Research/Recherche

Selective population chemotherapy among schoolchildren in Beheira governorate: the UNICEF/Arab Republic of Egypt/WHO Schistosomiasis Control Project

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Selective population chemotherapy using a single dose of praziquantel (40 mg per kg body weight), which was offered to 29 365 schoolchildren in Abu El Matameer and 40 241 in Abo Homos districts, Beheira governorate in the Nile delta, reduced the prevalence of schistosomiasis from 75.4% to 40.9% (reduction of 45.8%) and from 80.5% to 30.8% (reduction of 61.7%), respectively. Of those with only S. mansoni infection, 10.6% before treatment and 1.7% one year later had more than 800 eggs per gram of faeces. The prevalence of S. haematobium in Abu El Matameer was reduced from 35.4% to 7.4% after a single treatment. Infections with both S. mansoni and S. haematobium were reduced by more than 90% after one year. These reductions in prevalence and intensity of schistosomiasis in the face of continuing transmission and water contact augur well for the future role of chemotherapy in control programmes.

Introduction

Praziquantel has been shown to have high cure rates against *Schistosoma mansoni* and *S. haematobium* infections in clinical trials and small community-intervention studies (*1*, *2*); its effectiveness to reduce both the intensity of infection and the morbidity has been confirmed in different endemic areas (*3*). Some studies have found that, after treatment, the egg negative rate and the reduction in intensity of infection, as measured by faecal egg counts, have not been as high or persistent in children as among adults (*4*, *5*). As the large-scale use of chemotherapy in national control programmes increases, operational research studies are essential to evaluate the effectiveness of treatment and to determine the appropriate regimen for a maximum impact on morbidity. Since most national control activities lack both human and financial resources to support costly, detailed field research, the available data must be used for evaluation as well as for operational decisions on where to increase or decrease control efforts.

In 1983 UNICEF, WHO and the Department of Endemic Diseases of the Egyptian Ministry of Health collaborated jointly in a large-scale schistosomiasis control project. The object was to determine the prevalence and intensity of *S. mansoni* and *S. haematobium* infection among schoolchildren in two districts of Beheira governorate in the Nile delta of Egypt and to assess the impact of selective population chemotherapy using a single dose of praziquantel.

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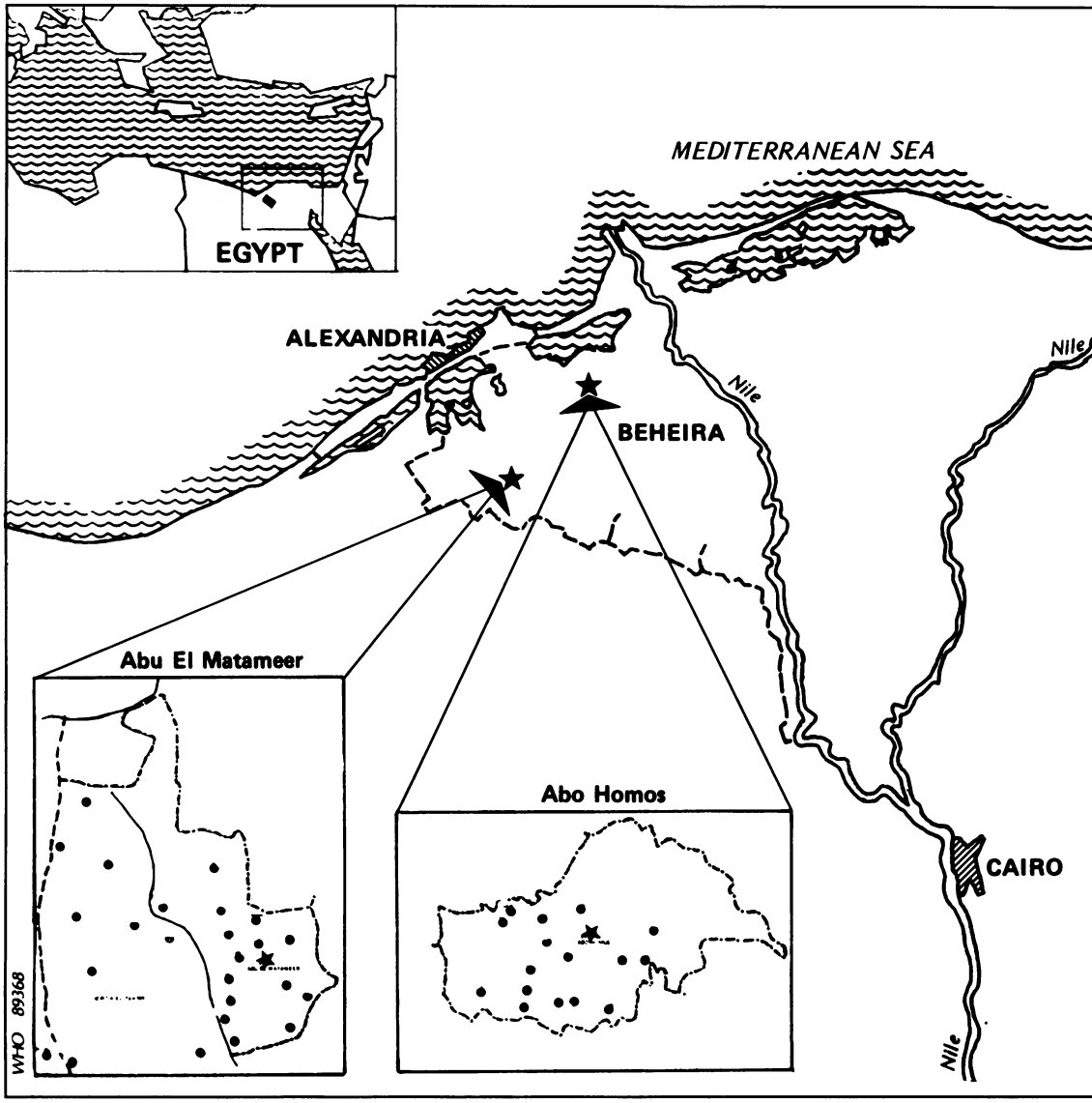
Materials and methods

Study areas. The districts of Abu El Matameer and Abo Homos in Beheira governorate are situated about 20 km apart, some 40 km southeast of Alexandria and 150 km northwest of Cairo (see Fig. 1). Their populations numbered 160 000 and 217 822, respectively in 1987. Both districts are major irrigated agricultural areas to the west of the main channel of the Nile river. Schistosomiasis has been recognized as a major public health problem in the Nile delta, the Beheira governorate being the site of previous operational research activities conducted by WHO (*6*).

Preparatory phase. In January 1983, during an Area Development workshop with community leaders in Abu El Matameer, schistosomiasis was recognized

Fig. 1. **Map showing location of study areas in Abu El Matameer and Abo Homos.**



by the public as the most important problem for intervention in the development phase. At the community's request an operational research project was undertaken to evaluate the selective treatment of schoolchildren in this district and in a neighbouring district, Abu Homos, after one year. Baseline data were obtained from Ministry of Health reports on the distribution and prevalence of schistosomiasis. WHO conducted a five-day workshop for Ministry of Health staff and technicians. Subsequently over 400 staff and technicians were trained in the districts. The training emphasized basic laboratory techniques, organization of efficient surveys and supervisory skills.

Methods. Both urine and faecal specimens were collected on the same day. If there was no gross haematuria in the urine specimen, a chemical reagent strip (Hemastix, Ames-Miles Laboratories) was used to assess microscopic haematuria. If the latter was negative, a single random 10 ml sample of urine was syringe-filtered through a 20 HD Nytrel filter (UGB, Panissières, France). After one drop of Lugol's solution was added to the filter, it was examined microscopically. If *S. haematobium* eggs were present, they were counted up to 50 and recorded; larger numbers were not counted and recorded as 50+ eggs. The Kato-Katz cellophane thick-smear technique for faecal examination was used. A single sample from each stool specimen was examined microscopically within 24 hours of preparation. The microscopists recorded the actual number of *S. mansoni* eggs observed in each sample up to 34 eggs.

After completion of the examinations, all infected persons were treated, usually the next day, with a single dose of praziquantel (40 mg per kg of body weight). Treatment was given in anticipation of the known peak transmission between June and August. Thus, the timing of treatment between October and May was designed to permit the maximum period of reduced risk of re-exposure to infection. Throughout this project, the health communication activities were intensive among school teachers, religious leaders, community officials and lay groups. No snail control, water supply and sanitation interventions were implemented during the period of this study.

Operations. All diagnosis and treatment surveys in the community were carried out by mobile teams and static teams in the rural health units. Each mobile team consisted of 9 persons (a physician, 2 microscopists, 2 clerks, 1 community worker, 2 laboratory aides and a driver). Four mobile teams executed the community surveys in each district. Each static team was located in a rural health unit, with 4 persons (a physician, nurse, laboratory technician and a health aide). There were 48 static teams, 22 in Abu El Matameer and 26 in Abu Homos.

In each district one physician and 3 senior laboratory technicians supervised the mobile and static teams. During the school surveys one supervisor was attached to each mobile team. Four staff members in each district health office received the school survey summary record forms from the mobile teams and checked these against the individual record forms. The data were further analysed and tables were prepared from the individual record forms.

School surveys. Each mobile team prepared a timetable for the surveys of schools in their operational area. The operational objective was for each team to prepare Kato slides from faecal specimens of 400 schoolchildren each day and to examine 200 slides per day. Thus examination and treatment of 400 children required two working days. The schedule of school surveys was as follows:

Abu El Matameer
First survey: October 1983 to May 1984
Second survey: October 1984 to May 1985
Abu Homos
First survey: October 1984 to May 1985
Second survey: October 1985 to May 1986.

Community surveys. These began in Abu El Matameer in 1985 and in Abu Homos in 1986. The community surveys were done jointly by the mobile and static teams. Remote villages were surveyed only by mobile teams.

Results

School surveys

In Abu El Matameer. During the first survey 29 365 children (99% coverage) were examined in 83 schools with an overall prevalence of 75.4% (Table 1). The prevalence of *S. mansoni* infection was over 90% in the schools of one council area where all *S. haematobium* infections were associated with *S. mansoni* (Zawiet Sakr). The prevalence of double infections was always higher than single infections with *S. haematobium* in all council areas except El Tahrir.

The prevalence was higher in boys than in girls except in Zawiet Sakr where the overall prevalence was highest in the district. El Tahrir, the council area with the lowest prevalence of *S. mansoni* and the highest prevalence of *S. haematobium*, had the highest prevalence of intestinal helminths (16.5%), more than twice that observed in the other council areas (range, 2.7–8.2%).

One year after treatment, 31 084 children were examined in 86 schools with an overall prevalence of 40.9% (Table 2). The prevalence of *S. haematobium*

Table 1: **Prevalence of schistosomiasis infection in schoolchildren at the first survey (October 1983 to May 1984), by sex and council area in Abu El Matameer district, Beheira governorate**

Council area	No. of schools	Sex[a]	No. examined	No. positive for:			Total
				S. mansoni	*S. haematobium*	Both	
Abu El Matameer town	14	M	4547	2489 (54.7) [b]	82 (1.8)	238 (5.2)	2809 (61.8)
		F	2377	1187 (48.9)	37 (1.6)	65 (2.7)	1289 (54.2)
		T	6924	3676 (53.1)	119 (1.7)	303 (4.4)	4098 (59.2)
Koum El Farag	17	M	4140	3100 (74.9)	109 (2.6)	607 (14.7)	3816 (91.2)
		F	1231	956 (77.7)	31 (2.5)	109 (8.8)	1096 (89.0)
		T	5371	4056 (75.5)	140 (2.6)	716 (13.3)	4912 (78.0)
El Nomariah	12	M	3759	2397 (63.8)	147 (3.9)	854 (22.7)	3398 (90.4)
		F	1367	827 (60.5)	70 (5.1)	298 (21.8)	1195 (87.4)
		T	5126	3224 (62.9)	217 (4.2)	1152 (22.5)	4593 (89.6)
Zawiet Sakr	12	M	3106	2810 (90.5)	0 (0.0)	205 (6.6)	3015 (97.1)
		F	964	877 (90.8)	0 (0.0)	69 (7.2)	946 (98.1)
		T	4070	3687 (90.6)	0 (0.0)	274 (6.7)	3961 (97.3)
El Tahrir	28	M	5332	1375 (25.8)	920 (17.2)	873 (16.4)	3168 (59.4)
		F	2542	616 (24.2)	392 (15.4)	390 (15.3)	1398 (55.0)
		T	7874	1991 (25.3)	1312 (16.7)	1263 (16.0)	4566 (58.0)
All areas	83	M	20 884	12 171 (58.3)	1258 (6.0)	2777 (13.3)	16 206 (77.6)
		F	8481	4463 (52.6)	530 (6.2)	931 (11.0)	5924 (69.8)
		T	29 365	16 634 (56.6)	1788 (6.1)	3708 (12.6)	22 130 (75.4)

[a] M (males), F (females), T (total).
[b] Figures in parentheses are percentages.

infection was reduced from 6.1% to 2.5%, and that of double infections from 12.6% to 1.1%. The prevalence of single *S. mansoni* and double infections was highest in males while the prevalence of single *S. haematobium* infections was highest in females.

A single treatment with praziquantel resulted in a reduction in overall prevalence of 45.8% after one year (see Table 5). The overall reduction of double infections was greater than 90% in all village councils. The reduction of *S. mansoni* infections in this school population was only 33.9%. The reduction of single *S. mansoni* infections was least (12.2%) in El Tahrir, the village council with the highest initial prevalence of single *S. haematobium* and double

Table 2: **Prevalence of schistosomiasis infection in schoolchildren at the second survey (October 1984 to May 1985), by sex and council area in Abu El Matameer district, Beheira governorate**

Council area	No. of schools	Sex[a]	No. examined	No. positive for:			Total
				S. mansoni	*S. haematobium*	Both	
Abu El Matameer town	15	M	4846	1195 (24.7) [b]	3 (0.06)	6 (0.1)	1204 (24.8)
		F	2853	522 (18.3)	1 (0.04)	1 (0.04)	524 (18.4)
		T	7699	1717 (22.3)	4 (0.05)	7 (0.09)	1728 (22.4)
Koum El Farag	17	M	4316	2421 (56.1)	3 (0.07)	7 (0.2)	2431 (56.3)
		F	1338	711 (53.1)	1 (0.07)	1 (0.07)	713 (53.3)
		T	5654	3132 (55.4)	4 (0.07)	8 (0.1)	3144 (55.6)
El Nomariah	13	M	4058	2057 (50.7)	79 (1.9)	142 (3.5)	2278 (56.1)
		F	1615	772 (47.8)	28 (1.7)	42 (2.6)	842 (52.1)
		T	5673	2829 (49.9)	107 (1.9)	184 (3.2)	3120 (55.0)
Zawiet Sakr	13	M	2947	1615 (54.8)	0 (0.0)	0 (0.0)	1615 (54.8)
		F	1072	535 (49.0)	0 (0.0)	0 (0.0)	535 (49.0)
		T	4019	2150 (53.5)	0 (0.0)	0 (0.0)	2150 (53.5)
El Tahrir	28	M	5056	1255 (24.8)	428 (8.5)	100 (2.0)	1783 (35.3)
		F	2983	528 (17.7)	236 (7.9)	31 (1.0)	795 (26.6)
		T	8039	1783 (22.2)	664 (8.3)	131 (1.6)	2578 (32.1)
All areas	86	M	21 223	8543 (40.2)	513 (2.4)	255 (1.2)	9311 (43.9)
		F	9861	3068 (31.1)	266 (2.7)	75 (0.8)	3409 (34.6)
		T	31 084	11 611 (37.4)	779 (2.5)	330 (1.1)	12 720 (40.9)

[a] M (males), F (females), T (total).
[b] Figures in parentheses are percentages.

Table 3: **Prevalence of schistosomiasis infection in schoolchildren at the first survey (October 1984 to May 1985), by sex and council area in Abo Homos district, Beheira governorate**

Council area	No. of schools	Sex[a]	No. examined	No. positive for:			Total
				S. mansoni	*S. haematobium*	Both	
Abo Homos	22	M	6655	2137 (32.1) [b]	1226 (18.4)	1452 (21.8)	4815 (72.4)
town		F	3362	858 (25.5)	613 (18.2)	387 (11.5)	1858 (55.3)
		T	10 017	2995 (29.9)	1839 (18.4)	1839 (18.4)	6673 (66.6)
Gawad Hosny	13	M	3591	1670 (46.5)	351 (9.8)	952 (26.5)	2973 (82.8)
		F	1576	675 (42.8)	192 (12.2)	317 (20.1)	1184 (75.1)
		T	5167	2345 (45.4)	543 (10.5)	1269 (24.6)	4157 (80.5)
Koum el Kanater	11	M	3025	877 (29.0)	619 (20.5)	1090 (36.0)	2586 (85.5)
		F	1022	304 (29.7)	219 (21.4)	262 (25.6)	785 (76.8)
		T	4047	1181 (29.2)	838 (20.7)	1352 (33.4)	3371 (83.3)
Demissna	13	M	2792	982 (35.2)	529 (18.9)	901 (32.3)	2412 (86.4)
		F	1528	501 (32.8)	346 (22.6)	346 (22.6)	1193 (78.1)
		T	4320	1483 (34.3)	875 (20.3)	1247 (28.9)	3605 (83.4)
Boutros	9	M	1563	621 (39.7)	200 (12.8)	541 (34.6)	1362 (87.1)
		F	452	155 (34.3)	75 (16.6)	160 (35.4)	390 (86.3)
		T	2015	776 (38.5)	275 (13.6)	701 (34.8)	1752 (86.9)
Berket Ghatas	7	M	2564	696 (27.1)	384 (15.0)	1080 (42.1)	2160 (84.2)
		F	994	224 (22.5)	173 (17.4)	327 (32.9)	724 (72.8)
		T	3558	920 (25.9)	557 (15.6)	1407 (39.5)	2884 (81.0)
Bessintawy	17	M	5040	1631 (32.4)	818 (16.2)	2299 (45.6)	4748 (94.2)
		F	1940	617 (31.8)	406 (20.9)	762 (39.3)	1785 (92.0)
		T	6980	2248 (32.2)	1224 (17.5)	3061 (43.8)	6533 (93.6)
Balakter	13	M	3086	1136 (36.8)	646 (20.9)	882 (28.6)	2664 (86.3)
		F	1051	317 (30.2)	275 (26.2)	180 (17.1)	772 (73.5)
		T	4137	1453 (35.1)	921 (22.3)	1062 (25.7)	3436 (83.1)
All areas	105	M	28 316	9750 (34.4)	4773 (16.9)	9197 (32.5)	23 720 (83.8)
		F	11 925	3651 (30.6)	2299 (19.3)	2741 (23.0)	8691 (72.9)
		T	40 241	13 401 (33.3)	7072 (17.6)	11 938 (29.7)	32 411 (80.5)

[a] M (males), F (females), T (total).
[b] Figures in parentheses are percentages.

infections. The overall reduction in prevalence was higher among females than males (50.4% vs. 43.4%).

In Abo Homos. During the first survey in 1985, 40 241 schoolchildren were examined with an overall prevalence of 80.5% (Table 3). The highest prevalence of single *S. mansoni* infections was in the village council, Gawad Hosny, with the lowest prevalence of *S. haematobium* infection. In three village councils with a school population of 14 585 the prevalence of double infections was higher than the prevalence of either of the single infections. Bessintawy village council had the highest overall prevalence (93.6%) and the highest prevalence of double infections (43.8%).

After a single treatment with praziquantel 47 183 schoolchildren were examined from 108 schools and the overall prevalence was 30.8% (Table 4). The prevalence of *S. mansoni* infection was higher than either *S. haematobium* infection alone or double infections. The village councils with the highest overall prevalence after treatment had the highest prevalence of double infections. The council area with the lowest overall prevalence, Abo Homos town, also had the lowest prevalence of single *S. mansoni* infections.

The overall reduction in prevalence after one year was 61.7% (Table 5). Double infections were reduced by 89.2%. The lowest overall reductions in *S. mansoni* infections occurred in the schools of the three village councils where the initial prevalence of double infections was higher than either of the single infections. The highest reduction of overall prevalence and either type of single infection occurred in Abo Homos town. As in Abu El Matameer, the reduction among females was greater than among males for all infections (69.3% vs. 58.8%).

Sex ratio. In both Abu El Matameer and Abo Homos, 70% of those examined were males. Although the prevalence of infection was higher in Abo Homos than in Abu El Matamee, there were several important epidemiological similarities: among the schoolchildren, in decreasing order, the prevalence of single *S. mansoni* infections was highest, followed by double infections and single *S. haematobium* infections.

Table 4: **Prevalence of schistosomiasis infection in schoolchildren at the second survey (October 1985 to May 1986), by sex and council area in Abo Homos district, Beheira governorate**

Council area	No. of schools	Sex[a]	No. examined	No. positive for: *S. mansoni*	*S. haematobium*	Both	Total
Abo Homos town	23	M	7191	1060 (14.7) [b]	489 (6.8)	214 (3.0)	1763 (24.5)
		F	4106	347 (8.4)	150 (3.6)	39 (0.9)	536 (13.0)
		T	11 297	1407 (12.4)	639 (5.7)	253 (2.2)	2299 (20.4)
Gawad Hosny	13	M	4163	1213 (29.1)	223 (5.4)	137 (3.3)	1573 (37.8)
		F	1944	395 (20.3)	79 (4.1)	33 (1.7)	507 (26.1)
		T	6107	1608 (26.3)	302 (4.9)	170 (2.8)	2080 (34.0)
Koum el Kanater	11	M	3364	747 (22.2)	369 (11.0)	142 (4.2)	1258 (37.4)
		F	1291	191 (14.8)	84 (6.5)	20 (1.5)	295 (22.8)
		T	4655	938 (20.2)	453 (9.7)	162 (3.5)	1553 (33.4)
Demissna	13	M	3242	731 (22.5)	262 (8.1)	92 (2.8)	1085 (33.5)
		F	1839	272 (14.8)	120 (6.5)	27 (1.5)	419 (22.8)
		T	5081	1003 (19.7)	382 (7.5)	119 (2.3)	1504 (29.6)
Boutros	10	M	2143	604 (28.2)	102 (4.8)	65 (3.0)	771 (36.0)
		F	601	108 (18.0)	17 (2.8)	6 (1.0)	131 (21.8)
		T	2744	712 (25.9)	119 (4.3)	71 (2.6)	902 (32.9)
Berket Ghatas	7	M	3152	821 (26.0)	306 (9.7)	185 (5.9)	1312 (41.6)
		F	1289	235 (18.2)	98 (7.6)	47 (3.6)	380 (29.5)
		T	4441	1056 (23.8)	404 (9.1)	232 (5.2)	1692 (38.1)
Bessintawy	17	M	5650	1519 (26.9)	315 (5.6)	206 (3.6)	2040 (36.1)
		F	2254	506 (22.4)	141 (6.3)	49 (2.2)	696 (30.9)
		T	7904	2025 (25.6)	456 (5.8)	255 (3.2)	2736 (34.6)
Balakter	14	M	3810	924 (24.2)	308 (8.1)	240 (6.3)	1472 (38.6)
		F	1144	177 (15.5)	76 (6.6)	23 (2.0)	276 (24.1)
		T	4954	1101 (22.2)	384 (7.8)	263 (5.3)	1748 (35.3)
All areas	108	M	32 715	7619 (23.3)	2374 (7.3)	1281 (3.9)	11 274 (34.5)
		F	14 468	2231 (15.4)	765 (5.3)	244 (1.7)	3240 (22.4)
		T	47 183	9850 (20.9)	3139 (6.7)	1525 (3.2)	14 514 (30.8)

[a] M (males), F (females), T (total).
[b] Figures in parentheses are percentages.

In both Abu El Matameer and Abo Homos, the prevalence among boys was higher than among girls. The reduction in double infections was higher than the reduction in either single infection or overall prevalence, thus after treatment the prevalence of double infections was less than either of the single infections.

Table 5: **Percentage reductions in prevalence of schistosomiasis infection in schoolchildren between surveys, by sex, in Abu El Matameer and Abo Homos**

	S. mansoni	*S. haematobium*	Both	Total
Abu El Matameer:				
Males	31.0	60.0	91.0	43.4
Females	40.9	56.4	92.7	50.4
Total	33.9	59.0	91.3	45.8
Abo Homos:				
Males	32.3	56.8	88.0	58.8
Females	49.7	72.5	92.6	69.3
Total	37.2	61.9	89.2	61.7

Intensity of* S. mansoni *infection. At the first survey among those with only *S. mansoni* infection, 10.6% had more than 800 eggs per gram of faeces and one year after treatment the prevalence of infections of this same intensity was only 1.7% or a reduction of 84% (Table 6). After treatment, 66.2% of the remaining infections were less than 100 eggs per gram of faeces as compared with 34.2% before treatment.

Table 6: **Intensity of schistosomiasis infection (eggs per gram of faeces, epg) among children with only *S. mansoni* in both districts**

Survey[a]	No. examined	No. positive	<100 epg	100–799 epg	≥800 epg
1	69 606	30 035	10 257 (34.2) [b]	16 612 (55.3)	3186 (10.6)
2	78 267	21 461	14 215 (66.2)	6883 (32.1)	363 (1.7)

[a] For dates of surveys 1 and 2, see Tables 1 to 4.
[b] Figures in parentheses are percentages of the number positive.

Table 7: **Prevalence of haematuria (assessed visually and by reagent strip test) and *S. haematobium* (S.h.) infection by filtration in schoolchildren in both districts (including single and mixed infections)**

	No. examined	Haematuria (%)		≥ 50 eggs/ 10 ml (%)	S.h. positive (%)
		Visually	Strip test		
Abu El Matameer:					
Survey 1 [a]	29 365	5.2	22.5	2.2	18.7
Survey 2	31 084	1.4	3.2	0.07	3.6
Reduction (%)		73.1	85.8	96.8	80.7
Abo Homos:					
Survey 1	40 241	6.6	15	9.8	47.2
Survey 2	47 183	0.9	1.9	0.8	9.9
Reduction (%)		86.4	87.3	91.8	79.0
Both districts:					
Survey 1	69 606	6.0	18.1	6.6	35.2
Survey 2	78 267	1.1	2.4	0.5	7.4
Reduction (%)		81.7	86.7	92.4	79.0

[a] For dates of surveys 1 and 2, see Tables 1 to 4.

Haematuria and* S. haematobium *infection. At the first survey in Abu El Matameer the prevalence of haematuria detected by reagent strips was higher than the prevalence of *S. haematobium* infection by filtration (Table 7). During the first survey in Abo Homos, the overall prevalence of *S. haematobium* infection (including haematuria) was 47.2% vs. 18.7% in Abu El Matameer. In both districts, one year after treatment the prevalence of gross haematuria was reduced from 6.0% to 1.1%. In the same period the overall prevalence of haematuria detected by reagent strips was reduced from 18.1% to 2.4%. The overall prevalence of *S. haematobium* infection was reduced from 35.2% to 7.4%.

The overall rates of gross haematuria and the prevalence of heavy infections (≥ 50 *S. haematobium* eggs per 10 ml of urine) were of the same order of magnitude before and after treatment.

Community surveys

Between 1985 and 1986, 86 512 persons were examined in Abo Homos (31.8% of the total population), and 97 923 persons in Abu El Matameer (66.2% of the total population). The overall prevalence in both communities was 73.5%. In Abu El Matameer the peak prevalence was in the 25–44-year-old age group; in Abo Homos the 15–24-year-old age group was the most affected (Table 8). Among 0–5-year-olds the overall prevalence was nearly twice as high in Abu El Matameer as in Abo Homos.

In contrast to the school surveys, the distribution of *S. mansoni* and *S. haematobium* infections in the two communities was different in all respects except that the prevalences of both infections (separately and together) were similar between males and females (Table 9). The prevalence of *S. mansoni* and the proportion of heavy infection (> 800 eggs per gram of faeces) was highest in Abu El Matameer. The prevalence of *S. haematobium* was highest in Abo Homos, 1.8% vs. 0.08%. The prevalence of double infections was 9.6% in Abo Homos as compared to 0.9% in Abu El Matameer.

In the Abu El Matameer communities *S. mansoni* was found in 98.2% of those infected; 0.8% were *S. haematobium* infections and 1.0% were double infections. Among the Abo Homos communities

Table 8: **Prevalence of schistosomiasis, by age group, in the communities of Abu El Matameer and Abo Homos**

Age group (years)	Abu El Matameer		Abo Homos		Both districts	
	Examined	Positive	Examined	Positive	Examined	Positive
0–5	7359	4590 (62.4) [a]	8578	3102 (36.2)	15 937	7692 (48.3)
6–14	21 327	16 673 (78.2)	27 872	17 913 (64.3)	49 199	34 586 (70.3)
15–24	27 401	24 873 (90.8)	24 636	17 087 (69.4)	52 037	41 960 (80.6)
25–44	26 237	23 902 (91.1)	14 352	9652 (67.3)	40 589	33 554 (82.7)
≥ 45	15 599	11 969 (76.7)	11 074	5732 (51.8)	26 673	17 701 (66.4)
Total	97 923	82 007 (83.7)	86 512	53 486 (61.8)	184 435	135 493 (73.5)

[a] Figures in parentheses are percentages.

Table 9: **Prevalence of schistosomiasis infection, by sex, in community surveys in Abu El Matameer and Abo Homos**

Sex	No. examined	No. negative	*S. mansoni*		*S. haematobium*			
			Positive	> 800 epg[a]	Positive	> 50 eggs/ 10 ml	Positive for both	Total positive
Abu El Matameer:								
Male	51 684	8084 (15.6) [b]	42 780 (82.8)	4358 (8.4)	349 (0.7)	46 (0.1)	471 (0.9)	43 600 (84.4)
Female	46 239	7832 (16.9)	37 731 (81.6)	3916 (8.5)	297 (0.6)	32 (0.1)	379 (0.8)	38 407 (83.1)
Total	97 923	15 916 (16.3)	80 511 (82.2)	8274 (8.4)	646 (0.7)	78 (0.1)	850 (0.9)	82 007 (83.7)
Abo Homos:								
Male	45 216	15 814 (35.0)	21 381 (47.3)	2074 (4.6)	3347 (7.4)	1020 (2.3)	4674 (10.3)	29 402 (65.0)
Female	41 296	17 212 (41.7)	18 107 (43.8)	1598 (3.9)	2338 (5.7)	550 (1.3)	3639 (8.8)	24 084 (58.3)
Total	86 512	33 026 (38.2)	39 488 (45.6)	3672 (4.2)	5685 (6.6)	1570 (1.8)	8313 (9.6)	53 486 (61.8)
Both districts:								
Male	96 900	23 898 (24.7)	64 161 (66.2)	6432 (6.6)	3696 (3.8)	1066 (1.1)	5145 (5.3)	73 002 (75.3)
Female	87 535	25 044 (28.6)	55 838 (63.8)	5514 (6.3)	2635 (3.0)	582 (0.7)	4018 (4.6)	62 491 (71.4)
Total	184 435	48 942 (26.5)	119 999 (65.1)	11 946 (6.5)	6331 (3.4)	1648 (0.9)	9163 (5.0)	135 493 (73.5)

[a] Eggs per gram of faeces (epg).
[b] Figures in parentheses are percentages.

73.8% of infections were due to *S. mansoni*, 10.6% to *S. haematobium* and 15.5% were double infections.

Discussion

In this highly endemic area the prevalences before treatment were higher than previously reported (*7, 8*). In the past *S. haematobium* was the predominant species in the Nile delta. This study has confirmed the dominance of *S. mansoni* infection as reported from other areas of the delta (*9, 10*). Abu El Matameer district is further to the west of the main Nile river channels and *S. haematobium* is almost absent from this district.

This study was designed to assess the effectiveness of chemotherapy using praziquantel in "worst case" conditions which are the rule rather than the exception in most endemic countries. Aside from differences in the epidemiology of schistosomiasis between endemic countries most control programmes are similar in their lack of coordination of snail control, water supply provision, and sanitation implementation. Thus the following aspects of this operational research activity would be anticipated to mitigate against the effectiveness of praziquantel during the study:

— only schoolchildren were treated and this cohort represented only about 70% of school-age boys and 30% of school-age girls;
— no coordinated snail control was conducted;
— no improvement in sanitation or water supply was initiated;
— treatment of the non-school population (adults and children) was incomplete.

One year after a single treatment with praziquantel the prevalence of schistosomiasis was reduced by more than 40% in both districts. More significantly, the prevalence of heavy *S. mansoni* infections (> 800 eggs per gram of faeces) was reduced by 84%. This reduction was accompanied by a shift in the distribution of the high and medium egg count classes to egg counts below 100 eggs per gram of faeces in those who remained infected. These results are similar to those obtained in other large-scale intervention studies using selective population chemotherapy (*3–5*).

Although in clinical trials the egg-negative rates for *S. mansoni* infections at 6 months or one year after treatment with praziquantel were consistently about 75–85% and slightly higher for *S. haematobium* infections (*1*), in large scale interventions these figures have been much lower (*4, 11*). These differences may be due to constant reinfection, different diagnostic techniques and quality control and timing of chemotherapy in relation to transmission. In operational control programmes a 40% reduction in prevalence at one year is the minimal acceptable reduction. If a lower reduction is reported a detailed review of operational procedures, quality control of microscopy, drug storage and supply, and drug expiration dates is warranted.

The reduction in prevalence of *S. haematobium* was proportionally greater than the reduction of *S. mansoni* infection. This reduction was such that subsequent interventions concentrated on stool examination and urine examinations were not done. During the past 20 years a gradual reduction in the prevalence of *S. haematobium* has been noted in the Nile delta. This has been variously attributed to reduction in the *Bulinus* populations related to perennial irrigation and reduced silting after the Aswan dam

construction; and to emphasis by the Ministry of Health on diagnosis and treatment of *S. haematobium* because of the ease of diagnosis and public recognition of haematuria as a sign of infection. Thus the dramatic reduction in *S. haematobium* cannot be attributed to praziquantel alone but also to the reduced risk of reinfection. The impact of appropriate timing of treatment cannot be evaluated in this study since no transmission variables were assessed.

The correlation between the prevalence of gross haematuria and heavy infections, as assessed by microscopy before and after treatment, found in this study confirms observations made elsewhere (*11*). On the other hand, the correlation between microhaematuria, as detected by the chemical reagent strips, and the presence of *S. haematobium* eggs in the urine was inconsistent. The reason for this discrepancy is not known but confirms the necessity of evaluating indirect techniques in each endemic area rather than assuming the validity of extrapolation from other areas.

The community surveys have shown that the prevalence of infection among adults was higher than among schoolchildren. Treatment was given during the survey and the effect of the single treatment was evaluated and is reported elsewhere.[a]

Quality control and adequate supervision have increased the reliability of the results and confidence in allocation of resources based on the data. Furthermore the feasibility of reliable data collection, processing and analysis in operational research programmes by minimally trained staff was confirmed (*12*). Thus, in areas with low prevalence after treatment, the interval of re-examination and retreatment can be extended and the use of the rural health units' laboratories to provide diagnosis and treatment on routine consultation can be expected to be sufficient for maintenance of the reduction in prevalence and intensity of infection achieved by the mobile teams.

The impact of chemotherapy in this study may have been enhanced by (1) the high coverage of the target school-age population, (2) the timing of treatment after the peak of transmission in an area where transmission is definitely seasonal, (3) the treatment of the target population within a short period of time rather than over a long interval, and (4) the high standard of quality control of microscopy which assured reliable diagnosis of the infection. The results of this operational research augur well for the future of large-scale chemotherapy in the control of schistosomiasis.

[a] **El-Malatawy, A.** *An integrated approach to schistosomiasis control.* Unpublished document, UNICEF, Cairo, 1989.

Note. This project was subsequently independently evaluated and the results 3–5 years after the last treatment confirm those in this short-term report (see Spencer, H.C. et al. Evaluation of UNICEF/Arab Republic of Egypt/WHO Schistosomiasis Control Project in Beheira governorate. *American journal of tropical medicine and hygiene*, **42**: 441–448 (1990)).

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Résumé

Chimiothérapie sélective chez des écoliers du Gouvernorat de Beheira: le projet UNICEF/République Arabe d'Egypte/OMS de lutte contre la schistosomiase

L'article décrit la méthodologie d'intervention et la prévalence et l'intensité des infestations à *Schistosoma mansoni* et à *S. haematobium* chez les écoliers de deux districts du Gouvernorat de Beheira dans le Delta du Nil, en Egypte, avant et après traitement par le praziquantel.

Dans le district d'Abu El Matameer, 29 365 enfants (couverture 99%) ont été examinés dans 83 écoles au cours de l'enquête réalisée avant traitement; la prévalence totale de la schistosomiase due à *S. mansoni* et/ou à *S. haematobium* était de 75,4%. Un an après chimiothérapie sélective, 31 084 enfants ont été examinés dans 86 écoles. La prévalence totale de la schistosomiase était alors de 40,9% (soit une baisse de 45,8%).

A Abo Homos, 40 241 écoliers ont été examinés lors de l'enquête avant traitement; la prévalence totale de la schistosomiase était de 80,5%. Un an plus tard, 47 183 écoliers ont été examinés et la prévalence totale était de 30,8% (soit

une baisse de 61,7%).

Lors de la première enquête réalisée avant traitement chez les écoliers des deux districts infestés uniquement par *S. mansoni*, 10,6% avaient plus de 800 œufs par gramme de selles. Un an après le traitement, la prévalence de ces infestations massives n'était plus que de 1,7%, soit une réduction de 84%. La diminution globale des infestations doubles par *S. mansoni* et *S. haematobium* était supérieure à 90%.

Dans les deux districts, un an après le traitement, la prévalence de l'hématurie clinique était passée de 6,0% à 1,1%, la prévalence globale de l'hématurie décelée par bandelettes réactives de 18,1% à 2,4%, et la prévalence de l'infestation à *S. haematobium* de 35,4% à 7,4%.

Lors des enquêtes portant sur l'ensemble de la communauté, 86 512 personnes ont été examinées à Abo Homos (31,8% de la population totale), et 97 923 personnes à Abu El Matameer (66,2% de la population totale). La prévalence totale de la schistosomiase dans ces deux communautés était de 73,5%.

Dans cette étude, l'impact de la chimiothérapie peut avoir été renforcé par: 1) la forte couverture de la population cible d'âge scolaire, 2) le moment du traitement, après le pic de transmission dans une région où la transmission est nettement saisonnière, 3) le traitement de la population cible sur une courte période plutôt que sur une période étendue, et 4) le niveau élevé de contrôle de la qualité de l'examen microscopique, qui garantissait un diagnostic fiable de l'infestation. Nous concluons que les résultats de cette recherche opérationnelle augurent favorablement des opérations de chimiothérapie à grande échelle dans la lutte contre la schistosomiase.

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