Schistosomiasis mansoni in Burundi: progress in its control since 1985

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Described is the evolution of the schistosomiasis control programme in Burundi since 1985. A single round of selective population chemotherapy was carried out in the Rusizi Plain and the Bugesera focus from 1985 to 1990. The prevalences and intensities of infection as well as the number of symptomatic cases detected in general health services decreased considerably. Annual sample surveys in the treated areas showed, however, that these improvements were rapidly reversed by reinfection of the demographically changing population. Since repeated selective population chemotherapy was not sustainable in the long term, a primary health care approach was adopted. In areas with good access to basic health services, approximately 10% of all schistosomiasis cases now receive treatment annually through this approach. Yearly selective chemotherapy in primary schools in suburban Bujumbura reduced the prevalence of schistosomal infection among pupils from 23% to 9% over the period 1984–90, and this programme has now been extended to highly endemic areas in Imbo-Sud. Focal snail control produced disappointing results, and emphasis has therefore shifted towards health education and environmental control of transmission.

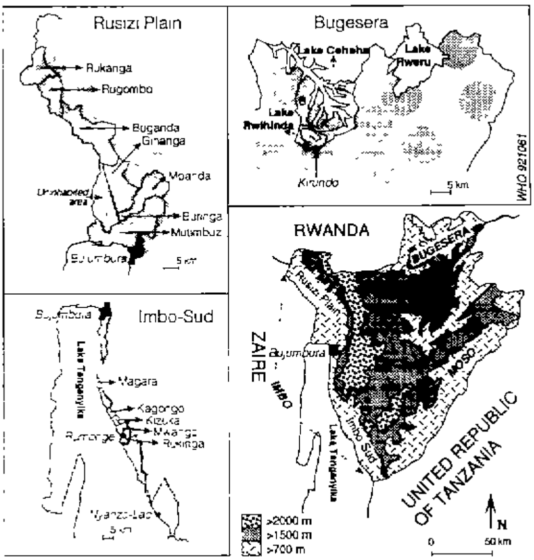
Introduction

In Burundi intestinal schistosomiasis caused by *Schistosoma mansoni* is essentially a man-made problem: land reclamation, agricultural development, and human resettlement have largely contributed to its spread since the 1950s. The history of schistosomiasis in Burundi and the development of a national control programme based on extensive epidemiological and operational studies have been reviewed elsewhere (*1*). The present article presents an overview of this programme since its implementation in 1985 as well as the resulting shifts in control strategy.

Burundi is a small (area: 28 000 km^2) but densely populated country (1990 census population 5.3 million). The centre of the country consists of highlands (altitude: 1500–2000 m), which towards the west form mountains of height up to 2600 m. The highlands are surrounded by lowland areas (altitude: 700–1400 m): the Imbo Plain in the west, the Bugesera depression in the north, and the Moso Plain in the east (Fig. 1). Schistosomiasis is currently confined to these lowlands.

From an operational point of view, four distinct endemic areas can be considered: the Rusizi Plain; the suburban focus of Bujumbura; Imbo-Sud, border-

Fig. 1 **Maps of Burundi as a whole and of the three major rural areas endemic for schistosomiasis.** Population at risk (1990): Rusizi Plain — 180 000; Bujumbura — 130 000, Imbo-Sud — 160 000, Bugesera — 70 000, and Moso — 200 000. Shaded circles: <5 km from a health centre.



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Reprint No. **5375**

ing Lake Tanganyika south of the capital; and the Bugesera depression, where schistosomiasis is mainly concentrated around Lake Cohoha and Lake Rwihinda. The number of people living in these endemic areas grew from 450 000 in 1985 to 520 000 in 1990. The characteristics of the endemic areas and populations have been reviewed previously (*1*).

Because of steady demographic pressure, human resettlement and agricultural development were initiated recently in the eastern part of the Bugesera depression (around Lake Rweru) and the Moso Plain. Although not yet a public health problem, schistosomiasis occurs in these areas and is likely to extend in the coming years. The number of people at risk is estimated to be 220 000.

Administratively, Burundi is divided into 15 provinces and 114 communes, each made up of several *collines*, which, in turn are divided into *sous-collines* (dispersed habitat) or *transversales* (organized habitat — Rusizi Plain). The ratio of health centres to population is approximately 1:14 000 in the Rusizi Plain, 1:20 000 in suburban Bujumbura, 1:35 000 in Imbo-Sud, and 1:40 000 in Bugesera. The annual recurrent budget for health in Burundi is US$ 1.6 per inhabitant, not including salaries. Drugs and reagents account for 27% of this budget.

Materials and methods

Morbidity control

In the initial attack phase of the programme, selective chemotherapy was used as the strategy for morbidity control. Screening was based on examining from each inhabitant a single 25-mg Kato smear (*2*), prepared from a fresh stool sample and left to clear for 45 minutes (*3*). All schistosome eggs were counted; the presence of eggs of other common intestinal helminths (hookworm, ascaris, trichuris, and taenia) was recorded semi-quantitatively. Persons with at least one schistosome egg on a single slide were treated with a single dose of praziquantel (40 mg/kg body weight); individuals with hookworm, roundworm, or whipworm infections were treated with a single dose of 50–150 mg of levamisole or 500 mg of mebendazole; and individuals with tapeworm were treated with a single dose of praziquantel (20 mg/kg body weight).

This strategy was applied to all communities and age groups in rural endemic areas. Chemotherapy campaigns were carried out once in the Rusizi Plain and Bugesera. In Imbo-Sud they were repeated several times in highly endemic *collines*, since systematic coverage was not feasible owing to the dispersed habitat and unstable demography. In the endemic suburbs of Bujumbura the same strategy was used annually for the high-risk group of children aged 6–15 years, through a programme in primary schools.

The impact of selective chemotherapy on infection was monitored by means of annual sample surveys in the Rusizi Plain (Rugombo, Buganda and Gihanga, Fig. 1). The samples comprised every 10th household, starting with a random number, in each *sous-colline* or on each *transversale*. If the household selected refused to participate, an adjacent household was included. In this manner a self-weighting 10% sample was obtained, taking into account the highly focal distribution of schistosomiasis.

Chemotherapy campaigns and surveys were carried out by two specialized mobile teams: one in the Rusizi Plain and Bugesera (6 microscopists) and the other in Bujumbura and Imbo-Sud (4 microscopists). Quality control was performed by systematic random re-examination of about an eighth of the daily number of Kato slides examined.

During the maintenance phase of the programme, the diagnostic capacity of health centres in endemic areas was improved by introducing the Kato method and well-defined clinical indications for stool examination (direct examination + Kato slide). After the initial training of microscopists in the health centres, quality control was performed once a year and refresher courses were organized if necessary.

The central mobile teams were integrated into the regional health services, and their services could be called upon to deal with particular problems.

Snail control

Snail populations were assessed using a man–minute method (4 collectors searching for 15 minutes). Niclosamide was applied using a knapsack sprayer for shallow stagnant waters (concentration of 1.5×10^{-3} mmol/l (0.6 ppm)) or using a constant-head applicator for flowing waters (concentration of 5.1×10^{-3} mmol/l (2.0 ppm) over 6 hours).

Environmental control of transmission

In Burundi safe water is commonly supplied to lowland areas by networks of piped water, collected on the (rainy) mountain crests. Standard laundry units consist of four basins, each with a tap and a simple draining system. Shower units consist of simple perforated pipes, fed by a tap and adjusted to waist or shoulder level to allow people to clean themselves after coming back from working in the fields. Public toilets consist of blocks of four ventilated pit-latrines. Private latrines are promoted by selling concrete slabs at a subsidized price (ca. US$ 10); once the latrine is built by the owner, it is checked by a health assistant before the vent piping is supplied.

Flipcharts on the following were developed and distributed to health centres: schistosomiasis, the importance of safe water and sanitation, environmental sanitation, and intestinal helminths. A 25-minute educational video-film was produced and is shown annually to the senior classes of all primary schools in areas of Burundi where schistosomiasis is endemic. More recently, simple information panels and posters, leaflets, and T-shirts promoting early diagnosis and prevention of schistosomiasis have been prepared for use in a more comprehensive large-scale information–education–communication (IEC) campaign.

Data collection and analysis

Standard procedures and record forms were used throughout the programme. Simple indices were calculated manually by each team leader to permit day-to-day monitoring. Data were further processed and analysed by computer using dBase III+, BASIC, and SPSS PC+ software. Mean egg loads were calculated as geometric means of positive individual egg loads per gram of faeces (epg). Egg count categories were defined as follows: 1–100 epg (1–2 eggs per Kato slide); 101–400 epg (3–10 eggs per Kato slide); >400 epg (>10 eggs per Kato slide).

The sequence of control measures in each of the four endemic areas is summarized in Table 1.

Table 1: **Sequence of control measures in the four areas of Burundi endemic for schistosomiasis, 1985–91**

Area	1985	1986	1987	1988	1989	1990	1991
	Rugombo	Gihanga	Rukana/Buganda	Mutimbuzi	Mpanda		
Rusizi Plain	Single selective chemotherapy + monitoring				E[a]		
					PHC programme[b]		E
			Snail control	"intensive"	E	"extensive"	
		Environmental control of transmission (southern part)					E
Bugesera focus					Single selective chemotherapy		
						PHC programme	E
Bujumbura	Annual selective chemotherapy of primary school children					E	
							PHC programme
Imbo-Sud	Repeated selective chemotherapy in highly endemic *collines*					E	
			"Extensive" snail control				
							PHC programme

[a] E = evaluation
[b] PHC = primary health care

Results

From 1985 to 1990 about 160 000 people participated in the selective population chemotherapy campaigns in rural areas and about 70 000 stool examinations were performed during the school programme in urban areas (Bujumbura, Rumonge). The campaigns in the Rusizi Plain took place between 1985 and 1989. The prevalences and intensities of schistosomal infection measured during these campaigns are summarized in Table 2. The average participation rate was 80%, and this varied from 67% to 97% in the various *collines*. The rate was highest in the northern part of the plain where the population was more stable. Bugesera was covered in 1989–90. The measured prevalences and intensities of infection are summarized in Table 2. Here, the participation rates varied from 54% to 97% in the various *collines*, with an average of 83% for the whole area. In Imbo-Sud repeated selective chemotherapy was used from 1985 to 1990 in the highly endemic *collines* just north of Rumonge. The prevalences of schistosomal infection measured during these campaigns are summarized in Table 3. The total cost of the selective treatment campaigns was approximately US$ 1 per person examined over the study period. The cost of praziquantel accounted for 50% of the running costs of the campaigns.

We were able to evaluate the effect of this strategy on the passive detection of cases in general health services in the northern part of the Rusizi Plain (Rugombo). The results are shown in Fig. 2.

The evolution of the prevalence of infection after selective population chemotherapy in the three monitored communes in the Rusizi Plain is shown in Fig. 3. Two years after intervention, the prevalence had reverted to 65%, 100%, and 85% of its initial level in Rugombo, Gihanga and Buganda, respectively. The proportions of people treated, examined (but found negative), or not examined during the treatment campaigns are also shown. The proportion of infected people who were new to the area became important from the third post-intervention year onwards.

Table 2: **Prevalences and intensities of schistosomal infection detected during selective population treatment campaigns in the Rusizi Plain and Bugesera, Burundi**

Commune or area	Average prevalence (%)	Mean egg load (epg)	% of individuals excreting >100 epg	% of individuals excreting >400 epg
Rusizi Plain				
Rukana	15 (2–36) [a]	95 (40–136)	4 (0–9)	1 (0–2)
Rugombo	32 (6–63)	122 (77–190)	13 (1–38)	4 (0–16)
Buganda	13 (3–48)	114 (75–268)	5 (1–17)	2 (0–11)
Gihanga	20 (6–31)	114 (72–160)	7 (2–15)	2 (1–7)
Mutimbuzi	33 (8–63)	178 (86–308)	16 (3–38)	8 (1–23)
Mpanda/Buringa	34 (5–56)	189 (81–294)	21 (2–36)	9 (0–19)
Bugesera				
Area A	19 (10–28)	133 (82–199)	10 (4–17)	3 (0–6)
Area B	7 (1–13)	82 (58–143)	2 (0–6)	0.5 (0–2)
Area C	4 (0–6)	116 (40–128)	2 (0–3)	0.5 (0–1)

[a] Figures in parentheses are the range, based on an analysis per *sous-colline*.

Table 3: **Prevalences of schistosomal infection detected during repeated selective population treatment campaigns in various *collines* in Imbo-Sud, Burundi, 1985–90**

	Overall detected % prevalences					
Colline	1985	1986	1987	1988	1989	1990
Magara	—	19 (11–3) [a]	5 (2–0)	—	—	—
Kagongo	17 (8–2)	16 (10–4)	—	27 (15–6)	19 (9–4)	22 (12–4)
Kizuka	33 (20–8)	18 (10–2)	22 (11–4)	—	31 (18–8)	—
Mwange	22 (11–4)	10 (4–1)	—	—	18 (12–8)	—
Rukinga	—	—	21 (13–3)	27 (15–6)	23 (12–4)	—

[a] The first figure in parentheses is the % of infections with >100 epg, while the second figure shows the % of infections with >400 epg.

Fig. 2. **Effect of selective population treatment on passive detection of schistosomiasis cases in general health services in Rukana/Rugombo (Rusizi Plain).**

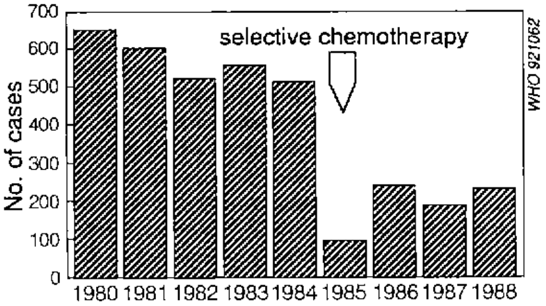
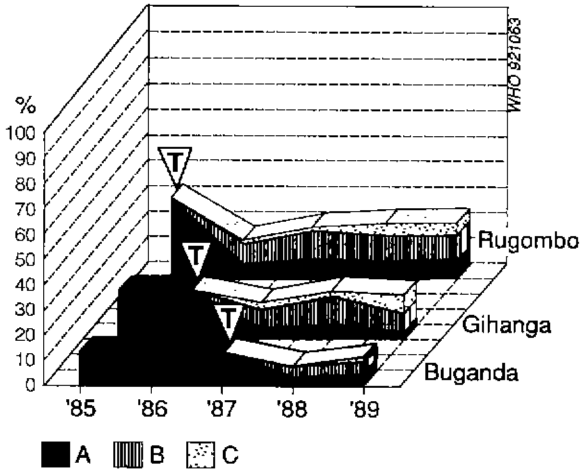


Fig. 3. **Endemic situation after selective chemotherapy in three communes in the Rusizi Plain** evolution of prevalences and proportions of people (A) treated: (B) examined but found negative, and (C) not examined during the selective treatment campaigns T = selective population chemotherapy.



Yearly selective chemotherapy of primary school children in the schistosomiasis-endemic suburbs of Bujumbura reduced the overall prevalence of schistosomiasis among such children by 61% (from 23% to 9%) over a period of 6 years (1984–90). The number of children examined increased from 7462 in 1984–85 to 15 886 in 1989–90. The effective coverage of school-age children (6–15 years) in these suburbs by the programme increased from 35% in 1984–85 to 61% in 1989–90.

To establish the maintenance phase of the programme, equipment and training for early diagnosis and treatment were provided to health centres in the Rusizi Plain in 1989, in the Bugesera focus in 1990, and in Bujumbura and Imbo-Sud in 1991. This considerably increased the number of cases detected in general health services: in the Rusizi Plain from 970 in 1988 to 3584 in 1991; and in Bugesera from 63 in 1988 to 180 in 1991. Of these cases, 93% presented with gastrointestinal symptoms, 6% with vague complaints, and only 1% with symptoms indicative of hepatosplenic disease. Quality control monitoring of the microscopic diagnosis in health centres in 1990 in the Rusizi Plain found reproducibility levels of 83% and 71%, respectively, for qualitative and quantitative diagnosis, compared with the results obtained by a specialized team. The extra cost for improved diagnosis and treatment of schistosomiasis and intestinal helminths in endemic areas was estimated to be US$ 0.02 per inhabitant per year, the cost of praziquantel accounting for 85% of this. Since the programme led to an improvement in the diagnosis and treatment of infectious intestinal pathology in general, part of this extra cost would presumably be offset by more appropriate use of other drugs e.g., metronidazole and antibiotics.

In 1987–88, intensive focal mollusciciding was performed in three communes of the Rusizi Plain (Rugombo, Buganda, Gihanga). All important sites of intense man–water contact (n = 130) in these communes were examined systematically every 2 months and treated if live *Biomphalaria* snails were found. Although on average 97% of the treated sites no longer had live snails immediately after treatment, most positive sites were rapidly recolonized, and 2 months after each treatment considerable populations of adult snails were again found in most of these sites. Although the recolonized snail populations never reached the initial levels again, they were sufficient to maintain schistosomiasis transmission. The cost of this type of snail control was US$ 0.20 per inhabitant per year, expenses for niclosamide accounting for 70% of this

Supplies of safe water and sanitation were introduced to the southern part of the Rusizi Plain (Gihanga, Mpanda, Mutimbuzi communes—80 000 people in 1990). From mid-1986 to mid-1991 a new network of piped water was installed and about 280 community standpipes were repaired or installed, increasing the ratio from 1 standpipe per 300 families to 1 per 60 families. Also, the following were constructed: 27 laundry units, near traditional washing places; 11 shower units, at the exits of rice fields; 62 blocks of public toilets, at schools and markets; and 12 footbridges, at frequently used crossing sites. About 4400 concrete latrine slabs were distributed to 25% of all families in the area. The cost of this programme was US$ 32 per inhabitant (US$ 22 for the new piped water system and US$ 10 for the additional infrastructure), representing about 2–3% of the planned investment in new irrigation schemes in the area.

Surveillance surveys were carried out in the new risk areas in the eastern part of Burundi. In Nyanza–Lac (1987) a population-based survey showed that the overall prevalence of schistosomiasis was 6% (range per *sous-colline*: 2–11%), almost identical to the prevalence in 1984. Among the population living along the shores of Lake Rweru (Fig. 1), 4% (range per *sous-colline*: 2–8%) was infected in 1989. A health-centre-based survey in the Moso Plain (1989) found few cases (6 out of 1005 people examined) scattered over the area, which is not much different from the situation in 1984 (*1*).

Discussion

Almost 5 years of fieldwork were required to carry out the selective chemotherapy campaigns in all the endemic rural areas. Monitoring surveys showed that communities rapidly became reinfected. In the first 2 years following the interventions, the majority of schistosomiasis cases in each of the study samples had participated in selective population treatment campaigns, but were found to be negative upon screening. These findings are consistent with the conclusions of preliminary operational studies (*4*) and can, at least in part, be explained by the low sensitivity of the screening method for relatively light infections. Under operational conditions this is compounded by the demographic changes in the study area. Indeed, despite the satisfactory participation rates only 60% of the 1990 population in the rural areas covered took part in the chemotherapy campaigns. Repeated interventions are thus necessary to ensure continuity of morbidity control. Financial, logistic and organizational limitations are major constraints to the long-term sustainability of such a strategy.

Therefore, an attempt was made to improve the capacity of morbidity control using a primary health care approach. The results have been encouraging. At the current rate of detection of schistosomiasis in the Rusizi Plain, approximately 10% of all cases (detectable with a single 25-mg Kato slide) receive treatment every year; comparison with selective population treatment (participation rate, 80%; 16% of cases treated yearly; demographic changes not taken into account) showed that the annual yield of cases detected by basic health services was 60%, at an eighth of the cost per inhabitant. Although the signs and symptoms of intestinal schistosomiasis are non-specific, and mixed intestinal infections are common, we can assume selection in favour of symptomatic cases. An additional advantage of a primary health care strategy is its ability to keep pace with demographic changes. A further increase in the demand for early diagnosis and treatment can be expected once the IEC campaign becomes fully operational. In some endemic areas of Burundi (Bugesera, Imbo-Sud) the impact of this type of strategy is still slight because of poor access to health services; rapid improvement of this situation can be expected in view of the strong commitment of national health authorities and funding agencies to increasing primary health care coverage.

Some aspects need to be further investigated; for example, the importance of schistosomiasis-related hepatic morbidity in Burundi and the impact of chemotherapy on it. Community-based surveys have shown increased rates of (mild) hepato- and splenomegaly related to schistosomiasis, but few or no cases of clinical portal hypertension (*1*). Health centres detect few cases of severe hepatosplenic disease. On the other hand, operational studies have not found a significant reduction in liver and spleen enlargement rates, even after repeated chemotherapy (*5*).[a] Recent ultrasonographic studies in the Gezira region of the Sudan have reported a high frequency of liver disease, its reduction by chemotherapy, and the unreliability of indirect assessment of schistosomiasis morbidity (*6, 7*). The planned use of ultrasonography in Burundi should clarify the situation and reveal whether additional control action is needed.

In view of the results of the school programme in Bujumbura, the frequency of the selective chemotherapy in two of the four endemic suburbs was reduced from 1990 onwards by restricting its use to only the first, fourth, and sixth classes in each school. This maintenance strategy has permitted extension of the school programme to risk areas in Imbo-Sud, where an unstable demographic and endemic situation, intensive reinfection, and relatively poor access to health services justify this extra intervention.

Despite considerable efforts and its high costs, the results of focal snail control have been disappointing. This is largely because of poor weed control, lack of maintenance, and the operational difficulty of covering entire water networks, leading to rapid recolonization of treated sites by snails.

[a] **Gryseels, B.** *Morbidity and morbidity control of schistosomiasis mansoni in sub-Saharan Africa* Ph.D. thesis, University of Leiden, 1990, pp 137–216

Therefore, the emphasis in snail control has shifted to proper engineering and maintenance, directed towards farmers and irrigation managers. Some operational research in the use of plant molluscicides has also recently been initiated.

The most satisfactory outcome of the programme is perhaps the progress that has been made in the supply of safe water. Donor as well as national agencies have been persuaded to increase the quantity of water supplied to areas endemic for schistosomiasis. In the southern part of the Rusizi Plain community standpipes are now available to all 80 000 inhabitants within 500–700 m of their homes. The rest of the Rusizi Plain and part of Imbo-Sud (Nyanza-Lac) will be covered in the next few years. Additional facilities (such as shower units, laundry units and footbridges) are being provided near traditional sites of intense man–water contact. Such facilities are very popular when they are in good working order. However, maintenance is still a problem and local authorities are trying to find adequate solutions to this difficulty: families have recently started paying an annual tax (US$ 0.40 per head) for this purpose. The private latrine programme started off well. Subsidized prices and credit facilities are a prerequisite for its success, although they may hinder the programme's viability after withdrawal of external funds. Although it has so far not been possible to evaluate the effect on transmission of schistosomiasis of this environmental control programme, its general impact on well-being is clear.

The health education programme has been limited to specific target groups such as schistosomiasis patients and primary school children (*8*). Large-scale health education programmes indeed serve no purpose if alternatives to traditional water contact activities are not available. In the southern part of the Rusizi Plain, where everything has now been set up to meet increased demand in all aspects of schistosomiasis prevention, an extended IEC programme is planned. Its objective is to increase awareness of risk behaviour and to create simple responses favouring early diagnosis and treatment and the use of alternative water sources and latrines.

Surveys in the eastern lowlands of Burundi, an area where rice cultivation is widely promoted, have shown that the progression of schistosomiasis in recent years has been slower than initially feared. However, further surveillance is necessary.

In conclusion, it can be stated that the strategy for schistosomiasis control in Burundi has evolved considerably since 1985. Morbidity control has shifted from systematic treatment of infections to early treatment of intestinal disease. The available health infrastructure has allowed the control strategy to be integrated to a high degree into basic health services, enabling it to be sustained and making it affordable for the national health budget. Whether hepatosplenic morbidity can also be reduced by this approach should be answered by the results of forthcoming ultrasound studies in Burundi. Efforts to reduce transmission of schistosomiasis by snail control met with limited success, and the costs were high. Emphasis has thus shifted towards environmental control of transmission, which is more fundamental and beneficial, not only to health, but also to the quality of life in general.

Acknowledgements

We are grateful to members of the schistosomiasis control teams and peripheral health personnel. We also acknowledge the local communities and administrative authorities for their collaboration. The Schistosomiasis Research and Control Programme in Burundi was initiated by the Institute of Tropical Medicine, Antwerp, Belgium, and is supported by the Burundi Ministry of Health, the Belgian Technical Cooperation Fund, and the European Development Fund. The programme is also funded by the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Disease (TDR). Provision of safe water and sanitation in the southern part of the Rusizi Plain was financed by the European Development Fund and the Kreditanstalt fur Wiederaufbau.

Résumé

La bilharziose à *Schistosoma mansoni* au Burundi: progrès de la lutte depuis 1985

La bilharziose intestinale à *Schistosoma mansoni* est présente au Burundi dans les régions de basse altitude. Un programme de lutte a été instauré dans quatre de ces régions la Plaine de la Rusizi, la zone semi-urbaine entourant Bujumbura, l'Imbo-Sud et le Bugesera. Au début de sa mise en œuvre en 1985, ce programme de lutte était basé sur. *a*) la chimiothérapie sélective, appliquée à toute la population en milieu rural et aux enfants scolarisés (6–15 ans) en milieu semi-urbain; *b*) la lutte ciblée contre l'hôte intermédiaire et *c*) l'amélioration des conditions d'hygiène. L'effet favorable de la chimiothérapie sélective (coût: 1 $US par personne examinée) sur la prévalence et l'intensité des infestations ainsi que sur le nombre de cas de bilharziose détectés dans les services de santé généraux, a été démontré. Pourtant, la réinfestation rapide dans une population changeante, associée à l'effet de la sensibilité réduite du test diagnostique (Kato 25 mg) en cas d'infestation légère, impose la répétition régulière de ce genre d'intervention afin d'assurer une

continuité dans le contrôle de la morbidité. Les chances de pérennisation de cette stratégie étant jugées faibles, une approche plus intégrée a été testée. Les capacités de diagnostic précoce des services de santé de base ont été améliorées, entre autres par l'introduction de la méthode Kato. Dans les régions où l'accessibilité à ces services est bonne, on a pu ainsi multiplier par 4 le nombre de cas détectés. En d'autres termes, environ 10% des cas présumés y sont actuellement détectés et traités chaque année par cette stratégie intégrée. Par rapport aux traitements de masse sélectifs cela représente un potentiel de détection de 60% pour 1/8 du coût. La morbidité ainsi détectée et traitée étant essentiellement intestinale, l'importance de la morbidité hépatosplénique et son évolution après traitement méritent d'être analysées plus en détail à l'aide de l'échographie. A Bujumbura, le programme scolaire a permis de réduire la prévalence chez les écoliers de 23% en 1984–1985 à 9% en 1989–1990. Suite à ces bons résultats, la fréquence du traitement sélectif a pu être réduite dans deux des quatre quartiers semi-urbains. Le temps ainsi économisé a permis d'étendre ce programme aux zones fortement touchées de l'Imbo-Sud où des campagnes répétées de chimiothérapie sélective n'avaient pas donné les résultats escomptés et où l'accessibilité aux services de santé de base est encore relativement faible. Malgré des efforts considérables associés à un coût élevé (0,2 $US par habitant par an), les résultats de la lutte contre l'hôte intermédiaire ont été décevants. Par conséquent. une plus grande attention a été accordée à l'amélioration des conditions d'hygiène des populations concernées. Dans ce domaine, beaucoup de progrès ont été réalisés dans la partie sud de la Plaine de la Rusizi, tant en ce qui concerne l'approvisionnement en eau potable que l'aménagement d'infrastructures sanitaires favorisant plus spécifiquement la prévention de la bilharziose (lavoirs, rampes lave-pieds, passerelles). Bien que très élevé en valeur absolue (32 $US par habitant), l'investissement dans ce domaine ne représente que 2 à 3% des dépenses prévues pour l'extension des réseaux d'irrigation. Grâce à l'amélioration des conditions d'hygiène, les activités d'éducation pour la santé du programme de lutte contre la bilharziose ont pu être étendues à la population générale. Ces activités étaient jusque-là limitées à des groupes-cibles comme les malades et les élèves des écoles primaires. La surveillance de l'endémie dans les nouvelles régions à risque de l'est du pays a montré une extension moins rapide que celle initialement redoutée.

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