# Helen Keller International Position Paper

# Control of Neglected Tropical Diseases

**HKI Mission Statement:**

*The mission of HKI is to save the sight and lives of the most vulnerable and disadvantaged. We combat the causes and consequences of blindness and malnutrition by establishing programs based on evidence and research in vision, health and nutrition.*

***Purpose***: To review the current situation in the field of control of neglected tropical diseases (NTDs), to review HKI's agency-wide involvement in the control of these NTDs and to provide information and guidance for HKI's future actions

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**For more information, please contact:**
Dr Yaobi Zhang, Regional NTD Coordinator for Africa, *yzhang@hki.org*
Chad MacArthur, Director of NTD Control, *cmcarthur@hki.org*

## Abbreviations

| | |
|---|---|
| APOC | African Programme for Onchocerciasis Control |
| CDTI | Community-Directed Treatment with Ivermectin |
| EMCF | Edna McConnell Clark Foundation |
| ENA | Essential Nutrition Actions |
| EU | European Union |
| HKI | Helen Keller International |
| ITI | International Trachoma Initiative |
| LCIF | Lions Club International Foundation |
| LF | Lymphatic filariasis |
| MDA | Mass drug administration |
| NGDO | Non-governmental Development Organization |
| NTD | Neglected tropical diseases |
| OCP | Onchocerciasis Control Programme |
| PCT | Preventive chemotherapy treatment |
| RTI | RTI International |
| SAFE | Surgery, Antibiotics, Facial cleaning and Environmental improvement |
| STH | Soil-transmitted helminthiasis |
| UNICEF | The United Nations Children's Fund |
| USAID | United States Agency for International Development |
| VA | Vitamin A |
| VAS | Vitamin A supplementation |
| WAHO | West African Health Organization |
| WB | World Bank |
| WHO | World Health Organization |

## Executive Summary

Neglected Tropical Diseases (NTDs) are defined as a group of chronic and debilitating conditions, caused by parasitic, bacterial, and viral infections. NTDs are the most prevalent diseases in the poorest populations in the world, affecting an estimated 2.7 billion people. They cause blindness (*e.g.* onchocerciasis and trachoma), disfigurement (*e.g.* lymphatic filariasis (LF), leishmaniasis, leprosy, and Buruli ulcer), and are often life-threatening at a later stage of the disease (*e.g.* African trypanosomiasis, Chagas Disease, Dengue fever, and schistosomiasis). They are also related to various clinical complications, such as anemia and malnutrition (*e.g.* schistosomiasis and soil-transmitted helminthiasis (STH)). In terms of the disability-adjusted life years (DALYs), NTDs as a group are among the top 10 leading causes of DALYs lost due to long-term disability and premature death worldwide. Sub-Saharan Africa bears the biggest burden of many of these NTDs. The numbers of people afflicted by several of these diseases are striking and represent over 90% of the world's burden for many of them. NTDs also overlap geographically, and a significant proportion of the poorest populations often harbors more than one of them. NTDs have severe socioeconomic consequences as they cause long-term illness, disfigurement, social stigma and marginalization, and decreased productivity. Successful control of NTDs will have a wide range of health and socioeconomic benefits to the poorest populations.

Control of NTDs has gathered momentum in recent years. Focus has currently been on five major 'tool-ready' ones – LF, onchocerciasis, schistosomiasis, STH and trachoma – so termed because they can be controlled through a package of integrated drugs according to the World Health Organization guidelines for preventive chemotherapy. The needed drugs are donated by pharmaceutical companies or can be purchased at a relatively low cost. Large-scale use of these safe and effective drugs is likely to achieve control, prevent morbidity or, in some cases, even eliminate these NTDs as public health problems. To date, with funds provided by governmental and non-governmental donors, a number of countries have been implementing or are about to implement integrated national NTD control programs with assistance from international organizations and non-governmental development organizations (NGDOs). Helen Keller International (HKI) has successfully assisted several of these countries in implementing integrated national programs (Mali, Sierra Leone, Cameroon, and soon Guinea).

HKI has long supported control activities for several individual NTDs, including onchocerciasis, trachoma, STHs and schistosomiasis. HKI's early work in NTD control dates back to the mid 1950s with support to eliminate blinding trachoma in Taiwan. The agency played a pivotal role in the development of the SAFE strategy (**S**urgery for trichiasis, **A**ntibiotics to treat infections, **F**acial cleaning and **E**nvironmental improvement) to control trachoma and the CDTI (Community Directed Treatment with Ivermectin) strategy to control onchocerciasis. More recently, HKI has undertaken integrated control activities in a number of countries in Africa. HKI's integrated NTD control efforts have included the integration of de-worming into child health days/vitamin A supplementation days for children 12-59 months, integration of de-worming into school health programs, and integration of albendazole into CDTI for LF elimination. Control of these NTDs fits into HKI's mission to "**combat the causes and consequences of blindness and malnutrition**", as these NTDs directly or indirectly cause blindness or have an impact on nutrition. HKI's

extensive technical capacity in blindness prevention and undernutrition, along with its longstanding institutional commitment to these issues, make it uniquely qualified to support integrated NTD control efforts.

HKI's approach and strength has been to partner with government ministries, particularly of Health and Education, to provide technical assistance to the national disease control teams, and to build capacity within countries with the goal of scaling up and creating sustainable systems. Throughout this work, HKI emphasizes the ownership of the disease control programs by the country and communities themselves. This approach will provide a foundation for a long-lasting NTD control effort within each country, and is essential if the NTD control programs are to be sustainable. HKI also partners with other organizations and private donors including pharmaceutical companies that donate medications. Another of HKI's core competencies is creating and disseminating high quality information, education and communication materials for both behavior change and advocacy.

Given HKI's operation in twenty two countries and its extensive experience in, and supporting national integrated NTD control efforts, HKI is uniquely positioned to bring more attention to the positive impact that NTD control has on undernutrition and to further expand NTD control efforts worldwide. HKI's objective is to have integrated NTD control become central to its programming in virtually every country portfolio – particularly in sub-Saharan Africa. HKI will continue to strengthen its partnerships and diversify the funding sources for NTD control. HKI will build on its strengths to advocate to political leaders, donors and general public, highlighting the difficulties – and vast potential – in controlling these NTDs and emphasizing the long-term commitment needed from all parties. HKI will continue to work together with all its partners to advocate and encourage country governments to commit and invest more in their own NTD control programs.

HKI recognizes the importance of contributing to the body of literature addressing integrated NTD control and of sharing its experiences in program implementation with other agencies. Through its NTD control programs, HKI will generate new knowledge on effective NTD control strategies. HKI will work together with partners to disseminate key technical updates on program-related research to the NTD control community in Africa through a monthly newsletter (NTD News for Africa). HKI will also identify gaps in the current NTD control strategies and solutions to address these. This position paper outlines the action plans for HKI to take to make greater contributions to NTD control.

## 1. Global Burden of Neglected Tropical Diseases

The neglected tropical diseases (NTDs) are a group of chronic and debilitating conditions, caused by parasitic, bacterial, and viral infections. There are different groupings of diseases considered as NTDs, the most important currently includes the following diseases [2, 3].

**Helminth Infections**
- Ascariasis
- Hookworm Infection
- Trichuriasis
- Schistosomiasis
- Lymphatic Filariasis
- Onchocerciasis
- Dracunculiasis

**Protozoan Infections**
- African Trypanosomiasis
- Chagas Disease
- Leishmaniasis

**Bacterial Infections**
- Buruli Ulcer
- Leprosy
- Trachoma

**Viral infections**
- Dengue fever

These diseases are poverty-driven and poverty-promoting. They are most prevalent and often co-endemic in the rural areas of low-income countries, and in particular, in sub-Saharan Africa, Asia and Latin America (Figure 1) [2, 4, 5]. Unlike HIV/AIDS, tuberculosis and malaria, these diseases are chronic, less overtly life-threatening, and in many cases, such as for intestinal helminthiasis and schistosomiasis, not overtly symptomatic in the early stages of infection. They are therefore often neglected by policy makers and donors, and unknown by the rural people who are themselves most affected.

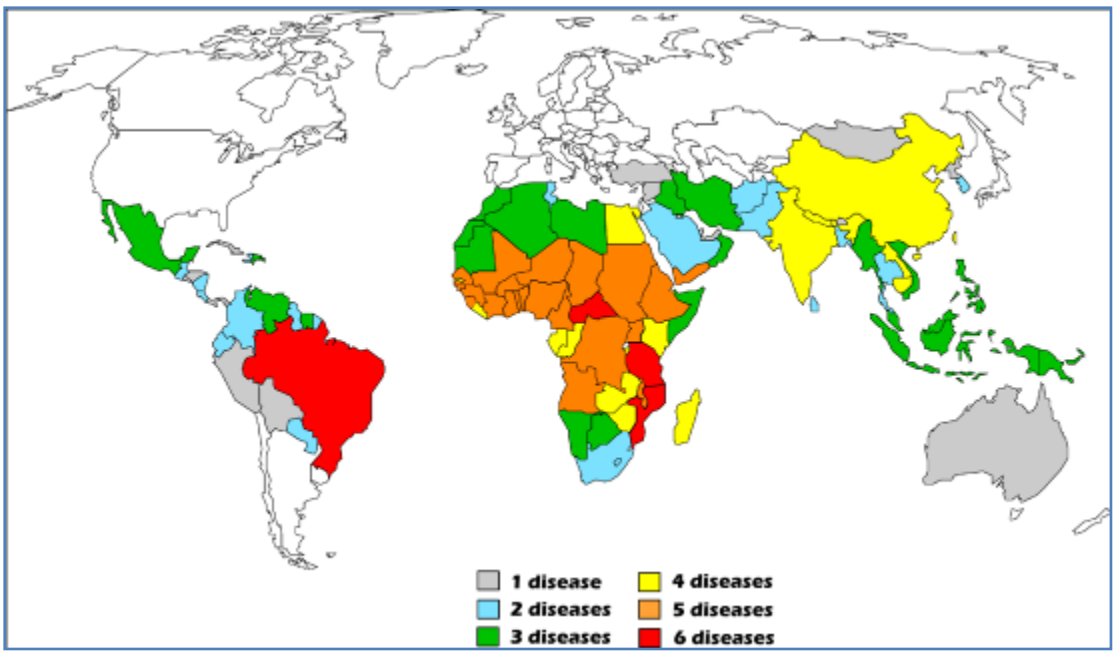



Figure 1 Geographic overlap of the major neglected tropical diseases (modified from Molyneux et al. 2005)

The true burden of these diseases is striking. Together they affect an estimated 2.7 billion people who live on less than $2 per day [10]. The global prevalence of these diseases is shown in the following Table 1 [10].

Table 1. The Major Neglected Tropical Diseases Ranked by Prevalence.*

| Disease | Global Prevalence (millions) | Population at Risk | Regions of Highest Prevalence | Source |
|---|---|---|---|---|
| Ascariasis | 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] |
| Trichuriasis | 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] |
| Hookworm infection | 576 | 3.2 billion | Sub-Saharan Africa, East Asia and Pacific Islands, India, South Asia, Latin America and Caribbean | Bethony et al.,[6] de Silva et al.[7] |
| Schistosomiasis | 207 | 779 million | Sub-Saharan Africa, Latin America and Caribbean | Steinmann et al.[8] |
| Lymphatic filariasis | 120 | 1.3 billion | India, South Asia, East Asia and Pacific Islands, sub-Saharan Africa | Ottesen,[9] WHO[10] |
| Trachoma | 84 | 590 million | Sub-Saharan Africa, Middle East and North Africa | International Trachoma Initiative,[11] Médecins sans Frontières[12] |
| Onchocerciasis | 37 | 90 million | Sub-Saharan Africa, Latin America and Caribbean | Basáñez et al.[13] |
| Leishmaniasis | 12 | 350 million | India, South Asia, sub-Saharan Africa, Latin America and Caribbean | Desjeux[14] |
| Chagas' disease | 8–9 | 25 million | Latin America and Caribbean | WHO[15] |
| Leprosy | 0.4 | ND | India, sub-Saharan Africa, Latin America and Caribbean | International Federation of Anti-Leprosy Associations[16] |
| Human African trypanosomiasis | 0.3 | 60 million | Sub-Saharan Africa | Févre et al.[17] |
| Dracunculiasis | 0.01 | ND | Sub-Saharan Africa | Carter Center[18] |
| Buruli ulcer | ND | ND | Sub-Saharan Africa | Global Buruli Ulcer Initiative[19] |

* ND denotes not determined.

NTDs are among the most important chronic debilitating health problems in the poorest countries and populations in the world. They cause blindness (e.g. onchocerciasis and trachoma) [13-17], disfigurement (e.g. lymphatic filariasis (LF), leishmaniasis, leprosy, and Buruli ulcer) [18-24], and are often life-threatening at a later stage of the disease (e.g. African trypanosomiasis, Chagas Disease, Dengue fever, and schistosomiasis) [25-33]. They are also related to various clinical complications, such as anemia and other forms of undernutrition (e.g. hookworm infections, schistosomiasis, ascariasis, and trichuriasis) [1, 34-39]. In terms of disability-adjusted life years (DALYs), NTDs as a group are among the top 10 leading causes of DALYs lost due to long term disability and premature death worldwide [2]. Sub-Saharan Africa bears the biggest

burden of many of these NTDs, and the number of people afflicted by each of several of these diseases is striking (Table 2) [4]. Sub-Saharan Africa represents over 90% of the global burden for six of these diseases.

**Table 2. Neglected tropical diseases in sub-Saharan Africa** [4]

| Disease | Estimated Population Infected in SSA | Estimated % of SSA Population Infected | Estimated % Global Disease Burden in SSA |
|---|---|---|---|
| Hookworm | 198 million | 29%[a] | 34%[b] |
| Schistosomiasis | 192 million | 25% | 93% |
| Ascariasis | 173 million | 25%a | 21%[2b] |
| Trichuriasis | 162 million | 24%[a] | 27%[b] |
| Lymphatic filariasis | 46–51 million | 6%–9% | 37%–44%[c] |
| Onchocerciasis | 37 million | 5% | >99% |
| Active trachoma | 30 million | 3% | 48% |
| Loiasis | ≤13 million | 1%–2% | 100% |
| Yellow fever | 180,000 | 0.02% | 90% |
| Human African trypanosomiasis | 50,000–70,000 (17,000 new cases annually) | <0.01% | 100% |
| Leprosy | 30,055 (registered prevalence); 21,037 new cases in 2007 | <0.01% | 14% |
| Leishmaniasis (visceral) | 19,000–24,000 new cases annually in Sudan and Ethiopia | <0.01 | ND |
| Dracunculiasis | 9,585 | <0.01% | 100% |
| Buruli ulcer | >4,000 | <0.01% | 57% |

Moreover, as shown in Figure 1, these NTDs often overlap geographically. A significant proportion of the poorest populations often harbors more than one NTD [3, 40, 41]. These NTDs have severe socioeconomic consequences as they cause long-term illness, disfigurement, social stigma and marginalization, and decreased productivity [42, 43].

Seven of the above mentioned NTDs are preventable/treatable by an annual drug treatment and a number of the drugs are donated by their respective manufacturers. Onchocerciasis is treated with ivermectin (Mectizan®) which is donated by Merck, while LF, where it is co-endemic with onchocerciasis, is treated with a combination of ivermectin and albendazole, the latter drug being donated by GlaxoSmithKline. (Albendazole is also effective against STH though the donation program is only for treatment of LF.) The preferred treatment for trachoma is azithromycin (Zithromax®) which is donated by Pfizer. Mebendazole for STHs is donated by Johnson & Johnson that recently announced to quadruple the donation over the next five years. Praziquantel for schistosomiasis is available through limited donation program (Merck – Germany respectively) though the global demand is such that these relatively inexpensive drugs also need to be purchased to complement the donations. Refer to Annex 1 for treatment information for each disease.

## 2. Status of NTD Control

### 2.1 Vertical control programs

Prior to 2000, there were only a handful of successful national control programs for NTDs, such as LF [44, 45] and schistosomiasis [46, 47] control programs in China; schistosomiasis control programs in Brazil and Egypt [48, 49]; onchocerciasis control programs in sub-Saharan Africa through the Onchocerciasis Control Programme (OCP), and then the African Program for Onchocerciasis Control (APOC); and trachoma control programs in Morocco, Myanmar and other parts of Asia. In the rest of the developing world and for the other NTDs, there were virtually no sizeable control programs, except some small-scale projects on individual NTDs usually supported by international or non-governmental development organizations. In 2006, Morocco, announced the elimination of trachoma as a cause of blindness through their successful national control program employing the SAFE strategy to reduce transmission [50, 51]. In support of the Global Elimination of Blinding Trachoma by the year 2020 (GET 2020) and building on the success in Morocco, the International Trachoma Initiative (ITI) has been working with governmental and non-governmental partners, including HKI, to support the implementation of the SAFE strategy in 18 endemic countries through the donation of Zithromax® as the antibiotic (A) of SAFE.

For onchocerciasis, the most successful control program in sub-Saharan Africa has been OCP which virtually eliminated river blindness from the 15 countries first by vector control, then with the addition of delivery of Mectizan®, although onchocerciasis still existed in pockets in some of those countries at the end of that program. Onchocerciasis control was expanded to include areas of Africa outside the OCP zone with a second program, APOC, which continues to exist and is responsible for enabling over 90 million treatments annually for onchocerciasis in 19 participating countries. Since 2000, the Global Program to Eliminate Lymphatic Filariasis has delivered mass drug administration to 546 million people worldwide with the majority in Southeast Asia. In 2002, the Schistosomiasis Control Initiative (SCI) was established with support from the Bill & Melinda Gates Foundation, and has since delivered over 40 million treatments against schistosomiasis and many more against intestinal helminths in several sub-Saharan African countries.

### 2.2 Integrated control of NTDs by Preventive Chemotherapy

The success of vertical programs to control the individual NTDs in many countries has significantly raised awareness of these diseases within the international community and has demonstrated the feasibility of an integrated control strategy to more effectively achieve greater geographic and population coverage. An integrated preventive chemotherapy (PCT)

package was proposed focusing on LF, onchocerciasis, schistosomiasis, STHs, and trachoma which are amenable to drug treatment and for which many of the drugs are donated. The World Health Organization (WHO) has been at the forefront of setting the necessary technical guidelines for their control [52]. Summaries of the guidelines for LF, onchocerciasis, schistosomiasis, STHs, and trachoma are found in Annex 1. Overall, the goals for the control of these targeted diseases as set by WHO are:

- Elimination of LF and onchocerciasis through preventive chemotherapy
- Elimination of trachoma as a blinding disease by 2020 using the SAFE strategy (GET2020)
- Morbidity control for schistosomiasis and STHs through preventive chemotherapy

The last few years have seen a tremendous growth in interest and funding in the integrated control of NTDs, in particular, for LF, onchocerciasis, schistosomiasis, STHs and trachoma. To date, funds have been committed by the United States Agency for International Development (USAID), the British Department for International Development (DFID), the Bill & Melinda Gates Foundation, and other donors. With these funds, a number of countries, Burkina Faso, Burundi, Ghana, Haiti, Mali, Niger, Rwanda, Sierra Leone, Southern Sudan, Tanzania, and Uganda, have been implementing integrated national NTD control programs with assistance from international organizations and non-government development organizations (NGDOs). A few additional countries, Bangladesh, Cameroon, Democratic Republic of Congo, Guinea, and Nepal, have either just started or are about to start integrated national programs. However, there are many heavily endemic countries that have yet to start their integrated national NTD control programs, in particular, countries in sub-Saharan Africa, Angola, Côte d'Ivoire, Ethiopia, Mozambique, and Nigeria, which together with the Democratic Republic of Congo harbor the highest NTD prevalence and disease burdens in the region [4, 53].

Possible reasons for the countries currently not being able to start national integrated NTD control programs include:

- Insufficient political or social stability
- Insufficient political commitment
- Insufficient capacity of national NTD control teams
- Insufficient disease mapping
- Inadequate integrated national NTD control plans
- Insufficient external funding

It is foreseeable that expansion of integrated NTD control programs to those countries currently not yet covered will eventually occur. In 2009, US President Obama announced a new global health initiative with $63 billion over 6 years to address a range of global health problems including NTDs. The US Government has since steadily increased funding in NTD

control from $15 million per year during 2006-2008 to $25 million in 2009 and to $65 million for 2010. A further increase in budget approval has been requested for 2011. The UK government in 2008 announced a commitment of £50 million over 5 years towards NTD control and elimination. In 2009, a $34 million grant was also provided by the Bill & Melinda Gates Foundation to establish regional strategies and funding mechanisms and leverage new investments to control and/or eliminate NTDs by 2020. Once this extra funding has been mobilized and committed, it will provide opportunities for HKI to expand its NTD control programs.

## 3. HKI and NTD control

HKI has long supported control activities for several of individual NTDs, including onchocerciasis, trachoma, STHs and schistosomiasis, and more recently has undertaken integrated control activities in a number of countries in Africa. HKI's work in trachoma goes back to the mid 1950s with support to eliminate blinding trachoma in Taiwan and the agency was a key partner in the development of the SAFE strategy through its work in Tanzania in the 1980s and 1990s. This included the testing of Zithromax® demonstrating its effectiveness in the A component of the SAFE [51]. HKI was the first home of ITI, created by Pfizer and the Edna McConnell Clark Foundation (EMCF) to manage Pfizer's donation of Zithromax®. HKI has worked in Community-Directed Treatment with Ivermectin (CDTI) for onchocerciasis control since 1992 and is considered to be one of the leaders in the development of this strategy [54]. Mass distribution experience has expanded to include Zithromax® for treatment of trachoma, integration of de-worming into child health days/vitamin A supplementation days for children 12-59 months, integration of de-worming into school health programs, and integration of albendazole into CDTI for LF elimination.

Control of these NTDs fits into HKI's mission to "**combat the causes and consequences of blindness and malnutrition**". **Control of trachoma and onchocerciasis directly prevents blindness** [50, 55, 56]. **Controlling STHs and schistosomiasis has an impact on nutrition** as it is well documented that both are closely correlated with anemia and other forms of undernutrition, particularly among school age children and pregnant women [1, 39, 57, 58]. Chronic anemia in young children is associated with reductions in physical growth as well as impaired cognition and school performance, and also adversely affects future productivity and wage-earning potential. In pregnant women, anemia results in several detrimental outcomes for both the mother and her infant, including low birth weight, impaired milk production, and increased risk of maternal and infant mortality. Therefore, the anemia caused by NTDs has massive economic consequences in the developing world (see Box 1).

LF does not directly contribute to eye problems or malnutrition, but it does cause severe disfigurement and social stigma and marginalization. This greatly reduces the productivity of these individuals and their families [59, 60], which in turn leads to fewer available resources and possibly inadequate nutritional practices among families with infected household members. In communities where this disease is highly prevalent, the reduced productivity and subsequent nutritional problems can adversely impact on the communities. Treatment of LF with albendazole ± ivermectin also has a direct impact on STHs (related to anemia and other forms of undernutrition) and on onchocerciasis (related to blindness) [18, 61, 62]. An integrated NTD control program provides an excellent platform to expand the coverage to reach those in need. Although the list of targeted NTDs may continue to expand, HKI's primary focus will remain on the five most prevalent diseases for which there are proven, effective, safe treatment and prevention strategies and are linked to HKI's core commitment to combating blindness and malnutrition.

**Box 1. Key Facts**

- Hookworm: 37.7 million women of reproductive age in sub-Saharan Africa infected (6.9 million pregnant women) [1]
- Schistosomiasis: ~40 million women of reproductive age infected[6]
- Anemia: 57% pregnant women in Africa and 48% pregnant women in South East Asia [7]
- Maternal mortality: pregnant women with severe anemia 3.5 times more likely to die[8]
- IQ: 1.73 points lower for each 1.0 g/dl decrease in hemoglobin[9]
- Productivity: 1% drop for every 1% drop in hemoglobin [11]
- Loss: $50 billion in GDP annually in low-Estimates of Economic Losses from Iron Deficiency Anemia (Cognitive & Productive)[12]

### 3.1 Onchocerciasis

Since 1992, HKI has pioneered programs to sustainably control onchocerciasis. The organization's success was recognized in 2009 by the Arab Gulf Program for United Nations Development Organizations (AGFUND), which awarded HKI the first category of the International Prize for Innovative Human Development Projects for supporting developing countries' national policies and programs to control the disease [54]. HKI has implemented surveillance, education and treatment projects in ten onchocerciasis endemic countries – Burkina Faso, Cameroon, Côte d'Ivoire, the Democratic Republic of Congo, Guinea, Mali, Niger, Nigeria, Sierra Leone, and Tanzania. HKI has also assisted a number of other countries (for instance, Angola, Ethiopia, Equatorial Guinea, Liberia, Malawi and Sudan) through its work as part of the NGDO Group for Onchocerciasis Control and the Technical Consultative Committee for APOC. HKI's work to combat this blinding disease began in Cameroon in 1992. A major milestone was accomplished in 1995, when HKI and other non-governmental organizations successfully lobbied the World Bank to launch APOC. HKI worked closely with OCP throughout

much of West Africa for many years until it officially closed its operations in December 2002. After the closure of OCP, HKI's work was critical in re-establishing CDTI in war torn Sierra Leone and Côte d'Ivoire (where HKI was the only NGDO assisting the onchocerciasis program at the time). Since 1995, HKI has also worked with the Lions Club International Foundation (LCIF) in Cameroon and other NGDO partners to enable more than 6 million treatments to those who suffer from onchocerciasis.

Currently, HKI is supporting CDTI programs in Cameroon, Côte d'Ivoire, and Sierra Leone. In addition to supporting millions of treatments in these countries, HKI has trained tens of thousands of community-directed distributors and health professionals in CDTI. HKI also remains involved in Burkina Faso in the integrated distribution of ivermectin and albendazole for onchocerciasis and LF. Through its affiliate, HKI-Europe, in 2008 HKI was awarded a €1 million, 5-year grant from the European Union to work in partnership with the Government of Burkina Faso and Handicap International to expand this program. HKI has shared with local and global partners its considerable experience on the co-endemicity of onchocerciasis and loaiasis (a disease caused by infection with filarial parasite *Loa loa*), and the early detection and treatment of serious adverse events (SAEs)[1] [63, 64]. HKI pioneered the integration of other services into CDTI particularly vitamin A supplementation and primary eye care [65, 66]. This has led to the integration of the delivery of other commodities such as praziquantel for schistosomiasis control, and long-lasting insecticide-treated nets (for malaria). The use of CDTI as a delivery platform not only strengthens health systems by providing access to health care in the communities, but also strengthens and reinforces the CDTI system.

### 3.2 Trachoma

HKI has been working in trachoma since the mid-1950s, starting with the establishment of a pilot prevention program to assist Taiwan in its efforts to control and eliminate the disease. In the mid-1980s, with support from EMCF, HKI collaborated with John Hopkins University on determining why some families remained free of the disease while others were chronically afflicted in Tanzania [67]. This research led to community intervention trials for face-washing, the results of which ultimately factored into the conception of the four-pronged SAFE strategy, now formally endorsed by WHO. In 1996, with funding from EMCF and in collaboration with the Ministry of Health, HKI launched a pilot trachoma control program in Morocco with donated Zithromax® from Pfizer. The pilot demonstrated the effectiveness of Zithromax® and, more importantly, the feasibility of integrating it into a larger public health program – work that helped to refine the SAFE strategy. The pilot project's success influenced the decision made in

[1] Serious Adverse Events (SAE) are mainly associated with *Loa*-encephalopathy. This condition occurs following treatment with ivermectin (Mectizan®) for control of onchocerciasis especially in areas where heavy microfilarial infections with *Loa loa* are co-endemic with *Onchocerca volvulus* infections. The reactions can be severe and sometimes fatal.

1997 to create a non-profit organization, ITI, with grant commitments from Pfizer and EMCF of $3.2 million each as well as Zithromax® valued at $60 million.

In Asia, in addition to its earlier work in Taiwan, HKI began a trachoma control project in 1998 in Vietnam's northern Yen Bai Province, the area with the highest percentage of active disease. This eventually led to HKI extending this project, with government partners, into three trachoma-endemic provinces. The activities included rapid assessment of disease prevalence, training to identify trachoma cases, distribution of antibiotics (tetracycline ointment), and training in trichiasis surgery, as well as monitoring and evaluation. Although the program ended in 2002 due to lack of funds, it contributed to active trachoma being eliminated in Vietnam today, although trichiasis cases still exist. HKI also implemented innovative school health models in both Cambodia and Nepal over several years, which resulted in reduced prevalence of trachoma in the surrounding communities [68]. HKI has been instrumental in developing the National Trachoma Control strategy in Nepal, and continues to be an active member of this and the School Health Working Group.

In 2008, HKI received a 5-year, $5 million grant from the Conrad N. Hilton Foundation to assist Mali, Niger and Tanzania in achieving their national goals to eliminate trachoma as a blinding disease by their elimination dates of 2015 (Mali and Niger) and 2020 (Tanzania).

### 3.3 Lymphatic Filariasis

With the integration of the elimination of LF into the CDTI programs for onchocerciasis control, HKI started pioneering the addition of albendazole to the ivermectin already distributed for onchocerciasis into its projects in Burkina Faso and Cameroon. From 2003 until 2005, HKI assisted in the training of 2,226 community volunteers from 1,113 villages in Burkina Faso, reaching 100% geographical coverage and 86% therapeutic coverage in 2004. The project funded by the European Union, discussed above, includes a morbidity control component for LF which involves training afflicted people and their families to wash and care for their swollen body areas to prevent from secondary infections. In Cameroon, HKI assisted the Ministry of Health to pilot such an integrated drug delivery in the Far North region. The success of this pilot work led to the consolidation of the integrated national NTD control program funded by USAID through Research Triangle Institute (RTI) International.

Tanzania's national LF program began control activities in the Tanga Focus project area, where HKI was implementing CDTI for onchocerciasis control. To integrate the control activities in the overlapping areas, HKI provided technical support and funding for the training of the Community-directed Distributors for the integration, supervised the program with district onchocerciasis/LF and eye coordinators, helped with monitoring and evaluation and report writing, which led to the integration of activities in communities co-endemic with both diseases.

With funding from USAID through RTI International, since 2007 HKI has been assisting the Ministries of Health in Cameroon, Mali, and Sierra Leone in LF control as part of an integrated NTD control program, reaching full national coverage in Mali and Sierra Leone and scaling up in Cameroon.

### 3.4 Soil-Transmitted Helminthiasis

HKI is strongly involved in de-worming programs in sub-Saharan Africa, where we are focusing on 3 major target groups: children 12-59 months (primarily by including de-worming in large-scale vitamin A supplementation campaigns – e.g. "Child Health Days"); school children (as part of an integrated package of school health and nutrition interventions) and pregnant women (as part of a package of integrated anemia control e.g. iron/folate, de-worming, malaria control and food fortification). We are currently supporting the integration of de-worming with vitamin A supplementation programs or with Community-based Management of Acute Malnutrition (CMAM) programs in 10 countries of the region including Burkina Faso, Cameroon, the Democratic Republic of Congo, Guinea, Mali, Mozambique, Niger, Senegal, Sierra Leone and Tanzania, and anticipate expanding in additional program countries in the next two years. We are supporting integrated anemia control for pregnant women in four countries (Cameroon, Mali, Mozambique, Niger) in which de-worming plays an important role. HKI works in school health and nutrition in Burkina Faso and Mozambique, in which de-worming is a component, and we anticipate considerable expansion in this area. HKI's work in Burkina Faso has led to substantial scale-up to what will be an almost national-scale school health and nutrition program.

HKI has also been involved in promoting de-worming in the Asia Pacific region as part of an anemia reduction package in a number of countries including Bangladesh [69, 70], Cambodia, Indonesia and the Philippines. In Indonesia, several operational research activities have been undertaken that incorporated and assessed the added impact of de-worming for school aged girls and pregnant women on nutritional status (as part of an intervention package). Currently, HKI is working with the WHO Regional office to promote scale-up of Weekly Iron Supplementation for Women of Reproductive Age throughout the region, a strategy that includes annual de-worming.

### 3.5 Schistosomiasis

Of the target NTDs, HKI's experience in schistosomiasis control is growing rapidly. In the last few years, HKI started large scale schistosomiasis control with the implementation of the USAID-funded integrated programs in Cameroon, Mali and Sierra Leone [71] in which schistosomiasis control is an important element. As part of a 3-year project funded in Niger by the Danish Government in 1997 that focused on development of Information, Education and

Communication (IEC) capacity related to water-related diseases, HKI assisted in the development of IEC materials for schistosomiasis control.

### 3.6 Integrated control of NTDs

As summarized above, HKI is currently one of the major players in implementing integrated control strategies for NTDs in sub-Saharan Africa. Starting in 2007, HKI received USAID funding through RTI International to assist government partners in Mali, Sierra Leone, Cameroon and Guinea (soon to start) to implement integrated NTD control programs. Given HKI's long history in NTD control, across both regions, HKI is now in a unique position to expand its NTD control portfolio in a manner which enhances its eye health and nutrition portfolios and to take a greater global role in advocacy, program research, dissemination and implementation.

## Gaps and opportunities

The current major funding for the integrated NTD control programs focuses almost exclusively on the integrated mass drug administration for PCT. While this singular focus ignores a number of other components that are critical to the control and, in some cases, the elimination of these diseases, it provides HKI with a good opportunity to use its institutional strengths to bridge the gaps and broaden its role in the field of NTDs. Some areas in which HKI is well-positioned to respond or will be developing its capacity are as follows:

3.7 **Other disease control strategies**: The current funding overlooks the other possible measures critical to comprehensive disease control. Mass drug administration can achieve an immediate, and only short-term, impact on infections. For a long-term and sustainable impact, other measures, e.g. clean water supply, hygiene and sanitation, surgical treatment for extreme cases (e.g. eyelid surgery for trichiasis), snail management (which may not be realistic in Africa) and vector control, etc. must be addressed. A cross-cutting issue for all diseases is optimal behavior change communication strategies. More operations research is required to test impacts of key behavior change communication messages and approaches to support integrated disease control. See Annex 2 for summary of aspects of comprehensive control measures for each disease.

3.8 **Mapping**: There is still much mapping needed to be done to fully understand the breadth of the problem. This is particularly true for both schistosomiasis and trachoma. HKI can provide the necessary technical assistance to Ministries of Health and other NGDOs in the mapping of these diseases.

3.9 **School health**: School health is an essential element of NTD control particularly as the key target groups for schistosomiasis and STH are school age children. Schools provide a convenient mechanism for the delivery of praziquantel and albendazole (or mebendazole) especially in countries where school enrollment is over 70%. HKI has a long history of incorporating trachoma into school health and in several countries has developed comprehensive school health programs including de-worming. HKI will seek to expand its school health programs across its portfolio.

3.10 **Monitoring and evaluation**: Current NTD funding does not sufficiently emphasize monitoring and evaluation of the impact of MDA including morbidity reduction and reduction of undernutrition. Collection of such data is vitally important and the data would be strong evidence for further advocacy and community mobilization. It would also provide evidence for revising control and implementation strategies as the program goes on. There is a positive indication that such impact monitoring activities may be included in future new funding of national programs.

3.11 **Surveillance**: As greater successes in NTD control are achieved, establishing disease surveillance systems will be critical to ensure that low disease prevalence is maintained. HKI should work with Ministries of Health to set these systems up in the target countries providing the governments with the necessary technical assistance.

3.12 **Program sustainability**: The objective of the current major NTD funding is to assist countries to start up integrated national control programs, bring down the disease prevalence to a low level, and then allow the countries to sustain the control activities. However, given the financial situation in sub-Saharan African countries, it is not realistic and foreseeable for these countries to completely take this over without further external funding. HKI will work with countries and partners to develop concrete strategies that allow countries to sustain these integrated control programs. One important piece of this sustainability puzzle involves sustaining the role of the existing community drug distributors in CDTI by providing extra training to include additional drugs in their drug delivery pack.

3.13 **Advocacy**: More governments of developed countries and private donors are committing funds for integrated NTD control. This is good news for millions of poor families who are in desperate need. It needs to be realized, however, that the current level of funding may not be able to be maintained for the long term. Therefore there might be a danger of a new funding crisis after the current surge of interest. HKI will advocate to promote awareness and to encourage increased and sustained funding if gains in disease control are to be maintained and expanded. This could include encouraging donors to commit to long-term funding as well as encouraging recipient governments to include funding for

integrated NTD control in their annual budgets. One specific priority is to further the understanding of the links between NTD control and impact on undernutrition.

3.14 **Cross-border issues**: In sub-Saharan Africa, cross-border movement of populations, hence cross-country transmission of the NTDs, is very common. Successful control efforts in one country may be undermined if neighboring countries are not implementing control programs or are not maintaining adequate surveillance systems. HKI will advocate for regional approaches to disease control and cross border cooperation.

3.15 **Health system strengthening**: Integrated NTD control programs work synergistically with any given country's primary healthcare system. In order to achieve sustainable, long term health benefits, it is vital to integrate the NTD controls into the existing primary health care system where possible and to strengthen the infrastructure of the primary health system through such control programs. HKI will quantify the way in which its programs in Mali and Sierra Leone have strengthened the primary healthcare systems of each country, and can take a leading role in prioritizing this aspect of NTD control across sub-Saharan Africa.

## 4. HKI's approach and action plan

HKI's objective is to have integrated NTD control become central to its programming in virtually every country portfolio – particularly in sub-Saharan Africa. HKI's approach and strength has been to partner with government ministries, particularly of Health and Education, to provide technical assistance to the national disease control teams, and to build capacity within countries with the goal of scaling up and creating sustainable systems. To do this, HKI focuses on advocacy so that the Government recognizes and progressively takes on more responsibility for NTD control programs including allocating budgetary resources; capacity building to ensure that the knowledge and skills necessary to implement control programs are in place at every level of the health system; dissemination of information so that the Ministry of Health and partners are aware of the latest findings in disease control and can apply them to their own situation as appropriate; and resource mobilization so the necessary resources are available in the country to meet program objectives. Throughout this work, **HKI emphasizes the ownership of the disease control programs by the country and communities themselves.** This approach will provide a foundation for a long lasting NTD control effort within each country, and is essential if the NTD control programs are to be sustainable. **HKI will continue with this approach**.

Additionally, HKI has also partnered with many other organizations including WHO, The West African Health Organisation, The United Nations Children's Fund, SightSavers, CBM, ITI, The

Carter Center, and private donors including pharmaceutical companies that have donated medications. **HKI will continue to strengthen such partnerships and diversify the funding sources for NTD control**.

Another of HKI's strengths has been creating and disseminating high quality information, education and communication materials for both behavior change and advocacy. **HKI will build on this strength to get the right message across to target audiences, including political leaders, international communities, general public, and private donors, highlighting the difficulties – and vast potential – in controlling these diseases and emphasizing the long-term commitment needed from all parties**. HKI will work together with all its partners to advocate and encourage country governments to commit and invest more in their own NTD control programs.

HKI is well positioned to bring more attention to the positive impact that NTD control has on undernutrition and will leverage the agency's current integrated nutrition approach based on the Essential Nutrition Actions (ENA[2]) to further NTD control. Of the seven action areas under ENA, the control of anemia includes de-worming as a key focus. The details of the integrated ENA strategy are shown in Annex 3. HKI will take the lead to review these opportunities related to nutrition, prioritize appropriate research to fill evidence gaps and integrate these positive outcomes of NTD control into advocacy strategies.

Suggestions for HKI's future strategy in integrated NTD control are outlined below according to countries:

### 4.1 In countries where HKI is assisting with existing integrated control programs

In HKI's four existing integrated national NTD control programs (Cameroon, Guinea, Mali and Sierra Leone) HKI will continue to assist the countries in close collaboration with its program partners to:

- Advocate to the Ministry of Health and other governmental stakeholders the importance and need for continued national support for NTD control including increased governmental budgets

[2] The ENA framework aims to incorporate nutrition services into routine facility-based health care, using a life cycle-based approach to take advantage of all available contact points, and extending beyond the health system to deliver ENA through all available community groups and NGDO projects working in target zones. The seven action areas of ENA includes the promotion of optimal breastfeeding from birth to 24 months, optimal complementary feeding from 6 months onwards, adequate feeding and care of the sick child, control of vitamin A deficiency, control of anemia, optimal women's nutrition.

- Advocate to donors and governmental partners for funding to support NTD control components beyond just chemotherapy (e.g. sanitation, hygiene, behavioral change, surgery, morbidity management)
- Maintain HKI's position in the countries as the lead NGDO in NTD control by developing lessons learned, publishing results of program activities and taking the lead in mobilizing additional resources
- Continue to build in-country capacity through training in the various components of NTD control
- Complete national NTD mapping where necessary
- Increase coverage to all that are in need, and make sure the targets for epidemiological coverage and geographical coverage are achieved, as MDA coverage is crucial to the impact of PCT
- Advocate through school health curriculum and through general media to the public to promote public awareness of NTDs and public compliance in the programs
- Plan and conduct the monitoring and evaluation of the programs (coverage and impact)
- Advocate to the Ministry of Health and assist to set up surveillance systems to ensure no recrudescence of disease
- Seek other funding opportunities to complement the ongoing integrated NTD program, with a keen interest to adapt effective models for integrated delivery to the local context through operational research
- Plan exit strategies to sustain the national NTD control program

### 4.2 In countries where HKI is not assisting the existing integrated control programs

There are several countries that are implementing their integrated national NTD control programs with assistance from other organizations, but HKI is either not at all or only minimally involved. In such countries, HKI will:

- Actively engage in NTD control through advocacy efforts based on its demonstrated expertise from other countries, sharing its experience with governmental and non-governmental partners as to the situation in their country and the importance of responding to the problem
- Identify gaps in coverage or areas of need where HKI can work with partners to expand HKI's scope of working and country's program coverage through a landscape mapping of resources/stakeholders within the country

- Seek other funding opportunities to complement the ongoing integrated national NTD program, with a keen interest to adapt effective models for integrated delivery to the local context using HKI's successful experience in other countries

### 4.3 In countries where there is currently no integrated control program

There are many countries that are not yet supported to implement an integrated national NTD control programs as described above. As noted earlier, there are many possible reasons for this. Wherever possible, HKI will collaborate with the Ministry of Health to identify the gaps and obstacles, and work together with any potential partners to overcome these and to prepare the countries for developing and implementing their national NTD control programs. HKI will:

- Advocate to the in-country USAID Missions to increase the Missions' awareness of, and interest in, NTDs and to position HKI as a viable NTD partner.
- Identify and collaborate with potential partners on integrated NTD control programs
- Map resources/stakeholders within the country, including infrastructure, any existing projects and funding by whom and where, etc.
- Establish partnerships with the Ministry of Health to prepare/start the national NTD control programs, including assisting with the following:
    - Establishing national coordination of NTD control if needed
    - Undertaking epidemiological mapping of the NTDs within the country
    - Preparing integrated national NTD control plans
    - Identifying external funding sources
    - Preparing proposals and submitting applications
- Identify and seek complementary funding for NTD control in the countries

### 4.4 Dissemination and publications

HKI recognizes the importance of contributing to the body of literature addressing integrated NTD control and of sharing its experiences in program implementation with other agencies. A major thrust of HKI will be to work with national partners and other stakeholders to document the programs, distill the lessons learned and disseminate the relevant findings. Building on HKI's successful Nutrition News for Africa, HKI is partnering with the Liverpool Centre for Neglected Tropical Diseases to launch a monthly NTD News for Africa to provide key technical updates to the NTD control community throughout Africa.

## References


1. Brooker, S., P.J. Hotez, and D.A. Bundy, *Hookworm-related anaemia among pregnant women: a systematic review.* PLoS Negl Trop Dis, 2008. **2**(9): p. e291.
2. Molyneux, D.H., P.J. Hotez, and A. Fenwick, *"Rapid-impact interventions": how a policy of integrated control for Africa's neglected tropical diseases could benefit the poor.* PLoS Med, 2005. **2**(11): p. e336.
3. Hotez, P.J., et al., *Incorporating a rapid-impact package for neglected tropical diseases with programs for HIV/AIDS, tuberculosis, and malaria.* PLoS Med, 2006. **3**(5): p. e102.
4. Hotez, P.J. and A. Kamath, *Neglected tropical diseases in sub-saharan Africa: review of their prevalence, distribution, and disease burden.* PLoS Negl Trop Dis, 2009. **3**(8): p. e412.
5. Hotez, P.J., et al., *The neglected tropical diseases of latin america and the Caribbean: a review of disease burden and distribution and a roadmap for control and elimination.* PLoS Negl Trop Dis, 2008. **2**(9): p. e300.
6. Friedman, J.F., et al., *Schistosomiasis and pregnancy.* Trends Parasitol, 2007. **23**(4): p. 159-64.
7. WHO, *Worldwide prevalence of anaemia 1993-2005*. 2008, Geneva: World Health Organization.
8. Brabin, B.J., M. Hakimi, and D. Pelletier, *An analysis of anemia and pregnancy-related maternal mortality.* J Nutr, 2001. **131**(2S-2): p. 604S-614S; discussion 614S-615S.
9. Stoltzfus, R.J., L. Mullany, and R.E. Black, *Iron deficiency anaemia*, in *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. I.*, M. Ezzati, et al., Editors. 2004, World Health Organization: Geneva. p. 163-209.
10. Hotez, P.J., et al., *Control of neglected tropical diseases.* N Engl J Med, 2007. **357**(10): p. 1018-27.
11. Levin, H.M., et al., *Micronutrient deficiency disorders*, in *Disease Control Priorities in Developing Countries*, D.T. Jamison and W.H. Mosley, Editors. 1993, Oxford University Press: New York.
12. WorldBank, *Anaemia*, in *Public Health at a glance*. 2004.
13. Mathew, A.A., A. Turner, and H.R. Taylor, *Strategies to control trachoma.* Drugs, 2009. **69**(8): p. 953-70.
14. Cromwell, E.A., et al., *The excess burden of trachomatous trichiasis in women: a systematic review and meta-analysis.* Trans R Soc Trop Med Hyg, 2009. **103**(10): p. 985-92.
15. Wright, H.R., A. Turner, and H.R. Taylor, *Trachoma.* Lancet, 2008. **371**(9628): p. 1945-54.
16. Stingl, P., *Onchocerciasis: developments in diagnosis, treatment and control.* Int J Dermatol, 2009. **48**(4): p. 393-6.
17. Berger, I.B. and J. Nnadozie, *Onchocerciasis and other eye problems in developing countries: a challenge for optometrists.* J Am Optom Assoc, 1993. **64**(10): p. 699-702.
18. Ottesen, E.A., et al., *The global programme to eliminate lymphatic filariasis: health impact after 8 years.* PLoS Negl Trop Dis, 2008. **2**(10): p. e317.
19. *Lymphatic filariasis: the disease and its control. Fifth report of the WHO Expert Committee on Filariasis.* World Health Organ Tech Rep Ser, 1992. **821**: p. 1-71.
20. Hepburn, N.C., *Cutaneous leishmaniasis: an overview.* J Postgrad Med, 2003. **49**(1): p. 50-4.
21. Barrett, R., *Self-mortification and the stigma of leprosy in northern India.* Med Anthropol Q, 2005. **19**(2): p. 216-30.
22. Hartzell, J.D., et al., *Leprosy: a case series and review.* South Med J, 2004. **97**(12): p. 1252-6.
23. Pszolla, N., et al., *Buruli ulcer: a systemic disease.* Clin Infect Dis, 2003. **37**(6): p. e78-82.
24. Weir, E., *Buruli ulcer: the third most common mycobacterial infection.* CMAJ, 2002. **166**(13): p. 1691.

25. Fevre, E.M., et al., *The burden of human african trypanosomiasis.* PLoS Negl Trop Dis, 2008. **2**(12): p. e333.
26. Kennedy, P.G., *The continuing problem of human African trypanosomiasis (sleeping sickness).* Ann Neurol, 2008. **64**(2): p. 116-26.
27. Sanchez-Sancho, F., N.E. Campillo, and J.A. Paez, *Chagas Disease: Progress and New Perspectives.* Curr Med Chem, 2009.
28. Schofield, C.J., J. Jannin, and R. Salvatella, *The future of Chagas disease control.* Trends Parasitol, 2006. **22**(12): p. 583-8.
29. Basurko, C., et al., *Maternal and fetal consequences of dengue fever during pregnancy.* Eur J Obstet Gynecol Reprod Biol, 2009. **147**(1): p. 29-32.
30. Ong, A., et al., *Fatal dengue hemorrhagic fever in adults during a dengue epidemic in Singapore.* Int J Infect Dis, 2007. **11**(3): p. 263-7.
31. Kheir, M.M., et al., *Mortality due to schistosomiasis mansoni: a field study in Sudan.* Am J Trop Med Hyg, 1999. **60**(2): p. 307-10.
32. Southgate, V.R., et al., *Towards control of schistosomiasis in sub-Saharan Africa.* J Helminthol, 2005. **79**(3): p. 181-5.
33. Zhou, X.N., et al., *The public health significance and control of schistosomiasis in China--then and now.* Acta Trop, 2005. **96**(2-3): p. 97-105.
34. Hotez, P.J. and D.H. Molyneux, *Tropical anemia: one of Africa's great killers and a rationale for linking malaria and neglected tropical disease control to achieve a common goal.* PLoS Negl Trop Dis, 2008. **2**(7): p. e270.
35. King, C.H., K. Dickman, and D.J. Tisch, *Reassessment of the cost of chronic helmintic infection: a meta-analysis of disability-related outcomes in endemic schistosomiasis.* Lancet, 2005. **365**(9470): p. 1561-9.
36. Stephenson, L.S., *Helminth parasites, a major factor in malnutrition.* World Health Forum, 1994. **15**(2): p. 169-72.
37. Stephenson, L.S., M.C. Latham, and E.A. Ottesen, *Malnutrition and parasitic helminth infections.* Parasitology, 2000. **121 Suppl**: p. S23-38.
38. Bates, I., S. McKew, and F. Sarkinfada, *Anaemia: a useful indicator of neglected disease burden and control.* PLoS Med, 2007. **4**(8): p. e231.
39. Friedman, J.F., H.K. Kanzaria, and S.T. McGarvey, *Human schistosomiasis and anemia: the relationship and potential mechanisms.* Trends Parasitol, 2005. **21**(8): p. 386-92.
40. Raso, G., et al., *Multiple parasite infections and their relationship to self-reported morbidity in a community of rural Cote d'Ivoire.* Int J Epidemiol, 2004. **33**(5): p. 1092-102.
41. McKenzie, F.E., *Polyparasitism.* Int J Epidemiol, 2005. **34**(1): p. 221-2; author reply 222-3.
42. Conteh, L., T. Engels, and D.H. Molyneux, *Socioeconomic aspects of neglected tropical diseases.* Lancet, 2010. **375**(9710): p. 239-47.
43. Ehrenberg, J.P. and S.K. Ault, *Neglected diseases of neglected populations: thinking to reshape the determinants of health in Latin America and the Caribbean.* BMC Public Health, 2005. **5**: p. 119.
44. Sun, D.J., *[Global significance of the elimination of lymphatic filariasis in China].* Zhongguo Ji Sheng Chong Xue Yu Ji Sheng Chong Bing Za Zhi, 2005. **23**(5 Suppl): p. 329-31.
45. WHO, *Global programme to eliminate lymphatic filariasis.* Wkly Epidemiol Rec, 2008. **83**(37): p. 333-41.
46. Xianyi, C., et al., *Schistosomiasis control in China: the impact of a 10-year World Bank Loan Project (1992-2001).* Bull World Health Organ, 2005. **83**(1): p. 43-8.
47. Wang, L., J. Utzinger, and X.N. Zhou, *Schistosomiasis control: experiences and lessons from China.* Lancet, 2008. **372**(9652): p. 1793-5.

48. Katz, N., *Schistosomiasis control in Brazil.* Mem Inst Oswaldo Cruz, 1998. **93 Suppl 1**: p. 33-5.
49. Webbe, G. and S. el Hak, *Progress in the control of schistosomiasis in Egypt 1985-1988.* Trans R Soc Trop Med Hyg, 1990. **84**(3): p. 394-400.
50. West, S.K., *Blinding trachoma: prevention with the safe strategy.* Am J Trop Med Hyg, 2003. **69**(5 Suppl): p. 18-23.
51. Chami, Y., J. Hammou, and J. Mahjour, *Lessons from the moroccan national trachoma control programme.* Community Eye Health, 2004. **17**(52): p. 59.
52. WHO, *Preventive Chemotherapy in human helminthiasis*. 2006, Geneva: World Health Organization.
53. Fenwick, A., Y. Zhang, and K. Stoever, *Control of the Neglected Tropical Diseases in sub-Saharan Africa: the unmet needs* International Health, 2009. **1**(1): p. 61-70.
54. AGFUND. *AGFUND PRIZE Contributes in Rescuing 100 Million African from River Blindness*. 2008 [cited 2010 February 24 2010]; Available from: http://www.agfund.org/english/news_d.asp?id=182.
55. Burton, M.J., *Trachoma: an overview.* Br Med Bull, 2007. **84**: p. 99-116.
56. Thylefors, B. and M. Alleman, *Towards the elimination of onchocerciasis.* Ann Trop Med Parasitol, 2006. **100**(8): p. 733-46.
57. Brooker, S., et al., *Age-related changes in hookworm infection, anaemia and iron deficiency in an area of high Necator americanus hookworm transmission in south-eastern Brazil.* Trans R Soc Trop Med Hyg, 2007. **101**(2): p. 146-54.
58. Ezeamama, A.E., et al., *Functional significance of low-intensity polyparasite helminth infections in anemia.* J Infect Dis, 2005. **192**(12): p. 2160-70.
59. Perera, M., et al., *Neglected patients with a neglected disease? A qualitative study of lymphatic filariasis.* PLoS Negl Trop Dis, 2007. **1**(2): p. e128.
60. Person, B., et al., *Health-related stigma among women with lymphatic filariasis from the Dominican Republic and Ghana.* Soc Sci Med, 2009. **68**(1): p. 30-8.
61. Cline, B.L., et al., *Albendazole in the treatment of onchocerciasis: double-blind clinical trial in Venezuela.* Am J Trop Med Hyg, 1992. **47**(4): p. 512-20.
62. Moncayo, A.L., et al., *Impact of long-term treatment with ivermectin on the prevalence and intensity of soil-transmitted helminth infections.* PLoS Negl Trop Dis, 2008. **2**(9): p. e293.
63. *Report of a Scientific Working Group on Serious Adverse Events following Mectizan(R) treatment of onchocerciasis in Loa loa endemic areas.* Filaria J, 2004. **2 Suppl 1**: p. S2.
64. Haselow, N.J., et al., *Programmatic and Communication Issues in Relation to Serious Adverse Events Following Ivermectin Treatment in areas Co-endemic for Onchocerciasis and Loiasis.* Filaria J, 2003. **2 Suppl 1**: p. S10.
65. Haselow, N., M. Obadiah, and J. Akame, *The integration of vitamin A supplementation into Community-Directed Treatment with Ivermectin: a practical guide for Africa*. 2004, Helen Keller International.
66. Obadiah, M., et al., *Assessment of visual acuity and cataract by Community Drug Distributors of Ivermectin in Adamawa State, Nigeria.* International Ophthalmology, 2009(in press).
67. Taylor, H.R., et al., *Hygiene factors and increased risk of trachoma in central Tanzania.* Arch Ophthalmol, 1989. **107**(12): p. 1821-5.
68. Emerson, P.M., et al., *School-based health education and trachoma control in Nepal.* Bulletin of World Health Organization, 2010(Submitted for publication).
69. Sarkar, N.R., et al., *Effect of deworming on nutritional status of ascaris infested slum children of Dhaka, Bangladesh.* Indian Pediatr, 2002. **39**(11): p. 1021-6.
70. Hall, A. and C. Holland, *Geographical variation in Ascaris lumbricoides fecundity and its implications for helminth control.* Parasitol Today, 2000. **16**(12): p. 540-4.

71. Koroma, J.B., et al., *Mapping of Schistosomiasis and Soil-Transmitted Helminthiasis and Determination of Preventive Chemotherapy Strategies in the National Neglected Tropical Diseases Control Program, Sierra Leone.* PLoS NTDs, 2010(in preparation).

Annex 1 Recommended PCT treatment strategies for each of the following NTDs

- **Schistosomiasis**

| Endemic category | Prevalence in school survey | Treatment Strategy with Praziquantel (PZQ) |
|---|---|---|
| High-risk community | ≥50% infected (*S. mansoni*, *S. haematobium*, by parasitological methods) | Treat all school-age children (enrolled and not enrolled), once a year;<br>Treat community adults at high risk, from special groups to entire communities living in endemic areas, once a year; |
| Moderate-risk community | ≥10% but <50% infected (*S. mansoni*, *S. haematobium*, by parasitological methods) | Treat all school-age children (enrolled and not enrolled), once every two year;<br>Treat adults at high risk (special groups only) |
| Low-risk community | <10% infected (*S. mansoni*, *S. haematobium*, by parasitological methods) | Treat all school-age children (enrolled and not enrolled), twice during their primary education;<br>Access to praziquantel for passive treatment. |

- **Soil-transmitted helminth infections**

| Endemic category | Prevalence of any STH infection among school-age children | Treatment Strategy with Albendazole (ALB) / Mebendazole (MBD) |
|---|---|---|
| High-risk community | ≥ 50% | Treat all school-age children (enrolled and not enrolled), twice a year;<br>Also treat pre-school children, women of childbearing age, including pregnant women in the 2nd and 3rd trimester and lactating women, & adults at high risk |
| Low-risk community | ≥ 20% but < 50% | Treat all school-age children (enrolled and not enrolled), once a year<br>Also treat pre-school children, women of childbearing age, including pregnant women in the 2nd and 3rd trimester and lactating women, & adults at high risk |
| - | <20% | No PCT intervention, affected individuals should be dealt with on a case-by-case basis |

- **Lymphatic filariasis**

| Endemic category | Prevalence in Community survey | Treatment Strategy |
|---|---|---|
| LF (where Oncho is co-endemic) | ≥ 1% prevalence | Community treatment with **Ivermectin (IVM)** and **Albendazole**, once a year |
| LF (where no Oncho) | ≥ 1% prevalence | Community treatment with **diethylcarbamazine (DEC)** and **Albendazole**, once a year |

- **Onchocerciasis**

| Endemic category | Prevalence in Community survey | Treatment Strategy with **Ivermectin (IVM)** |
|---|---|---|
| Meso- and hyperendemic areas | ≥ 40% prevalence<br>or ≥ 20% palpable nodules | Community-directed treatment with ivermectin (CDTI), once a year |
| Hypoendemic areas | < 20% nodule prevalence | CDTI is not warranted; clinic-based ivermectin treatment may be provided to those infected |

- **Trachoma**

| Endemic category | Prevalence in 1-9 year olds in communities | Treatment Strategy with **Zithromax©** |
|---|---|---|
| Meso- and hyperendemic areas | ≥10% active disease (Trachomatous inflammation follicular (TF)) | Annual treatment for three years to the whole community; after three years, if prevalence ≥ 5% continue annual treatment until prevalence < 5% |
| Hypoendemic areas | <10% but ≥5% active disease (TF) | No antibiotic treatment but F & E components of SAFE strategy are advised for three years; after three years, if prevalence ≥ 5% then continue F & E until prevalence < 5%. |
| Hypoendemic areas | <5% active disease (TF) | A, F & E components of SAFE strategy are not a priority |

**Annex 2 Risk factors, comprehensive control measures and endpoint control targets for each of five major NTDs**

| Disease | Major factors for human infections | Comprehensive control measures | Endpoint targets of control |
|---|---|---|---|
| Onchocerciasis | • Parasites<br>• Black flies (transmitting infective larvae during blood feeding)<br>• Human activities (near black fly breeding sites) | • Treatment with ivermectin<br>• Health education for self protection<br>• Case management | • Elimination |
| Lymphatic filariasis | • Parasites<br>• Mosquitos (transmitting infective larvae during blood feeding)<br>• Poor sanitation (mosquito breeding sites)<br>• Human behaviour (without self protection) | • Treatment with albendazole plus ivermectin or diethylcarbamazine<br>• Self protection (bednet)<br>• Health education for behavioral change<br>• Hygiene & sanitation<br>• Case management | • Elimination as a public health problem worldwide by the year 2020 |
| Schistosomiasis | • Parasites<br>• Intermediate host snails in fresh water releasing infective larvae<br>• Poor hygiene and sanitation<br>• Human behaviour (water contact and defecating/urinating in/near water) | • Treatment with praziquantel<br>• Snail management<br>• Health education for behavioral change<br>• Hygiene & sanitation<br>• Clean water supply<br>• Hospitalization of severe cases | • Morbidity control |
| Soil-transmitted helminthiasis | • Parasites<br>• Poor hygiene and sanitation<br>• Human behaviour (passing eggs to the environment in feces, barefoot, not washing hands, etc) | • Treatment with albendazole or mebendazole<br>• Health education for behavioral change<br>• Hygiene & sanitation<br>• Clean water supply | • Morbidity control |
| Trachoma | • Bacteria<br>• Poor hygiene and sanitation<br>• Human behaviour (lack of facial washing) | • Treatment (A) with azithromycin<br>• Case management (S)<br>• Clean water supply for facial washing (F)<br>• Hygiene & sanitation (E)<br>• Health education for behavioral change | • Elimination as a blinding disease worldwide by the year 2020 |

**Annex 3 The Essential Nutrition Action Framework**

## The Essential Nutrition Actions, including in the context of HIV and AIDS

| Optimal Breastfeeding (< 6months) | Adequate complementary to breastfeeding (6-23 months) | Nutritional care of sick & malnourished child | Control of Vitamin A deficiency | Control of Anemia | Control of Iodine Deficiency Disorders | Women's nutrition during pregnancy and lactation |
|---|---|---|---|---|---|---|
| **Essential Nutrition Actions for HIV negative or unknown status pregnant/lactating women and their children** | | | | | | |
| √ Early initiation of breastfeeding within one hour of birth<br>√ Keep newborn warm and dry (skin to skin)<br>√ Exclusive breastfeeding during first 6 months | √ Complementary feeding starting at 6 months with mashed foods<br>√ Continued breastfeeding until 24 months or beyond<br>√ Increased amount of food with age<br>√ Increased feeding frequency with age<br>√ Enriched diet with variety of foods and fortified foods<br>√ Responsive feeding<br>√ Hand washing before feeding<br>√ Food hygiene | √ Increased frequency of breastfeeding during and after illness<br>√ Increased frequency of complementary feeding during and after illness (6-24 months)<br>√ Ready to Use Therapeutic Foods (e.g. PlumpyNut) for acute malnutrition<br>√ Zinc supplementation for child with diarrhea<br>√ Vitamin A supplementation as recommended<br>√ Special care for malnourished child depending on severity<br>√ Kangaroo care for low birthweight newborns | √ Diversified diet with Vit A rich foods (ripe orange/yellow vegetables & fruits, liver) and fortified foods<br>√ Vitamin A supplementation for woman after delivery<br>√ Vitamin A supplementation twice a year for children 6-59 months<br>√ Neonatal vitamin A supplementation (??) | √ Diversified diet with iron rich foods (red meat, dark green leafy vegetables) and fortified foods<br>√ Iron/folic acid supplementation daily during 6 months for pregnant woman (continuing after delivery, if needed)<br>√ Micronutrient powders (e.g. Sprinkles)<br>√ De-worming for pregnant women after 1st trimester and children 12-59 months twice/yr<br>√ Delayed cord clamping<br>√ In malaria endemic areas: sleep under Impregnated Treated Net, and for pregnant women Intermittent Presumptive Treatment | √ Iodized salt when available | √ One additional meal daily during pregnancy<br>√ Two additional meals daily during lactation<br>√ Breast health during lactation<br>√ Less workload and more rest during pregnancy |
| **Child spacing and immunization** | | | | | | |
| **Clean water, hygiene and sanitation** | | | | | | |

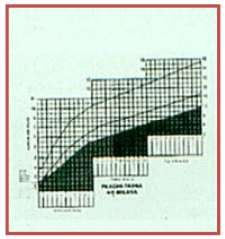
[1]

Developed by Agnes Guyon, Victoria Quinn and Robert Mwadime, Academy for Educational Development, 2006

# Six life cycle contact points to promote ENA

**PREGNANCY**: visits, iron/folic acid, de-worming, anti-malarial, diet, EBF, risk signs, FP, STI prevention, safe delivery, iodized salt

**POSTNATAL AND FAMILY PLANNING**: EBF, diet, iron/folic acid, diet, FP, STI prevention, child's vaccination



**WELL CHILD AND GM/P**: monitor growth, assess and counsel on BF and CF, iodized salt, check and complete vaccination, Vitamin A, De-worming

**DELIVERY/EARLY NEO-NATAL**: safe delivery, delay cord clamping, early BF & EBF, pp vitamin A, iron/folic acid, diet, FP, STI prevention


**IMMUNIZATION**: vaccinations, vitamin A, de-worming, BF, CF, assess and treat infant's anemia, FP, and STI referral


**CMAM/CTC & SICK CHILD**: assess and treat malnutrition per protocols, monitor growth, RUTF, counsel on BF & CF, assess and treat for anemia, check and complete vitamin A, ORS with zinc, Immunization/ de-worming