access to education and perpetuating cycles of poverty [37]. Similarly, women who are employed may have to forfeit their jobs to care for their household members affected by NTDs as part of their social obligation, thus compromising their ability to make an income [31].

The National Buruli Ulcer Control & Yaws Eradication Programme and the National Leprosy Elimination Programme in Ghana conducted an exploratory study on the gender-related factors affecting care of skin NTDs with the support of the Special Programme for Research and Training in Tropical Diseases (TDR)[6] as part of the Access and Delivery Partnership (ADP)[7] project. The study found that women in Ghana had better knowledge than men of the causes and symptoms of skin NTDs and were more likely to seek treatment at hospitals than herbalists; however, treatment-seeking behaviour remained heavily influenced by men, driven by unequal power relations, gender roles and access to resources [38].

Box 2. NTDs and reproductive and child health

NTDs also negatively impact reproductive, maternal and child health [39]. NTDs are associated with adverse pregnancy outcomes, low birth weights, and increased risk of maternal morbidity and mortality [39]. Pregnant and breastfeeding women are particularly vulnerable, since many NTDs, such as lymphatic filariasis and onchocerciasis, cannot be safely treated during pregnancy or breastfeeding, thus leaving them ineligible for treatment and at risk of infection [40].

[6] TDR is a global collaboration programme to strengthen efforts to combat diseases of poverty. For more information, see https://tdr.who.int/about-us.

[7] ADP was initiated in April 2013 as part of multi-partner efforts to strengthen capacity in low- and middle-income countries to improve access to and delivery of new health technologies. For more information, see https://tdr.who.int/activities/the-access-and-delivery-partnership.

2.3 National NTD policy landscape and coordination

The legislative background for health policy and delivery is set out in the Constitution of Ghana, which identifies the right of its citizens to quality health care, and in the Public Health Act 2012, which consolidates the law relating to public health, disease prevention and environmental sanitation [41][42].


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The direction and objectives of Ghana's health policy are set out in the National Health Policy (revised in 2020) [43], the Roadmap for Attaining Universal Health Coverage [44] and health sector development plans. These documents highlight Ghana's goals of eliminating selected NTDs, reducing unnecessary disabilities, and ensuring that discrete programmes, including those focused on NTDs, are fully integrated and financially sustainable [44][45][43].

Ghana's NTD response is laid out in its NTD Master Plan, which has a vision of a "Ghana free of NTDs and its associated morbidities and disabilities" [46]. The Master Plan is a multi-year strategic plan based on which national, regional and district annual work plans are developed. The 2020–2025 Master Plan is a comprehensive plan with the mission to "contribute to socio-economic development and wealth creation by promoting health, vitality and ensuring access to quality health services for all people living in Ghana" [12]. It has four strategic pillars:

- Enhance planning for results, resource mobilization and financial sustainability of the national NTD programme
- Scale up access to interventions, treatment and system capacity-building
- Enhance NTD monitoring and evaluation, surveillance and operations research
- Strengthen government ownership, advocacy, coordination and partnerships [12].

The Master Plan also highlights the importance of capturing lessons and best practices in the roll-out of the NTD programme [46]. In addition to its broader NTD programme, the Ghana Health Service has dedicated programmes focused on leprosy, Buruli ulcer and yaws [47].

Multisectoral coordination

The Ministry of Health collaborates with key ministries across government to implement NTD activities. They include the Ministry of Local Government and Rural Development, the Ministry of Education, the Ministry of Food and Agriculture, the Ministry of Sanitation and Water Resources and the Ministry of Finance. However, coordination and collaboration between the public and private sectors remain weak, which results in services being implemented vertically. Collaboration with non-governmental and civil society organizations is also limited [12].

Ghana relaunched its national coordinating body, the NTD Intra Country Coordinating Committee (ICCC), in 2020 [48]. The ICCC advises on and coordinates activities for NTD control in the country, playing a key role in liaising between the Ministry of Health and the NTD programme. It also convenes representatives from sectors outside health, including education, water and sanitation, agriculture, development partners and academia [12].

3. Methodology

Recognizing that there are 21 NTDs in the WHO's NTD road map, toolkit partners decided to approach the investment case toolkit incrementally. A prototype model was developed, examining three NTDs and incorporating a select number of distinct interventions. Following a review of NTD prevalence in Ghana, and discussions with epidemiologists and national experts, the team of economists provided a list of potential NTDs to be modelled in the toolkit, from which the Ghana NTD programme selected onchocerciasis, lymphatic filariasis and leprosy. These diseases were selected based on their widespread prevalence and the availability of epidemiological data required for the modelling.

3.1 Process

This investment case toolkit estimates the cost and benefit of current and new NTD interventions and calculates the return on investment (ROI) of the proposed new interventions for a defined period. The basic conceptual model for the investment case is illustrated in Figure 2.

In Panel A of the model, the current and future health and economic burdens are estimated assuming that the current levels of health care interventions are maintained, and no additional investments are made in existing or new interventions. These epidemiological data draw on estimates provided by the 2019 GBD study [49]. The cost-of-illness approach is used to estimate the economic burden of each of the three NTDs, which includes health care costs, the economic value of disabilities, and productivity losses that arise from presenteeism[6] and absenteeism.[7] Primary data were collected from Ghana where available and complemented with estimates obtained from a literature review. Expert opinion was also obtained from the Ghana Health Service, WHO NTD experts and Research Triangle Institute (RTI) NTD experts.

In Panel B, the costs and economic benefits of introducing or scaling up NTD interventions are estimated, with economic benefits encompassing averted health care expenditures, the economic value of reduced morbidity, and the impact on work absenteeism and employment retention. For costing new interventions, the total cost of introducing the identified intervention was determined, while for existing interventions, the focus was on calculating the incremental cost associated with expanding or enhancing the scope of the current intervention.

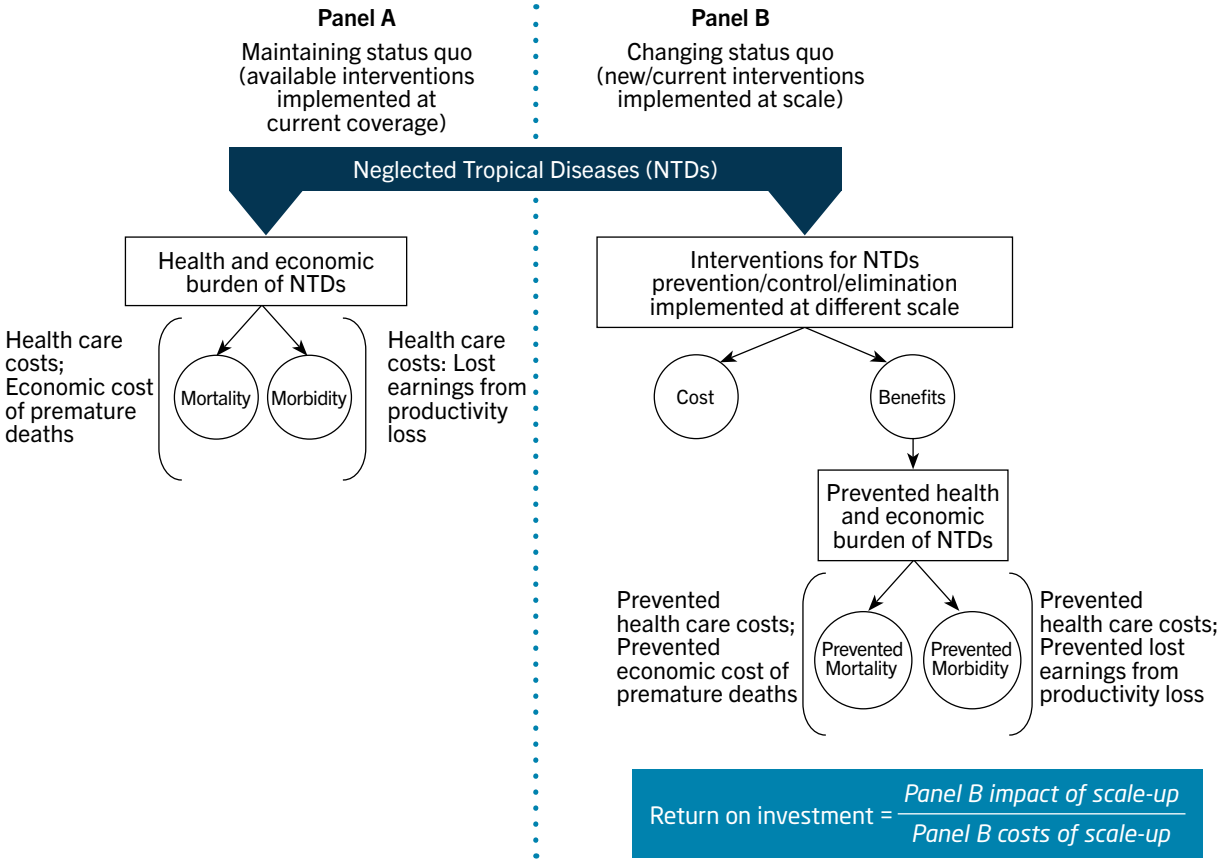
Once the costs and the benefits of the interventions were computed, an ROI analysis was conducted for each of the set of interventions targeting a specific disease. Two sets of estimates were made based on two scenarios: (*1*) where the cost of medicines is paid by the Government of Ghana; and (*2*) where all medicines are donated, and the medicine costs are thus excluded from the analysis.[8] Time-trend statistical modelling was used to model the short-term (5-year) impact (in line with the Ghana Master Plan [13] and the long-term (30-year) impact to illustrate a life cycle approach. This modelling was used to forecast the impact of the interventions, illustrated in the results section of this report.

[6] Presenteeism refers to individuals being less productive at work because they are suffering from an NTD.

[7] Absenteeism refers to individuals unable to attend work because they are suffering from an NTD.

[8] The second scenario is based on the fact that MDA medicine costs are currently donated in Ghana.

Figure 2. Conceptual model for the NTD investment case



The investment case adopts a government or payer perspective, estimating the burden that the three NTDs impose on the Government of Ghana and the benefits of scaled-up action. All costs are discounted at a rate of 3 percent, aligning with previous UNDP investment cases. A more in-depth description of the tools and methods used to create this investment case are available on request.

3.2 Interventions modelled

Following a comprehensive review of the literature, the interventions summarized in Table 1 were selected based on the depth of research conducted and their demonstrated potential to significantly reduce the burden of the three selected NTDs in Ghana.

For the control of lymphatic filariasis, three interventions were identified: a shift from annual to biannual MDAs, the introduction of surgery camps for the treatment of patients with hydrocele symptoms, and education and kits for patients to self-treat lymphoedema symptoms. For onchocerciasis, an increase in the frequency of MDAs and an increase in the availability of anti-epileptic medication were predicted to be the most effective interventions. For leprosy, self-care education and kits were identified as an optimal intervention, alongside an increase in contact tracing.

Table 1. Interventions for the prevention, control and management of the modelled NTDs: current level and scale-up

NTD	Intervention category	Status quo scenario	Scale-up of interventions scenario
Lymphatic filariasis 	**Preventive chemotherapy: MDA**	Once per year	Twice per year
	Case management: Hydrocele surgery camps	No camps; hospitals only	Six camps per year for 10 years
	Case management: Lymphoedema care	Ad hoc self-care; no training and kits	Self-care education and kits (integrated management)
Onchocerciasis 	**Preventive chemotherapy: MDA**	Twice per year	Four times a year
	Case management: Epilepsy treatment	Available anti-epileptic medication but low coverage (32 percent) [50]	Available anti-epileptic medication and 100 percent coverage
Leprosy 	**Case management: Wound care and management/ prevention of disability**	Ad hoc self-care; no training and kits	Self-care education and kits (integrated management)
	Preventive chemotherapy: Contact tracing	20 contacts per leprosy case	40 contacts per leprosy case

It is assumed that the costs of the interventions will decrease as the number of patients needing treatment falls. Following the trajectory of 2015–2021 trend data, the number of districts receiving the MDA intervention will decrease as elimination targets approach, and as such MDA intervention will only be necessary until 2036 for lymphatic filariasis and 2027 for onchocerciasis (for further details, see Annex 5 and Annex 10 in the Appendix). Hydrocele surgery camps will also only need to be run for 10 years before predicted elimination targets are met.

3.3 Limitations

Before discussing the empirical results, it must be noted that there are limitations to the toolkit. First, the model is based on available data for NTDs in Ghana up to 2019 and assumes that interventions begin in 2020. The model is therefore already somewhat outdated and could be strengthened with updated data inputs and information regarding the current status of interventions.

The analysis is limited by the paucity of relevant data and uses a government perspective, with a limited consideration of all possible economic impacts. Therefore, the economic impacts detailed in this report are likely to have been underestimated. While efforts were made to make the data accurately reflect current conditions in Ghana, where highly disaggregated epidemiological data from Ghanaian sources were not available, proxy data from the Institute for Health Metrics and Evaluation GBD were used instead, thus affecting the model's validity.

As with all models, not all relevant components can be captured. While indirect costs such as absenteeism and presenteeism are included, economic impacts from stigma or early retirement due to NTDs are not captured within the model. A lack of data meant that the proportion of employment loss for severe and moderate lymphoedema and hydrocele cases could not be calculated either. Thus the calculations of health implications and intervention costs are conservative.

Scenario 1 uses the assumption that all medicine costs for MDA (ivermectin, albendazole, single-dose rifampicin) are borne by the Government of Ghana, whereas Scenario 2 assumes that all medicine costs are borne by donors.[9] However, over the modelled period (2020–2050), it is possible that the costs will become split between the government and donors. In this case, ROIs can be assumed to lie between the two scenario estimates.

The 'status quo' assumes that there will be no change from the current level of government intervention. However, the status quo is influenced by multiple internal and external forces, and in an environment as fast-paced as Ghana in the 21st century, it can be difficult to predict the rate and direction of change.

Finally, the toolkit only examines the burden of three NTDs in Ghana, and provides just a glimpse of the broader and more extensive impact of all NTDs on the Ghanaian population and economy.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[9] This is the current situation in Ghana. However, as the economic model projects costs over 30 years, two scenarios were modelled to account for the possibility of costs being borne by the government in the future.

4. Results

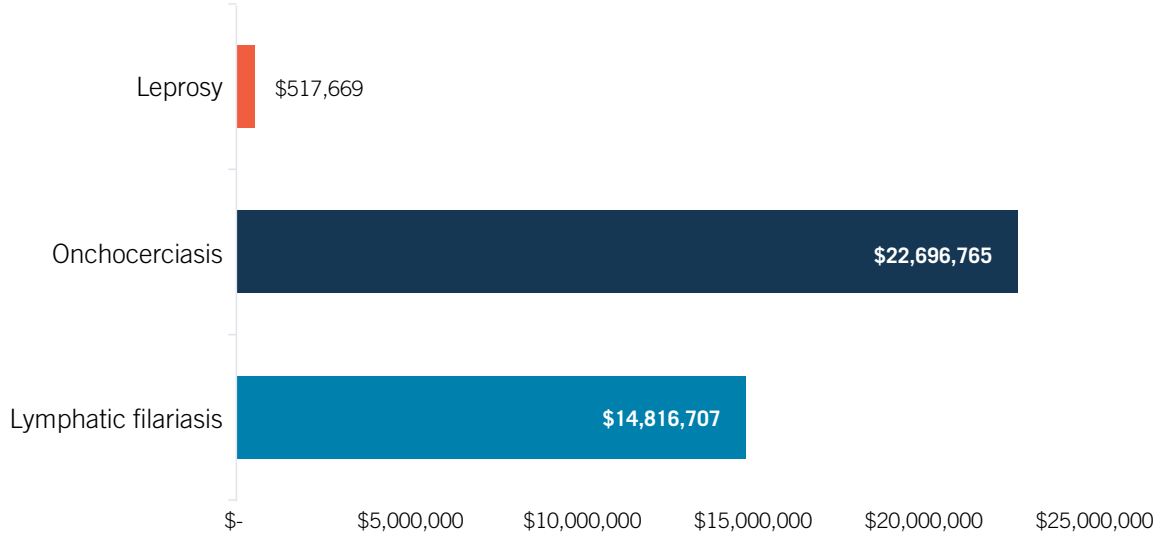
4.1 The economic burden of NTDs

Lymphatic filariasis, onchocerciasis and leprosy are endemic in Ghana, exerting a profound impact on both public health and the economy. As illustrated in Section 2 of this report, in 2020 alone, more than 250,000 individuals were affected by at least one of these diseases.

The economic toll of these diseases on the Ghanaian economy is substantial, totalling around US$38 million a year, equivalent to 0.05 percent of the country's GDP in 2020. This financial burden encompasses not only health care expenditures but also the economic value of disabilities and productivity losses resulting from presenteeism and absenteeism.

Onchocerciasis imposes the highest economic burden of the three diseases, amounting to US$23 million annually. Lymphatic filariasis follows closely behind, costing the Ghanaian economy an estimated US$15 million per year. While comparatively lower, leprosy still contributes an economic burden of around US$500,000 annually (see Figure 3).

Figure 3. Annual cost of lymphatic filariasis, onchocerciasis and leprosy in Ghana (US$)



4.1.1 Health benefits

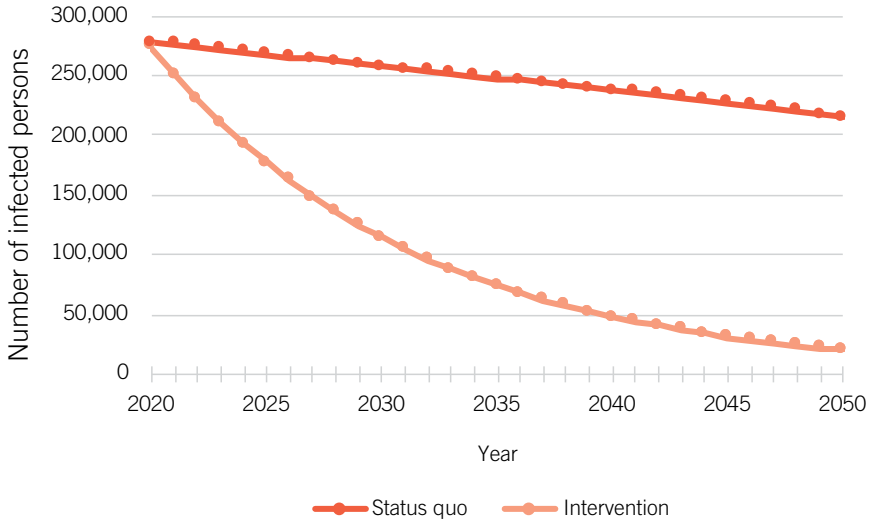
Implementing all three intervention packages will reduce the prevalence of lymphatic filariasis, onchocerciasis and leprosy by 4.66 million cases over the next 30 years. It will also reduce health complications by nearly 2.3 million cases.

The health complications modelled in the toolkit include lymphoedema, hydrocoele and episodic adenolymphangitis for lymphatic filariasis[10] and severe visual impairment and blindness, onchocercal skin diseases and epilepsy for onchocerciasis (for more details on averted health complications, see Annex 2 and Annex 3 of the Appendix).

Lymphatic filariasis package

By scaling up the package of lymphatic filariasis interventions, the number of persons infected would drop by one third in just five years (267,400 cases in status quo vs. 176,600 cases with the scale-up), as illustrated in Figure 4. Over 30 years, under a scale-up scenario, it is estimated that the number of cases would be just 10 percent of the number of the status quo (215,000 cases in status quo vs. 20,300 cases with the scaled-up package). Cumulatively over 30 years, 4.6 million cases of lymphatic filariasis would be averted.

Figure 4. Prevalence of lymphatic filariasis with status quo versus intervention scale-up



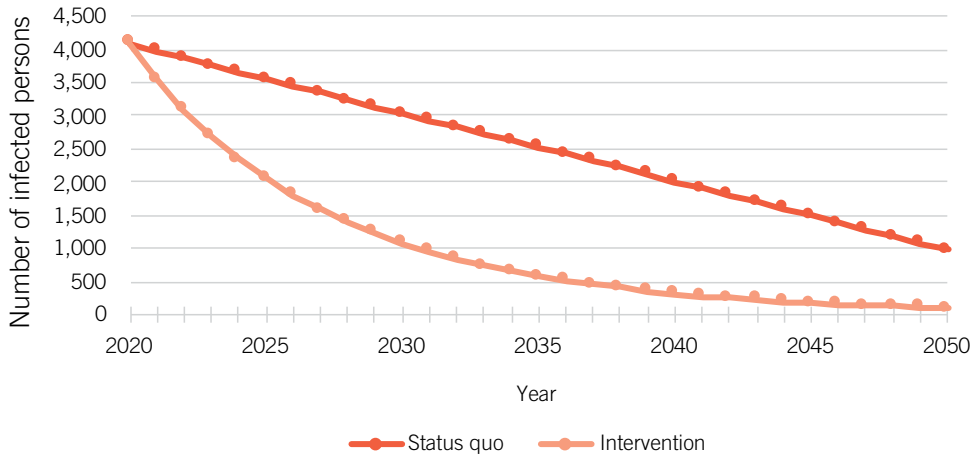
Scaling up the package of interventions would also greatly improve the quality of life of people with lymphatic filariasis by reducing the numbers of those suffering from common complications associated with the disease. By scaling up the package of interventions, it is predicted that within 30 years, the number of people suffering from complications of lymphoedema, hydrocele and episodic adenolymphangitis events would drop by 89 percent.

Onchocerciasis package

Figure 5 depicts the reduction in predicted cases of onchocerciasis following the scale-up of interventions, highlighting the swift health impact of the intervention soon after implementation. In five years, the number of persons infected with onchocerciasis would decrease by 42 percent compared to the status quo (3,600 cases in status quo vs. 2,100 cases with the scale-up). In 30 years, this would drop to 10 percent in comparison with the status quo (970 cases in status quo vs. 97 cases with the scale-up). Over the span of 30 years, close to 46,000 cases of onchocerciasis would be averted.

[10] Lymphoedema and hydrocoele are both common complications associated with lymphatic filariasis. Lymphoedema is a chronic swelling affecting the limbs, while hydrocoele is swelling of the scrotum, affecting only males aged mostly between 20 and 54 years. Episodic adenolymphangitis is also a common health complication and refers to recurrent attacks of fever accompanied by inflammation of the lymph nodes, often causing the individual to be incapacitated.

Figure 5. Prevalence of onchocerciasis with status quo versus intervention scale-up

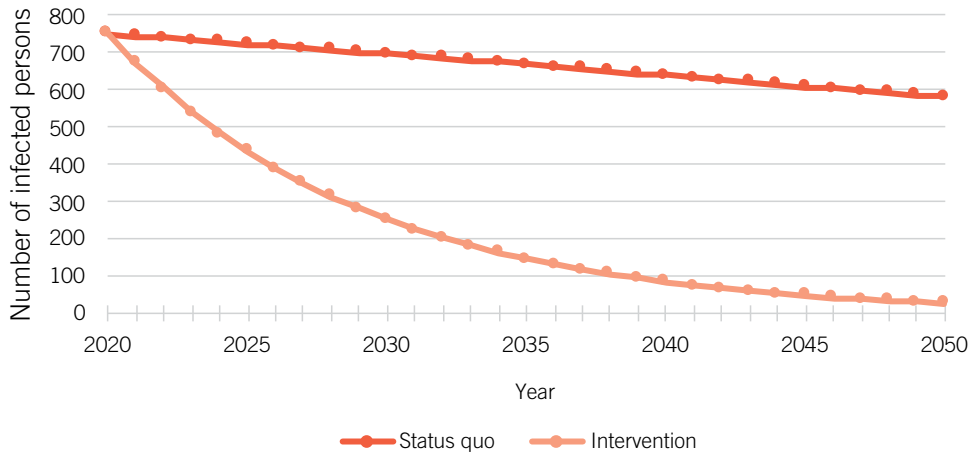


A number of life-inhibiting complications of onchocerciasis would also be averted, with a predicted 90 percent of incidences of moderate to severe visual impairment and blindness, onchocercal skin diseases and epilepsy prevented (see Annex 3 for more details).

Leprosy package

By scaling up the leprosy package of interventions, an estimated 3,500 cases of leprosy would be prevented in Ghana over 30 years (see Figure 6). Within five years, the number of cases of leprosy would be 40 percent lower than the status quo (724 cases with the status quo vs. 435 cases with the scale-up). Within 30 years, the number of cases would be just 5 percent of the status quo (582 cases with the status quo vs. 29 cases with the scale-up).

Figure 6. Prevalence of leprosy with status quo versus intervention scale-up



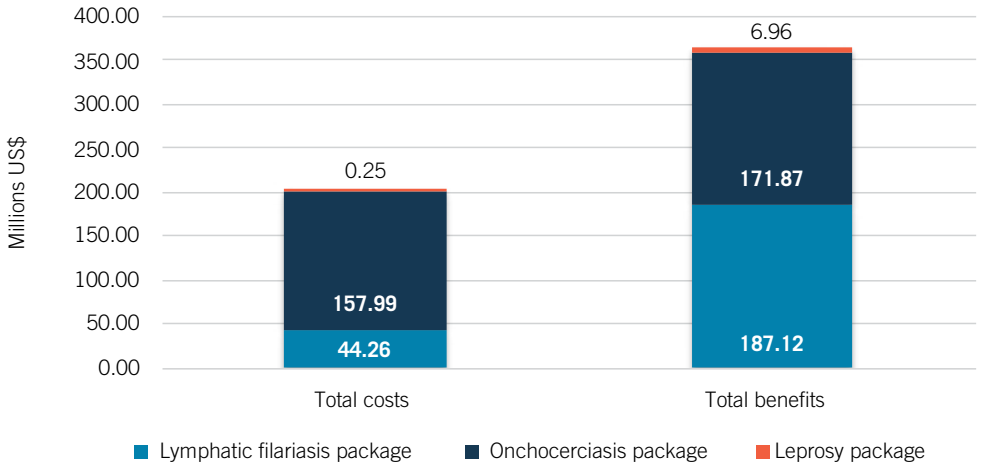
4.1.2 Economic benefits

Scenario 1: All costs paid by the Government of Ghana

In this baseline case analysis (Scenario 1), all medicine costs for MDA are borne by the Government of Ghana. In addition to the health benefits presented above, implementing the NTD interventions would greatly benefit Ghana's economy.

In Scenario 1, the total economic benefits over 30 years of the three combined packages of interventions (US$366 million) outweigh the costs (US$203 million). The ROI of the three combined programmes over 30 years is US$1.8 for every US$1 invested (see Figure 7).

Figure 7. Costs and benefits of all NTD packages combined over 30 years, 2020–2050 (US$ millions), Scenario 1



The breakdown of the costs and benefits for each package over 5 and 30 years is described in Table 2.

Table 2. ROI analysis over 5 and 30 years, Scenario 1

Intervention	2020–2025 (5 years)			2020–2050 (30 years)		
	Total cost (US$ millions)	Total benefits (US$ millions)	ROI (benefits/cost)	Total cost (US$ millions)	Total benefits (US$ millions)	ROI (benefits/cost)
Lymphatic filariasis package	29.95	16.49	0.55	44.26	187.12	4.23
Onchocerciasis package	157.22	36.10	0.23	157.99	171.87	1.09
Leprosy package	0.09	3.89	42.62	0.25	6.96	27.84
Total	**187.26**	**56.48**	**0.30**	**202.57**	**365.95**	**1.81**

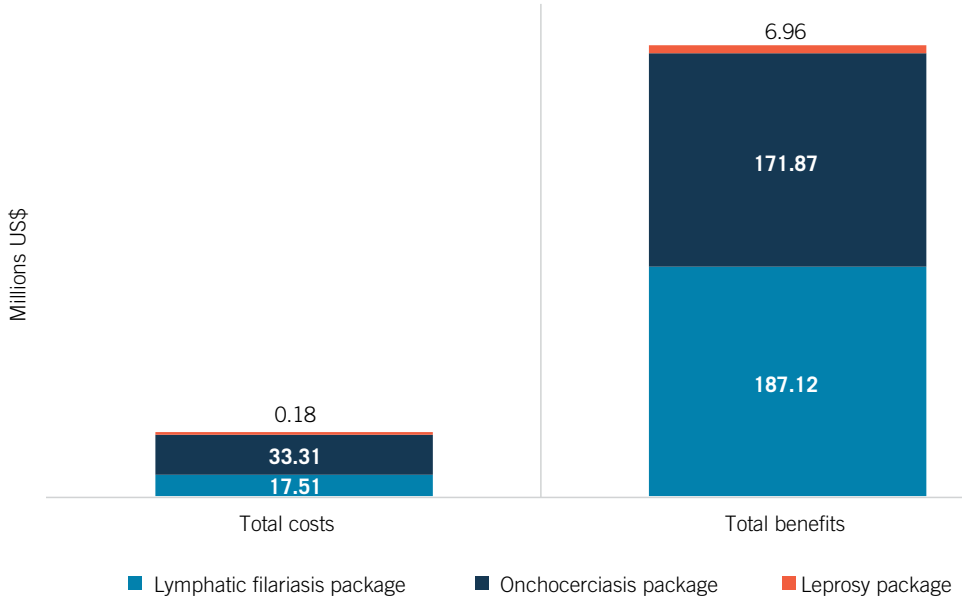
Note: Numbers are subject to rounding.

As can be observed in Table 2, it takes more than five years before the lymphatic filariasis and onchocerciasis packages achieve a positive ROI (i.e. >1). This is to be expected, particularly in case prevention initiatives such as MDAs which front-load costs to prevent new cases, leading to reduced costs in subsequent years. However, in the longer term, the ROI does rise above 1, justifying the investment once the positive impacts are fully seen across the population.

Scenario 2: Medicines for preventive interventions are donated

Scenario 2 assumes that the costs of medicines are borne by donors and not by the government, as this is the current situation in Ghana [51]. The cost component of MDA is thus excluded from the analysis of Scenario 2. As can be seen in Figure 8, the total benefits over 30 years (US$366 million) under this scenario outweigh the costs (US$51 million) by US$315 million. This yields a combined ROI of 7.2.

Figure 8. Costs and benefits of all NTD packages combined over 30 years, 2020–2050 (US$ millions), Scenario 2



Under Scenario 2, all interventions have positive ROIs over both 5 and 30 years from the start of the intervention scale-up (see Table 3).

Table 3. ROI analysis over 5 and 30 years, Scenario 2

Intervention	2020–2025 (5 years)			2020–2050 (30 years)		
	Total cost (US$ millions)	Total benefits (US$ millions)	ROI (benefits/cost)	Total cost (US$ millions)	Total benefits (US$ millions)	ROI (benefits/cost)
Lymphatic filariasis package	9.91	16.49	1.7	17.51	187.12	10.68
Onchocerciasis package	33.00	36.10	1.1	33.31	171.87	5.15
Leprosy package	0.07	3.89	56	0.18	6.96	37.78
Total	**42.98**	**56.48**	**1.31**	**51.00**	**365.95**	**7.18**
Medicine costs (ivermectin, albendazole, single-dose rifampicin) borne by donors						

Note: Numbers are subject to rounding.

4.1.3 Institutional and context analysis

The economic analysis was complemented by an institutional and context analysis conducted by the investment case team. The analysis was based on a desk review followed by a series of discussions conducted with key stakeholders and institutions in Ghana. The meetings explored the priorities of various sectors, key challenges facing the NTD response, and how to support a strengthened whole-of-government and whole-of-society response. Several key challenges were highlighted, such as inadequate funding, insufficient resources (staffing, equipment and medication), lack of awareness of NTDs among the public and some health professionals, and weak engagement with communities. A number of opportunities were also identified, such as strengthening data and surveillance, integrating interventions and health care services, using lessons learned from the ICCC to strengthen coordination at the subnational level, and enhancing health education, including through community health workers, religious leaders and traditional healers. The insights gained from these discussions are included in the report and have informed its findings and conclusions.

5. Conclusion and recommendations

Each year, lymphatic filariasis, onchocerciasis and leprosy collectively cost Ghana approximately US$38 million in economic losses. These diseases affect over 255,000 people, leading to significant suffering and hindering human development. This is just a snapshot of the wider burden of all NTDs on the Ghanaian population and economy annually.

Fortunately, as the investment case shows, there is an opportunity to reduce the economic, health and social burden of these three diseases in Ghana. Scaling up the three packages of interventions would, over 30 years, reduce the prevalence of lymphatic filariasis, onchocerciasis and leprosy by 4.66 million cases and reduce associated health complications such as lymphoedema, hydrocele, adenolymphangitis and skin diseases by 2.30 million cases.

In economic terms, these benefits are substantial, totalling US$164 million over the next 30 years. Importantly, the economic benefits of scaled-up action (US$366 million) greatly outweigh the costs of implementation (US$203 million), yielding an ROI of US$1.8 for every US$1 invested.

In an alternative scenario where all drugs for MDA are donated at no cost to the Government of Ghana, the economic benefits of scaled-up action (US$366 million) further outweigh costs of implementation (US$51 million), yielding an ROI of US$7.2 for every US$1 invested.

Based on the findings of this investment case, the following key actions can help protect public health and realize the benefits of strengthening the NTD response as an accelerator for sustainable development.

1. Increase investment in NTDs, including investing in and fully implementing the modelled interventions

Increasing investment in NTD interventions could reduce the significant human and economic losses that would be incurred. The investment case shows that, over 30 years, scaling up the three sets of interventions – increasing the frequency of MDA, increasing leprosy contact tracing and introducing targeted treatment for common debilitating symptoms – would yield substantial positive health impacts, reduce the economic burden of these diseases and generate a positive ROI. It would also help bring Ghana closer to achieving SDG Target 3.3 and the 2030 NTD targets [4]. This increased investment could be combined with strengthening integration of interventions with existing relevant interventions and broader integration with other relevant disease programmes, such as water, sanitation and hygiene (WASH) and vector control [52]. Efforts should be made to ensure that treatment coverage is maintained. Sustainable domestic financing of interventions should also be prioritized to ensure that the long-term health and economic benefits are fully realized.

More broadly, increasing investment in the NTD response can ensure sufficient funding for programmes. This may include increasing investment to ensure there are sufficient human resources with adequate training to effectively deliver NTD interventions and broader health care services, as the current workforce is insufficient [12].

2. Strengthen data, surveillance, monitoring and evaluation systems

Quality surveillance and information systems are required to accurately assess disease burden, population needs and intervention effectiveness, and to achieve elimination targets in Ghana. This includes ensuring accurate reporting coverage and obtaining a true picture of the endemic situation through field-friendly and sensitive diagnostic/surveillance tools that are acceptable in endemic communities [12]. While Ghana has made substantial improvements in its information management and reporting systems, gaps remain. Complex reporting tools and inadequate data management structures result in inconsistent and inaccurate data. There is also limited use of data in planning and resource allocation at the district level [12].

Investing in improving data collection tools and systems will allow Ghana to better understand the epidemiology of the diseases and its population needs, supporting effective planning and resource allocation. The following measure could help strengthen these systems:

- Strengthen capacity-building and surveillance
    - Invest in capacity-building for laboratories and health workers, including refresher programmes for health surveillance personnel using updated epidemiological methods and tools
    - Conduct training on NTDs reporting forms in the district health information management systems for the national level
    - Strengthen surveillance of preventive chemotherapy, transmission control and case management of NTDs
    - Implement monthly desk reviews of NTD data by desk officers and facilitate cross-border meetings to improve regional collaboration and data-sharing.
- Implement monitoring and evaluation
    - Develop and implement comprehensive monitoring and evaluation frameworks that include clear indicators for objectives and progress
    - Establish systematic feedback loops involving all stakeholders to refine interventions based on real-world effectiveness.
- Adopt a ‘one health’ approach
    - Strengthen intersectoral collaboration and coordination between animal, plant and human disease surveillance systems to achieve an effective system of disease surveillance
    - Incorporate a coordinated approach to sampling of human and other reservoirs of disease to predict and prepare for future outbreaks. The increased collection and synthesis of data will also allow specific and varying needs of certain areas and districts to be addressed [53].

Incorporating NTD indicators into the performance evaluation of health managers at various levels could also drive improvements. This approach would likely encourage managers to allocate more resources to NTD tasks and integrate NTD activities into community efforts. By including more NTD indicators in the key performance indicators of health managers at regional, district and facility levels, these managers would hold their staff accountable during yearly appraisals, driving better performance through a strengthened performance management system [51].

3. Strengthen community engagement and increase public awareness

Social mobilization at the grass-roots level is vital for implementing successful NTD interventions, as it leads to increased awareness of NTDs and acceptance of MDA. Challenges in NTD management include the timing of MDA, non-compliance with treatment, and a lack of community engagement in planning [54]. Poor MDA awareness perpetuates NTDs in endemic districts. Although community members receive MDA information before drug distribution, this information does not educate them on the importance of treatment, or potential side effects and their management [55].

Timing of treatment distribution is also challenging. Drug administration often depends on the area's endemicity and funding cycles, which may not align with community needs. Many lymphatic filariasis-endemic communities are rural and in farming areas, where annual MDA often coincides with planting season. Residents typically leave home early for farms and return late. It is crucial to engage communities in planning, align MDA schedules with their needs and consider their livelihoods [51][55].

Education is a key component in reducing the prevalence of NTDs [56]. Context-specific educational materials that deliver simple messages on how to avoid NTD infections by paying attention to personal hygiene, sanitary food handling, bug nets, removal of still water and other areas should thus be made widely available, including in the local languages, with an emphasis on reaching Community Drug Distribution (CDD) networks to increase accessibility, ensuring that vulnerable populations and rural communities are reached.

Public awareness and education campaigns should also be used to tackle stigma and discrimination. People living with NTDs, particularly those with physical disfigurement as a result, often experience stigma, discrimination and social exclusion. This can make people less likely to seek, access and adhere to treatment, causing a cycle which negatively impacts their recovery, in addition to overall efforts to eradicate NTDs [57]. Challenging negative community attitudes and improving knowledge about mental health and stigma among NTD programme staff are evidence-based strategies to reduce stigma [58].

Ghana can benefit from intensifying health education efforts and actively involving communities in the planning and implementation of lymphatic filariasis control activities. Engagement of churches, religious leaders and traditional healers, in addition to the media, may further facilitate community involvement and education. This can help improve understanding of the disease, increase participation in MDA campaigns, and encourage early detection and treatment of cases.

4. Integrate and mainstream NTDs into existing programmes, services and structures

Mainstreaming NTDs into existing health programmes and services can improve access for people living with NTDs and contribute to more sustainable, efficient NTD prevention and control. Mainstreaming NTD activities is also expected to result in greater cost efficiency and improved health outcomes [59]. Integrated management of NTDs among themselves and with other programmes has proven to be cost-effective with the potential of increasing treatment coverage [60]. Community-level practices such as leg washing, cleaning and hygiene should be widely incorporated into routine health care service delivery.

Mainstreaming NTD activities within the national health system across the different levels could prove beneficial. For example, at the community level, Ghana has successfully established CDD networks to train community members to distribute medication and provide health education [61]. Ghana can utilize CDD networks and community health workers to mainstream NTD activities at the community level. To sustain these valuable networks, efforts should be made to identify the needs of these community members so that

they are supported as much as possible [15]. Collaboration and mainstreaming of NTD activities with other health programmes could also include mental health, women's and children's health, disability and inclusion, nutrition and malaria programmes.

5. Strengthen multisectoral engagement for NTDs in Ghana and promote a whole-of-government and whole-of-society approach

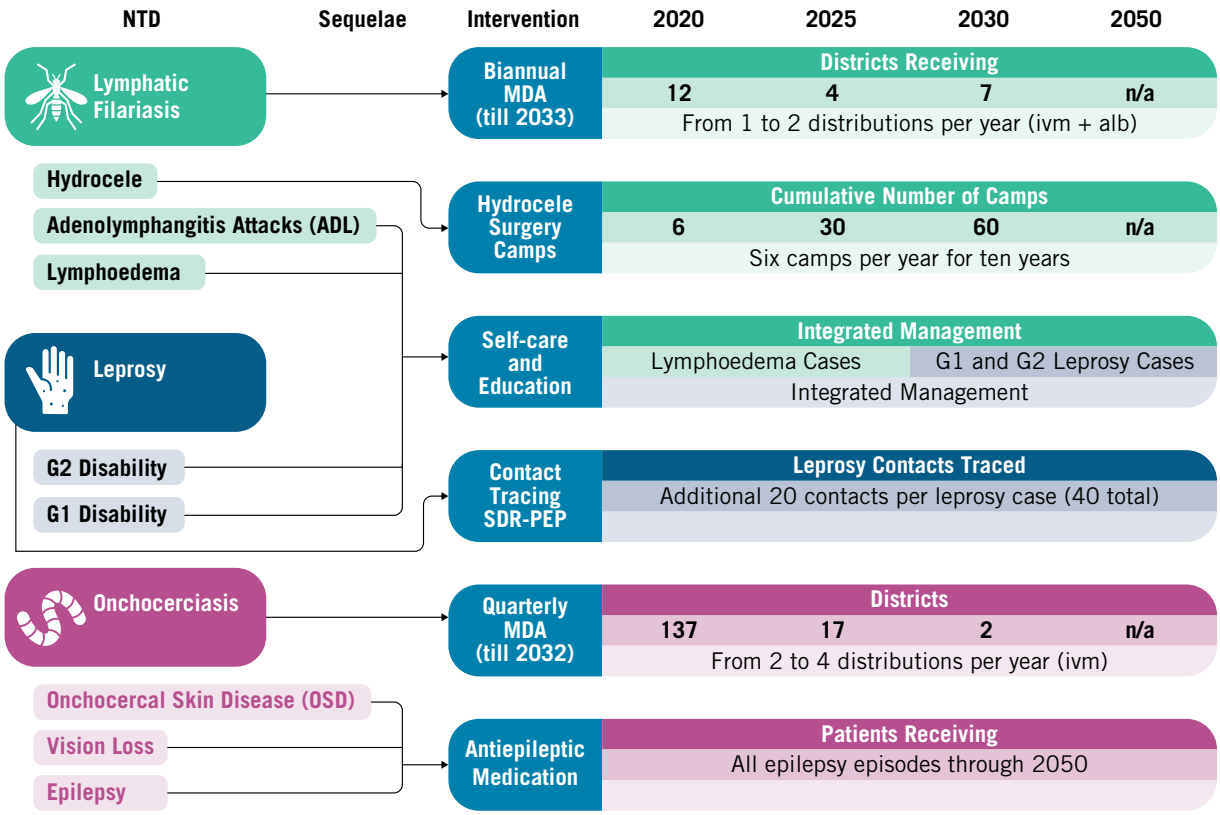
The WHO NTD road map 2030 emphasizes the importance of multisectoral coordination to advance NTD action and achieve the SDGs [4]. NTD management is inextricably linked with social, environmental and economic systems, requiring integrated approaches within existing systems of service delivery, operational capacity and policy and planning, as well as multisectoral collaboration across government ministries and stakeholders [62]. Ghana has made commendable efforts in ensuring multisectoral approaches broadly, as set out in the Coordinated Programme of Economic and Social Development Policies 2017–2024 [63], which includes objectives of scaling up disease prevention strategies and strengthening its health system, and highlights links between disease control and prevention and other issues such as climate change [63]. In addition to engaging the media, activities to increase political attention to NTDs in the country and prioritizing the sensitization of key decision makers and political leaders who have influence on priority-setting and resource allocation could help increase political commitment.

Ghana has also taken steps to strengthen multisectoral coordination within NTDs, such as the establishment of the ICCC. However, key gaps remain. Measures to strengthen coordination further, prioritizing stronger coordination with WASH, between the public and private sectors, civil society and non-governmental organizations, and across levels of government may be warranted [12][51]. The experience of the ICCC may also offer lessons that could inform strengthened coordination at the subnational level.

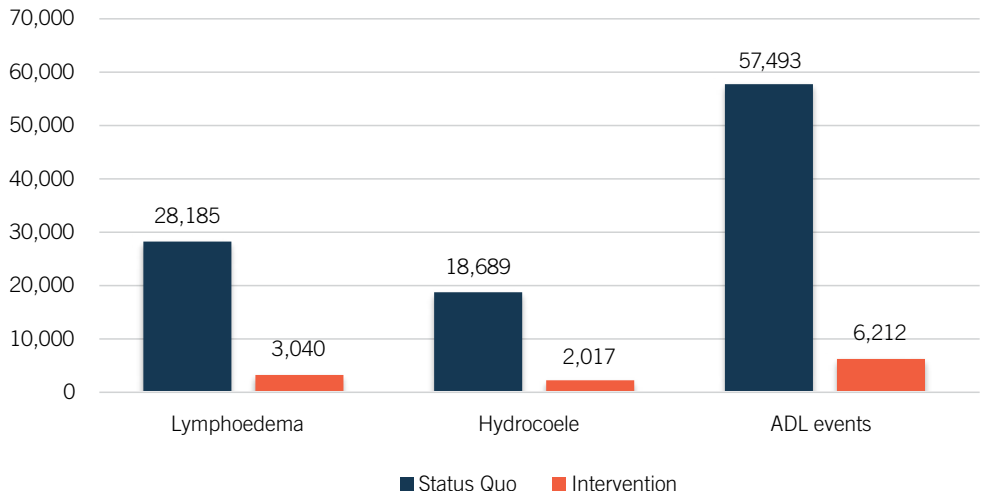
Strengthened collaboration with national gender institutions and gender-focused civil society organizations is vital for addressing NTDs and advancing gender equality in health outcomes. Key strategies include capacity-building and training, collaboration and networking, community mobilization and empowerment, and resource mobilization for integrating gender into Ghana's NTD programmes. Empowering civil society organizations and national gender institutions can help promote gender-responsive approaches to NTD prevention, treatment and control, ultimately contributing to and accelerating sustainable development, gender equality and social justice in the country.

Appendix 1. Supplementary figures

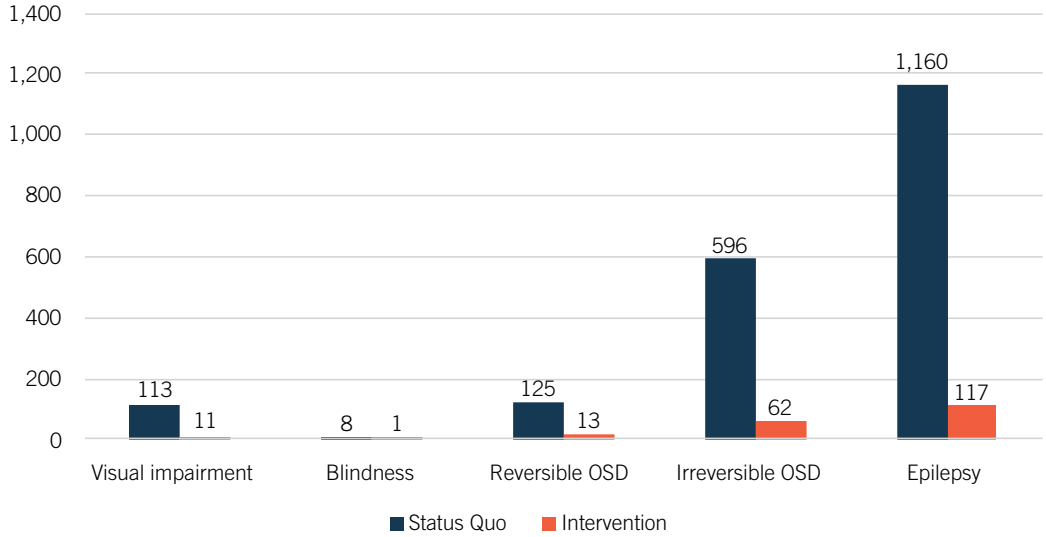
Annex 1. Intervention timeline for the prevention, control and management of focal NTDs



Annex 2. Comparison of the prevalence of health complications associated with lymphatic filariasis, status quo versus scale-up, 2020–2050



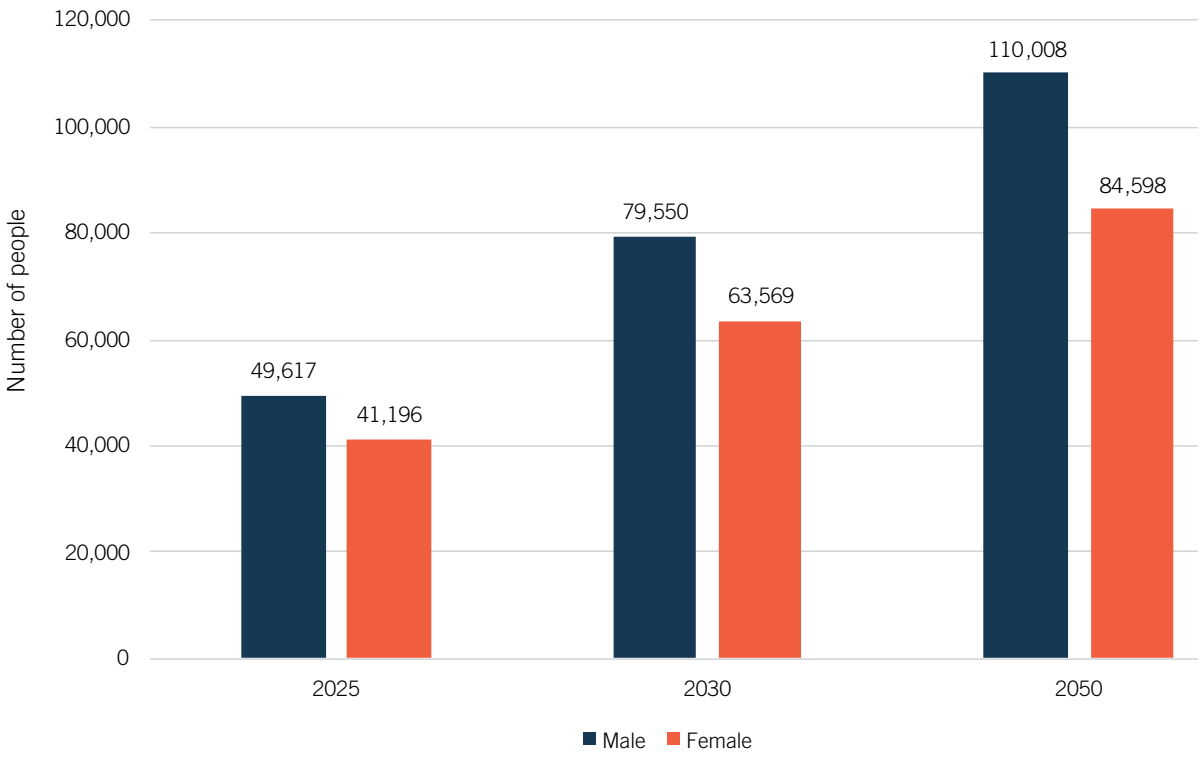
Annex 3. Comparison of the prevalence of health complications associated with onchocerciasis, status quo versus scale-up, 2020–2050



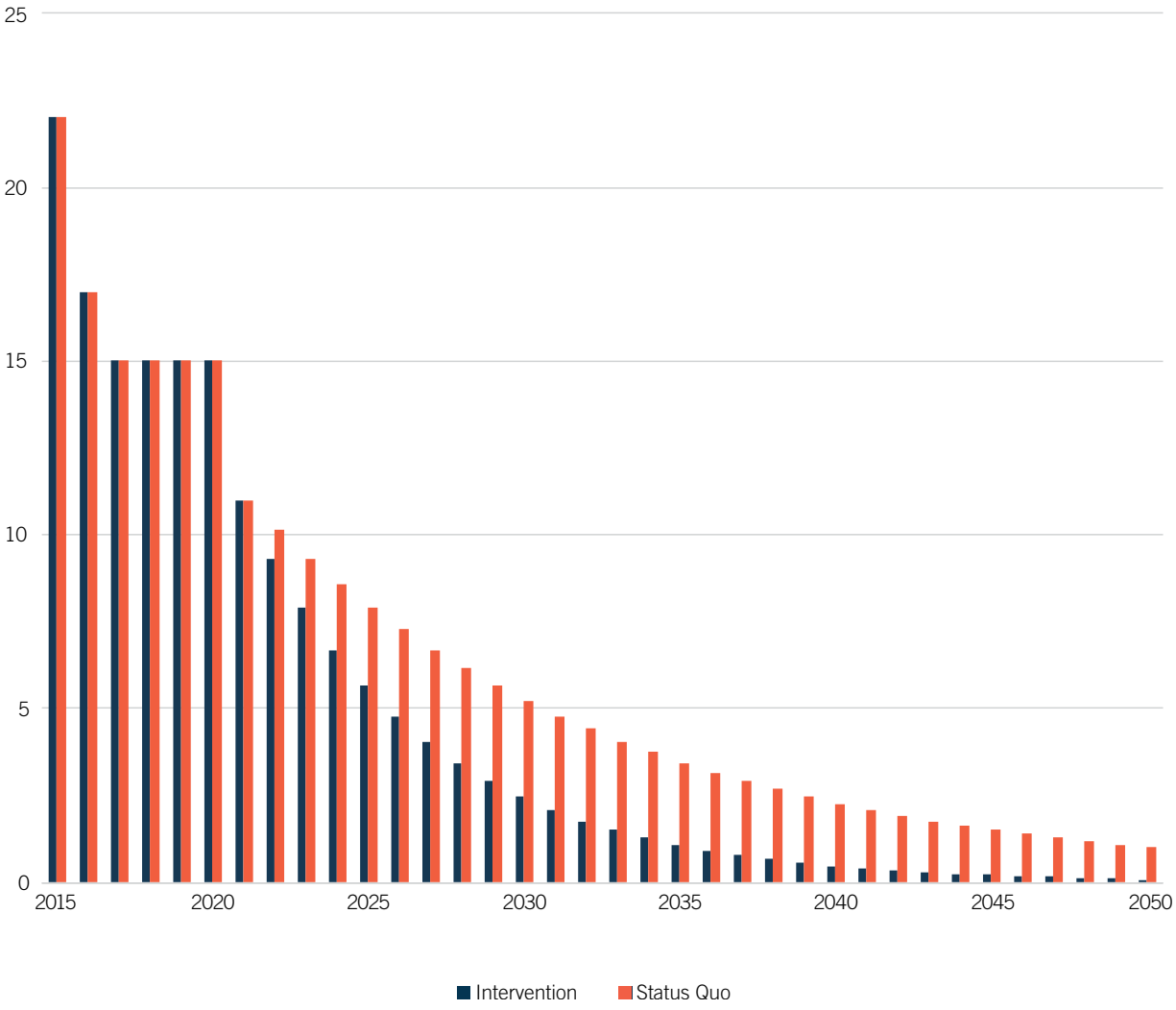
Appendix 2. Results disaggregated by disease

Lymphatic filariasis

Annex 4. Number of lymphatic filariasis cases averted with biannual MDA

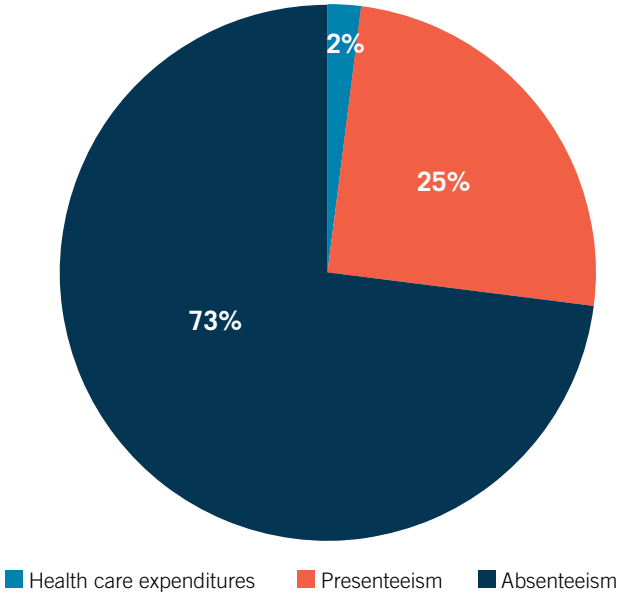


Annex 5. Number of remaining districts with lymphatic filariasis to receive MDA

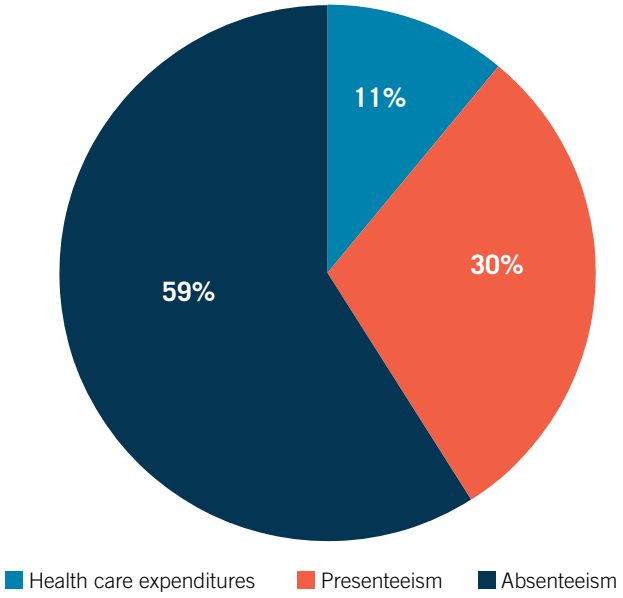


Note: 'Intervene' means scaling up the package of interventions.

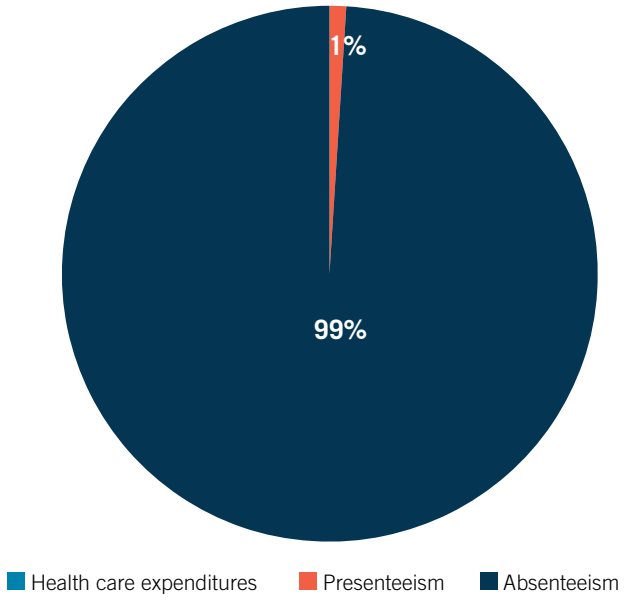
Annex 6. Economic burden (of lymphatic filariasis) averted by scaling up MDA, 2020–2050



Annex 7. Economic burden of lymphatic filariasis averted by scaling up surgery camps, 2020–2050

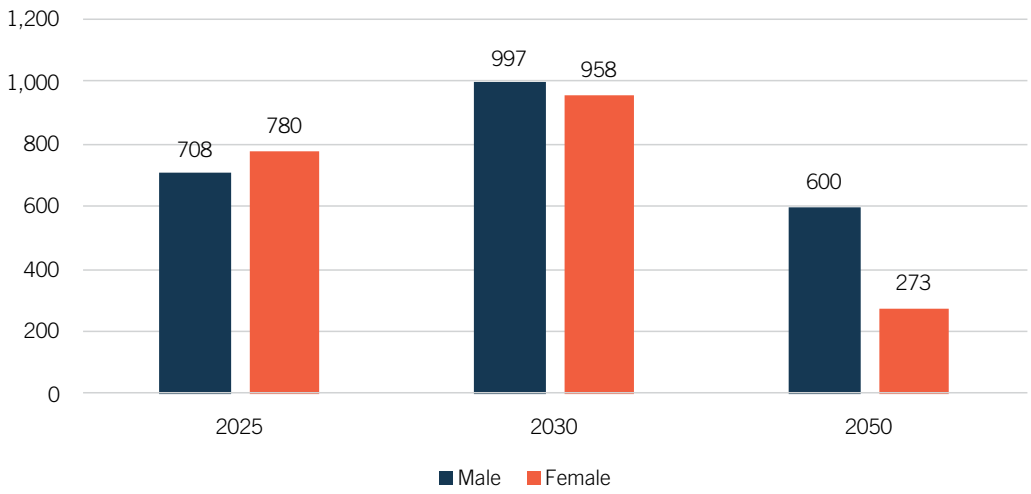


Annex 8. Economic burden of lymphatic filariasis averted by scaling up self-care kits, 2020–2050

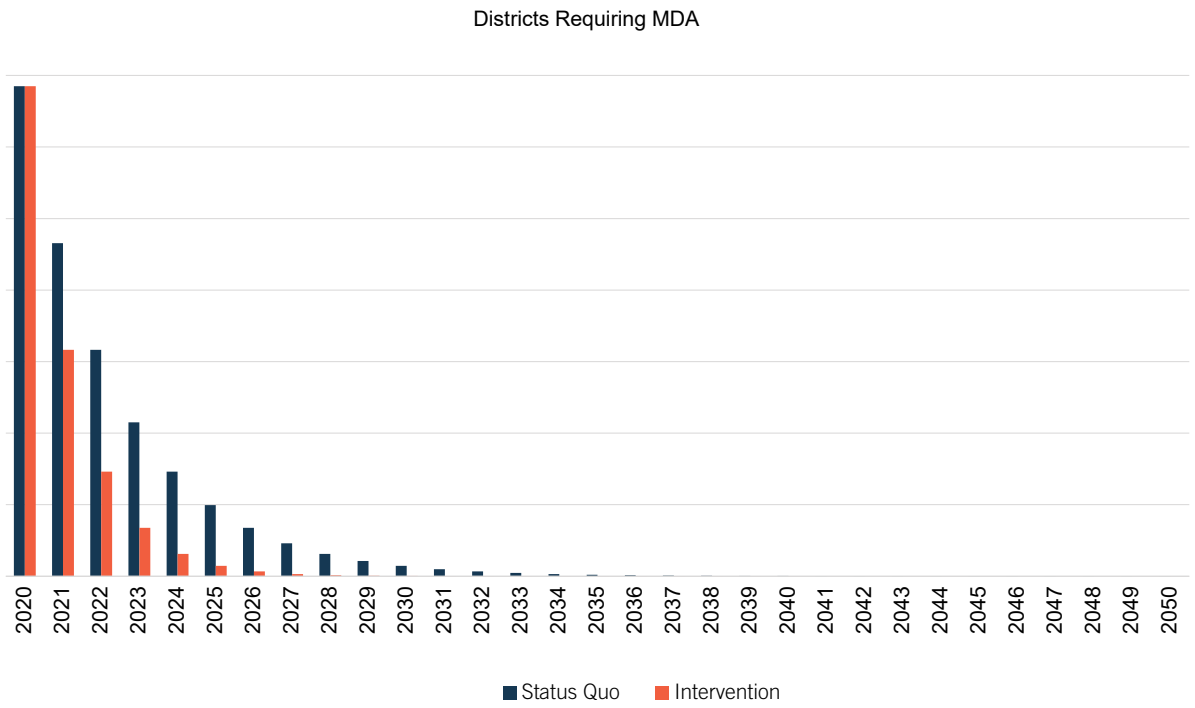


Onchocerciasis

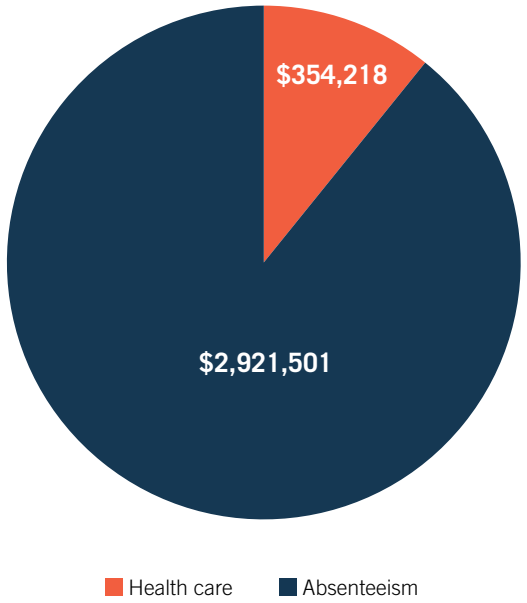
Annex 9. Cumulative number of cases of onchocerciasis averted by quarterly MDA



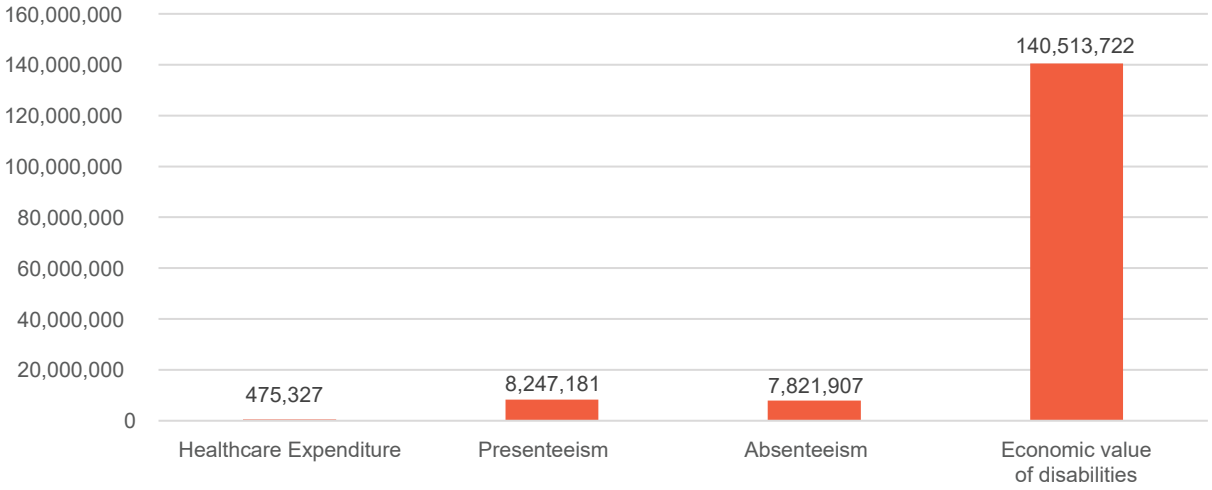
Annex 10. Number of districts with onchocerciasis requiring MDA



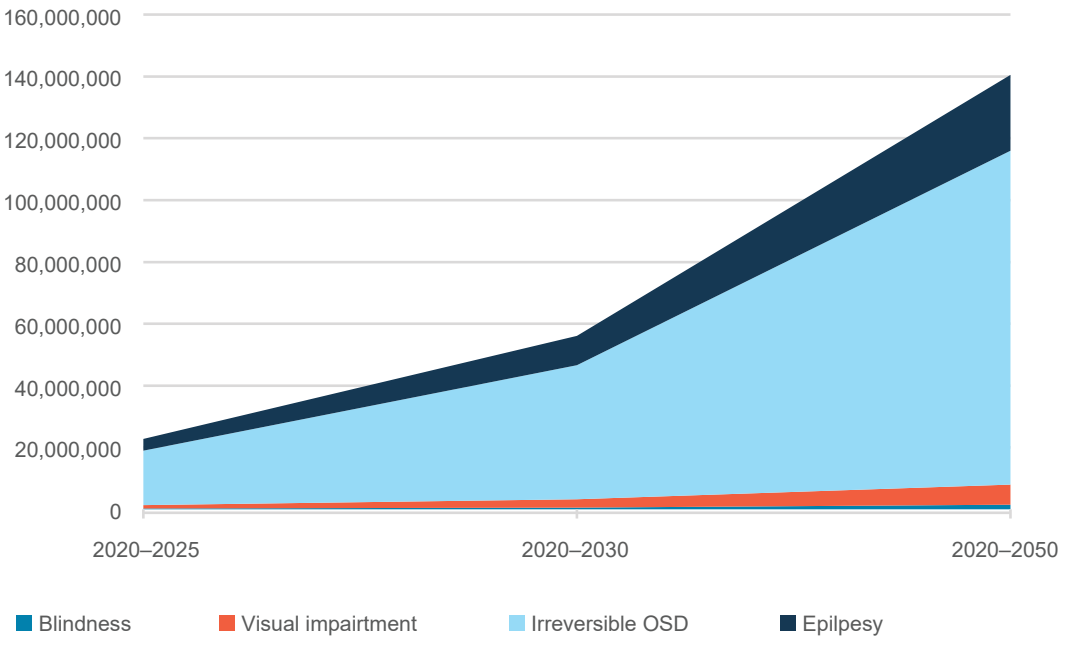
Annex 11. Economic burden of onchocerciasis averted by anti-epileptic medication, 2020-2050



Annex 12. Economic burden of onchocerciasis averted by quarterly MDA, 2020-2050

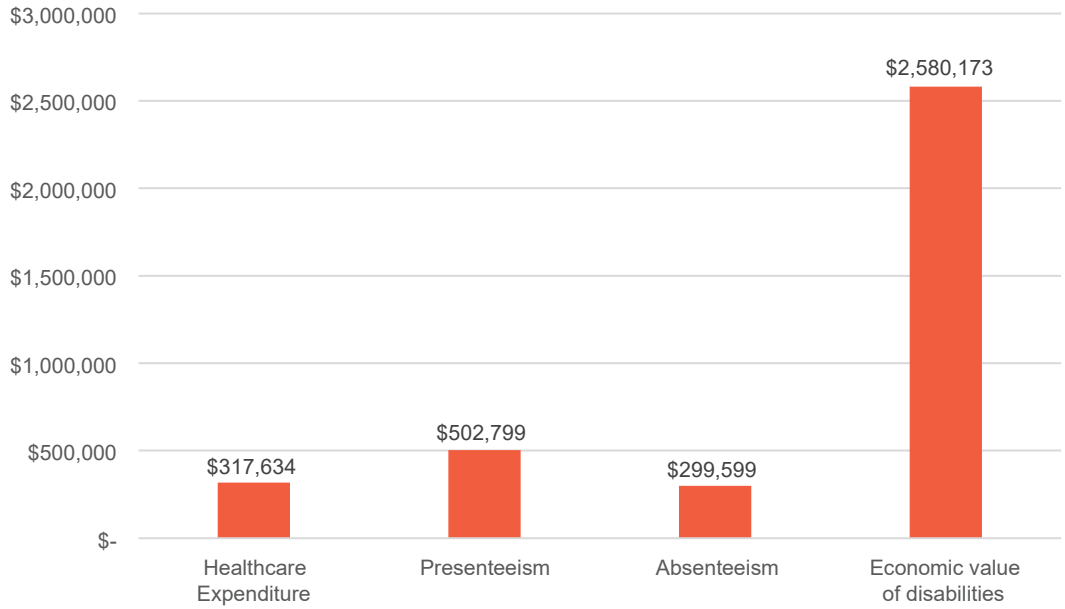


Annex 13. Economic burden of onchocerciasis averted: disaggregation of economic value of disabilities, 2025-2050

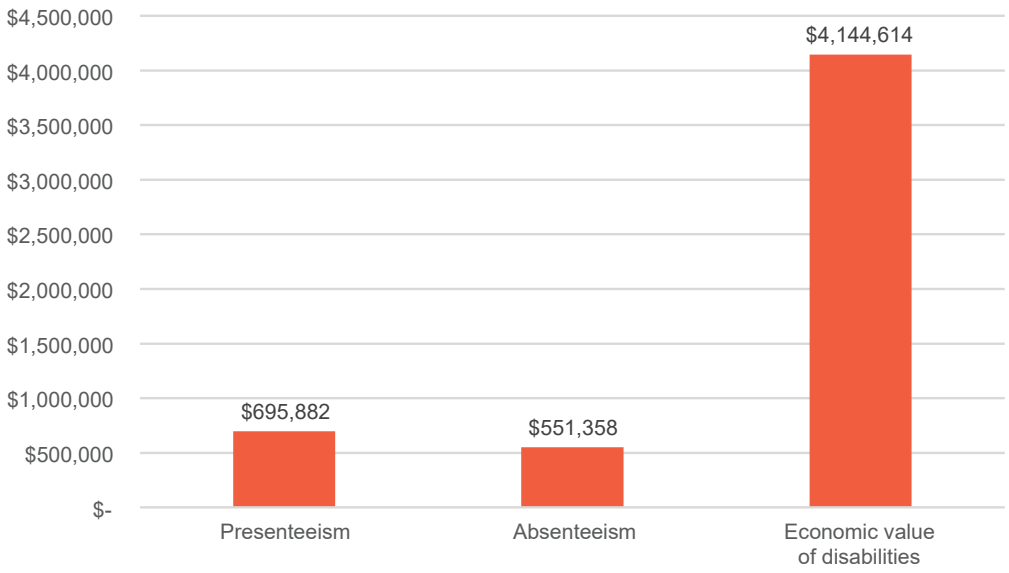


Leprosy

Annex 14. Economic burden of leprosy averted by scaling up contact tracing, 2020-2050



Annex 15. Economic burden of leprosy averted by scaling up self-care kits, 2020-2050



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