TRANSACTIONS OF THE ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE (1988) 82, 582-587

The morbidity of schistosomiasis mansoni in the Rusizi Plain (Burundi)

B. Gryseels* *Laboratory for Parasitology, State University of Leiden, P.O. Box 9605, 2300 RC Leiden, The Netherlands*

Abstract

A cross-sectional study was made of the morbidity due to *Schistosoma mansoni* infection in the Rusizi plain, Burundi. An evenly distributed 5% population sample (n=6203) was examined; each subject was submitted to a standardized medical history and abdominal palpation. The prevalence of infection was 33% and most infections were light. Diarrhoea was complained of by 26% of those infected and 21% of those not infected; "bloody diarrhoea" by 13% and 4%, respectively. The association with schistosomiasis was significant in all age groups. "Abdominal pain" was a very common complaint, "tiredness" an infrequent one; neither was associated with the infection. Left lobe hepatomegaly was found in 26% of those infected, and in 10% of those not infected; right lobe hepatomegaly in 7% and 5%, and splenomegaly in 30% and 24%, respectively. The frequency of organomegaly and its association with schistosomiasis was maximal in children, decreased in adolescents and young adults, and increased again in older adults; its intensity was generally mild. Ascites or histories of haematemesis were not recorded, though several cases of decompensated portal hypertension due to schistosomiasis have been documented at the central hospital of Bujumbura. The relation of morbidity to intensity of infection was limited to a correlation between hepatomegaly and egg load in those over 40 years old. It is concluded that, in this situation, selective mass treatment is a better strategy than targeted or selected group chemotherapy.

Introduction

In order to set up a control programme for *Schistosoma mansoni* in the Rusizi Plain (Burundi), a series of epidemiological and operational studies were carried out. Preliminary studies (GRYSEELS, 1984, 1985) had indicated that the distribution of the infection was focal and not easily predictable. A region-wide survey was therefore conducted, in which infection as well as morbidity rates were measured in a large, representative population sample. The general epidemiological results have been reported elsewhere (GRYSEELS & NKULIKYINKA, 1988); in this paper, the morbidity data are presented.

Area and Population

The area and population have been described in detail by GRYSEELS (1984, 1985). Briefly, the Burundese part of the Rusizi plain is just north of lake Tanganyika, between the Zaire-Nile crest and the Rusizi river. The area is about 1000 km^2 and the population is 130 000. Cotton and rice farming, in a peculiar cooperative system of "paysannats", are the main economic activities. On the foothills, traditional farming is dominant. The farms and houses are generally dispersed. The overall prevalence of schistosomiasis is 33%; it is endemic in almost all localities, with local prevalences ranging from 3 to 63%. The highest prevalences (>40%) have been recorded in irrigated and marshy areas: the rice paysannats of the south, the Rusizi delta, and the irrigated cotton paysannats in the northern part of the plain (GRYSEELS & NKULIKYINKA, 1988).

Malaria is hypo- to mesoendemic, except in the rice culture areas where it is holoendemic (COOSEMANS *et al.*, 1984).

Methods

Sampling. The sampling method has been described in detail by GRYSEELS & NKULIKYINKA (1988). Every twentieth house in each paysannat, hors-paysannat or village was selected, and all inhabitants of the selected houses were invited to participate. The aim was to obtain a geographically evenly distributed 5% population sample. Compliance was generally over 90%.

Parasitological methods. From each individual, duplicate 28 mg faecal thick smears were prepared from a fresh stool sample (KATZ *et al.*, 1972; POLDERMAN *et al.*, 1985), and examined the next day by two different microscopists; results were submitted to several checks. A direct slide was examined on the spot. "Mean egg loads" were calculated as the geometric means of the positive individual egg loads per gram (epg) of faeces.

Clinical methods. A standardized case history was taken in Kirundi from each individual by a nurse, familiar with the population. The following questions were asked. Have you been ill in the last two months? Did you have (bloody?) diarrhoea, abdominal pain? How often, for how long? Do you complain of general tiredness or weakness? Do you have any other complaints? Have you ever been seriously ill? Have you ever vomited blood? "Diarrhoea" and "abdominal pain" were considered significant if 2 episodes of at least one day had occurred in the last 2 months. With children under 5 years, the mother was interviewed.

Each individual was also subjected to an abdominal palpation in the supine position. Hepatomegaly was measured under the costal arch at the midsternal line (left lobe) and at the anterior axillary line (right lobe); it was considered significant if the liver extended 2 cm or more beyond the costal arch. Splenomegaly was measured by the method of HACKETT (1944). The abdomen was inspected for ascites or other signs of portal hypertension.

Statistical analysis. The relation of the (age-specific) frequencies of symptoms to the presence of infection

*Former affiliation: Project Bilharziose, Ministère de la Santé Publique du Burundi / Coopération Technique Belge, Bujumbura, Burundi. Affiliated with the Institute for Tropical Medicine, Antwerp, Belgium.

Table—Number of subjects, prevalence, intensities of infection, and mean egg loads per age group

Age	No.	Prevalence (%)	Percentage of subjects excreting following numbers of eggs per gram (epg) 1-100	101-350	351-1000	>1000	Mean egg load (epg)
0-4	1056	10·8	8·1	2·0	0·6	0·1	57
5-9	1041	26·8	13·9	7·0	4·0	1·8	114
10-14	775	42·5	22·7	10·2	6·5	3·1	116
15-19	436	46·1	23·4	10·8	8·5	3·4	129
20-29	987	44·1	25·5	10·8	6·3	1·4	102
30-39	731	37·1	22·2	10·5	3·8	0·5	87
40-49	573	33·7	21·6	8·9	2·1	1·0	82
50-59	346	35·3	22·3	8·1	3·5	1·4	86
>60	258	35·7	23·3	9·7	2·7	0·0	70
Total	6203	32·8	19·1	8·2	4·1	1·4	98

with *S. mansoni*, and their distribution over egg output classes, were tested with the chi-squared test. Sex-related epidemiological differences were relatively unimportant and were not considered in the analysis.

Results

6203 individuals (95·4% of the projected sample size) were examined. The number of subjects, prevalences, egg load distribution and mean egg loads per age group are shown in the Table.

The age-specific frequencies of "diarrhoea", "diarrhoea with blood", "abdominal pain", and "tiredness or weakness", as related to the presence of infection, are shown in Fig. 1.

"Diarrhoea" was complained of by 26% of those excreting *S. mansoni* eggs, and 21% of those not excreting ($\chi^2 = 24·8$, $P<0·005$). The frequency varied little with age and was significantly associated with the presence of *S. mansoni* infection in all age groups up to 30 years ($P<0·05$ to $P<0·005$). The association was also significant in those aged above 40 years, if considered as one group ($\chi^2=5·7$, $P<0·05$). "Bloody diarrhoea" was mentioned by 13% of the positives and 4% of the negatives ($\chi^2=120·2$, $P<0·005$). The association was significant ($P<0·05$ to $P<0·005$) in all age groups except those older than 60 years.

"Abdominal pain" was mentioned by 80% of those infected and 68% of those not infected, but this difference was biased by an age effect: both schistosomiasis and the complaint were much less frequent in children under 5 years than in other age groups. Allowing for this, abdominal pain was not significantly related to infection with *S. mansoni* in any age group.

"Tiredness or weakness" was infrequently complained of, and then only by people older than 20 years; it was not related to the presence of infection.

Other common complaints were rheumatic pains (8%), headaches (2%), itching and skin lesions (1%),

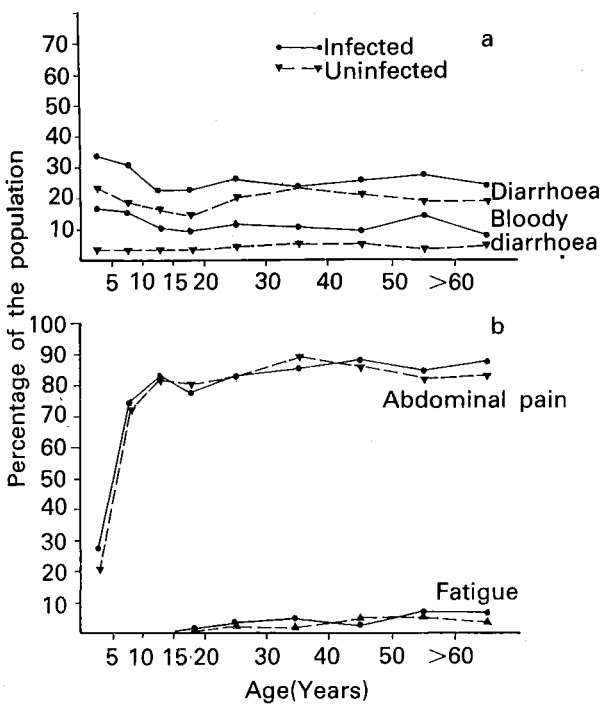

Fig. 1. Age-related frequencies of (a) diarrhoea and bloody diarrhoea, and (b) abdominal pain and fatigue in infected and uninfected individuals.

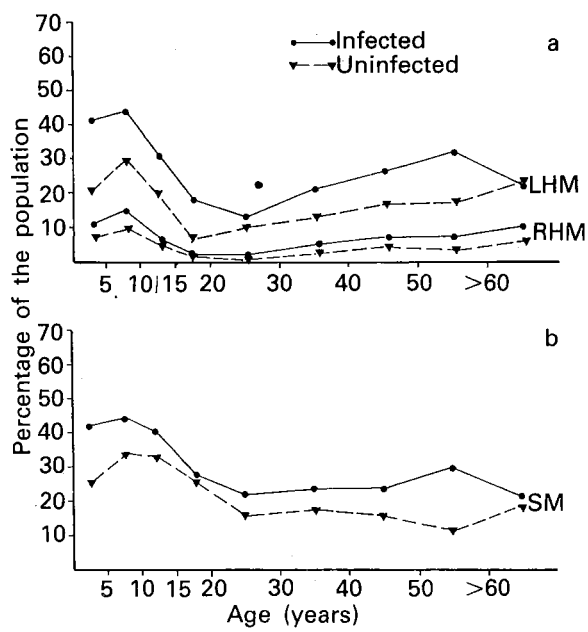

Fig. 2. Age-related frequencies of (a) left lobe hepatomegaly (LHM) and right lobe hepatomegaly (RHM), and (b) splenomegaly (SM) in infected and uninfected individuals.

nausea and vomiting (1.5%). None was related to schistosome infection.

The age-specific frequencies of hepatomegaly and splenomegaly, as related to the presence of infection with *S. mansoni*, are shown in Fig. 2.

Left lobe hepatomegaly was found in 26% of the infected subjects and 19% of those not infected ($\chi^2=45{\cdot}7$, $P<0{\cdot}005$). In both groups, the frequency was highest in young children, diminished in adolescents and young adults and increased again in older people. The symptom was significantly associated with the presence of *S. mansoni* in all age groups except those aged 20 to 29 years and those older than 60 years. Generally, hepatomegaly was mild: in only 4% of the subjects examined (6% of those infected and 3·5% of those not infected) did the left liver lobe extend 4 cm or more beyond the costal arch.

Right lobe hepatomegaly was found in 7% of those infected with *S. mansoni*, and in 5% of those not infected ($\chi^2=4{\cdot}9$, $P<0{\cdot}05$). The association was consistent over all age groups, but within age groups it was significant only in those aged 5 to 9 and 30 to 39 years. The age-related frequencies paralleled left lobe hepatomegaly; in the age groups from 15 to 30 years, the symptom was very infrequent (<2%). Right lobe hepatomegaly was always associated with left lobe hepatomegaly.

Splenomegaly was found in 30% of those infected, and in 24% of those not infected ($\chi^2=26{\cdot}1$, $P<0{\cdot}005$); in both groups the frequency was maximal in children and adolescents. The association with *S. mansoni* infection was significant in all age groups except those aged 15 to 19 years and those older than 60 years. 8% of the infected subjects, and 4% of those not infected,

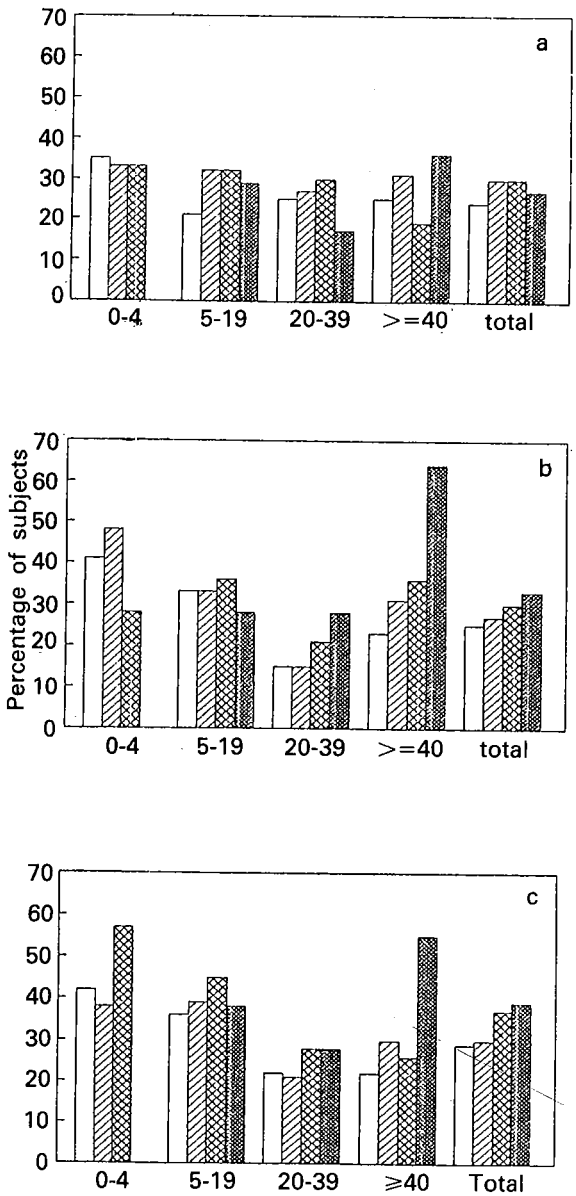

Fig. 3. Relation between egg count and the frequencies of (a) diarrhoea, (b) left lobe hepatomegaly and (c) splenomegaly, per age group and for the whole of the population
□ 1-100, ▨ 101-350, ▩ 351-1000, ▦ >1000 eggs per gram of faeces.

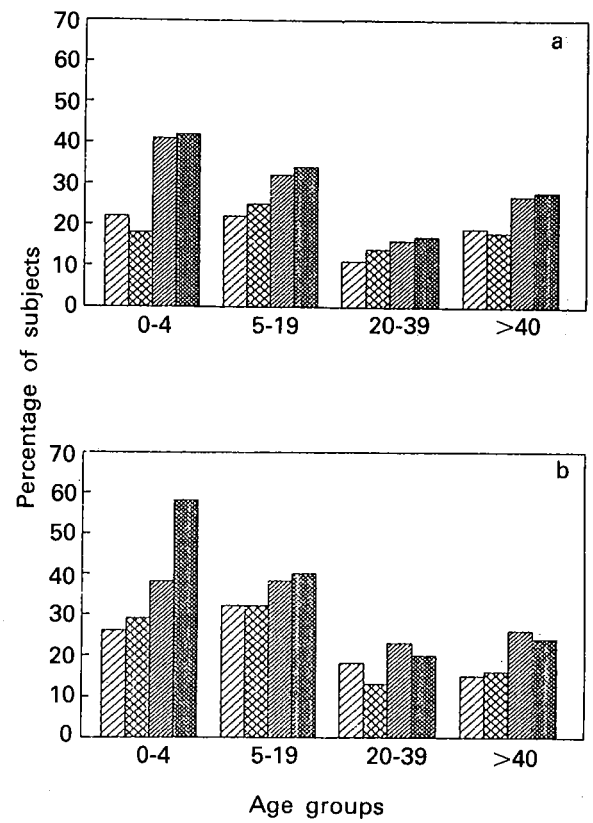

Fig. 4. Age-specific frequencies of (a) hepatomegaly and (b) splenomegaly, compared for rice culture areas (holoendemic malaria) and cotton culture areas (meso-endemic areas)
▨ Cotton area, not infected with *S. mansoni*.
▩ Rice area, not infected.
▨ Cotton area, infected with *S. mansoni*.
▦ Rice areas, not infected.

had a spleen rating greater than Hackett's grade 2.

16% of the egg-excreters, and 10% of the non-excreters, had combined hepatosplenomegaly. The age-specific frequencies paralleled those of splenomegaly.

No history or signs of oesophageal bleeding or ascites were recorded, nor family history of deaths due to such syndromes.

Fig. 3 shows the relation of the frequency of selected symptoms to the intensity of infection. For this analysis, the number of age groups was reduced to 4: 0-4 (1056 subjects), 5-19 (2253), 20-39 (1718), and 40 years or more (1117). For diarrhoea, the only significant relation to egg load was in the age group 5-19 years, and then only when those excreting fewer than 100 epg were compared to those excreting more ($\chi^2=11{\cdot}7$, $P<0{\cdot}005$). Left lobe hepatomegaly was significantly correlated with egg load only in those aged 40 years or more ($\chi^2=6{\cdot}0$, $P<0{\cdot}05$). There was no relation between splenomegaly and egg load in any age group. The tendencies observed in high egg output classes of adults were not significant: even in this large sample, such groups contained only a limited number of subjects.

No relation could be shown between the intensity of infection and the extent of either hepatomegaly or splenomegaly.

To check any possible confusion with malaria, the hepatomegaly and splenomegaly rates in rice culture areas (holoendemic malaria) and cotton-growing areas (hypo- to mesoendemic malaria) were compared (Fig. 4). In both areas, schistosomiasis was at least an important contributing factor to splenomegaly, especially in (infected) young children. In rice culture areas, the impact of schistosomiasis on splenomegaly in this age group appeared to be even more important than in cotton areas. The spleen rates in non-infected infants (and in other age groups) were not different in the 2 types of area; this somewhat contradicted the malaria classification of COOSEMANS *et al.* (1984). There was no difference in hepatomegaly rates between areas in any age group.

Discussion

This study attempted to measure the impact of *S. mansoni* on the health of the Rusizi plain population. Infection rates varied considerably from one locality to another (GRYSEELS & NKULIKYINKA, 1988). Therefore, the population sample was evenly drawn from all localities, to obtain a valid assessment on a regional scale. The usefulness and reliability of medical histories may be limited (FAROOQ *et al.*, 1966; ONGOM & BRADLEY, 1972; SMITH *et al.*, 1979). The interview must be standardized and simple, in the local language, and taken by a trained health worker familiar with the people. These conditions were fulfilled in this study.

The data show that schistosomiasis was an important cause of intestinal morbidity in the Rusizi plain. The infection was strongly correlated with diarrhoea in most age groups; bloody diarrhoea was up to three times as frequent in infected people as in those not infected. Abdominal pain, on the other hand, was too frequent to be correlated with the presence of any infection. The apparent but age-biased correlation on the population level shows how much care must be taken in analysing morbidity data. Intestinal helminthiases, and particularly ankylostomiasis which is highly prevalent (GRYSEELS & NKULIKYINKA, 1988), are probably also involved in producing this symptom. Tiredness was a surprisingly infrequent complaint.

Although there was a significant association between the excretion of *S. mansoni* eggs and the presence of hepatomegaly and splenomegaly, these symptoms were also frequent in non-infected subjects. Many of these cases were undoubtedly due to malaria, particularly in children, as demonstrated in the same area by COOSEMANS *et al.* (1984). However, a considerable proportion of infection with *S. mansoni* is not detected by a single stool examination, and some of the morbidity in "non-egg excreters" may be due to undetected infections. This possibility is supported by the observation that hepatomegaly of the left lobe, a condition typical of mansoni schistosomiasis (MOSTOFI, 1967; MACKENJEE *et al.*, 1984), was much more frequent than right lobe hepatomegaly, even in people with negative egg counts.

Hepatomegaly was significantly associated with infection in most age groups. Its biphasic age-related frequency suggests that the juvenile hepatomegaly is a reversible, hyperplastic process, while in adults it may be due to development of chronic liver fibrosis. Schistosomiasis was a contributing factor to splenomegaly in most age groups, and this in areas with holoendemic as well as with mesoendemic malaria. The association with schistosomiasis of both hepatomegaly and splenomegaly increased in adults, but disappeared in those older than 60 years. This might be explained by the earlier death of those affected with chronic bilharzial hepatosplenomegaly, but firm evidence for this assumption is difficult to obtain.

Nevertheless, in this large sample no history of oesophageal bleeding or clinical signs such as ascites, indicating decompensated portal hypertension, were detected. NIYONGABO (1983) performed a clinical and pathological study of 20 patients suspected of chronic hepatosplenic schistosomiasis over a period of 18 months in the main hospital of Bujumbura, the reference hospital for the endemic Imbo region. He found 3 cases of decompensated portal hypertension due to schistosomiasis, with oesophageal bleeding, portal hypertension and advanced periportal fibrosis, confirmed by gastroscopy, laparoscopy, and pathological examination. All were males, aged 20, 36 and 50 years.

There is thus no doubt that schistosomiasis can lead to decompensated portal hypertension in Burundi, and this in young as well as older people. The present epidemiological data suggest, however, that this is an infrequent complication: I did not find one suspected case in over 6000 subjects; even if only those infected and older than 15 years were considered, the frequency may be estimated at less than 1/1000.

Several authors have performed controlled, population-based studies on the morbidity due to *S. mansoni* in different black African countries. ONGOM & BRADLEY (1972) in West Nile Province (Uganda), and GRYSEELS & POLDERMAN (1987) in Maniema (Zaire), have demonstrated dramatic morbidity in extremely heavily infected communities, with high frequencies and intensities of bloody diarrhoea, abdominal pain, hepatomegaly and splenomegaly; in the Uganda study, ascites and haematemesis were

also frequent (ONGOM *et al.*, 1972). In other areas with lesser prevalences or intensities of infection, or both, varying situations have been described. ARAP SIONGOK *et al.* (1976) showed an association between heavy infection and abdominal pain, hepatomegaly and splenomegaly in a village in Machakos (Kenya). OMER *et al.* (1976) found an association between tiredness, bloody diarrhoea, and infection with *S. mansoni* in the Sudan; they reported 8 cases (in 1747 subjects) with either ascites or a history of oesophageal bleeding. ROUX *et al.* (1980) showed that *S. mansoni* was an important cause of hepatomegaly in adults in Ivory Coast and Burkina Faso, leading to ascites in 2% of the cases. SMITH *et al.* (1979) found little relation between any symptoms and the presence or intensity of infection in a community in Kisumu (Kenya). WALKER *et al.* (1970) and HIATT & GEBRE-MEDHIN (1977) found minimal morbidity in South Africa or Ethiopian school children, respectively.

Compared to these results, the present study showed a relatively important morbidity in an area with only moderate prevalences and intensities of infection. The intestinal morbidity was the most apparent, and should not be neglected. Diarrhoea is one of the major public health problems in Africa, and this study shows that schistosomiasis mansoni may be an important etiological factor, particularly of dysenteric syndromes. Autopsy studies have shown that bilharzial dysenteric syndromes can be fatal (BHAGWANDEEN, 1967; CHEEVER, 1968). The hepatosplenic morbidity, measured by spleen and liver enlargement rates, is also relatively important compared to other studies. Decompensated portal hypertension, however, is apparently less frequent than in some other endemic areas. This may be explained, at least partly, by the lower intensity of the infections; but such cases are rare also in highly endemic Maniema, where intense infections are very frequent (GRYSEELS & POLDERMAN, 1987). It therefore seems that other, host-related, factors also play an important role.

Another apparent discrepancy with other studies, and with generally accepted views (WHO, 1985), is the weak correlation between egg load and morbidity. In my study population, the only clear quantitative correlation observed concerned hepatomegaly in those aged over 40 years. GRYSEELS & POLDERMAN (1987) have shown, also in a highly endemic community, that this correlation may be limited, and in the other studies cited above the relation between egg output and morbidity is often restricted to one or some symptoms in some age groups, or attributable to age-effects.

The results of this study have some important implications for the planning of control measures in the Rusizi plain. "Selected group treatment" of specific age groups, or "targeted" mass chemotherapy, limited to high egg-excreters, have not been upheld as valid strategies: intestinal and hepatosplenic morbidity was important in all age groups, and showed no clear relation to egg counts. Although its cost is higher, selective mass treatment has been chosen as the optimal strategy.

Acknowledgments

My sincere thanks go to the following persons, whose support and advice have been essential: Dr Mpitabakana, Dr Ndikumana, Dr Nyunguka and Mr Simbandumbwe of the Burundese Ministry of Health; Dr Storme, Dr Burke, Dr Kivits (Belgian Cooperation Agency); Dr Mott (WHO); Prof. Dr Gigase and Prof. Dr Eyckmans (Institute for Tropical Medicine, Antwerp); and Dr Polderman (Laboratory for Parasitology, Leiden), who also critically reviewed the manuscript.

This work would not have been possible without the excellent technical assistance and dedication of Mr Nkulikyinka and his team-mates Messrs Nsekerebandya, Gakeme, Banyuruzyeko, Ndarwarukanye, Kanurwe and Ndayshimiye, and the cooperation of the authorities and population of the Rusizi plain.

The Burundi Schistosomiasis Study and Control Project is a joint programme of the Burundese Ministry of Health and the Belgian Cooperation Agency, co-financed by the Special Programme for Training and Research in Tropical Diseases of the WHO/UNDP/World Bank.

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Received 5 November 1987; accepted for publication 17 December 1987 (delayed in proof)

Book Review

Control of Lymphatic Filariasis. A Manual for Health Personnel. Geneva: World Health Organization, 1987. 89 pp. Price: Sw.fr. 15; USA $9.00. ISBN 92 4 154217 9.

This short and very practical manual has been produced by the Filariasis Unit of the Parasitic Diseases Programme of WHO, as "a guide to those who plan, manage and carry out filariasis control programmes." The book contains 3 main sections; a brief but entirely adequate account of the basic biology of filarial parasites and their vectors, together with geographical distribution, clinical manifestations, treatment and diagnosis; the objectives and methods of control, together with the constraints on control and suggested approaches in various epidemiological circumstances; and an account of the preparation, organization and techniques of clinical, parasitological and entomological surveys. Three annexes list the mosquito vectors in the main endemic zones of the world, give sample survey forms, and describe the collection and despatch of mosquito blood-meal samples for identification of animal origin.

The manual recognizes the importance of the primary health care approach to filariasis control, and the vital need for community acceptance of, and participation in, control schemes. It is particularly interesting and encouraging that the Parasitic Diseases Programme should endorse the concepts of low-dose diethylcarbamizine treatment given "by the people for the people", the most innovative new approach to filariasis control to emerge for many years.

The demands of brevity inevitably conflict with a desire for comprehensiveness in a work of this kind. In the circumstances, the authors are to be congratulated on their choice of topics, which are mostly very appropriate for the particular audience aimed at by the manual. However, a few additions or omissions could be considered for a second edition, even at the cost of a slight increase in overall length. A discussion of methods for the monitoring and evaluation of control programmes would be especially useful, and a closely related topic, the mode of presentation of summarized data collected in pre-control baseline surveys, and in serial follow-up operations, is a definite lack. A short account of national experiences in filariasis control, as given in the fourth report of the WHO Expert Committee on Filariasis (*World Health Organization Technical Report Series, no.* 702, 1984) would allow planners to set realistic targets for their own control programmes. I feel that techniques for dissection of animals for adult worms, and the identification of adult worms, are unlikely to be helpful to practical field workers, but tend to fall into th field of the more specialized research worker, even in areas where lymphatic filariasis is a zoonosis. The balance of this book is definitely titled towards south-east Asia (understandably, it originated in the region), but it is unclear if vector blood-meal identifications (pp. 72 and 89) at the Institute for Medical Research, Kuala Lumpur, Malaysia, are available to workers throughout the world.

This book is excellent value, and is an essential item for all those embarking on filariasis control.

B. L. Southgate