Control of intestinal parasitic infections in Seychelles: a comprehensive and sustainable approach

M. Albonico,¹ N. Shamlaye,² C. Shamlaye,³ & L. Savioli¹

Intestinal parasitic infections have been perceived as a public health problem in Seychelles for decades. A comprehensive strategy to reduce morbidity and, in the long term, transmission of intestinal parasites has been implemented successfully since 1993. Management of the programme is integrated into the well established primary health care system, with control activities being undertaken through existing health facilities. The strategy is based on periodic chemotherapy of schoolchildren, intense health education and improvement of sanitation and safe water supply. The initial objectives of the control programme were met after 2 years of activities, with an overall reduction in prevalence of intestinal parasitic infections of 44%. The intensity of infection with Trichuris trichiura, the commonest parasite, was halved (from 780 to 370 eggs per g of faeces). The programme’s integrated approach, in concert with political commitment and limited operational costs, is a warranty for the future sustainability of control activities. The programme can be seen as a model for other developing countries, even where health and socioeconomic conditions are different and the control of parasitic infections will need a much longer-term commitment.

Introduction

Intestinal parasite control programmes have been implemented in numerous areas within developing countries, aimed at the control of morbidity and, in the long term, at the reduction of transmission (1–3). However, few programmes have been planned at the national level and most have operated through a selective primary health care approach, with little integration into existing health care facilities and without an efficient monitoring and information system to assess their impact.

One of the most cost-effective strategies for reducing morbidity due to intestinal helminths is through periodic chemotherapy, targeted at specific groups of the population who are at highest risk, often children of school age and pregnant women, depending on the local epidemiology (4). The availability of cheap, safe, and effective anthelmintic drugs has contributed to the feasibility and sustainability of such a strategy. In addition, children can be reached in large numbers in schools and teachers can be involved. This reduces the drug-delivery cost and provides an opportunity for educating the children in basic hygienic practices that will help to reduce transmission. In a few control programmes based on targeted chemotherapy, the untreated portion of the population has been shown to benefit from the treatment of schoolchildren (5, 6). This can be explained by assuming an overall reduction in contamination of the environment followed by reduced exposure of the whole community to the infective stages of the parasites. Anti-parasite chemotherapy targeted at schoolchildren also offers an opportunity to reinforce collaboration between the Ministry of Health and the Ministry of Education and constitutes an entry-point for the integrated control of other communicable and non-communicable diseases.

The Seychelles Intestinal Parasite Control Programme was started in 1993 by the Ministry of Health, in collaboration with the Ministry of Education, with technical support from WHO. The objec-

¹ Schistosomiasis and Intestinal Parasites Unit, Division of Control of Tropical Diseases, World Health Organization, 1211 Geneva 27, Switzerland. Requests for reprints should be sent to Dr Savioli at this address.
² Manager, Intestinal Parasite Control Programme, Ministry of Health, Victoria, Mahé, Seychelles.
³ Special adviser to the Minister of Health, Ministry of Health, Victoria, Mahé, Seychelles.


5740

577

tive was to reduce intestinal parasitic infections to a level that no longer constituted a public health problem. From the beginning, the programme was integrated into the existing health care system, thereby reducing costs and human resource needs and strengthening the existing school health programme. The initiative has promoted the collaboration of health staff at the central and district levels and between the Ministries of Health and Education and the other ministries concerned (the Ministries of Finance and Communications, Environment, and Community and Development). Through the school system approach and with the support of the national press and other media, community participation has been stimulated.

This article describes the implementation and management of the programme, an analysis of the impact of 2 years of control activities, and an evaluation of the costs with a view to future sustainability.

Materials and methods

Geography and population

Seychelles comprises an archipelago of 115 islands with a land area of approximately 450 km² lying in the Indian Ocean north of Madagascar (Fig. 1). The islands were first settled in the eighteenth century and the population is predominantly of African and European origin with an Indian and Chinese minority. The official languages are English, French and Créole, with Créole being the language spoken at home.

Most (90%) of the population lives on Mahé, the largest of the islands with the remainder mainly living on the islands of Praslin and La Digue. The total population has been estimated at approximately 73000. Mahé is divided into five regions (north, west, east, central and south) each of which includes several districts. Praslin comprises two districts, while La Digue is a single district (see Fig. 1). Victoria, the capital, is the only town and has 10000 inhabitants.

The islands have an equable tropical climate influenced by monsoons: the north-west monsoon, warm and humid, blows from December to April; the south-east monsoon brings a cooler and drier season from June to September. The temperature ranges between 24 °C and 31 °C and rainfall averages 2200 mm per year.

The economy of the islands has recently developed successfully owing to the tourist trade, and the government is now in the process of diversifying in the areas of agriculture and fishing.

Health facilities

Victoria, the capital, has a central hospital provided with well equipped clinical and public health laboratories, which serves the north, central and east regions of Mahé and is the main referral centre for any specialized treatment. There are three cottage hospitals: one in Anse Royale, Mahé (referral centre for south region), and one each on Praslin and La Digue. All three have basic laboratory facilities. There are 16 health centres, with a maternal and child health component, supervised by district health coordinators. Antenatal clinics are located in three health centres and in the central hospital. Only a few of the health centres are equipped for microscopical examinations. Health centre nurses visit schools regularly to implement school health programmes.

Education facilities

There are 23 schools (about one school for each district), which include créches for children aged 3–5 years, primary and secondary classes, and the National Youth Service, a 1-year college for pupils aged 16–17 years. Total enrolment is about 20000, over 95% of those eligible.

A school health programme is currently being implemented, whose main activities are as follows: promotion of environmental health; health education; immunization; growth monitoring; and periodic...
health screening. All activities are performed by the school health nurses and environmental health officers from the local health centre. A health education programme (the Social Education Programme) is also carried out by specially trained teachers in primary and secondary schools; it covers personal hygiene, sex education, food hygiene, drugs, sexually transmitted diseases, and other communicable diseases.

Intestinal parasitic infections

Intestinal parasitic infections were the main reason for the first public health programme in Seychelles; in 1925, hookworm infections were recognized as a public health problem and from then until 1931 mass deworming campaigns were promoted and public latrines were constructed. Schools and teachers were actively involved in the campaigns (7). This approach was successful in reducing hookworm prevalence from 90% to 41%. However, owing to lack of continuity, together with misuse of anthelmintic drugs and poor community participation, infections persisted.

Intestinal parasitic infections are currently recognized as a major health problem by the Ministry of Health and also by teachers and families. Ascaris lumbricoides, Trichuris trichiura, hookworms, Strongyloides stercoralis and the protozoa Giardia intestinalis and Entamoeba histolytica are the main causes of morbidity both in the young and in adults. Several deaths due to S. stercoralis hyperinfection have been reported (Ministry of Health, Statistic Report 1985–1986).

A survey undertaken in 1988 indicated a total prevalence for intestinal parasites of 94.4%, with a high proportion of multiple infections. The individual prevalences were as follows: T. trichiura, 84%; hookworms, 22%; A. lumbricoides, 8%; G. intestinalis, 6%; and E. histolytica, 5%. A previous survey had reported higher prevalence rates in Praslin (8). At present, 70% of the population have access to a treated water supply. A proper sewage system is planned for Victoria and 60% of the households on the islands have flush-type latrines draining to septic tanks and soakaway pits. The remaining houses have single or common pit latrines, so that only 5% of the population lack latrines. Transmission, however, continues to take place owing to uncontrolled defecation by children and toddlers, the overflow of pit latrines, and leaking from septic tanks during the rainy season. The government expects to complete provision of sanitation and high standard water supplies to all families by the end of the year 2000.

Seychelles Intestinal Parasite Control Programme

Organization and management. The Ministry of Health formulated a plan of action along the lines recommended by WHO, with the objective of reducing intestinal parasitic infections to a level that no longer constitutes a public health problem. Children and pregnant women represented the main target groups. The operational objectives over a 3-year period were as follows:

— to reduce the intensity of infections (expressed in eggs per g of faeces) of A. lumbricoides by 60% and of T. trichiura and hookworms by 30% in school-age children;

— to reduce the prevalence of S. stercoralis infections by 30% in the target population; and

— to reduce the prevalence of amoebiasis by 40% in the target population.

Control activities have been undertaken in schools, by both health centre personnel and teachers, and in antenatal and mother and child health clinics, by health centre personnel. The total number of pregnant women attending antenatal clinics in 1991 was approximately 1500.

The primary health care system is well established (9) and the control programme has been integrated from the beginning into the local health structure. The programme is executed under the preventive directorate and programme activities are coordinated by a national coordinator (programme manager) with technical support from the Clinical and Public Health Laboratories (Health Education Unit and Epidemiology Unit). District health coordinators supervise the control activities in schools and health centres. School health nurses and environmental health officers are responsible for the control activities in their catchment area. Health centre staff, supervised by the central team and supported by the Epidemiology Unit, are responsible for carrying out baseline and evaluation surveys and


for supervising mass treatment in schools. Programme activities during the period 1992–94 are summarized in Table 1.

Preparation phase. Training. During April 1993, Ministry of Health staff were trained in the integrated approach. Special courses on stool quantitative diagnostic techniques, in particular, the Kato–Katz technique for detecting helminth eggs (10) and concentration techniques (formol–ethyl acetate) were organized for hospital and health centre laboratory technicians; and nurses, environmental health officers, and social education teachers were trained in the prevention and control of intestinal parasitic infections—their essential role as health educators was emphasized and their active participation was sought for the school deworming campaigns. Discussions with doctors on the diagnosis and treatment of intestinal parasitic infections were organized.

Collection of baseline data. In April–May 1993, prior to the start of control activities, faecal samples from 5% of all schoolchildren were examined using the Kato–Katz technique (10); the same stool samples were also examined for protozoa and for S. stercoralis larvae using the formol–ethyl acetate concentration technique (10). Quality control was performed at the central level by examining 10% of the slides. The sampling was randomized, choosing 1075 children from crèche, primary, and secondary classes. The same children were interviewed using a questionnaire to evaluate their knowledge about intestinal parasites before intervention. Between June and July 1993, all women (total, 338) attending antenatal clinics for their first visit also had their stools examined for helminths and protozoa and their haemoglobin level determined.

Data from the parasitological examination, together with the name, age, sex, weight and height of the person examined, were recorded on a form and entered on a microcomputer for statistical and epidemiological analysis, using the Epi Info software package, in the central office. The intensity of infections with A. lumbricoides, T. trichiura, and hookworms was measured indirectly as egg counts. Mean egg counts were calculated as the arithmetic means of all children examined and expressed as eggs per g of faeces. Prevalences and mean egg counts were compared using the \( \chi^2 \) tests and Student’s \( t \) tests, respectively.

The results from the parasitological surveys are summarized in Table 2 and Table 3 and in Fig. 2. On average, about 60% of children were infected with one or more parasites, with significant variation by region. T. trichiura was the commonest parasite with a prevalence of 53.3%, followed by A. lumbricoides with a prevalence of 17.7%; hookworm infections were present in 6.3% of schoolchildren and in 8.6% of pregnant women at low intensity. The distribution of intestinal parasitic infections by age (Fig. 2) shows the typical trend of high peak of infections in adolescent children, while prevalence of hookworm infections tends to increase with age, as seen in other endemic areas. Following usual epidemiological characteristics, G. intestinalis infections were more common in young children, while S. stercoralis were more frequent in adults. Such prevalence and inten-
Control of intestinal parasitic infections in Seychelles

Table 2: **Prevalence and intensity of intestinal parasitic infections in Seychelles at baseline** and after one year of periodic chemotherapy. The $P$ value indicates the statistical difference between survey 1 and survey 3 for prevalence and intensity.

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Survey 1, 1993</th>
<th>Survey 2, 1993</th>
<th>Survey 3, 1993</th>
<th>% reduction in:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevalence (%)</td>
<td>Intensity (epg)</td>
<td>Prevalence (%)</td>
<td>Intensity (epg)</td>
</tr>
<tr>
<td>Ascaris lumbricoides</td>
<td>17.7</td>
<td>1617</td>
<td>9.8</td>
<td>641</td>
</tr>
<tr>
<td>Trichuris trichiura</td>
<td>53.3</td>
<td>782</td>
<td>36.1</td>
<td>302</td>
</tr>
<tr>
<td>Hookworms</td>
<td>6.3</td>
<td>40</td>
<td>8.6</td>
<td>42</td>
</tr>
<tr>
<td>Strongyloides stercoralis</td>
<td>1.1</td>
<td>—</td>
<td>2.7</td>
<td>—</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>4.6</td>
<td>—</td>
<td>5.3</td>
<td>—</td>
</tr>
<tr>
<td>Giardia intestinalis</td>
<td>3.3</td>
<td>—</td>
<td>0.6</td>
<td>—</td>
</tr>
<tr>
<td>Cumulative prevalence</td>
<td>60.5</td>
<td>—</td>
<td>44.4</td>
<td>—</td>
</tr>
</tbody>
</table>

* Survey 1 in schoolchildren and survey 2 in pregnant women.
* Survey 3 in schoolchildren.
* No of eggs per g of faeces, expressed by arithmetic mean.
* $P < 0.001$.
* $P < 0.05$.

Table 3: **Prevalence (%) of intestinal parasitic infections in 1993 and 1994 surveys in schoolchildren, by region.** The $P$ value indicates the statistical difference between 1993 and 1994 for cumulative prevalence, by region.

<table>
<thead>
<tr>
<th>Region</th>
<th>Ascaris lumbricoides</th>
<th>Trichuris trichiura</th>
<th>Hookworms</th>
<th>Strongyloides stercoralis</th>
<th>Entamoeba histolytica</th>
<th>Giardia intestinalis</th>
<th>Cumulative prevalence</th>
<th>1993</th>
<th>1994</th>
<th>% reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>9.2</td>
<td>6.7</td>
<td>35.5</td>
<td>14.9</td>
<td>3.5</td>
<td>3.4</td>
<td>1.4</td>
<td>0.0</td>
<td>2.8</td>
<td>34.1</td>
</tr>
<tr>
<td>Central</td>
<td>17.0</td>
<td>4.9</td>
<td>45.3</td>
<td>19.6</td>
<td>2.5</td>
<td>1.4</td>
<td>1.4</td>
<td>0.2</td>
<td>2.0</td>
<td>0.8</td>
</tr>
<tr>
<td>East</td>
<td>29.4</td>
<td>1.5</td>
<td>62.6</td>
<td>38.3</td>
<td>3.7</td>
<td>2.6</td>
<td>0.0</td>
<td>0.0</td>
<td>3.2</td>
<td>3.7</td>
</tr>
<tr>
<td>West</td>
<td>19.2</td>
<td>3.0</td>
<td>63.8</td>
<td>39.0</td>
<td>13.6</td>
<td>10.5</td>
<td>1.7</td>
<td>1.5</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>South</td>
<td>9.6</td>
<td>2.4</td>
<td>64.4</td>
<td>36.6</td>
<td>11.9</td>
<td>8.9</td>
<td>0.7</td>
<td>0.0</td>
<td>8.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Praslin/ La Digue</td>
<td>18.3</td>
<td>9.0</td>
<td>56.1</td>
<td>29.2</td>
<td>8.5</td>
<td>2.2</td>
<td>1.3</td>
<td>0.0</td>
<td>20.0</td>
<td>6.7</td>
</tr>
</tbody>
</table>

* $P < 0.001$.

sity of intestinal parasitic infections justified the mass treatment of schoolchildren without prior screening. Only 14% of women had a haemoglobin level <110 g/l, in three cases (1%) it was <8 g/l and none had a level <7 g/l. No correlation was found between hookworm infection and anaemia in the study population of pregnant women.

**Operational phase. Periodic chemotherapy.** The mass treatment campaigns started in all schools in October 1993. All schoolchildren including those in crèche classes were dewormed every 4 months in the first year, with a coverage rate of 99.4%. Mebendazole, given as a single dose (500-mg tablet), was the anthelmintic chosen by the Ministry of Health for the periodic chemotherapy in schoolchildren, owing to the high prevalence of *T. trichiura*. An extensive advertising campaign through the mass media (television, radio, newspapers) was promoted to seek community participation, and, in particular, involvement of the parents of schoolchildren.

The treatment was delivered by teachers under the supervision of health staff from the nearest health centre. The chemotherapy campaigns carried out among the schoolchildren were widely acclaimed by parents, teachers, and by the community. The
good collaboration and coordination of schoolteachers, school health nurses and environmental health officers made these campaigns successful. Mebendazole tablets were also made available in health centres for the treatment of the general population.

Because of the low prevalence of infection among pregnant women, only the positive cases diagnosed by a routine stool examination performed during the first antenatal visit were treated. Treatment (with levamisole, mebendazole, albendazole or metronidazole, depending on the infection diagnosed) was administered after the first trimester of pregnancy.

Community participation and health education. Long-term control of intestinal parasitic infections cannot be achieved without a change in health behaviour. A major aim of the programme was therefore to increase community involvement and health education. Printed materials (newspapers, posters, leaflets) and electronic media (radio, television, audiovisual aids) were used extensively to increase public awareness and provide information about intestinal parasite control.

Since the start of the programme, preventive measures on intestinal parasites have been included in the school curriculum. Mobile health teams (environmental health officers, school health nurses), in collaboration with social education teachers, have organized sessions to disseminate health messages in all schools.

The Seychelles Broadcasting Cooperation and national newspapers participated actively in promoting the programme. A radio phone-in broadcast advertised the programme’s activities and general preventive methods, giving air-time to listeners’ questions. Television involvement included interviewing schoolchildren about the benefits of drug treatment.

A video film on prevention and control of intestinal parasites was produced in Seychelles by the programme and the WHO Division of Health Education and Health Promotion, in collaboration with the Ministry of Health. It was widely distributed in schools, health centres and hospital wards and also through local television.

A leaflet and a poster on the prevention and control of intestinal parasitic infection were produced in Creole and printed locally (10000 copies). A poster advertising the programme was also produced and distributed in schools and health centres.
Control of intestinal parasitic infections in Seychelles

Table 4: Costs of the various elements of the Seychelles Intestinal Parasite Control Programme

<table>
<thead>
<tr>
<th>Cost:</th>
<th>Quantity</th>
<th>1993</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory supplies (US$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microscope</td>
<td>8</td>
<td>8000</td>
<td>—</td>
</tr>
<tr>
<td>Centrifuge</td>
<td>3</td>
<td>4500</td>
<td>—</td>
</tr>
<tr>
<td>Kato–Katz kit for 500 examinations (reusable)</td>
<td>10</td>
<td>1500</td>
<td>—</td>
</tr>
<tr>
<td>Formol–ethyl acetate kit for 50 examinations (reusable)</td>
<td>10</td>
<td>1880</td>
<td>—</td>
</tr>
<tr>
<td>Training and health education materials (US$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Books</td>
<td>100</td>
<td>620</td>
<td>—</td>
</tr>
<tr>
<td>Posters</td>
<td>2000</td>
<td>1720*</td>
<td>—</td>
</tr>
<tr>
<td>Leaflets</td>
<td>10 000</td>
<td>860*</td>
<td>—</td>
</tr>
<tr>
<td>Computer hardware (US$)</td>
<td>1</td>
<td>2000*</td>
<td>—</td>
</tr>
<tr>
<td>Printer (US$)</td>
<td>1</td>
<td>1000*</td>
<td>—</td>
</tr>
<tr>
<td>Transport (US$)</td>
<td>1</td>
<td>15000</td>
<td>—</td>
</tr>
<tr>
<td>Maintenance (US$)</td>
<td></td>
<td>2400*</td>
<td>—</td>
</tr>
<tr>
<td>Drugs (US$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline survey (1075 treated)</td>
<td>32</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Evaluation survey (1244 treated)</td>
<td>—</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Treatment campaigns (20 000 treated)</td>
<td>—</td>
<td>1 800</td>
<td></td>
</tr>
<tr>
<td>3 times per year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local costs*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td>800</td>
<td>2400</td>
<td>—</td>
</tr>
<tr>
<td>Air fares</td>
<td>120</td>
<td>360</td>
<td>—</td>
</tr>
<tr>
<td>Stationery</td>
<td>1 600</td>
<td>800</td>
<td>—</td>
</tr>
<tr>
<td>Stool containers</td>
<td>1 160</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>800</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>41 692</td>
<td>7 856</td>
<td></td>
</tr>
</tbody>
</table>

* Local currency converted to US$; exchange rate, 5 rupees = US$ 1.00.

Results

Parasitological evaluation

The first parasitological evaluation following three chemotherapy campaigns was performed in October–November 1994. A random sample of crèche, primary, and secondary school pupils (1244 children, representing 5% of the schoolchildren population) in all schools was examined to monitor the reduction in prevalence and intensity of parasitic infections. The results (shown in Tables 2 and 3 and Fig. 2) were recorded and analysed using the same process and methods as used in the baseline survey.

The cumulative prevalence of intestinal parasites in schoolchildren dropped from 60.5% to 33.8%. There was a significant decrease for each of the parasites (except for G. intestinalis), particularly for A. lumbricoides (from 17.7% to 4.4%), T. trichiura (from 53.3% to 27.3%) and E. histolytica (from 4.6% to 1.1%). The arithmetic mean of eggs per g of faeces dropped to 15%, 47%, and 68% of the baseline survey mean for A. lumbricoides, T. trichiura, and hookworms, respectively. A. lumbricoides and T. trichiura infections decreased significantly in all age groups, while hookworm infections declined more in older age groups (Fig. 2).

Cost evaluation

The costs for the programme are shown in Table 4, the cost of the programme in 1994 was estimated to be US$ 0.4 per person treated, and US$ 0.1 per person calculated over the whole Seychelles population.

Discussion

The initial objectives of the programme were met after 2 years of control activities. The intensity of A. lumbricoides, T. trichiura and hookworm infections was reduced by more than 60%, 50% and 30%, respectively (Table 2). Also the prevalence of S. stercoralis and E. histolytica was reduced by more than 70% (Table 2). These data suggest that the control programme may even have had an impact on transmission.
The consistent but different reductions both in prevalence and intensity for the three intestinal nematodes (Table 2) may be partly explained by their distribution in the population. Owing to the non-linear relationship between intensity and prevalence at high intensity levels, a significant reduction in intensity is not reflected in a similar change in prevalence. When intensity is relatively low, as in Seychelles, halving the worm burden is accompanied by a large reduction in prevalence (11) — this relationship holds even when egg counts are used to estimate worm burden. The different reductions in prevalence and intensity for the three helminths studied can also be explained in terms of the anthelmintic drug used in schoolchildren. Mebendazole is extremely effective against *A. lumbricoides*, but less effective against *T. trichiura* and hookworms (12). The significant decrease of *S. stercoralis* and *E. histolytica* infections, against which mebendazole has no effect, indicates that changes in health behaviour and improvement of water supply and sanitation may have had an impact on transmission. However, the marked decrease in the diagnosis of *E. histolytica* infection, as in Praslin/La Digue, could be partly due to increased specificity of diagnosis and a reduction in confusion with other non-pathogenicamoebae (13). This hypothesis is reinforced by the insignificant decrease in *G. intestinalis* infections. However, a recent study has suggested an increase in *Giardia* infections among children receiving periodic anthelmintic treatment (14); such a trend has not been detected in Seychelles, but might be responsible for the negligible reduction in *G. intestinalis* infection.

These results are relevant for the planning of future control strategies. Despite the success of the control programme, there are some areas where cumulative prevalence is still high. In east, west, and south Mahé, and Praslin/La Digue increased control efforts are needed. In areas with low prevalence, however, the interval between treatments can now be prolonged and chemotherapy restricted to positive individuals.

The programme has promoted control of intestinal parasitic infections within a comprehensive primary health care approach. This has been feasible because of the well established primary health care system and health facilities, good collaboration and motivation of the health staff involved in the control activities, close collaboration between the Ministries of Health and Education, the direct involvement of teachers in the control activities, involvement of the community, and cooperation with other ministries (Environment, Finance and Communication, and Community and Development). The collaboration of the Seychelles Broadcasting Cooperation and the national newspapers has also been a key factor in the success of the treatment campaigns.

The cost of the programme, estimated to be US$ 0.4 per person treated, is relatively low compared to the health budget per person in Seychelles of US$ 280 in 1994. This is due to the reuse of most of the diagnostic kits and to the inexpensive drug delivery system. Costs will be further reduced in the future when a planned cost-sharing initiative to be undertaken by the schools to cover the cost of periodic treatment is implemented. This highlights the community participation, which, as demonstrated in other control programmes (15), is essential for the acceptability and sustainability of the programme. Periodic treatment has provided an excellent opportunity to stimulate the children and their families to learn about the importance of preventive aspects, such as hygienic practices and prevention of environmental contamination, that will have a long-term impact on the transmission of infections. Although in different situations the promotion of safe water supply and sanitation might have little impact in the short term (16), in Seychelles the association with chemotherapy has greatly hastened the preventive impact of sanitation.

The Seychelles Intestinal Parasite Control Programme is an example of effective control of a public health problem through the existing health care facilities. The programme has led to greater coordination between different sectors of the Ministry of Health and has facilitated collaboration with the Ministry of Education for the control of both communicable and noncommunicable diseases. In this respect the programme can be seen as a model for other developing countries, in which this comprehensive approach can provide an opportunity to reinforce the health system, and become the entry point for the control of other communicable diseases (3, 17). The effective school-based approach for helminth control adopted in Seychelles is only one of a range of strategies. Helminth control at the community level can easily be integrated into existing health care systems or into current health care programmes such as maternal and child health, family planning, water supply and sanitation, and health education (1, 18, 19).

Owing to the rapid socioeconomic development of the country, the control of intestinal parasitic infections in Seychelles is expected to be reached within a relatively short time. The high level of school attendance in Seychelles has significantly facilitated the promising results of this programme. In other developing countries, especially in sub-Saharan Africa, where school attendance is lower and an efficient peripheral
health care system is lacking, a more flexible ap-
proach fully integrated at the community level is
called for. In these countries the control of parasitic
infections will need a much longer-term commit-
ment (3, 17). The challenge for the long-term sustainability
of intestinal parasite control programmes is to plan
activities according to the local epidemiological
situation and to maximize the available resources
through the existing health facilities.

Acknowledgements
We are most grateful to the staff of the Ministry of
Health of Seychelles. In particular, we thank Mr C.
Decommarmond, Mr P. Palmyre and the dedicated labora-
tory technicians of the central hospital and health centres,
as well as the school health nurses, environmental health
officers, nurses in charge of the antenatal clinics and
teachers for their enthusiastic participation in this study.
Special thanks are due to Professor D.W.T. Crompton for
his most useful comments. The Seychelles Intestinal
Parasite Control Programme is supported financially by
the German Pharma Health Foundation through the World
Health Organization. Dr Albonico is supported by the
Direzione Generale per la Cooperazione allo Sviluppo of
the Italian Ministry for Foreign Affairs.

Résumé
Lutte contre les parasitoses intestinales
aux Seychelles: une approche globale et
durable
Les parasitoses intestinales sont reconnues aux
Seychelles en tant que problème de santé publique
depuis le début du siècle. En 1993, le Ministère de
la Santé, en collaboration avec le Ministère de
l’Education, a établi un programme national de lutte
contre les parasitoses intestinales visant à abaisser
la morbidité due à ces infections à un niveau qui
constitue plus un problème de santé publique.
Les objectifs opérationnels sur 3 ans étaient une
réduction de 60% de l’intensité (nombre d’œufs
par gramme de selles) des infections à Ascaris
lumbricoides et de 30% de celle des infections à
Trichuris trichiura et à ankylostomes chez les
enfants d’âge scolaire, et une réduction de 30% de
la prévalence des infections à Strongyloides
stercoralis et de 40% de celle des infections à
Entamoeba histolytica dans la population cible.
Pendant la phase de planification, le personnel du
Ministère de la Santé et les enseignants ont reçu
une formation portant sur le diagnostic, la préven-
tion et les méthodes de lutte. Une enquête parasito-
logique de référence a montré qu’en moyenne
environ 60% des enfants étaient infectés par un
ou plusieurs parasites, avec des différences géo-
graphiques sensibles. Les parasites les plus
courants étaient T. trichiura (prévalence 53,3%) et
A. lumbricoides (prévalence 17,7%); les infections à
ankylostomes étaient présentes, avec une faible
intensité, chez 6,3% des écoliers et 8,6% des
femmes enceintes.

La stratégie de lutte adoptée était basée sur
des campagnes de traitement de masse pour l’en-
semble des écoliers, y compris ceux des classes
maternelles. Les enfants ont été traités tous les 4
mois par du mébendazole en une seule dose (un
comprimé de 500 mg) administrée par les enseign-
ants sous la surveillance d’un personnel de santé.
La communauté était sensibilisée aux activités de
lutte grâce à des campagnes intensives d’éducation
sanitaire et d’information faisant largement appel
da des supports imprimés (journaux, affiches, bro-
chures) et aux médias électroniques (radio, télé-
vision et différents supports audiovisuels).

Les objectifs initiaux du programme ont été
atteints au bout de 2 ans d’activité de lutte.
L’intensité des infections à A. lumbricoides, T.
trichiura et à ankylostomes a été réduite, respec-
tivement, de plus de 60%, 50% et 30%. La pré-
valence des infections à S. stercoralis et E.
histolytica a été réduite de plus de 70%.
Ces résultats laissent à penser que le programme
de lutte pourrait même avoir eu un impact sur la
transmission.

Dès le début, le programme a été intégré dans
le système de soins, ce qui a permis de réduire les
coûts et les besoins en ressources humaines, et de
renforcer le programme existant de santé scolaire.
Cette initiative a de plus favorisé la collaboration
des personnels de santé entre le niveau central et
les districts. La collaboration entre le Ministère de
la Santé, le Ministère de l’Education et les autres
ministères concernés (Finances et Communica-
tions, Environnement, Communauté et Développe-
ment) a également été renforcée.

La viabilité des activités de lutte est assurée
par le faible coût opérationnel du programme et la
bonne participation de la communauté. Le pro-
gramme a permis de promouvoir avec succès la
lutte contre les parasitoses intestinales grâce à une
approche globale dans le cadre des soins de santé
primaires, conjointement avec l’amélioration de
l’approvisionnement en eau et celle de l’assainisse-
ment. A cet égard, il peut servir de modèle à
d’autres pays en développement, même lorsque les
conditions sanitaires et socio-économiques sont
différentes et que la lutte contre les parasitoses
nécessite un engagement de beaucoup plus longue
durée.
References

2. Elkins DB et al. The epidemiology of control of intestinal helminths in the Pulicat Lake Region of Southern India. Study design and pre- and post-treatment observation on Ascaris lumbricoides infection. Transactions of the Royal Society of Tropical Medicine and Hygiene, 1986, 80: 744–792.