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Short communication: **Soil-transmitted helminthiasis in Uganda: epidemiology and cost of control**

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Summary A countrywide description of the distribution of soil-transmitted helminths in Uganda is reported, based on data for 20 185 schoolchildren from 271 schools. The overall prevalence of *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm was 6.3%, 5.0% and 43.5%, respectively. The prevalence of *A. lumbricoides* and *T. trichiura* was unevenly distributed in the country with prevalence greatest in south-western Uganda whereas hookworm was generally more homogeneously distributed. Based on preliminary cost analysis of an ongoing school-based control programme, the financial delivery cost per schoolchild treated with albendazole is estimated to be between US$ 0.04 and 0.08 in different districts.

keywords soil-transmitted helminths, *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm, epidemiology, control, intervention costs, Uganda

After years of relative neglect, soil transmitted helminths (STH) have reached the global health agenda (Anon., 2004). Such prominence reflects both the growing recognition that STH (*Ascaris lumbricoides*, *Trichuris trichiura* and hookworm) exert subtle, yet significant, negative effects on the growth and education of schoolchildren (Awasthi *et al.* 2003; Hotez *et al.* 2004), and the availability of safe and efficacious single-dose oral treatments (Utzinger & Keiser 2004). To move forward control efforts, there is a requirement to provide epidemiological descriptions of STH on a countrywide basis as well as estimates of intervention costs. Here we report on both these issues for Uganda.

Between 1998 and 2005, pre-treatment surveys were conducted in 271 schools in 46 of Uganda's 56 (82%) districts. Stool samples provided by each child were examined microscopically using the semi-quantitative Kato-Katz technique for the eggs of STH and the concentration of eggs was expressed as eggs per gram of faeces (epg). Participation was voluntary and had been approved by the school committee and parents association, and ethical clearance was provided by the Ugandan Ministry of Health.

Data were available for 20 185 schoolchildren (11 413 males and 8772 females), aged 5–20 years. Overall, 54.8% were infected with at least one STH species. The prevalence of *A. lumbricoides* was 6.3% (range: 0–89.3% by school), *T. trichiura* was 5.0% (0–67.9% by school), and hookworm was 43.5% (0–90% by school). Figure 1 presents the distribution of STH species by school and shows that the prevalence of *A. lumbricoides* and *T. trichiura* was greatest in southwestern districts, with moderate prevalences occurring in selected central and eastern districts, and a near absence of transmission in the northern districts. By contrast, hookworm was more widespread throughout the country, although prevalence was lower in northeastern districts. Climatic differences as well as variation in sanitation and socio-economic status could lead to these geographical differences; however, a recent spatial analysis has indicated that both temperature and rainfall influence the large-scale distribution of STH species in Uganda (Brooker *et al.* 2004).

The financial costs of mass STH treatment were calculated using an ingredient approach (Guyatt 2003) and were based on preliminary cost analysis of the control programme in four districts in 2004. Only district-level costs are estimated here – future analyses will assess overall financial and economic costs of the national programme. The purchase, freight and insurance of drugs were paid in foreign currency. All other costs were paid in

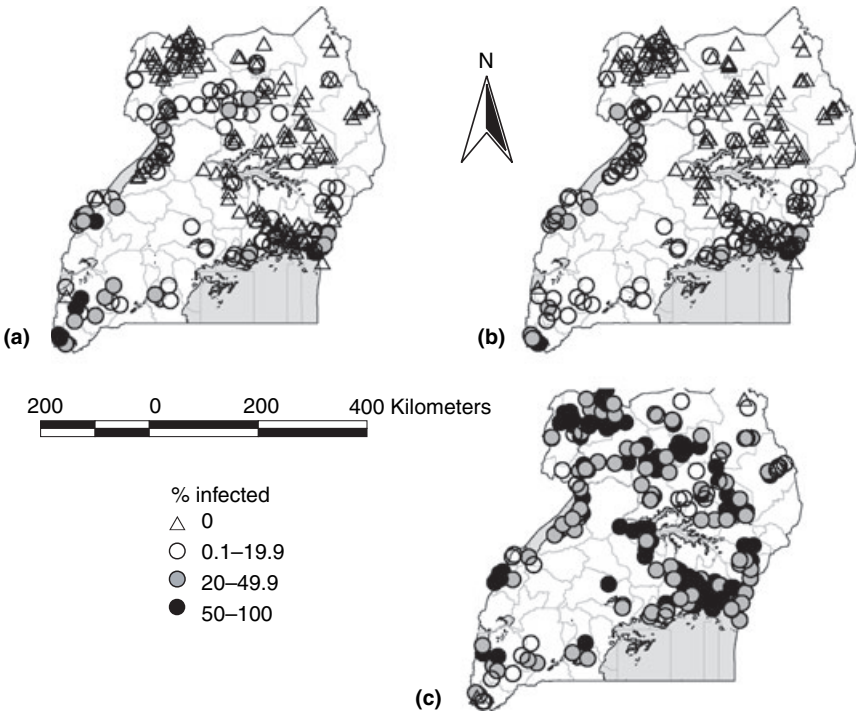

Figure 1 Geographical distribution of (a) *A. lumbricoides*, (b) *T. trichiura* and (c) hookworm in Uganda, based on 271 schools in Uganda, 2002–2005.

local currency and their current values were converted into equivalent US$ using the 2004 mid-year exchange rates of Ugandan Shillings 1943 to US$1. Since the programme delivered both albendazole and praziquantel, it was assumed that delivery of albendazole accounted for 50% of delivery costs. Numbers treated were estimated from treatment registers used in the 2004 treatment round. The cost implications are considered from a perspective of the control programme. The total financial cost per schoolchild treated with albendazole was estimated to be between US$ 0.063 and 0.105 and the financial delivery cost per schoolchild treated was estimated to be between US$ 0.04 and 0.08 (Table 1). Elsewhere in Africa, the financial delivery cost per child treated using albendazole delivered through the school systems was previously estimated to be US$0.04 in Ghana and US$0.03 in Tanzania (Partnership for Child Development 1999).

Based on these results, the number of school-aged children at risk of high prevalence of STH infection, and the target of control using mass treatment of albendazole can be quantified by combining prevalence estimates with population data. The projected population of Uganda in 2005 is 27.4 million, of whom approximately 7.5 million

Table 1 Estimated costs of school-based delivery of albendazole in four districts in Uganda in 2004

Numbers treated	Busia	Mayuge	Nebbi	Wakiso
Schools treated	40	75	14	145
Schoolchildren treated	20 058	35 510	12 185	37 837
Cost areas				
Sensitization and awareness	407 (17.6)	187 (8.3)	45 (4.5)	235 (6.8)
Teacher training	311 (13.4)	253 (11.3)	217 (22.0)	631 (18.3)
School registration	165 (7.1)	164 (7.3)	159 (16.2)	407 (11.8)
Drug distribution	520 (22.5)	838 (37.3)	288 (29.3)	893 (26.0)
Treatment	165 (7.1)	503 (22.4)	95 (9.6)	601 (17.5)
Reporting	251 (10.9)	75 (3.3)	51 (5.2)	77 (2.2)
Health education	495 (21.4)	226 (10.1)	129 (13.1)	595 (17.3)
Cost per schoolchild treated	0.105	0.063	0.081	0.091
Delivery cost per schoolchild treated	0.081	0.040	0.057	0.067

are aged 5–14 years (http://www.ubos.org). For those districts without epidemiological data, an estimate of expected prevalence category (0–19%, 20–49% and 50–100%) was made on the basis of prevalence in neighbouring districts with similar ecological characteristics. In terms of treatment, WHO recommends that in areas where STH prevalence is 50% or greater treatment is provided twice yearly, in areas where prevalence is 20–49% annual treatment is provided, and in areas with prevalence <20%, drugs are made available at the health facility. On this basis, 4.7 million school-aged children would be the target for twice yearly treatment and 2.7 million would be the target for annual treatment. Hence, it is estimated that the annual cost of treating the 7.4 million school aged children through the school system will be between US$ 0.46 and 0.77 million. These cost estimates do not include the higher costs of start-up or costs incurred at the central level. Nevertheless they suggest that countrywide control of STH is, from a financial perspective, an attainable goal.

Within Uganda, several activities are underway implementing STH control, which include mass deworming and health education. For example, since March 2003, the National Schistosomiasis Control Programme, with support from the Schistosomiasis Control Initiative (SCI), has targeted communities at high risk in schistosomiasis endemic areas in 18 most affected districts, providing health education and annual treatment with praziquantel and albendazole and this will continue until 2007 (Kabatereine *et al.* 2005). In addition, as part of its programme to provide routine and catch-up immunization against measles in October–November 2003, the Ministry provided albendazole to all children between 1 and 14 years of age. In 2004, the Ministry expanded these activities and introduced Child Days to be implemented throughout May and November every year. The challenge for the Ministry of Health will be to ensure coordination and integration of different programmes over the coming years so that control is sustainable and cost-effective.

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