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Can we eliminate soil-transmitted helminth infections in Sri Lanka?

In January 2012, the WHO released a report entitled *Accelerating Work to Overcome the Global Impact of Neglected Tropical Diseases: a Roadmap for Implementation* [1]. At the launch of the report, Margaret Chan (WHO Director General), Bill Gates, 13 pharmaceutical company chief executive officers, and officials from several governments pledged to eradicate or control by 2020, ten neglected tropical diseases, which together afflict more than a billion people [2]. This new thrust aims to eradicate Guinea worm; to eliminate lymphatic filariasis (LF), blinding trachoma, sleeping sickness and leprosy as public health problems; and to control soil-transmitted helminths (STH), schistosomiasis, river blindness, Chagas disease and visceral leishmaniasis. Of these ten diseases only three, leprosy, LF and STH infections, have posed significant public health problems for Sri Lanka. Leprosy was eliminated as a public health problem here by the end of the 20th century [3]. The last decade also saw the Health Ministry conduct a LF elimination programme based on annual mass drug administration (MDA) with diethylcarbamazine citrate and albendazole in eight LF-endemic districts. In 2006, Sri Lanka completed six rounds of treatment and started post-MDA surveillance [4]; the country is now working towards certification of LF elimination. This leaves only STH infections to combat.

STH infections (roundworm, whipworm and the hookworms) are estimated to affect over a billion people worldwide, mostly living in areas where sanitation is poor [5]. Occasionally, they can be fatal, especially when the worm burden is high. More often, STH infections have a chronic, insidious impact on the health and quality of life of those affected [6]. Heavy intensity infections impair physical growth and cognitive development, and cause iron-deficiency anaemia which leads to poor school performance and absenteeism in children; reduce work productivity in adults; and affect the course and outcome of pregnancy [7]. Strategies to control STH infections have evolved gradually. The first major historical effort to control worm infections was the Rockefeller Foundation's hookworm eradication campaign in the early 20th century. This campaign was primarily aimed at Southern USA, but the ripples reached Sri Lanka. The Director General of the International Health Board of the Foundation visited the country in 1914 in the course of a survey of the Orient, and discussed plans for bringing hookworm under control [8]. In the latter half of the 20th century, Japan and South Korea demonstrated that prevalence could be brought down from over 90% to near zero through regular mass deworming combined with health education and widespread improvements in sanitation [6].

In Sri Lanka, a strong tradition of preventive healthcare led to adoption of deworming. Anthelmintics have been offered on a routine basis to school children at annual school medical inspections for many decades. In 1994, the

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Health Ministry recommended that pregnant women be treated routinely with mebendazole, in order to reduce maternal anaemia [9]. This strategy made it possible to conduct a ground-breaking study that confirmed the safety of mebendazole in pregnancy [10], and enabled the WHO to recommend a similar policy in other hookworm endemic countries [11].

Morbidity due to STH infections becomes prominent in a given community only when many individuals have moderate or high worm burdens; this usually occurs when prevalence is high. The WHO currently recommends periodic administration of anthelmintics to high-risk populations (preventive chemotherapy) as the preferred strategy for control of morbidity due to STH infections, i.e. elimination of moderate or high intensity infections [12]. Unlike with LF, WHO does not promote the elimination of STH infections as a goal. There are several reasons for this. Firstly, breaking the cycle of transmission requires an effective and efficient infrastructure for maintenance of sanitation; the resources required for such infrastructure are rarely available in endemic countries. Secondly, although the anthelmintics used for preventive chemotherapy are very inexpensive and safe, deworming needs to be repeated periodically for many years because roundworm and whipworm eggs can survive in soil for long periods. Finally, preventive chemotherapy on its own can achieve the elimination of moderate and high intensity infections that cause almost all morbidity [12]. However, Sri Lanka is no longer an impoverished, low-income country, and elimination of STH infections, rather than limiting control strategies to eliminating only moderate or high intensity infections, should now be feasible.

The WHO also recommends that STH control strategies should be integrated within existing public health activities in order to reduce costs and increase effectiveness. It is widely accepted now that the school system offers an ideal setting for deworming and delivery of health care messages [6]. Vaccination and micronutrient supplementation programmes (e.g. vitamin A) present convenient opportunities for the deworming of pre-school children [12]. The WHO provides detailed guidelines for introduction and maintenance of deworming programmes [11]. In high-risk communities where the prevalence of any STH infection among school-aged children is more than 50%, it recommends mass treatment with albendazole 400 mg or mebendazole 500 mg at least twice a year. In moderate-risk communities where prevalence is 20 - 50%, once-yearly treatment is recommended. For those communities classified as low-risk because prevalence is below 20%, selective treatment of individuals diagnosed with infections is recommended. These thresholds are meant for communities with no prior use of preventive chemotherapy [11]. Unfortunately, there is little scientific evidence that can guide countries such as Sri Lanka, where regular deworming has been part of health care delivery for many decades, on when to reduce the frequency of preventive chemotherapy, or when it can be abandoned altogether. As with the case of antenatal deworming [10], Sri Lanka may have to play the role of a pathfinder rather than simply following international guidelines.

What is the current situation with regard to STH infections in Sri Lanka? A nationally representative survey was conducted among 2173 school children attending 144 schools in 2003 [13]. The findings showed an overall STH prevalence of 6.9%; prevalence ranged from 1.6% in Southern Province to 12.3% in Eastern Province. The investigators noted that these rates had to be interpreted with caution because children in some schools had received anthelmintics a few days before sample collection and nearly 9% were reported to have passed worms at some point in their lives. Other recent studies have also confirmed low prevalence rates in areas which do not have problems with sanitation [14]. Since per capita income has risen, and living conditions all over the country have steadily improved over the last decade, it is likely that national prevalence rates have further declined since 2003. The situation

is different in the plantation sector; a survey conducted in 2009 among 1890 school children selected from 114 schools in Nuwara Eliya, Ratnapura, Kandy, Badulla and Kegalle districts, showed the overall prevalence of combined STH infections to be 29% [15]. Prevalence ranged from 12.5% in Badulla to 38.2% in Nuwara Eliya; the commonest infection was roundworm. Hookworm infections were not detected in Nuwara Eliya and Badulla districts. But even here, the rates are a sharp contrast to those reported from a sector-wide survey conducted in 1992, when the prevalence was nearly 90% among children and women of reproductive age [16]. As a consequence of the 1992 survey, a mass deworming programme with twice yearly mebendazole 500 mg was introduced in 1994. In areas where hookworm infections were exceptionally common, albendazole was used instead of mebendazole, because of its greater efficacy against hookworm [17]. The programme was continued until 2005 when it was abandoned due to lack of funds.

Sri Lanka has a conducive environment for elimination of STH infection. Extensive public health infrastructure and high literacy rates, which are results of free health care and free education policies, mean that the target population has a high level of contact with the health system. Anthelmintics are administered to school children through school medical inspections, to under-fives through child welfare clinics, and to pregnant women through antenatal clinics. Together, these have a very wide reach because school enrolment is about 98% for Grades 1-5 and about 70% for Grades 6-12 [18]; >90% of pregnant mothers attend antenatal clinics regularly; and >80% of under-fives are brought to child welfare clinics (data from Evaluation Unit of the Family Health Bureau).

Over the course of 2011, the Family Health Bureau has worked on developing new guidelines for the control of STH infections among children and women in the community setting. These include recommendations for deworming children below five years of age, school children and pregnant women in the districts that encompass the plantation sector (high risk areas; the same groups in other districts which have a lower level of risk) and additional measures that promote STH control. The recommendations are to be implemented from 2013 after procurement of adequate stocks of anthelmintics. What is lacking is a strategic plan that identifies an explicit national target based on sound district-level prevalence data; target prevalence rates to be achieved by a given date; target coverage rates for deworming activities and sanitation coverage in high risk areas, etc. A high level inter-sectoral task force should be given the mandate to draw up such a plan, set out appropriate goals along with mechanisms for monitoring and evaluation of programme implementation. If that were to happen, it is very likely that, within this decade, Sri Lanka will be able to add STH infections to leprosy and LF in the list of neglected tropical diseases that have been eliminated as public health problems.

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