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The epidemiology of schistosomiasis in Burundi and its consequences for control

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Abstract

This paper summarizes the results of a series of studies on the epidemiology, morbidity and transmission of *Schistosoma mansoni* in Burundi, and discusses their consequences for control. The main endemic area is the Imbo lowland, consisting of the Rusizi plain, the urban focus of Bujumbura, and the shores of lake Tanganyika; a small, new focus was discovered in the highlands, around lake Cohoha. Distribution studies on 5–10% population samples with duplicate 28 mg Kato smears in these 4 foci showed prevalences of 33%, 26%, 17%, 19% and mean (positive) egg loads of 110, 105, 92, 144 eggs/g, respectively. The combined population at risk was estimated to be 400 000 people, the total number of detectable cases 90 000. Prevalences and intensities varied greatly at the subregional, local and even sublocal level. The age- and sex-related prevalences and intensities of infection showed typical peaks in children and adolescents, but remained relatively high in adults in many areas; these patterns varied from one area to another and could be related to ecology and water contact. Morbidity studies showed that, in children as well as in adults, schistosomiasis-related morbidity such as (bloody) diarrhoea, hepatomegaly and splenomegaly was apparent mainly in areas with prevalences over 30–40%. The intermediate hosts were *Biomphalaria pfeifferi* (Imbo), *B. sudanica* (Tanganyika marshes) and *B. stanleyi* (Cohoha). Population dynamic studies showed strong seasonal variations, the patterns of which were focal and even erratic in space and time. Snail densities and cercarial infection rates (0·85% overall in *B. pfeifferi*) were low. Behavioural studies showed that human contacts were most frequent in young adults, but their mean duration was highest in children. Most contacts were due to fording and to domestic activities. It is concluded that the most appropriate strategies for control are the following. (i) Targetting priority areas with prevalences over 30%. (ii) Selective chemotherapy based on the presence, not the intensity, of infection in all age groups. (iii) Sanitation aiming particularly at the reduction of fording and domestic water contact. (iv) Focal molluscciding only in well selected sites. (v) Close monitoring and surveillance.

Introduction

The first descriptions of *Schistosoma mansoni* in the Imbo lowlands of Burundi were made by DE BÈVE (1935) and by VAN DEN BERGHE (1939) in the marshes of lake Tanganyika, close to Bujumbura. The nearby Rusizi plain was largely uninhabited at the time, as the Burundese people preferred the fertile, cool highlands to the dry, hot, disease-infested plain, on which by tradition their king was not even allowed to set his eyes. In 1950, after successful campaigns to eradicate tick fever and trypanosomiasis, the colonial authorities started a land reclamation scheme on the Rusizi plain, which eventually led to the immigration of more than 50 000 people from the over-populated highlands. In the next few decades, the number of reported schistosomiasis cases increased thirty-fold (Fig. 1). A similar development was described in the Zairean part of the Rusizi plain by GILLET *et al.* (1960). In the 1960s, the situation became particularly worrying: a series of floods and erosion led to the deterioration of the hydraulic and sanitary infrastructure, while many refugees from neighbouring countries joined the exposed population. In 1966, the Mission d'Assainissement de la Plaine de la Rusizi (MAPR) was established for the control of malaria and schistosomiasis, with passive case detection in special dispensaries and vector control (DDT, Bayluscide®) as main strategies. Between 1966 and 1982, 395 000 stool examinations (direct smear) were performed in the MAPR dispensaries, 36 244 of which were positive for *S. mansoni*; infected patients were given an ambulant 7 d niridazole course. The positivity rate of the stool examinations declined from 21% in 1966 to 13% in 1970 and to 6% in 1980. However, most of the MAPR clientele was concentrated in villages near the dispensaries. Furthermore, the cure rate with niridazole in this population was only about 35%, and full compliance with the 7 d

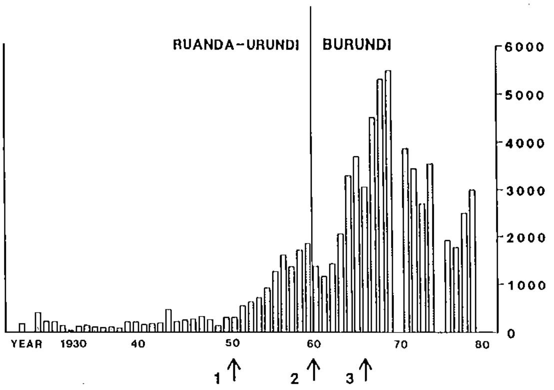

Fig. 1. Evolution of the number of reported cases of schistosomiasis in Burundi, 1924–1980. 1. Start of land reclamation in Rusizi plain. 2. Separation of Burundi and Ruanda; independence in 1962. 3. Establishment of Mission d'Assainement de la Plaine de la Rusizi.

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course was low; the direct smear detects only about 25% of the cases found with the Kato method (unpublished observations). The intensity and quality of the mollusciciding programme declined considerably over the years. Though many individual patients undoubtedly have been cured, the epidemiological impact of the MAPR activities has probably been limited. In the light of the development of new chemotherapeutic and diagnostic tools for the control of schistosomiasis morbidity (WHO, 1985), a new research and control programme was started in 1982. This paper summarizes some of the results and their implications for control.

Area and population

Burundi is a small, densely populated country with 4·5 million inhabitants and an area of 28 000 km^2, just north of lake Tanganyika. Most of the country consists of highland (altitude 1200–2000 m) and mountain chains (up to 2600 m), including the Zaire–Nile Crest. Along the western border, the elongated Imbo plain (altitude 700–1000 m) is bounded by lake Tanganyika, the Rusizi river, and the Zaire–Nile Crest. This is the only part of Burundi with a genuinely tropical climate; the mean temperature is 23°C, the annual rainfall 650–850 mm, and the dry season lasts from April to October. The northern part of the Imbo plain, the Rusizi plain (area about 1000 km^2), is divided into a flat Imbo-Centre plain and a hilly Imbo-Nord region. Most of the population (140 000 in total), lives in paysannats, a co-operative agricultural system. Cotton paysannats, which are generally not irrigated, consist of equally sized farms, geometrically arranged along parallel roads. The rice paysannats in the Imbo-Centre consist of diffuse villages at the end of densely irrigated rice culture areas. The hors-paysannats at the foot of the crest consist of traditional farms, dispersed amidst crop fields and coffee plantations. There are many rivers, streams, ponds, canals and marshes all over the area; the water levels generally vary greatly with rainfall and/or irrigation cycles.

Situated at the tip of lake Tanganyika, the capital Bujumbura (population approximately 130 000) consists of an administrative and commercial city centre, a few old central cités and more recent suburban cités. There are a few rivers and lakeshore marshes in this urban area. The southern part of the Imbo (Imbo-Sud) consists of a narrow strip along lake Tanganyika. The population (about 90 000) of fishermen and farmers lives in dispersed farms; in the city of Rumonge (population 20 000), and a few nearby villages, the habitat pattern is more concentrated. In the highlands, the only focus of *S. mansoni* known so far is situated on the hilly peninsulas which form the shores of lake Cohoha (altitude 1350 m), in the north-eastern Bugesera depression. The mean temperature in this area is 21°C, the annual rainfall 1000 mm. The lakeshore population (about 30 000) lives from farming and fishing; dwellings are dispersed.

Methods

Population samples (*n*%) were composed of every (100/*n*)th household on census lists. Parasitological surveys were based on the examination, by separate microscopists, of duplicate 28 mg Kato slides from a single stool sample. Mean egg loads were calculated as the geometric means of positive egg counts. Morbidity studies were based on a standardized case history and a clinical examination (GRYSEELS, 1988).

The dynamics of snail populations were studied in representative biotopes with a man-minute method (four collectors searching for 15 min) at three-weekly intervals. *Biomphalaria* specimens were measured, examined for cercarial shedding, and returned to their biotope. Direct water contact observations were performed at main contact sites in 4 representative villages (total population 2500), from 0600 h until 1800 h, every 6th week during 18–24 months.

Results

Distribution of the infection

Preliminary surveys in the Imbo plain showed that prevalences could be high in various ecological settings, and that *B. pfeifferi*, *B. sudanica*, or both, were present in almost all types of biotopes (GRYSEELS, 1984, 1985). Consequently, area-wide distribution studies were performed in each endemic area, the results of which are summarized in Table 1 and Fig. 2.

Rusizi plain. In the Rusizi plain, an evenly distribution 5% population sample was examined in all localities. The overall prevalence was 33%; in 58% of the detected infections the egg count was less than 100 eggs/g. Prevalences and intensities varied greatly from one locality to another and even within the localities (GRYSEELS, 1984; GRYSEELS & NKULIKYINKA, 1988). Nevertheless, 10 more or less homogenous 'eco-epidemiological' areas could be recognized (Fig. 2). High prevalences were recorded in varying ecological situations: irrigated cotton areas in the Imbo-Nord, rice culture areas in the Imbo-Centre, and the marshy Rusizi delta.

Bujumbura. In Bujumbura, the surveys were at first based on systematic screening of all primary school children (age 5–15 years). School prevalences ranged between 20% and 45% in the central and the northern cités, but in the more developed quarters and in the recently established southern suburbs prevalences were lower than 10%. Community surveys on random 5% samples of all age groups in a central (Buyenzi) and a northern (Kinama) cité revealed overall prevalences of 24% and 27%, respectively.

Imbo-Sud. Though often based on non-random population samples, the surveys in this area again showed a very focal distribution with high prevalences only in Rumonge and particularly the surrounding villages. Elsewhere, prevalences were less than 15%.

Table 1. Overall results of distribution studies of *Schistosoma mansoni* in endemic areas

Area	Prevalence (%)[a]	Mean epg[b]	No. examined
Rusizi plain	33 (3–68)	110	6203
Bujumbura schools	25 (3–45)	105	9460
Communities[c]	26 (25–48)	85	1736
Imbo-Sud	17 (5–45)	92	4599
Cohoha	19 (4–51)	144	1957

[a] Ranges in parentheses.
[b] Eggs/g of faeces; means of positive specimens only.
[c] In two cités (Buyenzi, Kinama).

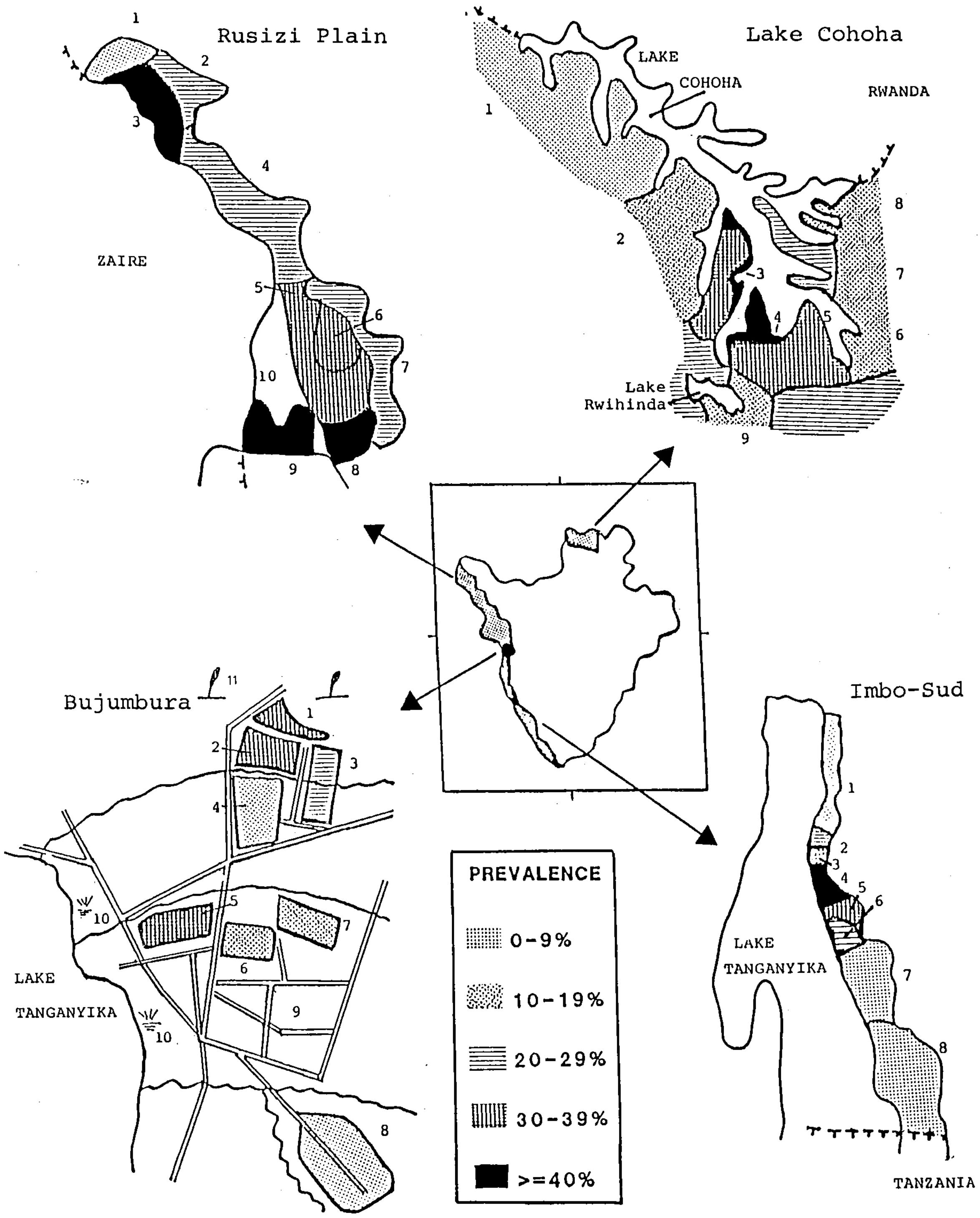

Fig. 2. The distribution of *S. mansoni* infection in the four endemic areas in Burundi. Explanation of numbers: Rusizi Plain: 1. Rukana. 2. Northern hors-paysannats. 3. Cotton paysannats of Rugombo-Cibitoke including workers' villages. 4. Mid-Plain cotton paysannats. 5. Cotton paysannats, Imbo-Centre. 6. Rice culture area, Imbo-Centre. 7. Southern hors-paysannats. 8. Rice culture area of Mutimbuzi. 9. Rusizi delta. 10. Rukoko (cattle grazing area). Bujumbura: 1. Kinama. 2. Cibitoke. 3. Kamenge. 4. Ngagara. 5. Buyenzi. 6. Bwiza. 7. Nyakabiga. 8. Musaga. Residential and administrative quarters. 10. Tanganyika marshes. 11. Rice fields of Imbo-Centre. Imbo-Sud: 1. Kanyosha/Kabezi/Gitaga. Magara/Rutumo. 3. Minago. 4. Kagongo/Kizuka. 6. Rumonge. 7. Gatete/Cabara/Kigwena. 8. Nyanza-lac. Cohoha: 1. Kyionza/Kigina/Gaturanda. 2. Nyamabuye. 3. Runyonza. 4. Yaranda. 5. Muramaba. 6. Kagege. 7. Gisenyi. 8. Murambi. 9. Kanyinia.

Lake Cohoha. An unknown, probably new focus was discovered around lake Cohoha, in the north-eastern highlands of Burundi (GRYSEELS *et al.*, 1987b). The overall prevalence in the shore population was 19%, but surveys on random 10% community samples revealed once again a strongly focal distribution. Prevalences were up to 50% in 3 'central' peninsulas, and diminished gradually to less than 5% in the peripheral areas. Intensities of infection were generally higher than in the Imbo plain.

Other areas. In Gisuru, a village in the Moso region where a few schistosomiasis cases had been reported, 3% of a population sample (n=784, mainly schoolchildren) were found to be infected. So far, surveys and health records elsewhere in the Moso and in the highlands have not given any indication of other suspicious situations.

Distribution in the population. The age- and sex-related prevalences in the different areas are shown in Fig. 3. Intensity curves were generally congruent with the prevalence curves (GRYSEELS & NKULIKYINKA, 1988; GRYSEELS *et al.*, 1987b). As usual, peak prevalences were observed in the age group of 10–19 years, but the distribution patterns nevertheless varied from one area to another. In the Rusizi plain the prevalences remained relatively high in adults and particularly in males. In Bujumbura a classic curve with little difference between the sexes was observed. In the Imbo-Sud, adult men were less commonly infected than women; in the Cohoha focus this relation was reversed, and infection rates in adults fell much more dramatically than in the other areas.

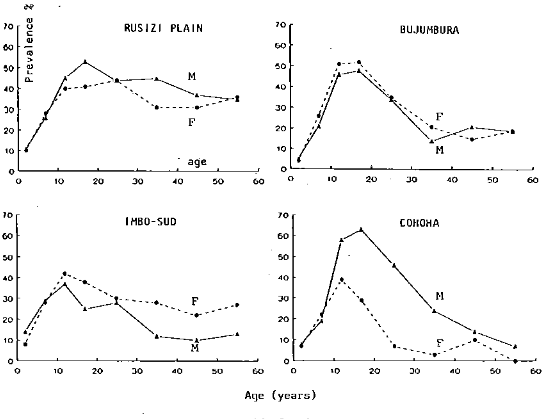

Fig. 3. Prevalences of *S. mansoni* infection according to sex and to age in the four endemic areas. Males: ▲; females, ●.

Morbidity

The results of population-based morbidity studies in the Rusizi plain and the Cohoha area have been described by GRYSEELS (1988) and GRYSEELS & NKULIKYINKA (1990). At the individual level, (bloody) diarrhoea and hepatomegaly were related to the presence, but much less to the intensity, of infection in most age groups. Only a few (suspected) cases of clinical portal hypertension were found. Table 2 shows a community-based analysis of selected results of these studies. In the Rusizi plain, morbidity rates increased significantly in areas with a prevalence over 40%; in the Cohoha focus the increase was more gradual.

Intermediate hosts

B. pfeifferi, widely present in all kinds of water bodies and water courses throughout the Imbo plain except the Rusizi river, its main tributaries and lake Tanganyika, was the main intermediate host of *S. mansoni* in Burundi. It was also found in marshes in the highlands and in streams and pools in the Moso, but apparently the conditions for transmission were (still) unfavourable in these areas. *B. sudanica (tanganyciensis)* was present and transmitting *S. mansoni* in marshes and lagoons near lake Tanganyika, but not in its (alkaline) main body. Both species were also transmitting *S. rodhaini* on the Imbo plain (GRYSEELS, 1985). An isolated population of *B. stanleyi* was found, probably transmitting *S. mansoni* in lake Cohoha and in the nearby lake Rwihinda. Its relation to, and even its distinction from, *B. pfeifferi* is not always clear (GRYSEELS *et al.*, 1987b).

The populations of all snail species showed very marked and locally varying seasonal fluctuations; in the majority of foci, however, snail densities and cercarial infection rates were generally low. In the Rusizi plain, 106 sites in 25 representative biotypes of *B. pfeifferi* were followed-up over a period of 18 to 22 months. Of 2268 visits (each of 1 man-hour), 899 (40%) were positive for *B. pfeifferi,* 655 were negative, and in 714 cases the site was (temporarily) dry. In total, 29 199 *B. pfeifferi* were collected, representing a mean density of 0·3 snails per man/minute (excluding dry biotopes). Dense popula-

Table 2. Morbidity in the community as related to prevalence of infection

	Rusizi plain			Cohoha		
		Prevalence[a]			Prevalence[a]	
	<20%	20–39%	≥40%	<10%	10–29%	≥30%
Number examined	1011	3218	1967	365	662	552
Mean prevalence (%)	12	31	47	5	16	35
Mean egg load (eggs/g)	57	86	122	51	90	231
Diarrhoea (%)	19	21	28	19	25	36
Abdominal pain (%)	77	71	69	83	78	86
Fatigue (%)	1	2	2	0·5	2	6
Hepatomegaly (%)	18	19	27	9	18	30
Splenomegaly (%)	26	24	30	3	10	18

[a]Varying prevalence classes were used because of different distribution patterns.

tions were found only in pools and in the clear water of streams and irrigation canals, particularly near local obstructions. Only 249 (0·85%) of the collected snails shed human schistosome-type cercariae; some of these may have been *S. rodhaini.* The maximal infection rate at one visit and site was 2·0%. In general, snail populations fluctuated strongly and often unpredictably with rainfall, irrigation and drainage cycles. Typical examples are shown in Fig. 4. In natural habitats, variations were related to rainfall cycles, but patterns varied according to the type of biotope: in streams, peak populations were observed in the dry season, while in ponds and marshes densities were highest in the rainy season. In canals, the fluctuations were erratic and related to (often ill-regulated) irrigation cycles. Usually, neither snail densities nor cercarial infection rates could be related to prevalences and intensities in nearby human communities.

In Bujumbura, a monthly follow-up over 2 years of the main rivers showed that these played no role in transmission. The *B. sudanica* populations in the Tanganyika marshes showed erratic, mostly unexplained, waves of high mortality, sometimes after droughts. In lake Cohoha, the *B. stanleyi* populations showed a significant increase in the dry season, mainly due to pollution by harvest debris (GRYSEELS *et al.*, 1987b). Of 2497 collected specimens, only 6 shed human-schistosome type cercariae.

Water contact

In the 4 selected villages where water-contact studies were performed, 171 329 contacts were observed during a total of 56 observation weeks; the mean number of observed contacts was 5 to 9 per inhabitant per week. Selected results are shown in Fig. 5. Fording and domestic activities were by far the most frequent reasons for water contact. The frequency of contact was highest in young adults, but children generally had longer contacts. The contact patterns were highly focal; specific types of contact occurred in specific sites.

Discussion

The distribution of *S. mansoni* in Burundi is still largely limited to the Imbo plain; the total population at risk can be estimated at about 400 000. On the basis of global prevalences, the total number of

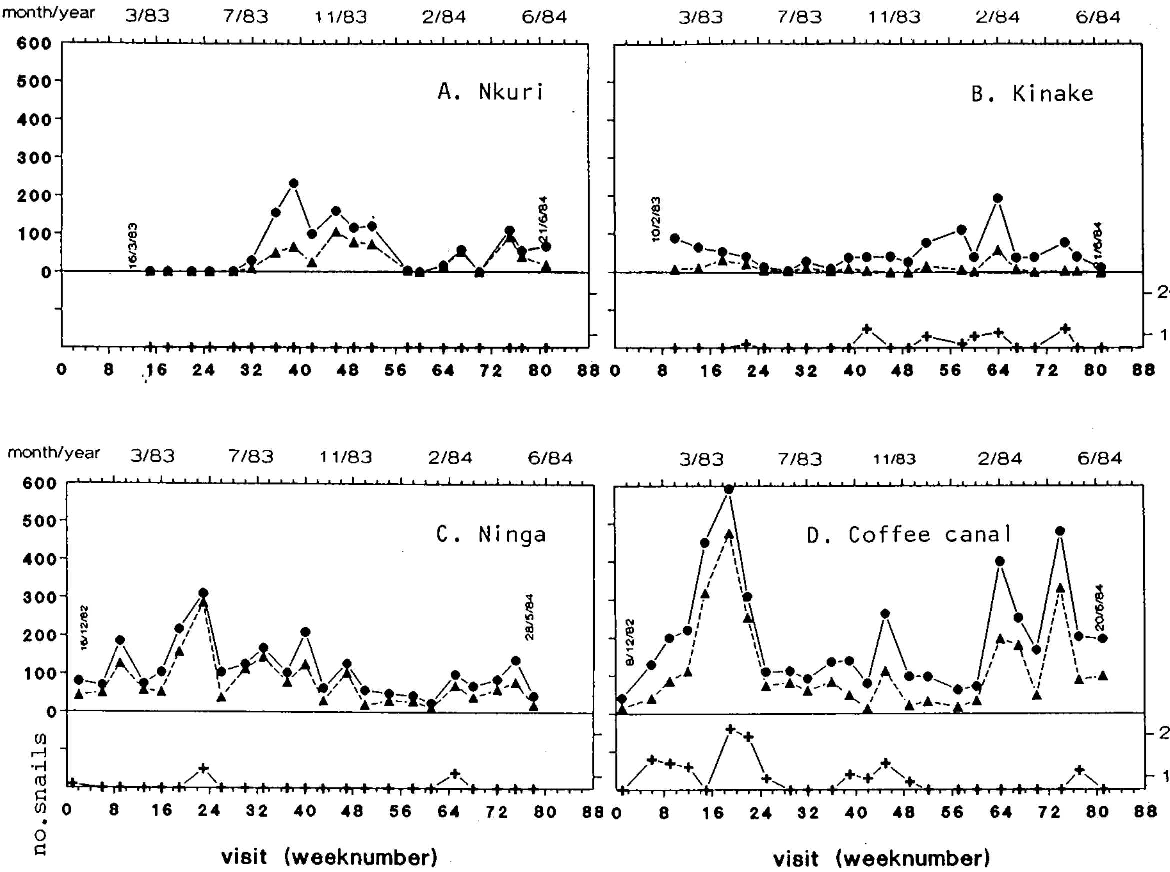

Fig. 4. Seasonal fluctuations of *Biomphalaria pfeifferi* populations in a few typical biotopes in the Rusizi plain. Total numbers (●) and numbers of young snails (▲): upper part of each graph, left ordinate; number of positive snails (+): lower part of each graph, right ordinate. A. Stream Nkuri (Kagunuzi, Imbo-North); 3 sites. B. Pond Kinake (Kagunuzi, 100 m from Nkuri); 3 sites. C. Canal Ninga, main drain of the rice culture scheme near Gihanga; 13 sites. D. Irrigation canal of coffee plantation in the same irrigation scheme, near Gihanga; 1 site.

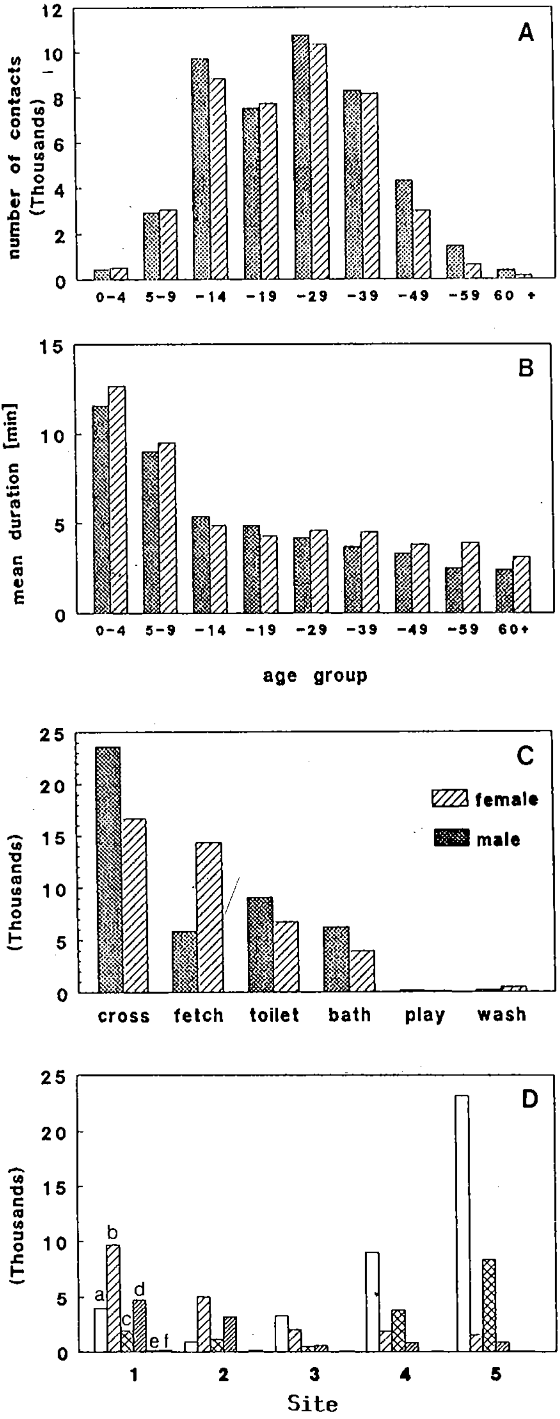

Fig. 5. Water contact patterns in four localities in Burundi. A. Number of contacts by age group (years) and sex. B. Mean duration of contacts by age group (years) and sex. C. Number of contacts by type of activity and sex. (Symbols for males and females are the same in graphs A–C.) D. Number of contacts by types of activity and site (symbols indicated by lower case letters thus: a, crossing water; b, fetching water; c, washing hands and/or face; d, bathing; e, playing; f, washing).

infections (detectable with duplicate 28 mg Kato slides from a single stool sample) could be estimated at 87 000: 43 000 in the Rusizi plain; 23 000 in Bujumbura; 15 000 in the Imbo-Sud; and 6000 in the Cohoha focus. Repeated examinations indicated that the real figures were at least 30% higher (GRYSEELS, 1988). Intestinal morbidity was surprisingly important: intermittent (bloody) diarrhoea was a frequent complaint, clearly related to infection with *S. mansoni*. Hepatomegaly and splenomegaly, at least partly related to schistosomiasis, were found in a considerable proportion of the populations, though their significance in terms of functional morbidity was not entirely clear (GRYSEELS, 1988; GRYSEELS & NKULIKYINKA, 1990). On the basis of these data, schistosomiasis has been recognized as an important public health problem in Burundi, justifying active intervention.

Schistosomiasis was endemic over virtually the whole Imbo area, but prevalences and intensities varied strongly at the local level. In the Rusizi plain, high prevalences occurred in various ecological settings. The sometimes extreme focality of schistosomiasis in this area, with highly varying prevalences and intensities between neighbouring localities and even between different parts of small communities, has been described elsewhere (GRYSEELS, 1984; GRYSEELS & NKULIKYINKA, 1988).

The occurrence of schistosomiasis in Bujumbura has long been known, but the relatively high prevalences still come as a surprise, particularly in the central cités where no convenient intra-urban transmission sites could be detected. It must be assumed that most infections were contracted in the rice areas of Imbo-Centre, at a distance of several kilometers. Obviously, these were also the main source of infection for the population of the northern suburbs. In Imbo-Sud, the potential for transmission was present all over the area. Nevertheless, high prevalences were found only in areas with a concentrated habitat pattern. Perhaps a 'human concentration factor' is critical for efficient transmission to occur in these conditions, where interventions resulting from irrigation and other schemes have not yet influenced transmission. As such works are now in progress, schistosomiasis may become more important and widespread in this area as well. The Cohoha focus was still small, but appeared to be expanding along the lakeshore. The only explanation of the observed focality is indeed that this is a relatively recent, still growing focus. Its extension to other parts of the Burundese and Ruandese highlands would be particularly worrying, as these are among the most densely populated rural areas in Africa. *B. pfeifferi* can be found in many highland marshes, but apparently ecological factors have hindered the establishment of transmission so far. The current trend to drain and exploit these marshes, e.g. for rice cultivation, may lead to increased snail breeding and human water contact, thus improving the odds for highland transmission. New foci may thus unexpectedly be discovered in the future, and perhaps Gisuru is the first in a series.

The distribution of the infection within the population varied from one area to another; age- and sex related patterns could vary greatly even from one village to another in the same area (GRYSEELS, 1984).

In the Rusizi plain, the sustained high prevalences in adults, particularly in males, may reflect a stable endemic situation with relatively important occupational exposure. In the Cohoha focus, the very substantial drop of infection rates in adults may have been due to the lack of chronic infections, persisting from childhood, in this probably young focus. The much higher rates in male adults, as compared to females, can be explained by the exposure related to fishing in the lake, one of the main professional activities. In Imbo-Sud, fishing was also a main occupation of male adults; however, transmission was not occurring in lake Tanganyika but rather in small streams used for domestic purposes, and infection rates were highest in women. These observations suggest that water contact patterns determine, at least in part, the distribution of infection in the population; observations on the development of infection rates in immigrant communities settled for different periods also support this assumption (GRYSEELS, 1984). On the other hand, the water contact studies indicated that, in fact, adults had as much or even more water contact than children, at least in the Rusizi plain. Nevertheless, infection and reinfection rates were highest in children (GRYSEELS & NKULIKYINKA, 1989). Thus, apparently both water contact and acquired immunity play their role, the relative importance of each probably depending on the local level of transmission.

The studies on the intermediate host showed that snail populations were widespread, but that this transmission potential was not efficiently exploited; snails densities were low and fluctuated erratically, and infection rates were very low. This was partly compensated for by the abundance of human water contact, but the fact that a large proportion of the population was not infected illustrates the inefficiency of transmission. Not only the densities and dynamics of snail populations, but also water contact patterns, showed focal patterns in time and space. Thus, the dynamics of transmission depend on a complex set of local and temporary conditions, explaining the focal and varying geographical and demographic distribution of the infection.

It is thus obviously difficult to predict these variations other than by detailed parasitological surveys, posing a serious problem in the planning of control interventions. For the control of morbidity by chemotherapy, a standard strategy with regards to target population and mode of treatment (selective, mass, targetted) cannot easily be defined. In some control programmes, e.g. in Brazil (MACHADO, 1982) and Mali (BRINKMANN *et al.*, 1988), the strategy was adapted in each target community as a result of preliminary sample surveys. However, in such an approach the relevance and scope of intervention become apparent only while executing the programme; proper operational and budgetary planning is not really feasible. Moreover, it is not easy to apply correct sampling techniques in operational large-scale programmes. Therefore, we have chosen to apply a uniform strategy, based on a thorough preliminary epidemiological evaluation. As geographical operational units, the 'eco-epidemiological' zones such as those described in Fig. 2 are used. The size of the populations (a few thousands), the clear geographical delimitation (which is important given the dispersed habitat), and the distances (5–20 km) allow for convenient planning and operations. As morbidity rates increased significantly in areas with prevalences over 30–40%, the threshold and target level for intervention in the first phase has been set at a prevalence of 30%.

As morbidity was clearly associated with the presence, but much less with the (generally low) intensity, of infection, targetted treatment of individuals with high egg counts only does not seem justified (GRYSEELS, 1988; GRYSEELS & NKULIKYINKA, 1990); this approach appears also ethically unacceptable to authorities, communities and health workers. Selective treatment, based on the presence of infection, has been adopted as the most appropriate approach. Based on comparative chemotherapeutic trials, praziquantel 40 mg/kg has been selected as the optimal drug regimen for the treatment campaigns (GRYSEELS *et al.*, 1987a).

As prevalences and intensities remained relatively high in adults and schistosomiasis-related morbidity was also present in all age groups, it was decided to cover the entire community (all age groups), rather than only the younger age groups (GRYSEELS, 1988). Other arguments for this approach are the low reinfection rates in adults (GRYSEELS & NKULIKYINKA, 1989), and the low rate of school attendance, which make a school-based approach of little use. In urban areas (Bujumbura, Rumonge), where school attendance rates were high and compliance in adults generally low, a school-based strategy is more appropriate.

The focality of transmission, and thus of expected reinfection patterns, requires detailed monitoring of the communities. In the first phase, random 5–10% samples of the treated communities will be examined annually; intervention will be repeated if the prevalence reaches 30% again.

Given the abundance of snail biotopes, only focal mollusciciding can reasonably be considered as a strategy of (chemical) snail control. It is difficult, however, to identify intense transmission sites on the basis of ecological factors; the varying and often erratic seasonal fluctuations of the snail populations further complicate the planning of a manageable focal mollusciciding programme. In practice, mollusciciding will be limited to focal applications in treatable transmission sites, identified on the basis of (re)-infection rates in humans. The water contact studies showed that fording accounted for up to 50% of the contacts, and domestic activities for a large part of the rest. Relatively simple sanitary interventions, such as the construction of foot bridges and laundry basins, could thus have a considerable impact on transmission. In order to consolidate the results of chemotherapy as much and as soon as possible, this sanitation component—which furthermore has a much broader impact than on schistosomiasis only—will be emphasized from the start.

Based on the above described considerations, an attempt has been made to find a balance between the need for operational standard approaches and the consideration of local epidemiological characteristics. The various control measures are now being implemented in a large part of the endemic areas of Burundi. In the first phase specialized teams are being brought into action, but integration into the primary health care system, especially of health education, is being pursued as much as possible (ENGELS & MPITABAKANA, 1988). It is hoped that the results and experiences of the Burundi programme, which will be reported in due time, will also be useful for other countries and will contribute to the advancement of schistosomiasis control in general.

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