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Neglected Tropical Diseases in Uganda:

the Prospect and Challenge of Integrated Control

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Abstract

So-called neglected tropical diseases (NTDs) are becoming less neglected, with increased political and financial commitment to their control. These recent developments have been preceded by substantial advocacy for integrated control of different NTDs, on the premise that integration is both feasible and cost-effective. Although the approach is intuitively attractive, there are few country-wide experiences to confirm or refute this assertion. Using the example of Uganda, this article reviews the geographic and epidemiological basis for integration, and assesses the potential opportunities and operational challenges of integrating existing control activities for some of these diseases under an umbrella vertical programme.

Potential for integration

Increased emphasis is being given to controlling neglected tropical diseases (NTDs) (http://whqlibdoc.who.int/hq/2006/WHO_CDS_NTD_2006.2_eng.pdf). These are so-called because they exclusively affect the poor and marginalized in low-income countries and, until recently, received little or no advocacy or funding. The most important African NTDs are shown in Table 1. Although these diseases are thought to kill up to 500,000 people per year [1], mortality figures alone do not capture their main impact on public health, which largely arises from chronic disability and morbidity [2]. In an effort to control or eliminate this disease burden, a number of vertical global initiatives have been established [3]. Since 2004, there has been increased advocacy for the logistical and economic benefits of integrated NTD control whereby different treatment strategies are bundled together [4,5,6]. Integration can also involve another aspect: linking intervention packages with ongoing health care delivery [7].

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Small-scale efforts to integrate vertical programmes have been undertaken in a number of African countries. For example, in Nigeria integrated distribution by community volunteers of anthelmintics combined with insecticide-treated nets (ITN) resulted in increased ITN uptake without adversely affecting mass drug administration (MDA) coverage [8]. To help support national programmes, WHO has recently published guidelines on integrated helminthiasis control. These have been designed to deal with drugs and their coordinated use in all epidemiological situations, including those where there is limited geographical overlap (http://whqlibdoc.who.int/publications/2006/9241547103_eng.pdf). In addition, the Global Network for Neglected Tropical Disease Control, was launched in October 2006 with the aim to provide advocacy and coordinate efforts of NTD control partners [9]. However, although the concept of integration is logistically and economically appealing, experience at the country level is surprisingly limited.

Like many other developing countries, Uganda is affected by a high burden of NTDs: visceral leishmaniasis (VL; kala-azar) [10], human African trypanosomiasis (HAT) [11], trachoma [12], Buruli ulcer [13], soil-transmitted helminths (STH) [14], schistosomiasis due to *Schistosoma mansoni* [15], lymphatic filariasis (LF) [16] and onchocerciasis [17] (Table 2). Dracunculiasis and leprosy have recently been eliminated from the country[1] [18]. Uganda provides a useful insight into the control of NTDs since it is one of the few African countries that has undertaken nationwide assessments for a number of NTDs [15,16,17] and has already piloted integrated control [19]. It also implements a broader integrated health package through the Ministry of Health's (MoH) Child Health Days and is one of five African 'fast track' countries to receive support from the US Agency for International Development (USAID) to develop an integrated NTD control programme (www.rti.org/newsroom). Implementation of such a package necessitates careful consideration of a number of issues, including the geography, epidemiology and ecology of different NTDs, as well as the advantages and disadvantages of the existing control strategies.

Geography of integrated control

Understanding which geographical areas require intervention is fundamental for cost-effective disease control. The mapping of Uganda's NTDs has been based on a variety of survey methodologies. Onchoceriasis distribution has been estimated using the Rapid Epidemiological Mapping of Onchoceriasis method [20], allowing communities to be classified into three categories: priority areas requiring community-directed drug treatment with ivermectin (CDTI); areas not requiring treatment; and possible endemic areas requiring further investigation [17]. Rapid mapping of LF included school surveys using immunochromatographic antigenic detection cards and the application of geostatistical methods to create a nationwide surface of LF prevalence [16]. Distributions of schistosomiasis and STH infections were defined on the basis of nationwide parasitological surveys [14,15]. More recently, rapid mapping of schistosomiasis used Lot Quality Assurance Sampling (LQAS) to finely target control [21]. LQAS has also been used to estimate the prevalence of *Trypanosoma brucei gambiense* trypanosomiasis in northern Uganda, enabling communities to be ranked according to prevalence categories [22]. Elsewhere, distributions of HAT have been assessed on the basis of expensive case detection through passive or population mass screening: *T. b. gambiense* occurs in northwestern Uganda, whereas *T. b. rhodesiense* has traditionally occurred in southeastern areas [23]. These two foci are currently geographically separated but are becoming worryingly close [11,24]. Endemicity of VL has so far been defined only on the basis of passive case detection data, which suggests that the disease is restricted to Pokot County, a semiarid

[1]GLRA/NTPL. Leprosy Status Report 2004. German Leprosy Relief Association/National TB and Leprosy Programme. Wandegeya, Kampala, Uganda, 2004.

lowland area in Nakapiripirit district [10]; although there are concerns that VL endemicity may be more widespread. Trachoma is thought to be endemic in at least 26 districts, putting approximately 7 million people at risk. A nationwide survey is planned to provide detailed data on trachoma distribution and burden.

On the basis of these geographical assessments, it is possible to qualitatively define the co-distribution of different NTDs (Figure 1). Existing data indicates that onchocerciasis, schistosomiasis and LF are co-endemic in 10 districts of northwestern Uganda, putting more than 500,000 people at risk of co-acquiring them. LF is co-endemic with schistosomiasis in at least 19 districts and with onchocerciasis in at least 13 districts. Further surveys will be required to confirm whether co-endemicity applies to whole districts or is more localised.

Epidemiology and ecology of integrated control

Control of different NTDs needs to be based on a detailed understanding of their epidemiologies and modes of parasite transmission. The target age groups may differ between NTDs [4]. The prevalence and intensity of schistosomiasis and STH (except hookworm) is greatest among school-aged children or young adults and decreases throughout adulthood [15,25], whereas, for LF and hookworm, age-specific prevalence rises throughout childhood and attains a stable asymptote, or rises marginally in adulthood [26,27,28]. Epidemiological patterns of onchocerciasis vary markedly between geographic zones [29]; in Uganda, infection prevalence increases throughout childhood and reaches a plateau at 20 years, whereas occurrence of nodules and onchocercal dermatitis increases throughout childhood and adulthood [30,31]. Thus, school-age children are the natural targets for population-based treatment of STH and schistosomiasis, whereas community-wide treatment is warranted for LF and onchocerciasis.

LF and onchocerciasis are vector-borne diseases, transmitted by several genera of mosquitoes and blackflies of the *Simulium* genus, respectively. Vector control has been highly effective in the control of onchocerciasis [32], for which the stated goal is interruption of transmission, and has the potential to play a significant role in LF elimination [33]. In both cases, communities within whole districts should be targeted with interventions [34,35]. Transmission of STH and schistosomiasis depends on contamination of the soil and snail-infested water with human faeces and urine, hindering elimination in settings with inadequate water and sanitation. Consequently, the goal of schistosomiasis and STH control is the reduction of morbidity, hence interventions typically target those age groups with the greatest morbidity, namely school-aged children and young adults in high prevalence communities or sub-districts [36,37]. These different treatment goals and varying intervention units require consideration in the design of integrated NTD treatment programmes.

HAT is transmitted by tsetse flies and occurs more often in adults [38], whereas VL is transmitted by sandflies and, at least in Uganda, is most common in children and teenagers [10]. Vector control can make an important contribution to reducing the burden of both diseases [39,40,41], but is rarely implemented due to lack of financial resources. Treatment is lengthy, expensive and relatively toxic. Development of new drugs and adequate diagnostic tools has been slow [42,43], although a reliable rapid diagnostic test for VL is now available [44].

Current NTD control in Uganda

The control of most NTDs is the mandate of the Vector Control Division (VCD) of the Uganda MoH. VCD was established in the early 1920s and led national vector-borne disease

control until the 1970s, when it virtually collapsed during military rule, only being rehabilitated in 1994 [45].

The longest running control programme in VCD is the national onchocerciasis control programme, established in 1992. Since the mid-1990s it has been supported by the Carter Centre's Global 2000 River Blindness Programme, Sight Savers International, the Gesellschaft für Technische Zusammenarbeit and the African Programme for Onchocerciasis Control. Intervention consists of annual CDTI, supplemented by vector control in isolated foci of *Simulium neavei* [46,47]. To date, geographical treatment coverage has reached 100% and therapeutic coverage remains stable at 80%. Large-scale vector control is unfeasible because the breeding sites are too widespread or inaccessible and extend into political unstable countries, such as the Democratic Republic of Congo.

The cornerstone of LF control is an annual MDA with a single dose of ivermectin plus albendazole, provided to the entire 'at-risk' population in targeted districts. The first MDA for LF was carried out at the end of 2002 in two districts with a population of one million people, reaching about 75% coverage. The scaling up to eight adjacent districts planned for 2003 was delayed because of insecurity and insufficient operational funds. In 2004, MDA was carried out in five districts with a total population of more than 2 million, and in 2005 was extended to cover 10 districts with a population of 4.9 million. In 2006 no distribution took place, due to lack of funds for drug delivery. MDA is carried out in schools and communities using trained teachers and community drug distributors (CDDs), respectively, with most districts having reached at least 65% coverage. It is increasingly appreciated that the use of ivermectin and albendazole in MDA for LF elimination has ancillary benefits against onchocerciasis and STHs [4].

For the combined control of schistosomiasis and STH infection, a national programme was established in 2003 [48], with support from the Schistosomiasis Control Initiative. The programme is managed by VCD at central level, but implemented by district health teams. MDA with praziquantel and albendazole is provided to all school children in target sub-counties (at the sub-district level), and to the whole community in areas where prevalence of infection exceeds 50%. Treatment in schools is carried out by teachers and in communities by CDDs [49].

HAT control activities, consisting of mass treatment of livestock with trypanocides and some vector control, were implemented in parts of Soroti district between January 2000 and December 2003. However, a survey conducted in 2004 in Soroti markets showed a high prevalence of *T. b. rhodesiense* in cattle, bought from endemic sleeping sickness areas of southeast Uganda. This showed that control activities have been largely ineffective and that the trade and resultant movement of animals infected with trypanosomes continues [11]. Currently, no control is undertaken against VL, Buruli ulcer or trachoma.

Progress and prospects of integrated control

The feasibility study of integrating treatment for onchocerciasis with schistosomiasis and STH infections showed that treatment coverage of ivermectin, praziquantel and mebendazole all increased under the integrated approach [19]. An identified disadvantage was that supplies of praziquantel and mebendazole ran out more frequently, because treatments were being administered to non-target groups. The investigators suggested that CDDs may have thought that they or their immediate relatives had schistosomiasis and/or STH infections, and thus treated themselves or their family before treating the targeted high risk groups in the neighbourhood. Despite the promising results, this integration has not been put into practice to date, although financial support from USAID aims to expand integrated delivery of anthelmintic treatment from 2007 onwards.

STH control also forms one of the components of Uganda's Child Health Days (CHD), which take place twice a year in April and October. CHDs are a period of accelerated routine maternal and child health interventions, delivered at all static health units and through outreach in communities and schools. The package of interventions includes Vitamin A supplementation, childhood vaccination and promotion of home and school hygiene. Implementation is through a multi-disciplinary team of health workers, community members (including CDDs), vaccinators and mobilisers. The provision of periodic, annual albendazole treatment delivered through this integrated approach has been shown to increase nutritional status of young children [50].

The strategy proposed for integrated control of LF, onchocerciasis, schistosomiasis, STH and trachoma, to be supported by USAID, focuses on the integration of individual drug delivery activities under an umbrella programme, to provide simultaneous, or almost simultaneous[2], population-based treatment. Only four drugs - albendazole, ivermectin, praziquantel and azithromycin - are used to control seven major neglected diseases - schistosomiasis, hookworm, trichuriasis, ascariasis, trachoma, LF and onchocerciasis. These exhibit considerable geographical overlap [1], at least if viewed at country level [6]. It is thus thought that a single structure, such as CDTI, CHDs or the National Malaria Control Programme, could be readily used to deliver more than one treatment. As the structures are 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 [4,51,52]. In Uganda, however, there is a limited geographic overlap between the different NTDs (Figure 1), necessitating a more geographically targeted approach. Furthermore, the structural changes required to deliver an integrated package are still being undertaken. In the interim it is already planned that the LF programme will provide ivermectin in April and the onchocerciasis control programme will provide ivermectin in October each year. In areas co-endemic for LF and onchocerciasis, such an approach has the potential to eliminate both diseases [53,54].

As well as differences in delivery structure and target geographical areas, control programmes differ in their frequency. STH treatment is recommended every 6-12 months, whereas treatment for onchocerciasis and LF is recommended annually, though the frequency and number of rounds of ivermectin treatment required to interrupt transmission of LF or onchocerciasis remain unknown [29]. Although schistosomiasis treatment with praziquantel is currently provided annually, longer treatment intervals may become justified as infection levels decrease. Coordinating these different treatment intervals represents a challenge for integration.

Treatment regimes for HAT and VL are too toxic and lengthy to be delivered outside a health facility [23,42,55] and are thus not suitable for inclusion in this new integrated approach. A threat exists therefore that control of HAT, VL and other NTDs will continue to be neglected, as attention is focused on those diseases that have a population-based chemotherapy strategy. Recent NTD advocacy has contributed to the allocation of funds for the development of a new generation of control tools (drugs, diagnostics, vaccines) for VL, HAT as well as other NTDs (e.g. see: http://www.dndi.org; www.sabin.org), but has had little impact on the allocation of funds to deliver existing HAT and VL control tools. Until new tools become available, control with existing, though imperfect, tools needs to be intensified [42, 56].

[2]Due to lack of drug safety data, the administration of praziquantel has to be delayed by at least one week from the time when ivermectin and albendazole are given. Similar restrictions apply in communities where trachoma is co-endemic and zithromax is to be included in the MDA package.

Apart from integrating treatment, there is considerable potential for integrated vector control for some NTDs, which receives little mention. In Uganda, the same mosquito species transmit both LF and malaria in the same districts [26]. Increasing the coverage with long-lasting insecticide-treated nets (LLINs) as part of malaria control efforts is thus likely to impact on LF vector densities and transmission [57,58], and merits further investigation (http://whqlibdoc.who.int/hq/2002/WHO_CDS_CPE_PVC_2002.3.pdf). Use of LLINs is also likely to provide personal protection against sandfly vectors of VL [59]. As VL and malaria are co-endemic in Uganda, it would be a good investment in health if LLIN coverage was scaled-up in the VL focus.

Challenges for integrated control

Approaches to integrated control are still being developed and best practice will only emerge after some experience resulting from actual implementation. Opportunities for implementation on a national scale are now being created through the USAID funding. In designing and implementing country programmes a number operational challenges exists and integrated control may not be straightforward and as cost-effective as portrayed[3] (http://bmj.bmjjournals.com/cgi/eletters/328/7448/1129) [60]. Potential shortcomings include an increased bureaucratic burden, leading to reduced effectiveness of health services (http://bmj.bmjjournals.com/cgi/eletters/328/7448/1129) [7]. Also, 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. The increased workload may prove detrimental to their performance related to any one activity, as already documented for the onchocerciasis control programme [61], and leads to demands for incentives in compensation for the work [62]. Whether and to what extend the capacity of CDDs in Uganda is underutilized requires further investigation, but it is already apparent that all of the programmes that heavily draw on them experience increasing demands for incentives [63,64]. These demands could, potentially, be overcome by increasing the number of CDDs so that the workload of each individual is reduced. However, to increase the pool of CDDs, more funding would be needed for training, health education and monitoring/supervision.

The current model of integrated MDA differs from the more common definition of integration: “a process where disease control activities are functionally merged or tightly coordinated with multifunctional health care delivery” [7]. Therefore, another challenge is the possibility that linking of vertical control programmes may promote the development of a parallel health delivery system, with separate funding, drugs, delivery channels and staff (http://www.foreignaffairs.org/20070101faessay86103/laurie-garrett/the-challenge-of-global-health.html). Ideally, drugs should be distributed from the centre to health facilities, who then distribute them to CDDs and schools as part of their outreach activities. Health workers should also be involved in training and monitoring and supervision. If the programme is to be sustainable in the long term and not reliant on continual donor support, it is essential that interventions are delivered through existing MoH staff and are funded at national and local levels.

A further challenge is the harmonization of information, education and communication (IEC) messages and their effective delivery. To date, social mobilization/sensitization of the target communities has often been inadequate, because resources for activities such as surveys on knowledge, attitude and practice, development of IEC materials and community meetings were limited. Furthermore, for both the STH/schistosomiasis and the

[3]Danish Bilharziasis Laboratory. Strength, limitations and knowledge gaps for evidence-based integrated helminth control in Africa. Danish Bilharziasis Laboratory - Institute for Health Research and Development. Workshop Report, 16-19 January 2006, Lusaka, Zambia.

onchocerciasis control programme, communities were sometimes not involved in the selection of their CDDs. In these cases communities were reluctant to participate in control activities and CDDs were more likely to 'drop-out' [63]. These experiences show that resources are urgently needed to improve on the development, implementation and evaluation of the health education component of each programme, and that communities need to be empowered to select their own health workers. An integrated approach will face the same challenges.

The safety and efficacy of certain drug combinations is also unknown[3] [65]. Combinations currently approved by WHO (http://whqlibdoc.who.int/publications/2006/9241547103_eng.pdf) are shown in table 3. Studies are required on the co-administration of ivermectin, albendazole and praziquantel and on co-administration of anthelmintics and zithromax [60]. Implementation of integrated chemotherapy with unknown potential side-effects needs to be accompanied by vigorous pharmacovigilance. A general pharmacovigilance system is currently being put in place in Uganda, but its implementation already poses numerous practical challenges [66]. These and the need for additional training, monitoring and supervision of health workers should limit implementation of an integrated package to a pilot area and be supported by a strong operational research component designed to yield the necessary evidence on safety, effectiveness and operational constraints [60].

Finally, monitoring and evaluation activities will need to be carefully designed and implemented, to answer important operational questions and to be able to modify and support control packages where necessary. Guidance on the epidemiological aspects of evaluating helminth control programmes is already available [67] and a WHO manual on evaluating integrated control is currently being developed. However, evaluation of the health benefits of an integrated control package represents a major challenge.

Conclusion

The success of integrated control depends on a clear understanding of the distribution and epidemiology of the diseases to be targeted. In most countries this information is incomplete, requiring detailed surveys to establish areas of co-endemicity and formulate MDA packages accordingly. With the move towards integrated control there is a need to broaden the scope of research, including studies of the effectiveness and cost-effectiveness of integrated NTD control as compared to existing control programmes. There is also a need to evaluate the impact of integration on the existing health systems, including quality of health care and staffing levels. Efforts to implement integrated control must be accompanied by investment in and strengthening of health systems and human resources, since these are prerequisites for the success of global health initiatives [68].

We hope that other health sector donors will soon follow the example of USAID and start to support the unmet needs for NTD control. Resources are urgently required to establish an evidence-base for integrated control and to curb the burden of diseases that cannot be controlled through MDA. Case-management for these diseases needs to become a functioning component of the existing health system [56]. Obvious gaps in the Ugandan context are HAT and VL, which will not benefit from integrated control as currently planned.

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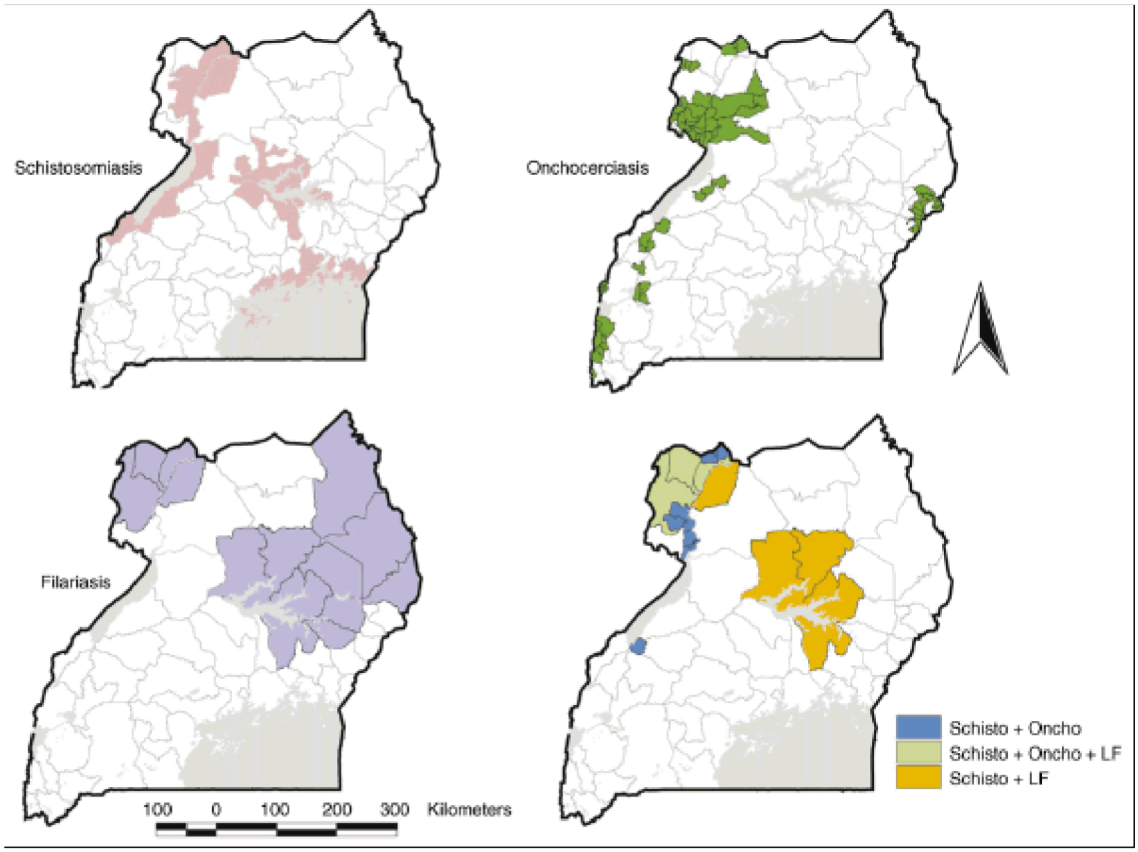

Figure 1.
Areas of Uganda endemic or co-endemic for NTDs that are controlled by the use of preventative chemotherapy through mass drug administration. Areas shown in red are endemic for schistosomiasis, light green areas for onchocerciasis, yellow areas for visceral leishmaniasis, light blue areas for lymphatic filariasis. Dark blue areas indicate counties (administrative areas below district level) co-endemic for schistosomiasis and onchocerciasis, orange areas are district where schistosomiasis and lymphatic filariasis are co-endemic and dark green areas are those where schistosomiasis, lymphatic filariasis and onchocerciasis are present. STH are endemic throughout Uganda

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Table 1

ed tropical disease and their control in Africa

	Etiologic Agent	Distribution	Control strategy	Drugs	International programmes
d helminths	*Ascaris lumbricoides* *Trichuris trichiura* Hookworm	*A. lumbricoides* and *T. trichiura* restricted to equatorial regions; hookworm is widespread	Annual mass treatment of schoolchildren and of whole communities in high prevalence areas	Benzimidazole anthelmintics, albendazole and mebendazole	Mebendazole Donation Initiative supported by Johnson and Johnson (see: www.taskforce.org)
s (Bilharziasis)	*Schistosoma haematobium, S. mansoni*	Africa-wide	Annual mass treatment of schoolchildren and of whole communities in high prevalence areas	Praziquantel	Schistosomiasis Control Initiative (www.schisto.org)
riasis (Elephantiasis)	*Wuchereria bancrofti*	Endemic in 39African countries	Annual MDA to treatment entire population for a (currently undefined) long period to interrupt transmission.	Albendazole and ivermectin	Global Alliance for the Elimination of Lymphatic Filariasis (www.filariasis.org)
s (River Blindness)	*Onchocerca volvulus*	Endemic in 30 African countries	Vector control through spraying of larvicides and annual community-directed-treatment (CDT) with ivermectin	Ivermectin	African Programme for Onchocerciasis Control (www.apoc.bf/en/)
(Guinea Worm)	*Dracunculus medinensis*	Eliminated as public health problem	Active case detection and provision of water supply and use of cloth filters		Guinea Worm Eradication Program (www.cartercenter.org/health/guinea_worm/index.html)
shmaniasis	*Leishmania tropica, L. major, L. infantum*	Scattered foci throughout Africa	Case detection and treatment. Personal protection through use of mosquito nets	Pentavalent antimonials; second line drug is amphotericin	
maniasis (kala-azar)	*L. donovani*	Scattered foci in Horn of Africa, Sudan, Ethiopia, Somalia, Kenya and Uganda	Case detection and treatment. Personal protection through use of mosquito nets	Pentavalent antimonials; second line drug is amphotericin	Drugs for Neglected Diseases initiative (www.dndi.org/)
n Trypanosomiasis	*Trypanosoma gambiense T. rhodesiense*	Endemic in 37 African countries	Case detection and treatment, and vector control through spraying, traps and targets.	*T. rhodesiense*: suramin or melarsoprol in early- or late stage disease, respectively *T. gambiense*: pentamidine or suramin for early- or late-stage disease, respectively. Alternative for melarsoprol refractory late stage *T. gambiense* treatment is eflornithine	Programme Against African Trypanosomiasis (www.fao.org/ag/againfo/programmes/en/paat/home.html)
	Chlamydia trachomitis	Widespread throughout the continent	SAFE strategy: surgery, antibiotic therapy, facial cleanliness, and environmental improvement	Zithromax	International Trachoma Initiative (www.trachoma.org)
	Mycobacterium ulcerans	Reported cases from 8 west African countries, 7 central Africa countries and Malawi and Uganda	Case detection and treatment and surgery	Rifampicin and streptomycin/amikacin	
	Mycobacterium leprae	Close to elimination (defined as prevalence of <1 cases/10,000	Multi-drug therapy (MDT)	Dapsone and rifampicin	

Etiologic Agent	Distribution	Control strategy	Drugs	International programmes
	population) though pockets of high endemicity remain in some areas of Angola, Central African Republic, Democratic Republic of Congo, Madagascar and Tanzania			

Table 2

Uganda's Neglected Tropical Diseases

Disease	Distribution[a]	Nationwide burden	Reference
A. lumbricoides and *T. trichiura*	Unevenly distributed, highest prevalence in south-western Uganda	<10% average prevalence, but >50% in south-western Uganda	[14]
Hookworm	Throughout Uganda (prevalence lower in NE)	>50%	[14]
Schistosomiasis	30 districts, particularly near the shores of lakes Albert and Victoria and along the Albert Nile	Approx. 4 million cases 16.7 million at risk	[15]
Lymphatic filariasis	North of Victoria Nile and in W Uganda	13.9 million at risk 0.4 - 30.7% prevalence of circulating filarial antigens in school children	[16]
Onchocerciasis	27 districts; highly endemic in West Nile region, central shores of Lake Albert, Mt Elgon & foci in SW Uganda	> 2 million at risk 1.36 million infected	[17]
Dracunculiasis	Eliminated as public health problem	Eliminated	[18]
Visceral Leishmaniasis	Pokot County, Nakapiripirit district (NE Uganda)	Unknown; > 600 cases treated per year, 70% from Kenya	[10]
Human African Trypanosomiasis	NW Uganda, predominantly in Adjumani, Moyo, Arua & Yumbe district	In 2005, 267 cases reported	[11, 24]
	SE and E Uganda	In 2005, 479 cases reported	
Trachoma	15 districts (based on HMIS records); nationwide survey planned	Unknown	[12]
Buruli ulcer	Unknown	Unknown	
Leprosy	Eliminated as public health problem	2.5 new cases / 100,000 population (2004)	1

[a]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

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Table 3

Summary of approved preventative schedules for helminthic diseases (adapted from http://whqlibdoc.who.int/publications/2006/9241547103_eng.pdf) [a]

Disease	Treatment
LF	Treat entire population at risk with ALB + DEC or ALB + IVN
LF + Onchocerciasis	Treat entire population at risk with ALB + IVN
LF + Schistosomiasis	Round 1: Treat entire population at risk with ALB + DEC or ALB + IVN Round 2 (at least one week after round 1): Treat school-age children and adults at risk with PZQ
LF + STH	Round 1: Treat entire population at risk with ALB + DEC or ALB + IVN Round 2 (after 6 months): If STH prevalence ≥ 50%, treat school-age children with ALB or MEB
LF + Onchocerciasis + Schistosomiasis	Round 1: Treat entire population at risk with ALB + IVN Round 2 (at least one week after round 1): Treat school-age children and adults at risk with PZQ
LF + Onchocerciasis + STH	Round 1: Treat entire population at risk with ALB + IVN Round 2 (after 6 months): If STH prevalence ≥ 50%, treat school-age children with ALB or MEB
Onchocerciasis	Treat entire population at risk in meso- & hyper-endemic communities with IVN
Onchocerciasis + Schistosomiasis	Round 1: Treat entire population at risk in meso- & hyper-endemic communities with IVN Round 2 (at least one week after round 1): Treat school-age children and adults at risk with PZQ
Onchocerciasis + STH	Round 1: ALB (treat school-age children) and IVN (treat entire population at risk in meso- & hyper-endemic communities) Round 2 (after 6 months): If STH prevalence ≥ 50%, treat school-age children with ALB or MEB
Schistosomiasis	Treat school-age children and adults at risk with PZQ
Schistosomiasis + STH	Round 1: ALB or MEB (treat school-age children) and PZQ (treat school-age children and adults considered at risk) Round 2 (after 6 months): If STH prevalence ≥ 50%, treat school-age children with ALB or MEB
STH	Round 1: Treat school-age children with ALB or MEB Round 2 (after 6 months): If STH prevalence ≥ 50%, treat school-age children with ALB or MEB

[a]Note: ALB = albendazole, DEC = diethylcarbamazine, IVN = ivermectin, MEB = mebendazole, PZQ = praziquantel; LF, lymphatic filariasis; STH, soil-transmitted helminths