

## Leading Article

**Schistosomiasis and soil-transmitted helminth infections: forging control efforts**

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'...both school performance and worm burden are significantly related to the social and hygienic conditions of families' (DE CARNERI *et al.*, 1967)

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Ten years ago in this journal we issued a challenge to expand the delivery of affordable and sustainable interventions for intestinal parasite control in a global effort commensurate with the scale of the problem (SAVIOLI *et al.*, 1992).

After gradual intensification of efforts over the ensuing 10 years, the WHO and its member states and partners are implementing a combined strategy for the control of schistosomiasis and soil-transmitted helminths, integrated into ongoing health and education initiatives (WHO, in preparation, a).

This strategy is summarized in the World Health Assembly (WHA) resolution of May 2001 (WHA, 2001). The resolution urges member states to ensure access to essential drugs against schistosomiasis and soil-transmitted helminthiasis in all health services in endemic areas for the treatment of clinical cases and groups at high risk of morbidity such as women and children, with the goal of attaining a minimum target of regular administration of chemotherapy to at least 75% and up to 100% of all school-age children at risk of morbidity by 2010. This policy is based on the evidence that morbidity can be controlled by periodical treatment of high-risk groups with anthelmintics.

**The burden of disease**

The burden of disease due to schistosomiasis and soil-transmitted helminth infections remains enormous. About 2 billion people are affected worldwide, of whom 300 million suffer associated severe morbidity. In 1999, the WHO estimated that these infections represented more than 40% of the disease burden due to all tropical diseases, excluding malaria.

Because of their hygiene and play habits, children are especially vulnerable to these infections. The over 400 million school-age children who are infected with schistosomes or soil-transmitted helminths (WHO, in preparation, a) are often physically and intellectually compromised by anaemia, attention deficits, learning disabilities, school absenteeism, and higher drop-out rates. The failure to treat school-age children therefore hampers child development, yields a generation of adults disadvantaged by the irreversible sequelae of infection, and compromises the economic development of their communities and nations (PARTNERSHIP FOR CHILD DEVELOPMENT, 1997; WHO, in preparation, a).

Eighty-five percent of the 200 million people with schistosomiasis live on the African continent (CHITSULO *et al.*, 2000). The burden of disease due to schistosomiasis in Africa has recently been re-estimated (VAN DER WERF *et al.*, in press). Seventy million individuals

have haematuria associated with *Schistosoma haematobium* infection and 18 and 10 million respectively suffer major bladder wall pathology and hydronephrosis. *S. haematobium*-related mortality due to non-functioning kidney and portal hypertension due to *S. mansoni* are estimated to be respectively 150 and 130 thousand per year (VAN DER WERF *et al.*, in press).

**Chemotherapy-based morbidity control**

Accumulated experience from medium- to large-scale programmes has clearly demonstrated that human suffering and the burden due to these infections can be significantly reduced through repeated/regular treatment with single-dose anthelmintics delivered through school health programmes or other ongoing health or education programmes (PARTNERSHIP FOR CHILD DEVELOPMENT, 1998; ALBONICO *et al.*, 1999). Several controlled trials demonstrated a positive effect on growth, even if differences were observed on the extent of benefit gained (DICKSON *et al.*, 2000; MICHAEL, 2000; SAVIOLI *et al.*, 2000). The plummeting price of praziquantel has made this approach more feasible than it was 10 years ago. Moreover, recent tests of praziquantel samples from 19 different manufacturers collected in the field reassured that many low-cost generics are of satisfactory quality (APPLETON & MBAYE, 2001).

Treatment of a child with praziquantel currently costs approximately US\$0.20. A single-dose treatment for soil-transmitted helminth infections with any of the 4 anthelmintics on the WHO list of essential drugs (albendazole, levamisole, mebendazole and pyrantel) costs less than US\$0.30. The WHO has calculated that the cost of intervention, including delivery, where schistosomiasis and soil-transmitted helminth infections are both endemic is typically less than US\$1 and can be as low as US\$0.30 per child per year, while treatment of soil-transmitted helminth infections alone costs as little as US\$0.10 per child per year (MONTRESOR *et al.*, 2002c; WHO, in preparation, a)

**Progress in least-developed, low-income and lower-middle-income countries**

Encouraging health effects have been reported from programmes implementing these control measures. In mainland Tanzania a single treatment with praziquantel delivered to school-age children infected with *S. haematobium* eliminated 88% of the urinary tract pathology after the first 6 months, with more complete resolution of lesions in the younger age group. In this intense transmission area, regular treatment as infrequently as every 18–24 months, starting in primary school, was indicated as an effective means to control morbidity and prevent the development and persistence of severe urinary tract pathology and genital lesions (HATZ *et al.*, 1998).

Again in Tanzania, the Zanzibar Helminth Control Programme prevented 1260 cases of moderate to severe anaemia and 276 cases of severe anaemia per year in a population of 30 000 schoolchildren by administering

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500 mg of mebendazole three times a year (STOLTZFUS *et al.*, 1998). In addition to reaching 98% of the enrolled schoolchildren, a further 60% of non-enrolled school-age children were reached by simply inviting their siblings and friends to the deworming school day (MONTRESOR *et al.*, 2001a).

In these 2 African high-transmission settings, in spite of continuous reinfection, morbidity is controlled and irreversible sequelae in adulthood prevented by regular and inexpensive treatment of schoolchildren.

With the cooperation of the Ministry of Health, the Ministry of Education, the World Food Programme (WFP), and the WHO, schools in Nepal provide anthelmintic treatment to each child every 6 months, an enriched hot meal on school days, and food for girls to take home as an incentive for good attendance. The programme also sustains the supply of drugs and strengthens the local economy by developing the capacity of a local pharmaceutical company to produce the required medication at low cost. The periodical control of the drug guaranteed its quality throughout the programme (KHANAL & WALGATE, 2002).

School-based deworming programmes have been cost-effective in boosting school participation. In Kenya, such a programme reduced school absenteeism by 25%, with the largest gains among the youngest children (MIGUEL & KREMER, 2001). Perhaps even more importantly, this study showed that even those children who had not themselves been treated were able to benefit from the generally lowered transmission rate in the schools.

Unlike the other common helminthic infections, the prevalence and intensity of hookworm infections slowly increase with age (WHO, 1996). Hookworm infection is the leading cause of pathological blood loss in tropical and subtropical regions (TORLESSE & HODGES, 2000). Some 44 million pregnancies are currently complicated by maternal hookworm infection (BUNDY *et al.*, 1995), placing both the mother and her child at higher risk of death during pregnancy and delivery. In Sierra Leone, an additive effect was shown when anthelmintic treatment was combined with iron and folate supplements to control maternal anaemia during pregnancy (TORLESSE & HODGES, 2000). In Sri Lanka, the same combined intervention improved the health of the mothers with a beneficial effect on their birth outcome without any increase in risk of malformations (DE SILVA *et al.*, 1999; BRADLEY & HORTON, 2001).

However, this progress is impeded by the poor access to praziquantel in peripheral health services documented in Ghana and Cambodia in 2002 (M. J. van der Werf, personal communication; C. Urbani, personal communication). Experience shows that effective morbidity control requires regular treatment of high-risk groups, especially school-age children, and access to treatment in the peripheral health care structures of endemic areas.

### Strategy, tools, targets and drug monitoring

Technical problems associated with large-scale chemotherapy campaigns have been addressed and solved. For example, teachers and other non-health personnel are able with minimal training to distribute effectively anthelmintic drugs to school-age children (BUNDY & DE SILVA, 1998; WHO, in preparation, a). Treatment with praziquantel at the peripheral health and school level may be simplified by the use of a 'dose pole'—a measurement of the child's height that determines the correct dosage (HALL *et al.*, 1999; MONTRESOR *et al.*, 2001b, 2002b). To improve health and prevent sexually transmitted diseases due to the genital lesions caused by schistosomiasis, praziquantel should be made available to all school-age and adolescent girls and women of reproductive age in areas where schistosomiasis is endemic. A recent expert meeting concluded that praziquantel treatment should also be offered to pregnant women with schistosomiasis, as the

benefits of such treatment greatly outweigh any reported adverse effects (WHO, in preparation, b). Mebendazole, albendazole, and other anthelmintics have also recently been approved for use in children over 12 months of age (WHO, in preparation, b), so that there is no further justification for excluding these children from treatment to prevent severe complications due to soil-transmitted helminths (MONTRESOR *et al.*, 2002a).

The WHA (2001) resolution set the global target of regularly treating 75% of school-age children at risk by 2010. This represents approximately 600 million children today and approximately 645 million in 2010, taking into account projected global growth rates. The challenge is to establish start-up activities in all endemic countries on all continents, and to expand them to a national level in the next 8 years.

Ongoing small-scale initiatives so far cover some 4 million school-age children in Africa, corresponding to only 4% of the target for this continent. Last year, however, in cooperation with the WFP and the World Bank, the WHO trained representatives of the ministries of health and education of 21 countries. Start-up funding of up to US\$50 000 per country was provided by the Canadian International Development Agency and deworming and school-feeding programs have already begun in 19 of the 41 African endemic countries.

In April 2000, at the Dakar World Education Forum, a partnership was launched by UNESCO, UNICEF, WHO, Education International, and the World Bank to assist countries in Focusing Resources on Effective School Health (FRESH), including support for the distribution of anthelmintics through schools (FRESH, 2000). This 'FRESH' partnership aims to improve the health and nutrition of schoolchildren as a contribution to the global Education for All efforts to ensure universal access to basic education. To date, more than 20 projects targeting 45 million school-age children have been supported in Africa, and projects being developed should significantly increase the number of beneficiaries.

On other continents, the strategy must be adapted to the epidemiological setting. For example, in south-east Asia, activities are also targeting food-borne trematodes and cestodes.

Expanding treatment programmes will increase the drug pressure on parasite populations. The danger of drug resistance is probably more real for soil-transmitted helminths than for schistosomes (GEERTS & GRUYSELS, 2001). To prevent or delay the emergence of resistance, chemotherapy should be targeted only at high-risk groups such as schoolchildren, with possible alternation among different drug classes. Frequency of retreatment should be sufficient to control morbidity but also reduced to a minimum to avoid drug pressure on parasite populations. Monitoring and surveillance of drug efficacy must be built into operational programmes (WHO, 1999).

### Moving ahead

Scaling-up interventions will require a concerted effort at both global and country level. A key step in achieving this has been the request from the 54th WHA (2001) to WHO 'to combat schistosomiasis and soil-transmitted helminthiasis by advocating new partnerships with organizations of the United Nations system, bilateral agencies, non-governmental organizations, and the private sector, and by continuing to provide international direction and co-ordination'.

The WHO has proposed a broad partnership that promotes the incorporation of deworming into regular, current activities in the field, for both the education and health sectors. In June 2001 and April 2002, 2 meetings of the Partnership for Parasite Control (PPC) took place in Geneva and Rome, hosted respectively by the WHO and WFP. The PPC mobilizes increased resources and permits new synergy among public and

private efforts for the control of soil-transmitted helminths and schistosomiasis at global and national level.

In 1992 we expressed concern that the public health impact of helminthic infections was consistently and considerably underestimated (SAVIOLI *et al.*, 1992). Today the burden of disease has been reassessed, practical field tools have been further refined, the price of anthelmintics has dropped, a public health policy has been developed, the education sector has recognized its role in parasite control, and political commitment by endemic countries and international organizations is building. The possibility of significantly reducing the morbidity caused by schistosomiasis and soil-transmitted helminths, and having a real and lasting impact on one group of the neglected diseases of the poorest of the poor, is no longer a dream.

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