

# NEGLECTED TROPICAL DISEASES AND THEIR CONTROL IN UGANDA

## SITUATION ANALYSIS AND NEEDS ASSESSMENT

*April 2006*

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## EXECUTIVE SUMMARY

**Background:** Neglected tropical diseases (NTDs) are a group of 13 infections caused by parasitic worms, protozoa or bacteria. They strike the world's poorest people, living in remote and rural areas of low-income countries in Sub-Saharan Africa, Asia and the Americas, causing life-long disability, disfigurement, reduced economic productivity and social stigma. When expressed in disability-adjusted life years (DALYs), NTDs account for approximately one-quarter of the global disease burden from HIV/AIDS and for almost the same burden as malaria.

For the first time, international advocacy is drawing attention to the global NTD burden and to the fact that substantial improvements can be readily achieved at relatively low cost. Targeting this group of diseases is therefore widely promoted as a means to reaching some of the Millennium Development Goals (MDGs). As many of the NTD occur in the same geographical areas and, in some cases, can be treated with the same drug, there is potential for integration of control activities, both within this group of diseases as well as with other interventions.

Uganda is one of the Sub-Saharan countries affected by many NTDs, but also by HIV/AIDS, tuberculosis and malaria ('the big three'). To date, most of the attention and funding has been dedicated to the control of 'the big three', though NTD specific efforts have been made and led to considerable achievements during implementation of the Health Sector Strategic Plan I (HSSP I) from 2000/01 to 2004/05. However, for Uganda to have a better chance of reaching the MDGs, control efforts for NTDs will need to be stepped-up. This has been recognised in HSSP II, where specific targets for most of Uganda's endemic NTDs have been included. To reach these targets it is necessary to fully understand the epidemiology and control of infection and disease, and the advantages and shortcomings of present efforts to control NTDs. It will also require investigations into the potential of modified or new approaches to improve on the current situation. The present document aims to provide this information and, based on this, to suggest ways in which the Malaria Consortium (MC) could support national NTD control activities.

**Methods:** The information presented in this document is based on relevant publications, most of which were identified and provided by the Vector Control Division (VCD) of the Ministry of Health (MoH). These were supplemented by a literature search of the electronic online database PubMed (US National Library of Medicine, Bethesda, USA). Further searches were conducted by accessing the websites of the World Health Organization (WHO, <http://www.who.int/>) and using the web-based search engine GOOGLE (<http://www.google.com>). Additional non-peer reviewed and unpublished literature as provided by various MoH departments was examined for information related to the subject. Desk-based work was accompanied by regular meetings and e-mail exchanges with key contributors to discuss and clarify specific issues and to agree on which recommendations are the most relevant.

**Findings:** The NTDs of major public health and socio-economic importance in Uganda are soil-transmitted helminths (STH), schistosomiasis, lymphatic filariasis (LF) and onchocerciasis. Control programmes for these are housed in VCD and with external funding have achieved considerable successes over the years. What is needed now is further financial support to continue implementation and to scale it up where required. In this context it will be necessary to investigate the feasibility and potential benefits of delivering some or all of the interventions for these diseases as an integrated package in areas of geographical overlap. Another NTD for which a control programme is well established is Human African Trypanosomiasis (HAT). Though it causes a comparatively low burden of disease in Uganda, the current danger lies in the ongoing spread of the rhodesiense form of the disease, due to uncontrolled cattle movement. This has resulted in a number of outbreaks and could soon result in the overlap of the two HAT forms,

which would have important implications for patient care and national control policy. Financial support is required to implement control measures and to monitor the disease dynamics.

The importance of some other NTDs in Uganda remains as yet less clear. Visceral leishmaniasis (VL), trachoma, Buruli ulcer and podoconiosis are known to be endemic in some districts, but detailed data on the associated burden is lacking. For VL and trachoma, multi-sectoral initiatives are underway to better describe them. Once results from these studies become available, further funding will be necessary to scale-up interventions. Buruli ulcer has not benefited from any activities to improve on the understanding of its distribution and impact in Uganda. As a first step it will be necessary that the MoH identifies a department and a focal point that take responsibility for it. Subsequently, a funding proposal needs to be developed to conduct a national case search and to determine the epidemiological characteristics of the disease. Areas at risk of podoconiosis have been suggested on the basis of geography and climate, but most of them remain to be verified. Though it is a debilitating disease and causes stigma, it is of comparatively low priority and presently unlikely to attract financial support to conduct the surveys that would be necessary to target prevention and control.

As a result of sustained control efforts, the remaining NTDs present in Uganda, leprosy and guinea worm, occur at such low prevalences that existing control programmes can readily address them. Though ongoing surveillance is required, it is presently not envisaged that additional implementing partners would be able to make a significant contribution towards their control.

Current shortcomings in ongoing NTD control are largely attributable to lack of funding. Given the considerable technical expertise in country, disease-specific technical support has so far been less important than financial support and has often already been provided ad-hoc by institutions outside Uganda. However, with the envisaged move to integrated control of some NTDs in areas of geographical overlap, technical in-country support, particularly to VCD, is likely to become more important.

**Conclusion:** For the MC to get involved in NTD control, the entry point is to partner with VCD and other institutions (e.g. Imperial College, Danish Bilharziasis Laboratory (DBL)) in the development of funding proposals to design, implement and evaluate a NTD control package (or packages). Depending on the needs of VCD, the role of the MC in the partnership could be the provision of in-country technical support, by seconding a full or part-time technical advisor to VCD, and/or to become a strong implementing partner in rolling-out the proposed control package(s). Specific expertise of MC staff and logistic support could supplement the existing expertise and control capacity of VCD to provide stronger implementation. Technical support could be extended to include all diseases housed within VCD (i.e. be extended to HAT, VL and Buruli ulcer, if responsibility for the latter is given to VCD).

Involvement in work on trachoma should presently only be explored if the MC can secure funding for district-wide surveys. The Trachoma Task Force does not seem to require additional support in the implementation of survey activities in selected initial districts that are already funded. Once results from ongoing surveys become available there may be opportunities to get involved in the delivery of the national control strategy. However, this should only be considered in areas where this could easily be incorporated into existing MC activities and if funding was readily available.

## UGANDA'S NEGLECTED DISEASES AT A GLANCE

Parasite	Disease (Common Name)	Etiologic Agent	Distribution*	Burden
Protozoan	Visceral Leishmaniasis (Kala-Azar)	<i>Leishmania donovani</i>	Pokot County, Nakapiripirit district (NE Uganda)	Unknown; > 400 cases treated per year, 70% from Kenya
	Human African Trypanosomiasis	<i>Trypanosoma gambiense</i>	NW Uganda, predominantly in Adjumani, Moyo, Arua & Yumbe district	In 2004, 354 cases were reported
		<i>T. rhodesiense</i>	SE and E Uganda	In 2005, 154 cases and 7 deaths were reported
Bacterial	Trachoma	<i>Chlamydia trachomatis</i>	15 districts (based on HMIS records)	Unknown
	Buruli ulcer	<i>Mycobacterium ulcerans</i>	Unknown	Unknown
	Leprosy	<i>Mycobacterium leprae</i>	Eliminated as public health problem	2.5 new cases / 100,000 population (2004)
Helminth (Worms)	Soil Transmitted Helminths (Common Intestinal Worms)	<i>Ascaris lumbricoides</i> (Roundworm)	SE Uganda	80% prevalence
		<i>Trichuris trichiura</i> (Whipworm)	Whole of Uganda	6.3% prevalence
		Hookworm	SE Uganda	80% prevalence
		(Species in Uganda unconfirmed)	Whole of Uganda	5.0% prevalence
	Lymphatic filariasis (Elephantiasis)	<i>Wuchereria bancrofti</i>	Throughout Uganda (prevalence lower in NE)	53.5% prevalence
	Onchocerciasis (River Blindness)	<i>Onchocerca volvulus</i>	North of Victoria Nile and in W Uganda	13.9 million at risk 0.4 – 30.7% CFA prevalence in school children > 2 million at risk
	Dracunculiasis (Guinea Worm)	<i>Dracunculus medinensis</i>	21 districts; highly endemic in West Nile region, central shores of Lake Albert, Mt Elgon & foci in SW Uganda	1.36 million infected
	Schistosomiasis (Bilharziasis)	<i>Schistosoma haematobium</i>	Eliminated as public health problem	Eliminated
		<i>S. mansoni</i>	Districts on northern shores of Lake Kyoga	Approx. 4 million cases 16.7 million at risk
N/A	Podoconiosis (Non-Filarial Elephantiasis)	Crystalline blockage of the limb lymphatics	38 districts	
			Unknown, to date only documented in Kwen Country, Kapchorwa district and in Kisoro & Kamwenge district	4.5% prevalence in study area

\*The number of districts quoted here and elsewhere in the document refers to the number prior to recent administrative changes that have divided some of the previous districts

## ACRONYMS

ACT	-	Artemisinin-based Combination Therapy
ALB	-	Albendazole
APOC	-	African Programme for Onchocerciasis Control
CDD	-	Community Drug Distributor
CDTI	-	Community-Directed Treatment with Ivermectin
CFA	-	Circulating Filarial Antigens
CHDs	-	Child Health Days
CORP	-	Community Owned Resource Person
DALY	-	Disability-Adjusted Life Year
DANIDA	-	Danish International Development Agency
DBL	-	Danish Bilharziasis Laboratory
DDHS	-	District Director of Health Services
DEC	-	Diethylcarbamazine
DOTS	-	Directly Observed Therapy (in the treatment of Tuberculosis)
DVCO	-	District Vector Control Officer
DHE	-	District Health Educator
FAO	-	Food and Agriculture Organisation
GFATM	-	Global Fund to Fight AIDS, Tuberculosis and Malaria
GIS	-	Geographical Information Systems
HAT	-	Human African Trypanosomiasis
HBMF	-	Home-Based Management of Fever
HMIS	-	Health Management Information System
HSSP	-	Health Sector Strategic Plan
IDP	-	Internally Displaced Person
IEC	-	Information, Education and Communication
IRS	-	Indoor Residual Spraying
ITN	-	Insecticide-Treated Net
IVN	-	Ivermectin
KAP	-	Knowledge, Attitude, Practice
KHHRA	-	Katakwi Health and Human Rights Association
LEV	-	Levamisole
LQAS	-	Lot Quality Assurance Technique
LSHTM	-	London School of Hygiene & Tropical Medicine
LF	-	Lymphatic Filariasis

MC	-	Malaria Consortium
MDA	-	Mass Drug Administration
MDG	-	Millennium Development Goal
MDP	-	Mectizan Donation Program
MEB	-	Mebendazole
MSF	-	Médecins Sans Frontières
MoH	-	Ministry of Health
NGO	-	Non-Governmental Organization
NMCP	-	National Malaria Control Programme
NTD	-	Neglected Tropical Disease
OCP	-	Onchocerciasis Control Programme
PELF	-	Programme for Elimination of Lymphatic Filariasis
PHC	-	Primary Health Care
PPP	-	Public-Private Partnership
PZQ	-	Praziquantel
PYR	-	Pyrantel pamoate
REMO	-	Rapid Epidemiological Mapping of Onchocerciasis
SCI	-	Schistosomiasis Control Initiative
STH	-	Soil-Transmitted Helminths
TB	-	Tuberculosis
UNDP	-	United Nations Development Programme
UNICEF	-	United Nations Children's Fund
USAID	-	US Agency for International Development
VCD	-	Vector Control Division (of the Ministry of Health)
VL	-	Visceral Leishmaniasis
WHO	-	World Health Organization

## **ACKNOWLEDGEMENTS**

The writing of this document was led by myself, Jan Kolaczinski, but depended largely on the information provided by staff of the Ministry of Health of Uganda. I would like to thank all who gave-up their valuable time to assist me in compiling this information and in the stimulating discussions that we had along the way. Specifically I would like to thank Dr Narcis Kabaterine for the facilitation of information sharing and meetings at VCD, for 'keeping the ball rolling' and for input on schistosomiasis and STH. Also of great assistance on specific diseases were Dr Ambrose Onapa, Dr Richard Ndyomugenyi, Dr Abbas Kakembo, Dr Stanley Bubikiri, Dr Kawuma and Gabriel Matwale. Continuing comments and inputs from all the main contributors when they reviewed the various drafts of this document were exceptionally helpful, as were the comments and suggestions of Dr Andrew Collins and Dr Graham Root. Valuable input on document structure and content was provided by Simon Brooker, who also provided most of the maps.

# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b>	<b>I</b>
<b>UGANDA'S NEGLECTED DISEASES AT A GLANCE</b>	<b>III</b>
<b>ACRONYMS</b>	<b>IV</b>
<b>ACKNOWLEDGEMENTS</b>	<b>V</b>
<b>1. INTRODUCTION</b>	<b>1</b>
<b>2. THE NEGLECTED TROPICAL DISEASES OF UGANDA</b>	<b>2</b>
<b>2.1 LEISHMANIASIS</b>	<b>2</b>
2.1.1 BACKGROUND	2
2.1.2 LEISHMANIASIS AND ITS CONTROL IN UGANDA	2
2.1.3 CONTACT PERSON	3
<b>2.2 HUMAN AFRICAN TRYPANOSOMIASIS</b>	<b>4</b>
2.2.1 BACKGROUND	4
2.2.2 HUMAN AFRICAN TRYPANOSOMIASIS AND ITS CONTROL IN UGANDA	4
2.2.3 CHALLENGES FOR THE NATIONAL CONTROL PROGRAMME	5
2.2.4 CONTACT PERSON	6
<b>2.3 SOIL TRANSMITTED HELMINTHS</b>	<b>7</b>
2.3.1 BACKGROUND	7
2.3.2 SOIL TRANSMITTED HELMINTHS AND THEIR CONTROL IN UGANDA	7
2.3.3 CHALLENGES FOR THE NATIONAL CONTROL PROGRAMME	9
2.3.4 CONTACT PERSON	9
<b>2.4 SCHISTOSOMIASIS</b>	<b>10</b>
2.4.1 BACKGROUND	10
2.4.2 SCHISTOSOMIASIS AND ITS CONTROL IN UGANDA	10
2.4.3 CHALLENGES FOR THE NATIONAL CONTROL PROGRAMME	12
2.4.4 CONTACT PERSON	12
<b>2.5 LYMPHATIC FILARIASIS</b>	<b>13</b>
2.5.1 BACKGROUND	13
2.5.2 LYMPHATIC FILARIASIS AND ITS CONTROL IN UGANDA	14
2.5.3 CHALLENGES FOR THE NATIONAL CONTROL PROGRAMME	15
2.5.4 CONTACT PERSON	16
<b>2.6 ONCHOCERCIASIS</b>	<b>17</b>
2.6.1 BACKGROUND	17
2.6.2 ONCHOCERCIASIS AND ITS CONTROL IN UGANDA	18
2.6.3 CHALLENGES FOR THE NATIONAL CONTROL PROGRAMME	20
2.6.4 CONTACT PERSON	20
<b>2.7 BURULI ULCER</b>	<b>20</b>
2.7.1 BACKGROUND	20
2.7.2 BURULI ULCER AND ITS CONTROL IN UGANDA	21
<b>2.8 OTHER NEGLECTED TROPICAL DISEASES</b>	<b>22</b>
2.8.1 LEPROSY	22
2.8.2 DRACUNCULIASIS (GUINEA WORM)	23
2.8.3 TRACHOMA	24
2.8.4 PODOCONIOSIS (NON-FILARIAL ELEPHANTIASIS)	25
<b>3. PARTNERSHIPS</b>	<b>26</b>

<b>3.1 INSTITUTIONAL PARTNERSHIPS</b>	<b>26</b>
<b>3.2 PUBLIC-PRIVATE PARTNERSHIPS</b>	<b>27</b>
<b>4. INTEGRATED CONTROL</b>	<b>28</b>
<b>4.1 BACKGROUND</b>	<b>28</b>
<b>4.2 INTEGRATED CONTROL OF NEGLECTED DISEASE IN UGANDA</b>	<b>28</b>
<b>4.3 POSSIBLE PACKAGES OF INTEGRATED CONTROL TOOLS</b>	<b>29</b>
<b>5. CONCLUSION</b>	<b>31</b>
<b>5.1 DISEASE SPECIFIC</b>	<b>31</b>
<b>5.2 SUPPORT SPECIFIC</b>	<b>31</b>
<b>6. RECOMMENDATIONS</b>	<b>33</b>
<b>6.1 GENERAL RECOMMENDATIONS</b>	<b>33</b>
<b>6.2 RECOMMENDATIONS SPECIFIC TO THE MALARIA CONSORTIUM</b>	<b>34</b>
<b>7. REFERENCES</b>	<b>35</b>
<b><u>ANNEX 1: BROAD-SPECTRUM EFFECTS OF ANTHELMINTICS</u></b>	<b><u>41</u></b>
<b><u>ANNEX 2: SUMMARY OF APPROVED PREVENTATIVE SCHEDULES FOR HELMINTHIC DISEASES</u></b>	<b><u>42</u></b>
<b><u>ANNEX 3: SUMMARY OF PREVENTATIVE SCHEDULES FOR HELMINTHIC DISEASES THAT ARE UNDER DISCUSSION</u></b>	<b><u>43</u></b>



## 1. INTRODUCTION

Most resources dedicated to improving the health of the world's poor are justifiably directed towards fighting the three most devastating diseases, HIV/AIDS, tuberculosis and malaria. Prominent partnerships and initiatives are now devoted to these 'big three' and have managed to raise considerable funds and awareness (Hotez *et al.* 2006a). However, an equal amount of advocacy for the control of a group of diseases that exclusively affect the poor in rural and impoverished urban areas of low-income countries has been conspicuously absent.

The most important of these 'neglected tropical diseases' (NTDs) are three vector-borne protozoan infections – leishmaniasis, human African trypanosomiasis (HAT) and Chagas disease; three bacterial infections – trachoma, leprosy and Buruli ulcer; and seven helminth infections – hookworm, ascariasis, trichuriasis, lymphatic filariasis (LF), onchocerciasis, guinea worm and schistosomiasis (Hotez *et al.* 2006b).

Uganda, as most other developing countries, is affected by a high burden of infectious and parasitic diseases, most of which are readily preventable and/or treatable. Many of these endemic diseases fall into the category of NTDs. The ones that have been reported in Uganda are visceral leishmaniasis (VL, also called kala-azar), HAT, trachoma, leprosy, Buruli ulcer, soil-transmitted helminth infections (STH, i.e. hookworm, ascariasis and trichuriasis), podoconiosis, LF, onchocerciasis, dracunculiasis and schistosomiasis. The populations affected by them are largely poor and marginalized with limited access to health care. These features explain, at least in part, their relative neglect by the public health community despite the availability of cost-effective tools and proven strategies for their control. Encouragingly, in Uganda NTDs already received some attention during the implementation of the Ugandan Ministry of Health's (MoH) Health Sector Strategic Plan I (HSSP I) from 2000/01 to 2004/05 and further emphasis on the eradication or elimination of most of them is given in the current HSSP II (MoH 2005). The current environment of increasing international attention to the control of NTDs (Molyneux *et al.* 2005, Hotez *et al.* 2006a, Vogel 2006, Sachs & Hotez 2006) provides a good opportunity for Uganda to secure adequate resource to improve on current efforts and to realise its plans.

The aim of this document is to conduct a situation analysis of the burden and control of Uganda's NTDs and to provide specific recommendations on how the Malaria Consortium (MC) can respond to NTDs and thus contribute to putting HSSP II into practice. To set the scene, each disease is introduced in general, followed by national specifics on its distribution, burden, history of control and current needs. The potential for new approaches to improve on existing national initiatives is explored.

## 2. THE NEGLECTED TROPICAL DISEASES OF UGANDA

### 2.1 Leishmaniasis

#### 2.1.1 Background

**The parasite and its life-cycle:** The leishmaniasis are a group of diseases caused by over 17 species of the protozoan *Leishmania* parasite. Infection is transmitted by the bite of phlebotomine sandflies and results in cutaneous, mucosal or visceral manifestations.

**Disease burden:** In terms of global disease burden, the leishmaniasis are the third most important vector-borne disease (after malaria and lymphatic filariasis), responsible for an estimated 2.1 million DALYs and 51000 deaths annually (WHO 2004a). These figures are thought to be an underestimate, as only 40 of 88 endemic countries consider leishmaniasis a reportable disease (Croft *et al.* 2003).

**Geographical distribution:** Much of the disease burden due to the leishmaniasis in Africa is concentrated in East Africa. Here, VL or 'kala-azar' is endemic in remote regions of Uganda, Sudan, Ethiopia and Kenya. In this part of the world it is caused by *Leishmania donovani*.

**Clinical features:** VL is characterised by fever, hepatosplenomegaly, and cachexia (wasting and weakness). Up to 90% of untreated cases eventually die due to organ failure, anaemia or secondary infections (Desjeux 1996).

**Control options:** Classically the diagnosis of VL is confirmed by demonstration of the parasite. Intracellular leishmania can be identified from aspirates of the spleen, bone marrow, lymph node or liver. Diagnostic yield with this method is highest, but there are contraindications, precautions are necessary and complications, though rare, may be serious (Guerin *et al.* 2002). Serological techniques (enzyme-linked immunosorbent assay, direct agglutination test and immunochromatographic strips) have been developed for field use. PCR is still not easily useable in the field.

Efficient case management is the key to limit morbidity and to prevent mortality. Effective treatment, mainly using antimonial drugs, is also a measure to control reservoir and transmission. In addition, vector control should be implemented where feasible. Insecticides used for malaria control are also effective against leishmaniasis vectors. To set up an effective control strategy for visceral leishmaniasis is a challenge in endemic areas, as these are largely in the poorest countries of the world, in remote places and/or in complex settings (e.g. civil war in Sudan). Personal protection by use of insecticide-treated nets (ITNs) is possible in foci where sandflies bite at night. One major limitation has been the cost of regular re-impregnation of the nets, which is being overcome through development of nets with long-lasting insecticide impregnation. Whether ITNs are an effective method of prevention in nomadic people remains to be shown. Vaccines are being investigated, but none is yet ready for use.

#### 2.1.2 Leishmaniasis and its control in Uganda

In Uganda, VL is transmitted by the sandfly vector *Phlebotomus martini* and transmission is thought to be anthroponotic (humans are the sole reservoir). However, studies elsewhere have detected *L. donovani* in dogs and goats (e.g. Mukhtar *et al.* 2000, Dereure *et al.* 2003), and the possibility that these may also play a role in transmission in Uganda can presently not be excluded. The disease has only been reported in Pokot County, which forms part of the north-eastern district of Nakapiripirit; however, the extent of the problem elsewhere in Uganda is presently unknown. Pokot County is a semi-arid area lying between mountains at an altitude of 1000 – 1500 metres. It is the extension of an endemic focus from West Pokot district in Kenya, which has similar climatic conditions (Sondorp 1999, Mueller *et al.* 2005). Termite mounds are a dominant feature of the area and form the main breeding and resting site for the sandfly vector (Stevenson 2004).

The area is mainly inhabited by the Pokots, a semi-nomadic tribe of pastoralists. Members of the tribe move back and forth between Uganda and Kenya depending on local security and the availability of food and water for their livestock. Women and children often remain in semi-permanent camps (*manyatas*) with the men moving around with the livestock. According to the last census there are about 60,000 inhabitants in Pokot County (Uganda) and 220,000 in West Pokot district (Kenya). Nakapiripirit district and its population is one of the most underserved, vulnerable populations of Uganda (along with the internally displaced persons living in camps in the North). In the most recent health sector report for Uganda, the district was amongst the 10 worst performing in the health league table.

VL was first described in Uganda in 1946, but received little attention until 1997 when Médecins Sans Frontières (MSF) started to provide assistance to Amudat Health Centre in Pokot County. Soon it was realised that VL was endemic and antimonial treatment was made available. Following a VL assessment (Sondorp 1999), MSF initiated a control programme in 2000, focusing on case detection and drug treatment. Over the years, a diagnostic algorithm has been developed and diagnostic methods have been evaluated and amended (Chappuis *et al.* 2005). From January 2002 until May 2005 a total of 1422 VL cases from both Uganda and Kenya had been treated. 48% of these cases were between 5 and 15 years old and 70% were male. Approximately 70% of the patients had come from Kenya to obtain treatment. The number of patients treated is increasing and has more than doubled since 2000. The actual burden of VL in the local population is unknown, but studies elsewhere have shown 30-100 sub-clinical infections for every overt case of VL.

To date, no preventative component has been developed, because information on vector behaviour and risk factors is limited, and it is unclear which potential interventions are appropriate in the given context. To guide the development of such component and to provide answers to some of the most urgent questions on the epidemiology and control of VL in Uganda, the Sir Halley Stewart Trust is funding a collaborative project implemented by the Vector Control Division (VCD) of the MoH, the London School of Hygiene & Tropical Medicine (LSHTM), MSF and the MC. Implementation started in March 2006 and will continue over two years.

No specific targets or interventions to control VL in the Pokot tribe have been identified by the Ugandan MoH in HSSP II. However, the document mentions that specific action will be taken to address the health needs of nomadic people in Karamoja district and other parts of the country. Most relevant in this context is the strategy of 'develop(ing) appropriate health service delivery models for populations with peculiar health needs by adapting HSSP norms to the region's needs for the UNMHCP (Uganda National Minimum Health Care Package) and its support systems namely: Health Infrastructure, Human Resources, Essential Drugs Medicines and Supplies, Diagnostic Services, and Information for Decision Making' (MoH 2005).

### **2.1.3 Contact person**

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## 2.2 Human African Trypanosomiasis

### 2.2.1 Background

HAT, also known as sleeping sickness, is a severe disease that is fatal if left untreated.

**The parasite and its life cycle:** HAT is caused by protozoan parasites of the genus *Trypanosoma*, which is transmitted between infected humans and animals by tsetse flies (*Glossina spp.*) and enters the blood stream during blood feeding. Two species of *Trypanosoma* cause HAT, *Trypanosoma brucei rhodesiense* and *T. b. gambiense*.

**Disease burden:** HAT occurs in both epidemic and endemic patterns across more than 200 foci throughout Sub-Saharan Africa. Latest WHO estimates put the number of cases at 300,000 to 500,000, with 100,000 dying every year ([www.who.int/mediacentre/factsheets/fs259/en/](http://www.who.int/mediacentre/factsheets/fs259/en/)). The extrapolated estimates are somewhat imprecise, since less than 10% of the population at risk of HAT (about 60 million people) is under surveillance (Barrett *et al.* 2003). In terms of DALYs lost, HAT ranks third among parasitic diseases, behind malaria and lymphatic filariasis and ahead of leishmaniasis, schistosomiasis and onchocerciasis.

**Geographical distribution:** *T. b. rhodesiense* occurs mainly in east and southern Africa, while *T. b. gambiense* mainly occurs in west and central Africa. Antelopes, hyenas, lions, sheep and cattle can serve as a reservoir for *T. b. rhodiense* (zoonosis), whereas humans are the only known reservoir for *T. b. gambiense*. In animals, many other *Trypanosoma* species are known to cause Trypanosomiasis, also called Nagana, next to *T. b. rhodiense*.

**Clinical features:** Once inside the human host, trypanosomes multiply and invade most tissues. Infection leads to malaise, lassitude and irregular fevers. Early symptoms, including fever and enlarged lymph glands and spleen, are more severe and acute in *T. b. rhodesiense* infections. Early signs are followed by a range of symptoms including headache, anaemia, joint pains, swollen tissues and a primary chancre; advanced symptoms include neurological and endocrine disorders. As the parasites invade the central nervous system, mental deterioration begins, leading to coma and death. *T. b. rhodesiense* infection is usually acute, causing severe symptoms and death within a few days or weeks. *T. b. gambiense* infection tends to progress more slowly (over several years) and is less severe.

**Control options:** Control of *T. b. gambiense* involves active case-finding and screening of the population with the card-agglutination test; for *T. b. rhodesiense* passive case-finding, based on clinical algorithms, is recommended because diagnostic tools are not readily available. Treatment of infected people has always been difficult and expensive, as few effective drugs are available and it requires specialised administration of drugs and long period of hospital care (Legros *et al.* 2002). In addition, reduction of tsetse fly numbers can play a significant role, especially against the rhodesiense form of the disease. In the past, this has involved extensive clearance of bush to destroy tsetse fly breeding and resting sites, and widespread application of insecticides. More recently, efficient traps and screens have been developed that can keep tsetse populations at low levels. However, this method has proven difficult to sustain for various reasons, including physical degradation, damage, theft and lack of education in use of the traps (Kuzoe *et al.* 2005).

### 2.2.2 Human African Trypanosomiasis and its control in Uganda

Uganda is the only country where endemic foci of both forms of HAT are known to occur. Both sub-species are transmitted by the tsetse fly species *Glossina fuscipes fuscipes*, a vector that prefers to feed on cattle, rather than humans (Hide *et al.* 1996). Transmission of *T. b. gambiense* occurs in the northwest of the country, in Adjumani, Arua, Gulu, Koboko, Moyo and Yumbe districts, whereas *T. b. rhodesiense* has traditionally occurred in the southeast, in Bugiri, Busia, Kayunga, Jinja, Iganga, Kamuli, Mayuge, Mukono, Pallisa and Tororo districts.

The two foci are geographically separated by the Rift Valley and, for the last century, remained fairly unchanged. However recent detection of *T. b. rhodesiense* in Masindi district (Enyaru *et al.*

1999) and outbreaks in Soroti (1998), Kaberamaido (2003) and Lira (2004) districts show that the two sub-species are getting worryingly close (Fèvre *et al.* 2001, 2005). The area affected by the acute form of HAT has increased 2.5 fold since 1985 (Picozzi *et al.* 2005) and it is feared that the two forms of HAT will soon overlap (Hutchinson *et al.* 2003). Since treatment and diagnostic methods for the two forms differ, any convergence in their range will have important implications for patient care and national control policy.

The spread of *T. b. rhodesiense* HAT to Soroti and onwards is attributable to uncontrolled cattle movements (Fèvre *et al.* 2001). In response to the initial epidemic, control activities consisting of mass treatment of livestock with trypanocides and some vector control were implemented in parts of Soroti between January 2000 and December 2003. However, a survey conducted in 2004 showed a very high prevalence of *T. b. rhodesiense* in cattle at the market, which are mainly imported from endemic sleeping sickness areas of Uganda. This indicated that control activities have been largely ineffectual and that the trade and resultant movement of animals infected with trypanosomes continues (Fèvre *et al.* 2005).

Furthermore, the above survey showed that from the detection of the first HAT case in Soroti in 1998 until April 2004, 428 cases of sleeping sickness had presented at the only health facility equipped to diagnose and treat the disease in the district. An estimated additional 299 cases went unreported. 67% of the reported cases were in the late stage of sleeping sickness, indicative of poor early detection by both the health system and communities (Fèvre *et al.* 2005).

Close monitoring of the dynamics of the two disease foci is needed to be able to detect if/when the overlap occurs and to mount a rapid response in the form of revised diagnostic and treatment procedures. To improve on the current situation, extension of health services and public-health messaging are needed to improve knowledge and reporting of *T. b. rhodesiense* HAT. Integrated intersectoral action to support this process is in place in Uganda, but could be strengthened. The national policy, which stipulates the control of livestock movement and treatment of livestock before movement, needs to be reinforced possibly by targeting livestock markets. Also, given the human population movement as a result of the ongoing conflict in the northern districts and its possible role in *T. b. gambiense* spread, it would be prudent to reinforce active surveillance of the human reservoir population. Establishment of a national screening laboratory has been proposed to support surveillance activities (Picozzi *et al.* 2005).

The focus of the Ugandan MoH during HSSP II (until 2009/10) is to scale-up efforts to interrupt transmission through integrated vector management (IVM) and active case detection and management. The targets are: i) To improve access to and quality of diagnostic and treatment facilities by 80%, and ii) To empower all of the affected communities for HAT control. The interventions that will be deployed to achieve these targets are social mobilization, drug distribution, IVM, case detection and management, including regular screening of communities, and surveillance and monitoring.

### ***2.2.3 Challenges for the national control programme***

Control of HAT, like that of other NTDs in Uganda, faces numerous challenges as a result of limited resources. For example, surveillance activities that rely on 'sleeping sickness assistants' at community level are severely hampered by a lack of funds to facilitate their activities. Ideally these assistants would take blood slides of suspected cases and forward the slides for diagnosis to the nearest facility with a microscope. However, to do this effectively often requires a bicycle or other transport, which is generally not available. Their activities are meant to be supervised by the district vector control officer, who also lacks the resources to do so. A well functioning surveillance system was previously operational in northwest Uganda under MSF (French section), but has deteriorated since this organisation left in 2002. Integration of some components of HAT control, particularly surveillance and IEC, is thus under discussion but no plans as to what

components should be integrated at what level have been made or where such integration could be piloted. Retreatment of tsetse fly traps with pyrethroid insecticides could maybe also be linked to annual retreatment campaigns for ITNs. However, vector control of HAT is complicated by the fact that it is under the responsibility of the district entomologist, who is linked to the Ministry of Agriculture and who has insufficient resources to address tsetse control in a comprehensive and continued manner.

Other challenges arise from the decreasing distance between the two HAT forms in Uganda. Should this overlap occur, then new diagnostic tools will be needed to be able to quickly identify with which parasite a patient is infected and to initiate appropriate treatment. Treatment itself is presently getting more difficult, as *T. b. gambiense* has developed resistance to melarsoprol (up to 30%) and eflornithine now needs to be used instead. However, this later drug is only effective against *T. b. gambiense*, making accurate diagnosis in the case of overlapping HAT forms paramount. A TDR funded trial of a eflornithine and nifurtimox combination is currently ongoing in Arua and might be expanded to Moyo, to investigate this treatment as an option for melarsoprol resistant *T. b. gambiense*.

To try and prevent the spread of both HAT forms and their eventual overlap, it is necessary to strengthen control measures (surveillance, vector control, monitoring of animal reservoirs) and to intensify IEC activities. As previously mentioned, these and other HAT related activities require additional resources. To obtain these it will be necessary to mobilise leaders at all levels and get them to commit to controlling HAT.

#### ***2.2.4 Contact person***

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## 2.3 Soil Transmitted Helminths

### 2.3.1 Background

**The parasite and its life cycle:** STHs are also known as common intestinal worms. In terms of public health, three types are important: roundworms (*Ascaris lumbricoides*), hookworms (*Ancylostoma duodenale* and *Necator americanus*), and whipworms (*Trichuris trichiura*). A person infected with STH has parasite eggs in their faeces. In areas where there is no latrine system, the soil and water around the community become contaminated with faeces containing worm eggs. In the soil, the eggs mature over 2 to 4 weeks, depending on the type of worm and environmental conditions, and then infect humans by being ingested or by penetrating the skin (hookworms only).

**Disease burden:** Globally, it is estimated that over a billion people living in the tropics and subtropics are infected with STHs. Although the largest numbers of infections occur in Asia, the greatest burden of disease occurs in Africa since the morbidity caused by STHs is related to the intensity of infection and host nutrition, and infections are most intense and nutrition woefully inadequate in Africa.

**Geographical distribution:** STHs are widely distributed throughout the tropics and subtropics and are particularly prevalent throughout much of sub-Saharan Africa, as well as in South China, the Pacific and Southeast Asia.

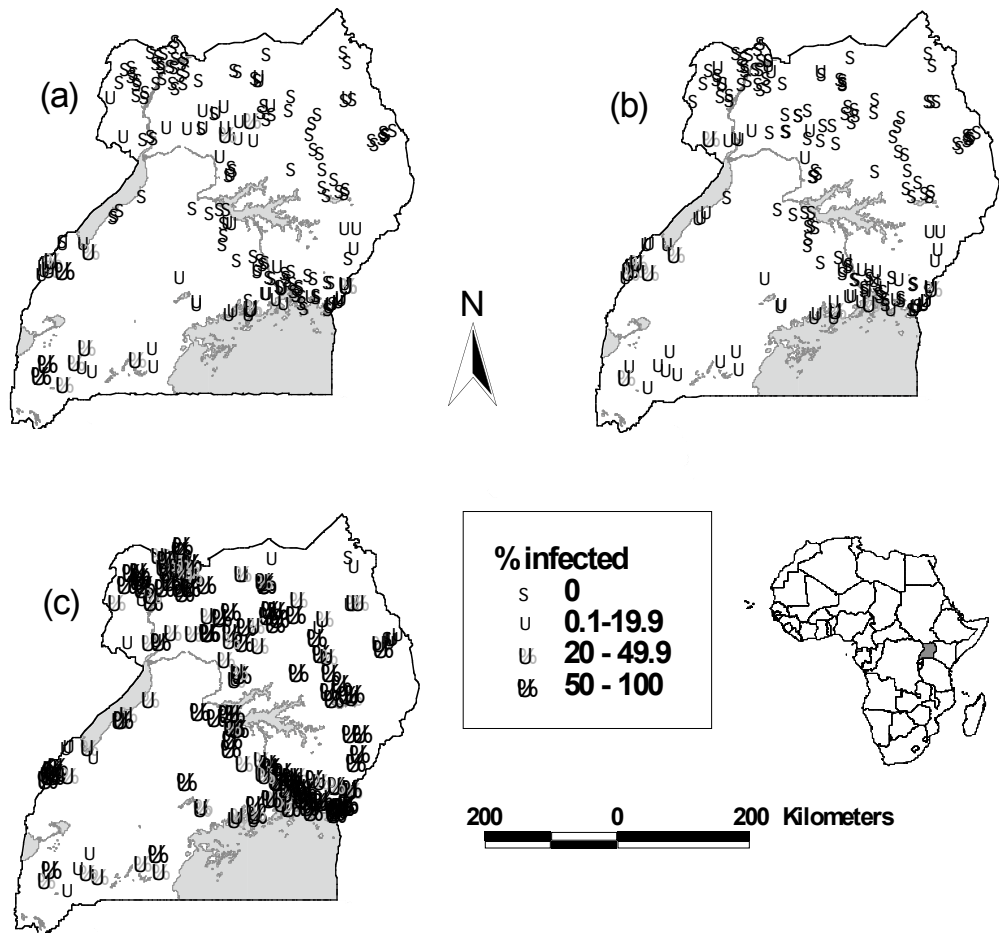
**Clinical features:** The symptoms of infections are non-specific and only become evident when the infection is particularly intense. Non-specific symptoms include nausea, tiredness, abdominal pain, loss of appetite and, in children, a cough or wheeze. Chronic and intense STH infections can contribute to malnutrition and iron-deficiency anaemia, and also can adversely affect physical and mental growth in childhood (Bethony *et al.*, in press).

**Control options:** Current efforts to control STH infection, as well as schistosomiasis, focus on the school-age population. The cornerstone of control is population-based chemotherapy, especially targeting schoolchildren. School-age children are the natural targets for treatment, and school-based treatment delivery programmes offer major cost advantages because of the use of the existing school infrastructure and the fact that schoolchildren are accessible through schools. There are four drugs to treat STH infections (see annex 1 for spectrum of anthelmintic activity): Albendazole (ABL) and mebendazole (MEB) are particularly attractive because they are easy to administer. Pyrantel pamoate (PYR) and levamisole (LEV) are alternatives for treatment of hookworm and ascaris infections (WHO 2005); the former is not effective for treatment of trichuriasis and they are administered by bodyweight. As a general strategy, WHO recommends that in areas where STH prevalence is  $\geq 50\%$  treatment is provided twice yearly, in areas where prevalence is between 20 – 49% annual treatment is provided and in areas with prevalence  $< 20\%$  drugs are made available at the health facility (WHO 2002a).

### 2.3.2 Soil transmitted helminths and their control in Uganda

A recent study conducted in 46 of Uganda's former 56 districts reported overall prevalence for *A. lumbricoides*, *T. trichiura* and hookworm of 6.3%, 5.0% and 53.5%, respectively, though prevalences of the former two parasites are around 80% in the south-east (Kabaterine *et al.* 2005). Hookworm is prevalent throughout the country, although prevalence is lower in north-eastern regions (figure 1). In contrast, *A. lumbricoides* and *T. trichiura* are restricted to the southwest of the country. These distributions are suggested to reflect large-scale spatial trends as the result of climatic factors, especially temperature (Brooker *et al.*, 2004a).

Figure 1. Geographical distribution of soil-transmitted helminth infections in Uganda: (a) *A. lumbricoides*, (b) *T. trichiura* and (c) hookworm.



In a situation such as Uganda, where every child is likely to be infected with STH or at risk of being infected, mass treatment of all school-aged children is recommended (WHO 2002a). Ideally this should take place twice a year using ALB (preferably for hookworm) or MEB. The aim is to reach 75% of all school-aged children with regular treatment by 2010, which is consistent with a resolution put forward at the 2001 World Health Assembly (Kabaterine *et al.* 2006a). The cost of such school-based mass treatment for STH with ALB was estimated to be between US\$ 0.04 and 0.08 per child, depending on the district. At a national scale this would amount to between US\$ 0.46 and 0.77 million to treat 7.4 million school aged children (Kabaterine *et al.* 2005).

Several STH control activities such as mass de-worming and health education are underway as integral part of the Schistosomiasis Control Programme (SCI, <http://www.schisto.org>), which



was launched in 2003. For example, in March 2003 SCI targeted communities at high risk in schistosomiasis endemic areas in the 18 most affected districts, providing health education and annual treatment with praziquantel (PZB) and ALB. This will continue until 2007 (Kabaterine *et al.* 2006a). STH control also forms one of the components of the Child Health Days (CHDs) strategy. This is a period of accelerated routine maternal and child health interventions at all static health units, outreaches in communities and schools. The package of interventions varies between countries. In Uganda the strategy has been renamed to CHDs Plus, including Vitamin A supplementation, routine and catch-up immunization, distribution of ivermectin (IVN), PZB and ALB/MEB, and promotion of family care practices, home and school hygiene and sanitation. CHDs Plus are held every May and November. Implementation is through a multi-disciplinary team of health workers, community owned resource persons (CORPs), including community drug distributors (CDDs), vaccinators and mobilisers.

Progress to date has been impressive, having achieved coverage rates in schools and communities of 91.4% and 64.7%, respectively. However, continued support and further improvements are needed to increase and sustain coverage over time. To date, involvement of communities in the selection of CDDs was limited, which might impact negatively on the acceptance of the STH/schistosomiasis control programme. Also, less than half of the communities had received health education and had not been informed of the SCI activities before they commenced. Due to insufficient training, side effects were not recorded in almost all schools and communities.

In future, CDDs will need to be better trained and communities be better informed, particularly to alleviate fear of side effects. More funding is needed to conduct training and produce educational materials. In general, better supervision and monitoring of STH/schistosomiasis control will be required. This could be very costly and might jeopardize sustainability if it is dependent on central or district staff. It might thus be best if CDDs are supervised by local health workers as part of routine outreach services. To ensure sustainability of regular mass deworming in future, it will be necessary to integrate STH/schistosomiasis control with other vertical control programmes where diseases are coendemic, as is the case with lymphatic filariasis and onchocerciasis in parts of Uganda (Kabaterine *et al.* 2006b).

The aim of the Ugandan MoH until 2010/11, as outlined in HSSP II, is to scale-up the STH and schistosomiasis control interventions to reach new populations at risk, to achieve 100% coverage of all the endemic districts, and to ensure re-treatment of previously targeted populations, both in communities and schools. In all of the affected districts, STH and schistosomiasis prevention and control will need to be integrated within the district work plans. The core interventions to control both diseases will be: i) Social mobilization, ii) Periodic mass chemotherapy, iii) Regular treatment of school-age children, iv) Selective vector control, and v) Advocacy for improved water supply and sanitation (MoH 2005).

### ***2.3.3 Challenges for the national control programme***

The main challenge is sustainability, as districts are currently not budgeting for STH control. ALB costs US\$ 0.02 per tablet and cannot be procured and delivered unless it is included in the budget for each endemic district. A questionnaire survey is currently being conducted at district level to investigate why the major NTDs of Uganda fail to be absorbed into general health service delivery. Findings will be shared at a workshop on integrated NTD control in Kampala on 25/26 April.

### ***2.3.4 Contact person***

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## 2.4 Schistosomiasis

### 2.4.1 Background

**The parasite and its life cycle:** On the African continent human schistosomiasis, a water-borne disease, is caused by three species of blood flukes called schistosomes: *Schistosoma mansoni* causes intestinal schistosomiasis; *S. haematobium* causes urinary schistosomiasis; and to a lesser extent *S. intercalatum* which also causes intestinal schistosomiasis. The schistosomes require a molluscan intermediate host in which to undergo development. Freshwater snails from four different genera form an essential component in the life cycle of the four major schistosome species that are responsible for human schistosomiasis. This ties transmission of the disease to places where people and snails come together at the same water habitat. Hence, schistosomiasis tends to be commonly found in rural communities where contact with freshwater bodies is a routine and inevitable occurrence.

**Disease burden:** Among human parasitic diseases, schistosomiasis, sometimes called bilharziasis, ranks second behind malaria in terms of socio-economic and public health importance in tropical and subtropical areas. The disease is endemic in 74 developing countries, infecting more than 200 million people in rural agricultural and peri-urban areas. Of these, 20 million suffer severe consequences from the disease and 120 million are symptomatic. In many areas, schistosomiasis infects a large proportion of children under 14 years. An estimated 500-600 million people worldwide are at risk from the disease.

**Geographical distribution:** *S. haematobium* occurs mainly in Africa and also in the Middle East, while *S. mansoni* occurs throughout Africa and in parts of South America.

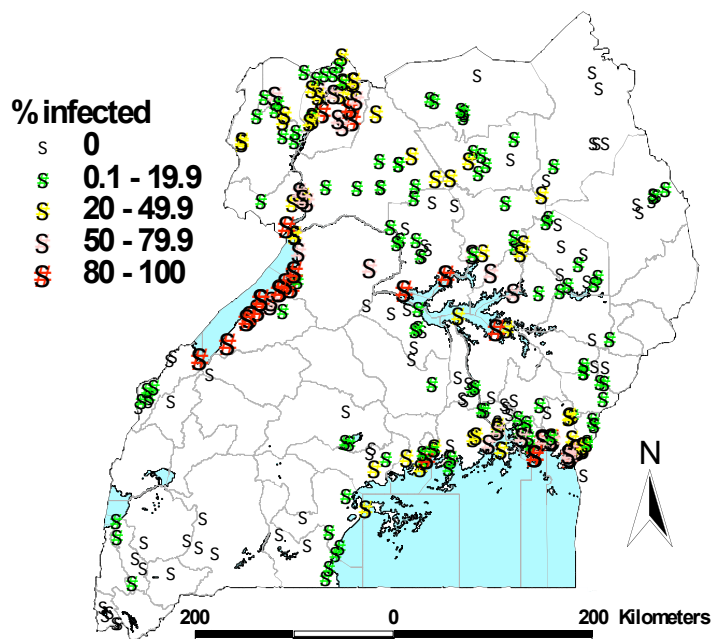
**Clinical features:** Disease is caused primarily by schistosome eggs, which are deposited by adult worms in the blood vessels surrounding the bladder or intestines, depending on the specific species. *S. haematobium* causes bladder wall pathology, leading to ulcer formation, hematuria, and dysuria. Granulomatous changes and ulcers of the bladder wall and ureter can lead to bladder obstruction, secondary urinary tract infections and subsequent bladder calcification, renal failure, lesions of the female and male genital tracts, and hydronephrosis. The morbidity commonly associated with *S. mansoni* infection includes lesions of the liver, portal vein, and spleen, leading to periportal fibrosis, portal hypertension, hepatosplenomegaly, and ascites. Schistosomiasis also causes chronic growth faltering and can contribute to anaemia

**Control options:** Schistosomiasis control aims to reduce the amount of disease, rather than to halt transmission entirely. The main strategy for controlling morbidity due to schistosomiasis is based on chemotherapy using praziquantel (PZB). Even though re-infection may occur after treatment, the risk of developing severe organ pathology is diminished and even reversed in young children.

### 2.4.2 Schistosomiasis and its control in Uganda

It has long been recognised that schistosomiasis constitutes a serious public health problem in Uganda (Nelson 1958, Ongom & Bradley 1972). It is mainly caused by *S. mansoni*, which is endemic in at least 38 of the former 56 districts in the country (figure 2). This species is transmitted by snails of the genus *Biomphalaria* - aquatic snails that thrive in irrigation canals, and along lakeshores – and causes intestinal schistosomiasis. For treatment, ALB is co-administered with PZB, because of the widespread distribution of STH.

Figure 2. Geographical distribution of *S. mansoni* in Uganda.



A recent nationwide assessment conducted by VCD (Kabaterine *et al.*, 2004) showed a wider distribution than that previously described by WHO (Doumenge *et al.*, 1987). It also provides evidence that there is no or very little transmission in areas where total annual rainfall is less than 900 mm and at altitude above 1400 m. It was additionally shown that prevalence consistently exceeded 50% in areas within 5km of Lakes Victoria and Albert. Outside these two ecological areas, where smaller rivers and water bodies are numerous, transmission also occurs. *S. haematobium* – which causes urinary schistosomiasis – is limited to districts on the northern shores of Lake Kyoga, where it coexists with *S. mansoni*.

In 1992 the MoH drafted a national schistosomiasis control plan, which was put into action in 2003 with funding from the Gates Foundation through SCI (<http://www.schisto.org>). The National Schistosomiasis Control Programme is managed by VCD at central level, but at district level it is the responsibility of the District Director of Health Services (DDHS) and the District Vector Control Officer (DVCO) and the District Health Educator (DHE). Treatment in schools is carried out by teachers and in communities by CDDs, selected by the community and trained by district trainers (Kabaterine *et al.* 2006b).

Control efforts were initially targeted through a three-step process using geographical information systems (GIS) to map available epidemiological data collected with traditional parasitological methods. This generated the results summarised above (also see Brooker *et al.* 2004b). Based on these results, 18 districts were initially selected for intervention. Areas of no transmission were excluded from further surveys, as were areas within 5 km of Lakes Victoria and Albert, where prevalences consistently exceeded 50%.

Following WHO guidelines (WHO 2002a) the National Schistosomiasis Control Programme uses three categories to classify communities for treatment: (1) in communities with high prevalence ( $\geq 50\%$ ) schoolchildren are treated every year and high risk groups, such as fishermen, are

treated; (2) in communities with moderate prevalence ( $\geq 20\%$  and  $\leq 50\%$ ) schoolchildren are treated once every 2 years; and (3) in communities with a low prevalence ( $\leq 20\%$ ) chemotherapy is made available in health facilities for treatment of suspect cases.

In 2005, the third round of mass drug administration took place in the original 18 districts and was expanded to an additional 9 districts. It is estimated that approximately 3.6 million children and adults were treated by the programme during that year. In early 2006 a rapid mapping exercise using the Lot Quality Assurance Technique (LQAS, Brooker *et al.* 2005) was conducted in all the 27 districts with known schistosomiasis prevalence by a team from the VCD. The results will be compared to pre-treatment data to evaluate the impact of the programme over the last three years and to indicate how treatment coverage can be scaled down in future. Specific plans of the Ugandan MoH to address schistosomiasis and outlined in HSSP II are the same as those for STH summarised in section 2.3.2 (MoH 2005).

#### ***2.4.3 Challenges for the national control programme***

As with STH control, the main challenge is sustainability. Districts are currently not budgeting for schistosomiasis control and PZB, which costs US\$ 0.07 per tablet, and cannot be procured and delivered unless it is included in the budget for each endemic district. A questionnaire survey is currently being conducted at district level to investigate why the major NTDs of Uganda fail to be absorbed into general health service delivery. Findings will be shared at a workshop on integrated NTD control in Kampala on 25/26 April.

#### ***2.4.4 Contact person***

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## 2.5 Lymphatic Filariasis

### 2.5.1 Background

LF, more commonly known as elephantiasis, is a painful and profoundly disfiguring disease.

**The parasite and its life cycle:** LF is caused by infection with mosquito-borne, parasitic worm of the genera *Wuchereria* and *Brugia*. Bancroftian filariasis, caused by *Wuchereria bancrofti*, is mainly transmitted by *Culex quinquefasciatus* and by some species of *Anopheles* and *Aedes*. Infective larvae are transmitted to humans during blood feeding by infected mosquitoes. The parasites are deposited in the vicinity of the skin puncture wound, from where they penetrate the skin and migrate to the lymphatic vessels. Over a period of 6 - 12 months, they develop into adult worms that cause damage and dilatation of the lymphatic vessels. The filariae live for several years in the human host. During this period they produce millions of young stages of microfilariae that circulate in the peripheral blood and are ingested by mosquitoes when these bite infected humans. The larval forms further develop inside the mosquito before becoming infectious to man.

**Disease burden:** LF puts at risk more than a billion people in more than 80 countries. Over 120 million are estimated to be affected by it, of which over 40 million are seriously incapacitated and disfigured. Recent estimates indicate that more than 50 million people in sub-Saharan Africa are affected, accounting for 37% of the global burden (Michael & Bundy 1997).

**Geographical distribution:** One-third of the people infected with the disease live in India, one third in Africa and most of the remainder in South Asia, the Pacific and the Americas.

**Clinical features:** While LF is usually acquired in childhood, its visible manifestations occur in adults where they lead to temporary and permanent disability. As such, the disease has a major social and economic impact on endemic countries. LF is now recognized as a major source of morbidity and physical disability (Ramaiah *et al.* 1997) and has been ranked by WHO as the second major cause of long-term disability after mental illness (WHO 1999). Filariae lodge in the lymphatic system where they cause inflammation, dilatation and lymphatic system failure. They are responsible for a variety of clinical manifestations, including lymphoedema of the limbs, genital disease (hydrocele, chylocele and swelling of the scrotum and penis) and acute, recurrent secondary bacterial infections known as "acute attacks". The vast majority of infected people are asymptomatic, but virtually all of them have sub clinical lymphatic damage and as many as 40% have renal involvement.

**Control options:** The strategy of the Global Programme to Eliminate Lymphatic Filariasis (PELF) has two components: firstly to interrupt transmission and secondly to alleviate the suffering of affected individuals. To interrupt transmission, endemic districts must be identified and mass drug administration (MDA) be implemented to treat the entire at-risk population. In most countries this will be based on once-yearly administration of single doses of two drugs given together: ALB plus either diethylcarbamazine (DEC) or IVN, the latter in areas where either onchocerciasis or loiasis may also be endemic. This yearly single-dose treatment must be carried out for 4-6 years. To alleviate the suffering caused by the disease, community education is used to raise awareness in affected patients. This promotes the benefits of intensive local hygiene and the possible improvement, both in the damage that has already occurred and in preventing the debilitating and painful acute episodes of inflammation. In addition to MDA, vector control is carried out where this is feasible. The control of *Culex* is normally based on measures aimed at the prevention of breeding. Control or elimination of breeding sites in polluted water is possible by improving sanitation systems and hygiene in general. Where such improvements are not possible, the emphasis should be on the prevention of mosquito bites by means of self-protection.

### 2.5.2 Lymphatic filariasis and its control in Uganda

The first baseline epidemiological investigations on LF in Uganda were conducted during April – August 1998 in an area where it had repeatedly been reported to be a major health problem (Onapa *et al.* 2001a). Three communities were surveyed, one in each of the districts of Lira (Alebtong area), Soroti (Lwala area) and Katakwi (Obalanga area). LF was found to be highly endemic in these areas. Prevalences of hydrocoel in adult ( $\geq 20$  years) males were 28%, 7% and 17% and limb elephantiasis in adults were 9%, 4% and 4%, respectively.

More than 80% of microfilaria-positive individuals were infected with *W. bancrofti*, the remainder by *Mansonella perstans*. *W. bancrofti* was found to be transmitted by *Anopheles gambiae* and *An. funestus* mosquitoes. The two species appeared to be of equal importance as vectors in the study communities. Mosquito density related well to the prevalence of filarial infection in humans. The study also reported that local beliefs attribute elephantiasis to stepping on or over hidden ‘magic’. Only few victims would therefore normally consult modern medical practitioners, but prefer self-treatment or consult traditional doctors. Many individuals that were found to have limb elephantiasis showed signs of multiple scars on the affected limbs and scarification appeared to be a common traditional remedy to relieve the oedema.

The geographical distribution of LF in Uganda was subsequently assessed in more detail, to plan control activities by the PELF (Onapa 2005, Onapa *et al.* 2005). A survey was conducted among school-aged children at 76 sites throughout the country. At each site the children were checked for *W. bancrofti*-specific circulating filarial antigens (CFA) with a rapid immunochromatographic card test. [Note: i) An evaluation of the ICT card test published in 2002 quotes the cost per test at US\$ 2.75 (Chandrasena *et al.* 2002) this is consistent with the price paid by VCD; ii) Supply of this test can be slow as the manufacturers wait for orders to accumulate before production of a batch (A. Onapa, pers. com.)]

*W. bancrofti* infections were concentrated in a large focus located in the north of the Victoria Nile, covering most districts in the east, north and north-western parts of the country. Particularly high prevalences were seen to the north of Lake Kyoga and in the northern part of the Albert Nile basin. Further analysis based on population data from 2002 indicated that approximately 8.7 million people (35.3% of the national population) lived in areas where more than 1% of the sampled children were CFA-positive (figure 3).

Lymphatic filariasis has now been mapped in all the districts except four that suffer from insecurity. The disease is endemic in 22 of the former 56 districts. LF is co-endemic with schistosomiasis in at least 20 districts and with onchocerciasis in at least 13 districts. At least 10 districts have all three of these parasitic diseases, mostly in the northwest and western regions of Uganda. The first MDA for LF was carried out at the end of 2002 in two districts (Katakwi and Lira) with a population of approximately one million people, reaching coverage rates of about 75%. The cost per person treated was 10 US cents.

The scaling up to 8 adjacent districts (Kotido, Moroto, Nakapiripirit, Soroti, Kumi, Kaberamaido, Apac, and Kamuli) planned for 2003 was hampered by a lack of operational funds and insecurity in the areas. In 2004, MDA was carried out in five districts, totalling a population of more than 2 million (Katakwi, Lira, Kotido, Moroto and Nakapiripirit). In 2005, MDA was extended to cover all of the 8 districts that could not be covered in 2003, increasing the total number of districts to 10 and the total population under MDA to about 4.9 million (table 1). In some of the districts, MDA was integrated with the Child Days Plus initiative during October/November 2005. MDA was carried out in schools and communities using trained teachers and CDDs. The exercise was generally successful and most districts reached at least 65% coverage. Further expansion of MDA is planned over the coming years, to cover all endemic districts by 2008 (table 1). Specific targets of the MoH as outlined in HSSII are: i) To achieve 90% therapeutic coverage of affected

populations with a single annual dose of IVN and ALB, and ii) To reduce morbidity and disability associated with LF by 25% until 2010. Proposed core interventions are MDA in all endemic areas, accompanied by intensive public education and social mobilization (MoH 2005).

Table 1: PELF plans for scaling-up of MDA (2005-2008)

Year	No. of districts (IUs) covered	Total population in IUs in millions	Percentage of endemic IUs under MDA
2005	10	4.9	39.5
2006	15	7.2	58.2
2007	20	11.1	89.1
2008	26	13.9	100

Note: Scaling-up could be more rapid if sufficient funds are made available

Disability due to LF is a serious problem in some communities in LF endemic districts. In 1996, an association was formed in Obalanga subcounty in Katakwi district to address the problem of hydroceles. This was long before baseline surveys were carried out in the area. The association called itself “Obalanga Hydrocele Development Association”. Its main objective was to bring together victims of hydroceles and examine ways of assisting these unfortunate individuals. The association has expanded to cover the whole of Katakwi district and has changed its name to Katakwi Health and Human Rights Association (KHHRA). As a result of their advocacy, disability management has been initiated in Obalanga subcounty.

In 2004, hydrocelectomy camps were organized in Kapelebyong health centre IV and the response was overwhelming. In 2005, Amuria and Katakwi health centres IV received support from the Danish International Development Agency (DANIDA) to carry out hydrocelectomy operations. To date, over 166 hydrocelectomies have been performed at Katakwi and Amuria health centres IV. Individuals to benefit from the surgery are identified by members of the KHHRA. There is a very high demand for hydrocelectomies, but consumables and allowances are limiting factors. Training of trainers in disability management in Katakwi District was carried out by WHO and PELF in 2005 and disability assessments, using WHO questionnaires, were carried out in some communities in Obalanga subcounty. Since then, lower level health workers and CORPs have been trained especially in lymphoedema management. Disability management at the community level is now being piloted in Obalanga subcounty and a report on this exercise is being awaited.

### 2.5.3 Challenges for the national control programme

The major challenges for PELF are:

- Lack of resources: There is no definite source of funding for this programme. Some support has been received from WHO and the Mectizan Donation Program (MDP) but the amounts are grossly inadequate. For example in 2005, a sum of US\$ 100,000 (donated by MDP) was available for all activities, including post intervention monitoring and data collection, in 10 districts. Allocation of this small amount to the 10 districts proved to be challenging.
- Inadequate training due to lack of funds.
- Insecurity: Some districts are permanently insecure e.g. Kotido, Moroto and Nakapiripirit.
- Population displacements makes follow-up very difficult. In some areas, new registration has to be carried out every year.
- Conflict: Districts most affected by LF are affected by ongoing conflict due to activities of the Lord’s Resistance Army. Despite the districts willingness to contribute towards PELF,

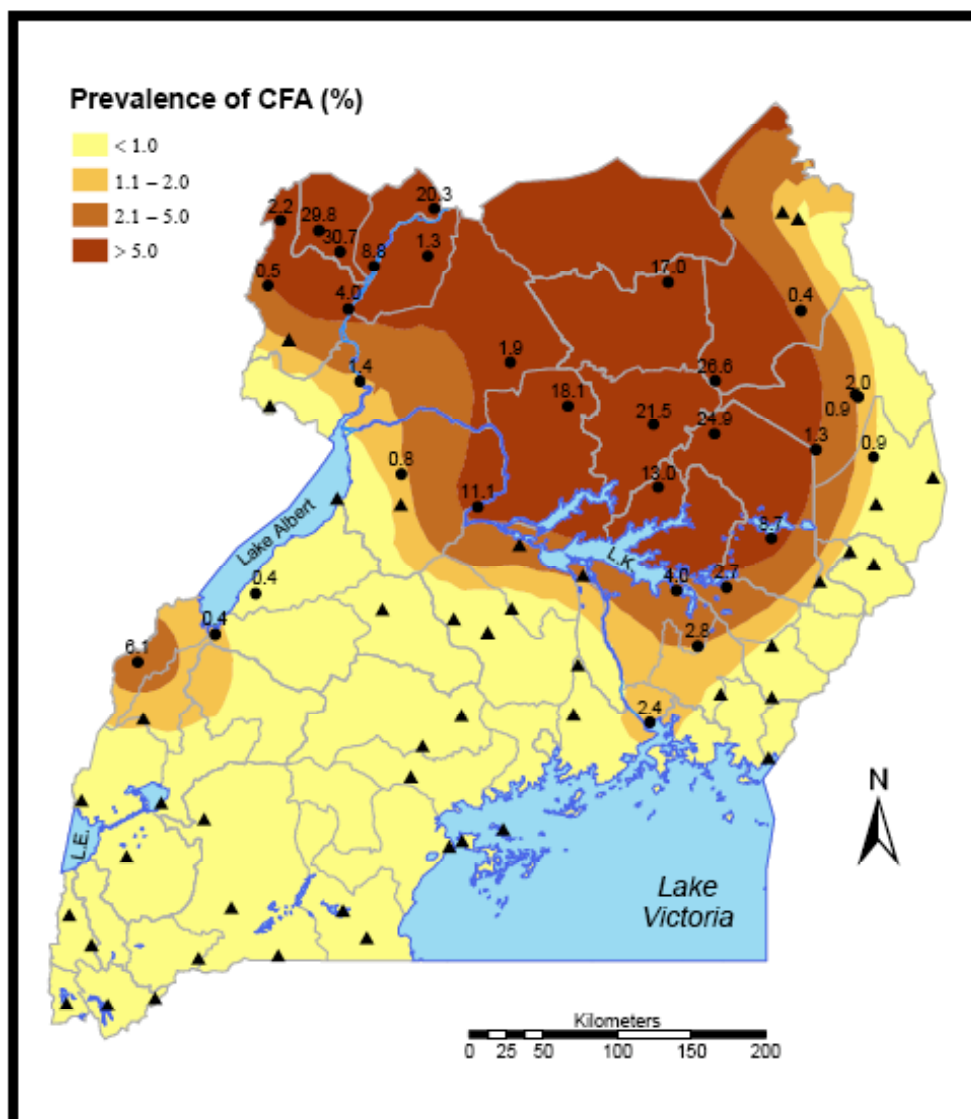
local revenue collections have been affected to such extent that the districts are not in a position to fulfil their obligations.

- Inadequate social mobilization/sensitization: Because of the limited resources, social mobilization is a challenge (IEC materials, KAP surveys).
- Post-intervention monitoring and establishment of sentinel sites: This is rarely done properly because of lack of funds.
- Demand for incentives: CDDs and teachers are increasingly demanding to be paid for their contribution of PELF
- Integration with other programmes: This still poses a challenge as there are major issues that need to be harmonized, for example treatment criteria.

#### 2.5.4 Contact person

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Figure 3. Geographical distribution of filariasis in Uganda.





## 2.6 Onchocerciasis

### 2.6.1 Background

**The parasite and its life cycle:** Onchocerciasis is an eye and skin disease caused by the worm *Onchocerca volvulus*. It is transmitted to humans through the bite of blackflies (*Simulium spp.*), which breed in fast-flowing streams and rivers in the inter-tropical zones. Living near these breeding sites increases the risk of blindness, hence the commonly known name 'river blindness'.

**Disease burden:** Onchocerciasis is the world's second leading infectious cause of blindness. Prior to concerted control efforts, about 50% of men over the age of 40 years in some West African communities had been blinded by the disease. People therefore fled the fertile river valleys to settle in less productive upland country. In the 1970s, the resulting annual economic losses were estimated at US\$ 30 million. According to recent estimates, 120 million people are at risk and 18 million are already infected. The disease is responsible for the loss of 1 million DALYs per year (WHO 2002b).

**Geographical distribution:** The disease occurs in 35 countries. Of these, 28 are in tropical Africa, which is where 96% of the people at risk of onchocerciasis and 99% of those already infected live.

**Clinical features:** Inside the human body, the adult female worm (macrofilaria) produces thousands of larvae (microfilariae) that migrate in the skin and the eye. The death of microfilariae is very toxic to the skin and the eye, producing terrible itching and various eye manifestations (lesions). After repeated years of exposure, these lesions may lead to irreversible blindness and disfigurative skin diseases sometimes named "leopard" skin and "lizard" skin.

**Control options:** Because of the dramatic consequences of onchocerciasis in West Africa, WHO in 1974 launched the Onchocerciasis Control Programme (OCP) in collaboration with the World Bank, the United Nations Development Programme (UNDP) and the Food and Agriculture Organization (FAO). Control of the vector by treating the breeding sites with larvicides was the only available approach. The programme systematically expanded over its first few years to achieve full coverage of several river systems in seven countries. Nonetheless, even this ambitious start was not sufficient and the programme subsequently doubled in size to cover 11 countries. At this point the programme stretched over 1 200 000 Km<sup>2</sup> to protect 30 million people. Vector control was the primary strategy in West Africa, and it was supplemented by drug distribution as of 1989-90. The OCP was officially closed in December 2002 after virtually stopping the transmission of the disease in all participating countries except Sierra Leone where operations were interrupted by a decade-long civil war.

Based on the knowledge and experience gained by the OCP, the sponsoring agencies and Non-Governmental Organizations (NGOs) launched a second programme in 1995, the African Programme for Onchocerciasis Control (APOC). This covered 19 more countries, the remainder of onchocerciasis endemic Africa. APOC is based on the distribution of Mectizan (Ivermectin), which was developed by Merck & Co. in the 1980s and is now donated for onchocerciasis control. Mectizan is distributed by communities themselves, trained and supported by the APOC partners; a strategy referred to as community-directed treatment with ivermectin (CDTI). It empowers local communities to fight river blindness in their own villages, relieving suffering and slowing transmission. In a few isolated foci in APOC areas, ground larviciding is used in addition to CDTI, with the aim of local vector eradication within a period of 1-2 years. After 8 years of operation, APOC had established 107 projects, which in 2003 treated 34 million people in 16 countries. The programme intends to increase this to treat 90 million people annually in 19 countries, protecting an at risk population of 109 million, and to prevent 43,000 cases of blindness every year. The distribution network is also being tested to deliver other interventions. This enticing possibility opens the door to further scaling-up and presents the opportunity to deliver other basic health interventions in the onchocerciasis areas, which are almost exclusively remote, rural, and poor. Most are not reached by other programmes and some are not reached by the national governments.

### 2.6.2 Onchocerciasis and its control in Uganda

In Uganda, *O. volvulus* is transmitted by species of the *Simulium damnosum* complex and by *S. neavei* s.s., with the latter accounting for more than 85% of the transmission (Barnley 1975). The use of Rapid Epidemiological Mapping of Onchocerciasis (REMO) has allowed classification of communities into three categories: priority areas which require CDTI; areas which do not require treatment; and possible endemic areas that require further investigation (Ndyomugenyi, 1998; Katarwa *et al.*, 1999).

The REMO results showed that onchocerciasis is highly endemic in the West Nile region, along the central shores of Lake Albert and in selected foci in southwest Uganda. Overall it is endemic in 21 of the former 56 districts, with prevalence ranging from 10% to nearly 100% (figure 4). Recent estimates indicate that more than two million Ugandans are at risk of infection and that about 1.45 million are already infected.

Figure 4. Geographical distribution of onchocerciasis in Uganda.



Fig. Endemicity of onchocerciasis in Uganda, as revealed by rapid epidemiological mapping. Nodule prevalences are shown as pie-charts: ◻, <1%; ◻, 1%-9%; ◻, 10%-19%; ◻, 20%-39%; and ◻, >40%. Areas clearly requiring treatment (red) and areas requiring further assessment (yellow) are also indicated.

Disease related blindness is not a major problem in Uganda. Instead most infected people suffer from skin disease characterised by severe itching and lesions. This is often attributed to witchcraft or poor personal hygiene, or lesions are mistaken for leprosy. Infection is thus associated with considerable stigmatisation (Kipp & Bamuhiiga 2002). Other complications frequently observed in onchocerciasis endemic areas of Uganda are epilepsy and retarded growth.

Implementation of the national strategy for onchocerciasis control began in late 1992 with financial assistance from the River Blindness Foundation. From 1996 onwards it was financially supported by the Carter Centre's Global 2000 River Blindness Programme. The first funding from APOC was received in 1997.

Intervention consists of large-scale, annual CDTI, supplemented by vector control in isolated foci of *S. neavei* (Ndyomugenyi *et al.* 2004). Control of the blackfly vector on a large scale is not feasible, because the vectors are too widespread, the difficult terrain makes foci inaccessible and foci extend into neighbouring countries (i.e. the Democratic Republic of Congo & Sudan) where there are no control activities. Implementation is carried out by communities in partnership with the MoH, local governments and NGOs, such as Sight Savers International.

The programme was initially reviewed after 5 years of implementation (1993 – 1997), by which time it was operational in 10 onchocerciasis endemic districts (Kabale, Kisoro, Rukungiri, Kasese, Nebbi, Moyo, Adjumani, Gulu, Apac and Mbale), covering approximately 1 million people (65% of all people affected by the disease nationally). The target coverage of 90% of the eligible population with IVN was achieved in 43% – 51% of the communities. Coverage was largely dependent on the performance of the CDDs. Whereas it was found that district staff could readily integrate onchocerciasis control with their other commitments, the involvement of CDDs in other programmes proved detrimental to their performance in controlling onchocerciasis (Katabarwa *et al.* 1999).

Over the years the programme has been highly effective in reducing the burden of onchocerciasis (Ndyomugenyi 1998). By now geographical coverage has been increased to 100% and therapeutic coverage has remained stable at 80%. CTDI is integrated with other health activities at all levels (e.g. with schistosomiasis/STH and lymphatic filariasis where co-endemic). However, some authors estimate that it would take at least 25 years to eliminate the parasite from medium to highly endemic areas, assuming that the strategy solely relied on annual IVN treatment at 80% coverage (Winnen *et al.* 2002), whereas others propose that annual treatment is insufficient to achieve elimination and may in fact need to be continued indefinitely (Richards *et al.* 2000; Burnham & Mebrahtu 2004). Much better impact is expected in areas where IVN treatment is combined with ground spraying of breeding sites, using temephos, to control the vector (Ndyomugenyi *et al.* 2004) and/or if treatment is administered more than once a year (Richards *et al.* 2000, Gardon *et al.* 2002).

Despite the concentrated efforts to control and eliminate onchocerciasis in Uganda the disease continues to cause a high burden of morbidity and disability. The underlying reason for this is inadequate funding, preventing the expansion or introduction of activities that are known to improve control and eliminate the disease in six to seven years (Cupp & Cupp 2005). Potential modifications of the programme are the expansion of vector control to all isolated foci of *S. meavei* and biannual distribution of IVN where this is logistically feasible (Ndyomugenyi *et al.* 2004), such as in the clearly identified foci of Kitomi, Mount Elgon, Bwindi, Bundogo and Wadei. Furthermore, it might be feasible to integrate onchocerciasis control with that of other NTDs, where these are co-endemic, i.e. in Moyo, Adjumani, Yumbe, Arua, Hoima and Masindi districts (Ndyomugenyi & Kabatereine, 2003). The success of the programme also requires ongoing monitoring of CDD activities, to be able to support them when and where necessary,

and health education to clarify and re-iterate issues that affect compliance with CDTI (Nuwaha *et al.* 2005).

The focus of the MoH over the next years, as outlined in HSSP II, is on advocacy for CDTI support by local governments, on integrating CDTI within the mainstream primary health care (PHC) structure, and on capacity building for prevention and management of onchocerciasis at district and community levels and in schools. These approaches have the aim of: i) Increasing therapeutic coverage to at least 70% in all affected communities, ii) Integrating CDTI into the district health plans in 90% of endemic districts, and iii) To eliminate onchocerciasis as a public health problem by 2010 (MoH 2005).

### ***2.6.3 Challenges for the national control programme***

Many operational challenges will have to be overcome to reach the targets set in HSSP II. One of these is the increasing demand of CDDs for incentives. This could, potentially, be overcome by increasing the number of CDDs so that the workload of the individual reduces and s/he is able to attend to activities that generate revenue (e.g. cultivating a field). However, to increase the pool of CDDs, more funding is necessary for training, health education and monitoring/supervision.

Given the predictions that the programme might need to continue indefinitely with the current treatment regime it also seems unlikely that elimination will be achieved unless biannual treatment is introduced. Though the drugs are donated, an increase in the frequency of treatment will require additional funding to deliver the intervention. Lastly, the communication line between the health services and the community is often weak and will need to be strengthened, which would again require additional resources.

### ***2.6.4 Contact person***

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## **2.7 Buruli Ulcer**

### ***2.7.1 Background***

**The parasite and its life-cycle:** Buruli ulcer is caused by *Mycobacterium ulcerans* and was named after an area of Uganda that was the site of many cases in the 1960s (Clancey *et al.*, 1962). The causative organism belongs to the family of bacteria that cause tuberculosis and leprosy. Most patients are women and children who live in rural areas near rivers or wetlands. The exact mode of transmission remains enigmatic (v. d. Werf *et al.* 2005); however, it has recently been suggested that it may be transmitted by biting water bugs, which means that it might be classified as a vector-borne disease (Marsollier *et al.* 2002). An alternative mode of transmission may involve penetrating skin injuries during fishing or farming activities that seed the micro-organism into subcutaneous tissues (Meyers *et al.* 1974).

**Disease burden:** Buruli ulcer is the third most common mycobacterial infection in healthy people after tuberculosis and leprosy and the most poorly understood of these three diseases. In Côte d'Ivoire, approximately 15,000 cases have been recorded since 1978 where up to 16 percent of the population in some villages are affected. In Benin, 4,000 cases have been recorded since 1989; in Ghana (6,000 recorded cases in a national survey in 1999) up to 22 per cent of villagers are affected in some areas. There is evidence of huge under-reporting of the disease.

**Geographical distribution:** Buruli ulcer emerged as an important cause of human suffering since 1980 and is most common in West Africa. All countries along the Gulf of Guinea are now

affected. It is predominantly found in riverine areas with a humid, hot climate in the tropical and sub-tropical regions of Africa, Asia, Latin America and the Western Pacific.

**Clinical features:** The disease often starts as a painless swelling in the skin and mainly occurs in the limbs. A nodule develops beneath the skin's surface teeming with mycobacteria. Unlike other mycobacteria, *M. ulcerans* produces a toxin, which destroys tissue and suppresses the immune system. Massive areas of skin and sometimes bone are destroyed causing gross deformities. When lesions heal, scarring may cause restricted movement of limbs and other permanent disabilities. One important feature of Buruli ulcer is the minimally painful nature of the disease, which may partly explain why those affected do not seek prompt treatment (v. d. Werf *et al.* 2005).

**Control options:** Treatment of Buruli ulcer with antibiotics has been unsuccessful to date although the organism is sensitive *in-vitro* to some of the antibiotics used for treatment of tuberculosis. At present, the only treatment available is surgery to remove the lesion followed by a skin graft if necessary. This is both costly and dangerous, leading to the loss of large amount of tissues/or permanent disability, and it does not prevent recurrence (v. d. Werf *et al.* 2005). Early detection and surgical removal of small lesions could prevent many complications. BCG (Bacille Calmette-Guérin) vaccination appears to offer some short-term protection from the disease. At the present time, BCG vaccination is the only biomedical intervention that may help control Buruli ulcer in the highly affected areas.

### ***2.7.2 Buruli ulcer and its control in Uganda***

Despite its long history in Uganda, very little is known about the distribution of Buruli ulcer across the country and, as elsewhere, it seems affected by considerable under-reporting. There is an urgent need to conduct a national case search to establish the extent of Buruli ulcer in Uganda and to determine the epidemiological characteristics of the disease.

Two key persons were identified. Dr Henri Wabinga, a pathologist at the Medical School at Mulago is the official contact point. He is not an MoH employee and may therefore not be the person to discuss any activities that involve health sector resources. Recently (January 2006), Mr Gabriel Matwale from VCD attended a course on the microbiology of *M. ulcerans* at the Centre Pasteur in Cameroun. Since then he is their staff member most familiar with this disease. As at present it has not been decided as to which department of the MoH addresses Buruli ulcer. Such decision will be required in order for the MC or other international organisations to collaborate. Discussion with Dr Mbulamberi, Assistant Commissioner for Vector Control, on this matter would be a useful next step. No reference to the control of Buruli ulcer is made in HSSP II.

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## 2.8 Other Neglected Tropical Diseases

### 2.8.1 Leprosy

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*, an acid-fast, rod-shaped bacillus. The disease mainly affects the skin, the peripheral nerves, mucosa of the upper respiratory tract and the eyes. At present it occurs in 15 countries and territories in Africa, Asia and Latin America (compared to 122 in 1985).

Transmission is thought to only occur between humans, *via* nasal discharge and droplets from the respiratory tract of untreated patients with severe disease, although it may also occur *via* skin contact. Humans seem to be the only natural host of *M. leprae*.

The clinical course varies from asymptomatic infections through to severe disfiguring disease. Following infection, skin lesions may appear and heal spontaneously. Infection slowly affects the skin, nerves and mucous membranes. As the disease progresses (usually over a period of several years) skin lesions may increase in number or spread. Lesions of the nerves can lead to loss of sensation and to muscle weakness and atrophy, and unnoticed burns and ulcers - especially on the hands and feet - resulting in deformities.

Leprosy was highly endemic in Uganda with a prevalence rate of 17.7 per 10,000 inhabitants in 1983. According to WHO ([http://www.who.int/neglected\\_diseases/countries/uga/en/](http://www.who.int/neglected_diseases/countries/uga/en/)) it has now been eliminated as a public health problem, with current efforts focusing on eliminating the disease at sub-national levels. During 2004, 46 out of 56 districts continued to detect new leprosy cases, ranging from one in Iganga, Hoima, Kabarole, Kyenjojo and Rukungiri to 82 in Lira (GLRA/NTPL 2004). The total number of notified new cases was 663. 40% of the new cases were reported from five districts (Lira, Apac, Kitgum, Pader, Gulu). The national case detection rate was 2.5 per 100,000 population.

While elimination of leprosy as a public health problem has been sustained at national level, seven districts still recorded prevalence rates > 1 per 10,000, i.e. had not reached the elimination target in 2004. The challenge over the coming years will be to maintain the required level of interest, skills, commitment and investment in resources to: i) Sustain the elimination status, and ii) To reduce the rate of grade II disability in newly diagnosed cases to less than 5%. Specific interventions that will be implemented under HSSP II will include leprosy elimination campaigns, active case finding, systematic contact surveillance for new leprosy cases, health worker training and awareness building of self care among persons affected with leprosy (MoH 2005).

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### 2.8.2 *Dracunculiasis (Guinea Worm)*

Dracunculiasis is caused by the parasitic worm *Dracunculus medinensis* or "Guinea worm". The parasite migrates through the victim's subcutaneous tissues causing severe pain especially when it occurs in the joints. The worm eventually emerges (from the feet in 90% of the cases), causing an intensely painful oedema, a blister and an ulcer accompanied by fever, nausea and vomiting.

Infected persons try to relieve the burning sensation by immersing the infected part of their body in local water sources, usually pond water. This induces a contraction of the female worm at the base of the ulcer causing the sudden expulsion of hundreds of thousands of first stage larvae into the water. They move actively in the water and can live for a few days. For further development, they need to be ingested by suitable species of voracious predatory crustacean, cyclops or water fleas.

When a person drinks contaminated water from ponds or shallow open wells, the larvae are released and migrate through the intestinal wall. After approximately four months, adult male and female worms mate. The male then becomes encapsulated and dies in the tissues while the female moves down the muscle planes. After about one year of the infection, the female worm with the uterus filled with larvae, emerges usually from the feet, repeating the life cycle.

Dracunculiasis used to be a formidable public health problem, mainly in terms of morbidity, incapacity and suffering for those affected. Due to concerted efforts made at eradicating the disease, the global incidence decreased by 2000 to less than 75 223 cases, 73% of which were notified in Sudan. The disease is still found among the poorest rural communities in areas without safe water supplies in sub-Saharan Africa.

The most powerful tools in monitoring eradication of dracunculiasis are village-based case containment and surveillance. Ideally, cases are identified prior to the emergence of the worm or at latest 24 hours after it appears when containment measures are initiated, the wound is kept bandaged for 2-3 weeks, and the patient is advised to avoid contact with water. Community members are educated regarding prevention and containment and are encouraged to filter drinking water. Case-containment has proven very effective and has been implemented in most endemic villages. The 14 endemic countries reported an average of 49% of cases as contained during 2000.

Guinea worm used to be highly endemic in Uganda, with over 200,000 cases being recorded per year. The major focus of the disease was in Gulu, Kitgum and Kotido districts all bordering Sudan. Thanks to efforts by the Uganda Guinea Worm Eradication Programme, supported by the Carter Centre's Guinea Worm Eradication Project (Wendo 2003), the disease was eliminated from Uganda by the end of 2003 (Carter Centre 2005, USAID 2005). The programme still faces challenges of containing cases imported from across the borders of DRC and Sudan. The insecurity that has plagued most of the previously highly endemic districts has resulted in massive cross border movements that increase the risk of reintroducing the infection. The target for the next 5 years outlined in HSSP II is to achieve 100% case containment through six core interventions that address the key areas of: i) access to safe water, ii) re-training of health staff down to community level in case management and containment, iii) vector control, and iv) active surveillance (MoH 2005).

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### 2.8.3 Trachoma

Trachoma is one of the oldest infectious diseases known to mankind and the leading cause of infectious blindness, responsible for 1.3 million cases of blindness (Resnikoff *et al.* 2004). It is caused by *Chlamydia trachomatis*, a microorganism resembling both bacteria and viruses, which spreads through contact with eye discharge from the infected person (on towels, handkerchiefs, fingers, etc.) and through transmission by eye-seeking flies. *C. trachomatis* provokes an inflammatory reaction in the eye with formation of follicles in the conjunctiva. After years of repeated infections, the inside of the eyelids may be scarred so severely that the eyelid turns inwards with eyelashes rubbing on the eyeball. If untreated, this condition leads to blindness.

The disease is associated with poor socioeconomic conditions, with overcrowding, poor personal and environmental hygiene and, in particular, with very limited access to water and sanitation. Trachoma has been eliminated as a blinding disease from several previously hyperendemic countries and regions, both through significant improvements in the socioeconomic status of populations and through specific control efforts. Despite these successes, blinding trachoma continues to be an important public health problem in many developed countries of the world. Control depends on the SAFE strategy, which stands for Surgery (trichiasis surgery), Antibiotics, Facial cleanliness and Environmental improvements (e.g. [www.cartercenter.org/doc2302.htm](http://www.cartercenter.org/doc2302.htm)).

Today, the disease is found mainly in poor rural areas, including parts of central and south America, most African countries and some countries in the Eastern Mediterranean. Trachoma is also still endemic in several Asian countries. However, there is a lack of updated information from some major populations, which remains an important obstacle to trachoma control efforts. Uganda is amongst those countries for which no data could be identified in a recent attempt to map the global distribution of trachoma (Polack *et al.* 2005).

The first step towards trachoma control in Uganda has been taken in 2003, when districts with reported cases of trachoma (based on HMIS records) were mapped by WHO. Based on the available data 15 districts were identified as endemic. In late 2005 funds were provided by Sight Savers International to conduct a trachoma survey in one of these districts (Kamuli, which is now split into two districts) and a Trachoma Task Force was formed. This consists of 8 staff, including representatives from the MoH, Sight Savers International and the Lions Club. The survey has been completed and the data are being analyzed. The aim is to finalise the analysis before October 2006 to be able to submit an application for funding to the International Trachoma Initiative. In March 2006 the Lions Club has agreed to fund surveys in Moyo and Kotido and WHO has expressed interest in funding surveys in 3 additional districts. Depending on the survey results, further funding applications might be formulated. Only if trachoma prevalence is >10% is it justified to intervene with azythromycin (Zithromax<sup>®</sup> donated by Pfizer), otherwise routine treatment with tetracycline will continue.

Specific targets for the MoH until 2010 are: i) To achieve integration of prevention and control measure within the district work plans of all endemic districts, ii) To reach all affected communities with mass distribution of tetracycline or erythromycin, and iii) To increase access to surgical services for patients with trichiasis by 30%. Many of the activities for trachoma control will evolve around capacity building for prevention and control at community and school level (MoH 2005).

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#### ***2.8.4 Podoconiosis (non-filarial elephantiasis)***

Podoconiosis is a nonfilarial, noninfective, usually crystalline blockage of the limb lymphatics, which almost always affects the lower limbs and especially the feet. Podoconiosis is most prevalent in Africa, especially in the higher altitude regions in the eastern and central regions, but also occurs in other parts of the world.

It is a disease of agrarian people who work barefoot, particularly on red clay soil in the neighbourhood of volcanoes. These soils are cytotoxic to macrophages, causing lymphatic obstruction. Tiny microparticles of silica from the volcanic soil and aluminosilicates penetrate the skin. Depending on the size of the particles the local lymphatics in the foot may be obstructed or there may be more proximal regional lymph node entrapment, fibrosis, and subsequent obstruction at the lymph nodes. The end result is chronic lymphatic obstruction and fibrosis, which is commonly accompanied by superinfection with *M. tuberculosis*, other fungi, or bacteria. Podoconiosis could be completely prevented if those at risk were to wear shoes.

One LF survey, which was conducted following reports that lymphatic filariasis was very common in Kwen County on the slopes of Mt. Elgon, has documented podoconiosis in this area (Onapa *et al.* 2001b). Overall prevalence of elephantiasis observed in the study area was 4.5%. Prevalence in individuals  $\geq 20$  years was 8.2%, and males and females were equally affected. Blood examinations were negative for *W. bancrofti* circulating antigen and microfilaria, and none of the mosquito vectors were infected with filarial larvae. Based on these results and on the geographical and environmental conditions of the study area it was concluded that elephantiasis in this area was due to podoconiosis. Further, smaller surveys to map LF in Uganda have shown that parts of Kisoro and Kamwenge districts are also endemic for the disease.

Areas of Uganda other than those identified during LF surveys have comparable environmental conditions (the chain of mountains north of Mt Elgon and highland of South and Southwest, including the Rwenzori and the Muhabura Range) and may therefore also be endemic for podoconiosis. A first step towards control of podoconiosis would be to identify and map out these other areas of endemicity. In communities with a high frequency of elephantiasis, the etiology should be established as filarial or non-filarial. Health authorities in podoconiosis affected areas will then need to be informed that this condition is due to soil particles absorbed through the feet. Health education materials would need to be developed to inform the local population of the disease etiology and to convey the message that wearing shoes prevents podoconiosis. However, at present the Ugandan MoH has no explicit plans to address this disease over the next 4-5 years (MoH 2005).

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### 3. PARTNERSHIPS

#### 3.1 Institutional partnerships

The priority NTDs of Uganda for which there exist nationwide data on geographical distribution and burden, are all vector-borne diseases. These are addressed by VCD, an important disease control unit of the MoH (Dunne *et al.* 2006). VCD was established in the early 1920s and led vector-borne disease control in Uganda until the 1970s, when it virtually collapsed during the military rule. In 1994 it was rehabilitated with funds from the African Development Bank. At the time, strengthening collaborations with institutions in neighbouring countries and overseas contributed to rebuilding the capacity of VCD to carry out operational research and control. Important partners were the DBL, the Division of Vector Borne Diseases of the Kenyan MoH and the Kenyan Medical Research Institute. The latest major collaborations were the launch of SCI in 2003 (see 2.4.2) and of various research projects with LSHTM.

Despite its strong links with institutions in other countries, there is limited direct technical support to VCD from international organisations within Uganda. International donors in Uganda have provided financial support to specific programmes, most of which has terminated or is about to do so, but have not put mechanisms into place to ensure that their initial investments into NTD control is more likely to be sustained over time. In contrast to this, the National Malaria Control Programme (NMCP) has benefited (and continues to do so) from a long-term technical advisor funded by USAID and from the support of various NGOs, particularly the MC. Much of this support builds capacity within the existing programme and strengthens service delivery.

The MC is registered as an international NGO in Uganda. Over the years, the expertise of the MC's technical team has been expanded beyond malaria and the organisation has become involved in the control of other communicable disease, most notably tuberculosis (TB). Here the MC collaborates closely with the district health services in north and north-eastern Uganda to strengthen the TB response. It also implements activities on diarrhoeal disease control in northern Uganda. By now the MC's technical team covers all areas of communicable disease control, as well as cross-cutting issues (health systems, partnerships, monitoring and evaluation, communications, capacity development). The MC is involved in all aspects of malaria control in Uganda from resource mobilisation and development of policies and strategies through to implementation and monitoring and evaluation. It works alongside the NMCP and, at district level, with the district health services. All its activities span the whole of Uganda and are carried out through existing governmental structures.

To give some specific examples of the MC's support to malaria control in Uganda: The organisation has been/continues to be involved in malaria vector control by having assisted in the development of an ITN delivery system through government health facilities in northern Uganda and in the development and implementation of a system to re-treat ITNs with insecticide. MC staff also lead a number of research projects to investigate the residual life of insecticides on ITNs and for indoor residual spraying (IRS). On diagnosis and treatment of malaria and other disease of importance to children, the MC has provided assistance on the design of a home-based care package for camps of internally displaced persons (IDPs). This and other activities have been further supported through the MC's health systems strengthening project, which seconded an information officer to the NMCP and addresses malaria in pregnancy, drug supply management systems, health management information systems and severe malaria case management in 4 districts (Hoima, Masindi, Kibale, Kiboga) in the West of Uganda. To support the MoH's aim of ensuring appropriate malaria treatment, the MC became a key partner in the process of changing antimalarial drug policy to artemisinin-based combination therapy (ACT) and will be of major importance in implementing this new policy. For all aspects of malaria control, IEC forms an important part of the national control strategy. This has also been

an area of work of the MC, where its staff are educating community and district leaders on malaria advocacy, prevention and treatment.

NTDs other than the well-described vector-borne ones addressed by VCD may also require additional support (both funding and technical). Based on their assumed burden, this mainly applies to Buruli ulcer and to trachoma. Whereas Buruli ulcer has not received any attention as yet and a contact person within the MoH remains to be identified to allow the establishment of a partnership, trachoma is receiving some support from Sight Savers International, the Lions Club and WHO, a partnership in the form of the Trachoma Task Force has been established and survey activities are underway.

### **3.2 Public-private partnerships**

Public-private partnerships (PPPs) to improve patients' access to existing treatments have started to alter the health care landscape. These partnerships are built around the fact that no single organization or sector has the skills and resources to solve the global health inequities alone. Many of the partnerships concentrate on improving access to treatments for NTDs and have re-energized efforts to fight diseases such as leprosy, lymphatic filariasis, sleeping sickness and river blindness. However public-private partnerships are not a panacea nor do they relieve the public sector of its responsibilities for public health (Mills *et al.* 2002, Sundaram & Holm 2005).

In Uganda the PPP initiative is fully embraced by the Government, which has put into place a national policy and guidelines for partnerships (MoH 2002) and established a coordinating office within the MoH (MoH 2005). Potentially, PPPs could permit the more efficient use of resources and reduced costs, increase the likelihood of sustainability, develop a stronger base of support by bringing in valuable knowledge and skills, prevent duplication of work, increase the scale and scope of activities, raise credibility, generate new outcomes and create understanding among different communities. However, to date the MoH has mainly focused on the potential of PPPs to reduce the burden of common childhood diseases, specifically diarrhoea, acute respiratory infection and malaria (MoH 2001, 2002). The potential contribution of the PPP approach to contribute to the control of NTDs in Uganda has not been explored and needs further investigation.

## 4. INTEGRATED CONTROL

### 4.1 Background

Over the last years, integration of NTDs control programmes has been advocated with the aim of increasing the likelihood of reaching the Abuja targets and MDGs (Molyneux & Nantulya 2004, Molyneux *et al.* 2005, Fenwick *et al.* 2005). Diseases proposed for integrated control are lymphatic filariasis, onchocerciasis, schistosomiasis, intestinal parasites and trachoma. Most recently it was suggested that a package of interventions targeted at NTDs could be integrated with programmes for HIV/AIDS, tuberculosis and malaria (Hotez *et al.* 2006a).

The rationale for the proposed integration is that current control programmes for NTDs are mostly vertical and often work in parallel. Only four drugs – ALB, IVN, PZB and azithromycin – are used to control six major neglected diseases – schistosomiasis, STH, trachoma, LF and onchocerciasis - that exhibit considerable geographical overlap. It is thus thought that a single structure, such as CDTI for onchocerciasis control or the NMCP, could be readily used to deliver more than one intervention. As the structure is already in place this would, in theory, only slightly increase costs when a component is added, or reduce costs if two structures were merged, while considerably expanding coverage (Molyneux & Nantulya 2004, Molyneux *et al.* 2005, Fenwick *et al.* 2005).

Unfortunately there is limited evidence to support the claim that integration of separate NTD control programmes, with each other or as a package with national control programmes for malaria or other disease, is as straightforward and as cheap as portrayed (Webster *et al.* 2004, DBL 2006). There are in fact potential dangers associated with the linkage of programme, such as that of an increased bureaucratic burden, leading to reduced acceptability and accessibility of health services (Van Dormael *et al.* 2004, Unger *et al.* 2003). It is also not known what the effect, both positive and negative, of combining various anthelmintics may be (Fenwick 2006).

Given the great potential that integrated delivery of NTD control could have and that a number of initiatives are underway to apply this approach (Fenwick 2006, Sachs & Hotez 2006), it will be important to clearly document these experiences. NTD programmes that are planning to integrate activities should be made aware of the limited evidence in this field to date and be supported to ensure that monitoring and evaluation systems are put in place to contribute towards building an evidence-base (DBL 2006). Useful guidance on the epidemiological aspects of such evaluations has been provided by Brooker *et al.* (2004c).

### 4.2 Integrated control of neglected disease in Uganda

Onchocerciasis, schistosomiasis and helminth infections are co-endemic in five districts of Uganda (Arua, Adjumani, Masindi, Hoima and Yumbe), where more than 500,000 people are at risk of co-acquiring them. Onchocerciasis can be effectively controlled through CDTI whereas the main strategy for schistosomiasis and STH control in Uganda is school-based treatment. This means that other groups at high risk of morbidity, such as non-enrolled children and pregnant women may not get treated. Theoretically, the control of schistosomiasis and STH infections in other high-risk groups could be integrated with CDTI for onchocerciasis control. Whether this is feasible in practice was investigated in a pilot study in two sub-counties in Arua district over a one-year period (Ndyomugenyi & Kabatereine, 2003).

The results showed that drug administration for schistosomiasis and STH control can be integrated with CDTI for onchocerciasis control without negatively affecting treatment coverage for the latter. IVN treatment coverage was in fact higher in the integrated approach than under routine CDTI, as was coverage with PZB and MEB. This was thought to be due to: i) the large

number of children brought to a central point by the caretakers, and ii) easy access to children not enrolled in school. Though not explored in this study, the above evidence indicates that integrated CDTI would also be feasible for treatment of schistosomiasis and STH in other high-risk groups.

A disadvantage of the integrated CDTI approach was the more frequent occurrence of drug shortage. This was due to treatment being administered to non-target groups that were perceived as having schistosomiasis and/or STH infections. To avoid such shortage, sufficient drugs should be supplied to treat all age groups in areas where the prevalence of schistosomiasis and STH infections is  $> 50\%$ , as recommended by WHO (1998).

Despite the promising results obtained from the study of the integrated CDTI, this approach has not been put into practice to date. The reasons for this are mainly of logistical and financial nature, with additional funding being required to support the scale-up, and technical support to monitor the implementation and to evaluate its impact. Senior VCD staff are drawing-up a strategic plan for integrated NTD control in Uganda, with the aim of obtaining funding from the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) and other sources. The preparation of the strategic plan is ongoing. Preparation of a strategy document on integrated control for the WHO regional office for Africa (AFRO) is also in progress.

#### **4.3 Possible packages of integrated control tools**

The implementation of an integrated NTD control package, like the one for onchocerciasis, schistosomiasis and STH described in the previous section (Ndyomugenyi & Kabatereine, 2003), involves the use of a number of drugs, either in combination or in sequence. Presently, there is limited information on the safety and efficacy of drugs that could potentially be co-administered (Fenwick 2006, DBL 2006) and only some combinations have been approved by WHO (see annex 2 for examples). Others, for example triple treatments for helminthic diseases, are under discussion (annex 3).

Formulation of a package of interventions for NTD control in Uganda will need to be based on the existing safety evidence. This might limited the number of drugs that can be deployed in a specific setting. For helminthic disease, the combination of treatments recommended by WHO for specific epidemiological settings should be used (annex 2). As co-endemicity varies within the country and as capacity for implementation depends on the level of the health system, it is likely that more than one package would need to be developed just to address the major NTDs. For example, if safe delivery of a drug regiment cannot be ensured at community level, a package might need to be modified to exclude delivery of a certain drug at this level of the health system.

A step further would be the implementation of a package that includes as yet unapproved combinations (see annex 3). Implementation of these packages, where there is limited information on potential side-effects, needs to be accompanied by vigorous pharmacovigilance. A general pharmacovigilance system is currently being put in place in Uganda. This and the need for additional training, monitoring and supervision of health workers should limit implementation of such package to a pilot area and be supported by a strong research component designed to yield the necessary evidence on safety, efficacy and operational constraints.

Integrating control of the major NTDs with that of other interventions is another option. Discussions are ongoing in health sector meetings on the expansion of the role of CDDs that currently provide home-based management of fever (HBMF) or home-based care. Integration with, for example, the control of helminthic disease could be envisaged, but needs further

assessment of feasibility and effects on the health system. A pilot study of expanded delivery through CDDs (using village health teams) is underway by WHO in Mpigi district.

Some aspects of the delivery of 'broad packages' are also currently being assessed in Uganda as part of a multi-country study funded by the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR). This multi-country study is implemented in Tanzania, Nigeria, Uganda, Cameroon and Togo over a three year period and is meant to investigate the feasibility of combining interventions for onchocerciasis, malaria, TB and Vitamin A deficiency, delivered through community health workers. In Uganda, it is implemented by CDDs in the districts of Sironko, Kanungu, Kyenjojo and Arua, with Nebbi serving as a control. Details of the combined interventions are shown in table 2.

Table 2: Combination of interventions being studied in Uganda

District*	Interventions		
	2005	2006	2007
Sironko	CDTI + DOTS	CDTI + DOTS + HBMF	CDTI + DOTS + HBMF + ITNs + Vitamin A
Kanungu	CDTI + HBMF	CDTI + HBMF + DOTS	CDTI + HBMF + DOTS + ITNs + Vitamin A
Kyenjojo	CDTI + ITNs	CDTI + ITNs + Vitamin A	CDTI + ITNs + Vitamin A + DOTS + HBMF
Arua	CDTI + Vitamin A	CDTI + Vitamin A + ITNs	CDTI + Vitamin A + ITNs + DOTS + HBMF
Nebbi	Control		

\* In each district shown, the intervention is implemented in one sub-district with a minimum of 50 villages

Current implementation is in year two and has already shown a number of problems. For example, as the number of interventions increases, the activities of the CDDs resemble that of a full-time job and they are unable to attend to activities that generate income. They therefore demand to be paid for their work. Also, the supply of certain items, in particular ITNs, has proven a challenge.

It remains to be seen what the final results of the ongoing studies will show. Once available, they will no doubt yield valuable information for the implementation of any integrated disease control package in Uganda. Meanwhile it will be important to decide where to target packages of NTD interventions and what these should consist of. This process should take account of the effect that integration might have on district focal persons (i.e. more work and less per-diems for monitoring and supervision visits), of limitations in the time and experience of CDDs and of recommendations on how to support, rather than undermine, the health sector in general (e.g. Unger *et al.* 2003).

## 5. CONCLUSION

### 5.1 Disease specific

In term of their documented burden, the NTDs of major importance in Uganda are STH, schistosomiasis, lymphatic filariasis and onchocerciasis. Control programmes for these are in place and have achieved major successes over the years. Biannual treatment with IVN in isolated foci is planned as a new strategy to eliminate the parasite in these areas. What is needed now is further financial support to continue implementation or to scale it up where required, and to investigate the feasibility and potential benefits of delivering some or all of the interventions for these diseases as an integrated package in areas of geographical overlap. To guide policy, better epidemiological descriptions of within and between population distributions and risks of co-infection and co-morbidity are clearly needed. This will help to better define the contribution of NTDs to overall disease burden and the potential health impact of removing or reducing combined disease risk.

Another NTD for which a control programme is well established is HAT. Though it causes a comparatively low burden in Uganda, the current danger lies in the ongoing spread of the rhodesiense form of the disease, due to uncontrolled cattle movement. This could soon result in the overlap of the two HAT forms, which would have important implications for patient care and national control policy. Financial support is required to implement control measures and to strengthen monitoring of the disease dynamics at district and community level.

The importance of some other NTDs in Uganda remains as yet less clear. VL, trachoma, Buruli ulcer and podoconiosis are known to be endemic in some districts, but detailed data on the associated burden is lacking. For VL and trachoma, multi-sectoral initiatives are underway to better describe them. Once results from these studies become available, further funding will be necessary to scale-up interventions. Buruli ulcer has not benefited from any activities to improve on the understanding of its distribution and impact in Uganda. As a first step it will be necessary that the MoH identifies a department and a focal point that takes responsibility for it. Subsequently, a funding proposal needs to be developed to conduct a national case search and to determine the epidemiological characteristics of the disease. Areas at risk of podoconiosis have been suggested on the basis of geography and climate, but most of them remain to be verified. Though it is a debilitating disease and causes stigma, it is of comparatively low priority and presently unlikely to attract financial support to conduct the surveys that would be necessary to target prevention and control.

The remaining NTDs present in Uganda, leprosy and guinea worm, occur at such low prevalences that existing control programmes can readily address them. Though ongoing surveillance is required, it is presently not envisaged that additional implementing partners would be able to make a significant contribution towards their control.

### 5.2 Support specific

As mentioned in the previous section, current shortcomings in ongoing NTD control are largely attributable to the lack of funding. Each of the major NTD control programmes is headed by a highly qualified and competent senior staff member, who is fully aware of the shortcomings of the programme, but unable to address these in the absence of technical support and cross-disease funding. This has previously led staff at VCD to investigate options for integration of onchocerciasis, schistosomiasis and STH control in the hope that it might reduce logistics and associated costs, and is currently driving the development of a strategic plan for integration and the search for new funding opportunities. Given the considerable technical expertise in country, disease-specific technical support has so far been less important than financial support and has often already been provided ad-hoc by research institutions outside Uganda (e.g. SCI, LSHTM,

DBL). However, with the envisaged move to integrated control in some districts of Uganda, technical in-country support to VCD is likely to become more important.

To get involved in NTD control, the entry point for the MC is to partner with VCD in the development of funding proposals to design, implement and evaluate a NTD control package. The good reputation and track-record of the MC would be likely to strengthen the position of VCD and *vice versa*. Existing MC donors could be approached to fund a VCD/MC implementing partnership. This might be more successful than individual applications. Depending on the needs of VCD, the role of the MC in the partnership could be to provide full-time in-country technical support on delivery, monitoring and evaluation of the integrated package and/or to be a strong implementing partner in rolling-out the proposed control package.

In preliminary discussions, senior VCD staff have already indicated that they would appreciate more technical support. Two mechanisms seem to be suitable for this. One option may be the secondment of a full or part-time technical advisor by the MC to VCD. S/he could provide technical input and carry out specific activities (e.g. prepare reports and publications) when senior staff are occupied with other aspects of VCD operations. Apart from the need to attract a relatively large amount of funding to implement a NTD control package there are also numerous smaller funding opportunities that the advisor could explore to support VCD activities (e.g. grants for operational research and for staff development). Assisting with the development of junior VCD staff would be particularly useful to ensure that good progress in NTD control achieved by the current senior staff will continue after their retirement. Details of such secondment would need further discussion, but if taken forward then it is suggested that the advisor should be housed in VCD and report to the head, Dr Ambrose Onapa.

Another option would be for the MC to support implementation of the integrated NTD package in a similar way as it already supports control activities for malaria and other communicable diseases (see 3.1). Specific expertise of MC staff and logistic support could supplement the existing expertise and control capacity of VCD to provide an altogether stronger implementation of an integrated package and of other interventions (see below).

The technical support outlined above could be extended to include all diseases housed within VCD (i.e. be extend to HAT, VL and Buruli ulcer, if responsibility for the latter is given to VCD). Though the development and implementation of an integrated package for the control of STH, schistosomiasis, lymphatic filariasis and onchocerciasis is certainly the most important and most likely to attract funding, all of the vector-borne NTDs would benefit from additional financial and technical support, and most of the VCD staff would benefit from staff development. A technical advisor could play a key role in identifying funds, writing proposals and in ensuring that successful applications are put into practice. With regards to assisting with the implementation of disease-specific activities, the MC could get involved in the monitoring of HAT disease dynamics and in ensuring that adequate control measure are put in place and maintained, and in studying the geographic distribution and epidemiology of Buruli ulcer. Once results from the ongoing work on VL become available there will also be a need to implement preventative methods in Karamoja district.

Involvement in work on trachoma should presently only be further explored if it is likely that funding for district-wide surveys could be secured. The Trachoma Task Force does not seem to require support in the implementation of survey activities that are already funded. Once results from ongoing surveys become available and if districts with a trachoma prevalence > 10% are identified, then there may be room for the MC to get involved in the delivery of the national control (SAFE) strategy. However, this should only be considered in areas where this could easily be incorporated into existing MC activities and if funding was readily available.



## 6. RECOMMENDATIONS

### 6.1 General Recommendations

- Many NTD interventions rely on CDDs and therefore face the challenge to replace those that do not keep up their responsibilities (as is the case with the Home-Based Management of Fever strategy). To maintain an adequate pool of CDDs, different mechanisms including a community system for replacement of CDDs should be investigated.
- When investigating mechanisms to strengthen the role and skills of CDDs this should be done in accordance with the MoH's plans to expand the coverage of village health teams (MoH 2005). At present there are health workers (CORPs/CDDs) in the community supported by different programmes. The connection between the multiple community health initiatives and HSSP II is not always evident. To overcome this weakness of health service delivery at the community level, village health teams have been established in some districts. These teams are meant to consist of 9-10 people and mainly have the responsibility of coordinating health related activities at the community level. However, the establishment of these teams has been slow and not well coordinated, and the linkage with the formal health system and the community remains weak. Activities to strengthen NTD control at community level should be carried out with a view of contributing towards the HSSP II objective of mobilizing community service providers, rather than be carried out in isolation of these broader plans (MoH 2005).
- In general, there is ongoing discussion on expanding the role of community health workers (CDDs and CORPS) in Uganda to address more and more diseases, but there is little recognition that there are limits to this expansion. Unless properly supported and monitored, community health workers will quickly end up with too many drugs and responsibilities, and too little knowledge to deliver health care according to best practice. The implementation of an integrated NTD control package will need to pay attention to the limitations at community level, as well as at higher levels of the health service, and be consistent with the capacity at each level. The design of a specific package for each level should be discussed, as should mechanisms for monitoring and supervision of delivery.
- Ongoing implementation of NTD control is already experiencing demands from CDDs for incentives, as their workload has grown to such extent that they are often unable to attend to other activities. A possibility of maintaining the voluntary nature of the CDD position would be to increase their pool to a number where their workload is reasonable and where they are able to engage in activities that provide them with food or money. Such increase will, however, be only be possible if more funding is made available to provide the necessary training, monitoring and supervision. Further discussion within the MoH, with donors and with NGOs will be needed to address this issue. Ideally, the ratio of CDDs to households should be standardised; previously it used to be 1:100, but the costs of supporting this system were considered unreasonable.
- Areas with a high burden and overlap of NTDs have been identified (see map **in progress**). An integrated NTD control package(s) should be developed for these areas that, ideally, adhere to the proposed 'code of best practice for disease control programmes' (Unger *et al.* 2003). Above issues related to the number and capacity of CDDs need to be taken into account in the formulation of the package and be addressed as part of it.
- Implementation of the package should emphasize monitoring and evaluation, to strengthen the evidence-base for combined interventions.

- The relative advantage of including vector control as part of this package (e.g. see onchocerciasis and ITNs for LF prevention (Pedersen & Mukoko, 2002)) should be investigated
- Options for adding some of the NTDs to Uganda's PPP strategy should be assessed
- Studies to investigate potential drug interactions and mechanisms for monitoring anthelmintic resistance and (side-)effects of the new treatment regime should be put in place
- Establishment of a mechanism to monitor the potential synergistic effect of artemisinin (introduced into Uganda for treatment of malaria in early 2006) on prevalence and intensity of schistosome infections should be discussed

## 6.2 Recommendations specific to the Malaria Consortium

- Through this assessment the MC has initiate discussions with VCD on their specific needs for support and on how the MC could contribute towards meeting these. Collaboration between the MC consultant and VCD has already been very productive, as it has resulted in the preparation of this joint report and led to an invitation to present the results at a workshop on integrated NTD control in Kampala on 25 & 26 April. It has also led to preliminary discussions with Alan Fenwick on development of a joint proposal for NTD control with Imperial College and other partners. Next steps are:
  - To discuss internally what role the MC could play as a VCD implementing partner (what activities could be supported given current and potential future resources).
  - Based on the results of above discussion to discuss with VCD how the two organisations can complement each other
  - To participate in the workshop on integrated control of NTDs in April
  - To present the findings from the report at the meeting. (Note: What is required is a basic introduction to NTDs for the district directors of health services)
  - As part of the workshop and leading on from it to participate in the development of a joint proposal for integrated control
  - To further discuss with VCD what role a technical advisor could play and how this could be funded (maybe include as part of joint proposal on integrated control)
- The potential of PPPs to contribute towards the control of NTDs in Uganda has not been explored. Further investigation into ways in which the existing MoH PPP strategy could incorporate some component aimed at controlling NTDs should be carried out. This should be done both for diseases that might in future be addressed as an integrated control package (schistosomiasis, STH, onchocerciasis, LF), and for diseases that are unlikely to form part of such package. MC staff could explore their links to relevant MoH staff to establish the current stage of PPP implementation in Uganda and the potential for expanding it to include a NTD component. The MC's PPP expert could explore his existing links with public and private service providers to contribute additional views towards such assessment.

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## ANNEX 1: BROAD-SPECTRUM EFFECTS OF ANTHELMINTICS

WHO recommended anthelmintic drugs for use in preventive chemotherapy, their target diseases and broad-spectrum effects (from WHO 2006). Prescribing information and contraindications are given in the WHO Model Formulary 2004 (WHO 2004b).

PZQ 40 mg/kg	IVN 150-200 µg/kg	ALB 400 mg or MEB 500 mg	DEC 6 mg/kg	PYR 10 mg/kg	LEV 2.5 mg/kg
Schistosomiasis	Onchocerciasis	Ascariasis	LF	Ascariasis	Ascariasis
Taeniasis (10 mg/kg)	LF	Hookworm Disease		Hookworm Disease	Hookworm Disease
Opisthorchiasis	Strongyloidiasis	Trichuriasis		Enterobiasis	Enterobiasis
Clonorchiasis	Ascariasis	LF			
Paragonimiasis	Trichuriasis	Enterobiasis			
Intestinal Trematodiasis	Enterobiasis	Cutaneous larva migrans			
	Ectoparasites				

## ANNEX 2: SUMMARY OF APPROVED PREVENTATIVE SCHEDULES FOR HELMINTHIC DISEASES

Disease	Treatment
LF	ALB + DEC (universal treatment)
LF + Onchocerciasis	ALB + IVN (universal treatment)
LF + Schistosomiasis	ALB + DEC (universal treatment)
LF + STH	Round 1: ALB + DEC (universal treatment) Round 2: ALB or MEB or LEV or PYR (targeted at school-age children, only if STH prevalence $\geq$ 50%)
LF + Onchocerciasis + Schistosomiasis	Round 1: ALB + IVN (universal treatment) Round 2: PZB (targeted to school children & adults at risk)
LF + Onchocerciasis + STH	Round 1: ALB + IVN (universal treatment) Round 2: ALB or MEB or LEV or PYR (targeted at school-age children, only if STH prevalence $\geq$ 50%)
Onchocerciasis	IVN (universal treatment, meso- & hyper-endemic communities)
Onchocerciasis + Schistosomiasis	Round 1: IVN (universal treatment, meso- & hyper-endemic communities) Round 2: PZQ (targeted to school children & adults at risk)
Onchocerciasis + STH	Round 1: ALB (targeted at school-age children) and IVN (universal treatment in meso- & hyper-endemic communities) Round 2: ALB or MEB or LEV or PYR (targeted at school-age children, only if STH prevalence $\geq$ 50%)
Schistosomiasis	PZQ (targeted to school children & adults at risk)
Schistosomiasis + STH	Round 1: ALB or MEB (targeted at school-age children) and PZQ (targeted at school-age children and adults considered at risk) Round 2: ALB or MEB or LEV or PYR (targeted at school-age children, only if STH prevalence $\geq$ 50%)
STH	Round 1: ALB or MEB or LEV or PYR (targeted at school-age children) Round 2: ALB or MEB or LEV or PYR (targeted at school-age children, only if STH prevalence $\geq$ 50%)

Note: Table adapted from WHO 2006

### ANNEX 3: SUMMARY OF PREVENTATIVE SCHEDULES FOR HELMINTHIC DISEASES THAT ARE UNDER DISCUSSION

Disease	Treatment
LF + Schistosomiasis + STH	Round 1: ALB + DEC (universal treatment) Round 2: PZQ (targeted at school-age children and adults considered at risk) and ALB or MEB (targeted at school-age children, only if STH prevalence $\geq$ 50%)
LF + Schistosomiasis + STH + Onchocerciasis	Round 1: ALB + IVN (universal treatment) Round 2: PZQ (targeted at school-age children and adults considered at risk) and ALB or MEB (targeted at school-age children, only if STH prevalence $\geq$ 50%)
LF + STH + Onchocerciasis	Round 1: ALB + IVN (universal treatment) Round 2: ALB or MEB or LEV or PYR (targeted at school-age children, only if STH prevalence $\geq$ 50%)
LF + Schistosomiasis + Onchocerciasis	Round 1: ALB + IVN (universal treatment) Round 2: PZQ (targeted at school-age children and adults considered at risk)
Schistosomiasis + STH + Onchocerciasis	Round 1: IVN (universal treatment in meso- & hyper-endemic communities) and ALB (targeted at school-age children, only if STH prevalence $\geq$ 50%) Round 2: PZQ (targeted at school-age children and adults considered at risk) and ALB or MEB (targeted at school-age children)

Note: Table adapted from WHO 2006