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The Epidemiology of *Schistosoma haematobium* and *S. mansoni* Infections in the Egypt-49 Project Area

2. Prevalence of Bilharziasis in Relation to Personal Attributes and Habits

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The over-all uncorrected prevalence rates of bilharziasis determined in this survey were —Control Division, 59.5%; Rural and Reclamation Divisions, 35.9%; Urban Division, 21.0%. There are significant differences in rates of infection between sections within a division, between adjacent villages and even between different parts of one village. Prevalence increases rapidly with age up to about the age of 14 years, declines somewhat up to the age af 40 years and then remains fairly constant at a rate of about 30%; the age-group 0-8 years should provide the most sensitive group for the assessment of control measures. S. mansoni *infection is acquired more slowly than* S. haematobium *infection during childhood and is more persistent among adults.*

Except for the youngest age-group, bilharziasis rates are higher in males than in females, but more detailed analysis shows that this is true only for farmers and farm labourers and for those who swim. In respect of occupational categories, farmers and farm labourers, with prevalence rates of 50.6% and 41.6%, respectivelx, bear the brunt of the infection, since they constitute 48% of the population, although fishermen (60.4%) and boatmen (52.0%) have higher infection rates.

Differences in bilharziasis rates can also be related to differences in religion, educational attainment and domestic habits (swimming, washing clothes, utensils and cattle) according to the opportunity provided for contact with polluted water. Swimming, because of the thorough exposure to possible schistosome infection that it provides, is one of the most important activities involved in the transmission of bilharziasis.

The sampling procedure and techniques employed in conducting a cross-sectional survey to obtain base-line data on rates of infection with *Schistosoma haematobium* and *S. mansoni* have been described by Farooq & Nielsen.[4] The present paper is concerned with an analysis and discussion of the data obtained in relation to important personal attributes and behavioural and social factors. All prevalence rates relate to the period in which the survey was carried out, namely, April 1962 to March 1963.

A general description of the project area was provided in Part 1 of this series,[4] but as it is proposed to discuss the prevalence data in relation to the four environmental divisions (Rural, Urban, Reclamation and Control) into which the project area has been divided, a brief review of the principal features of these divisions that influence the rate of infection is appropriate here.

Both the Rural Division and the Control Division are typical agricultural lands of the Nile Delta. Mahmoudia Canal (a major irrigation-navigation watercourse), running east to west along a ridge, constitutes the dividing line between the two areas, with the Rural Division draining south into El Umum drain and the Control Division draining

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north into Edku Lake. This prevents molluscicides and herbicides applied in the Rural Division from affecting the Control Division. The latter division is less well developed than the Rural Division, with poorer communications and more backward villages; however, the populations are similar in respect of ethnical background, religion, language, customs and living habits.

Until recently there was a preponderance in the Control Division of landless tenants (farm labourers) working for large landowners. These lands have now been distributed among the former tenants, raising their status to that of farmers. Large landowners are now few—0.2%, compared with 5.0% in the Rural Division. Nearly 80% of the population in these areas has access to a protected drinking-water supply. In the sample surveyed, 8.9% of the children aged 6-15 years in the Control Division attended school, compared with 28.0% in the Rural Division. A social centre providing out-patient medical care in the Control Division has recently (1963) been converted into a rural health centre providing both in-patient (16 beds) and out-patient care. In the Rural Division there are two such health centres and one combined unit; the latter provides educational, social welfare, agricultural extension and medical services, including 16 beds for in-patient care.

In the Urban Division, which includes the township of Kafr el Dawar, there are large textile factories; the largest employs nearly 15 000 workers, of whom over 2000 live in the housing colonies within the precincts of the factory and are provided with a protected water supply and privies in individual houses. Of the total population in the area, 98.9% have access to a protected water supply (31% with taps in their houses) and electricity is available in most of the houses. In the sample surveyed, 62% of children aged 6-15 years attend school. Medical facilities in the area consist of one Government general hospital with 132 beds, two private hospitals (Factory and Mebara), each with 40 beds, one fever hospital with 80 beds, a child-welfare centre and a school health unit.

The population of the Reclamation Division consists mostly of new settlers on land reclaimed during the past 10 years by draining an inland salt-water lake. Vocational training, agricultural guidance in the cultivation of desalted (leached) lands and aid in developing small industries and handicrafts are provided for the settlers and the area is intended to serve as a demonstration project in community organization under the auspices of the Egyptian-American Rural Improvement Service. Each farmer possesses five acres of land and farm animals; he lives in a well-built house provided with sanitary facilities, a protected water supply and electricity; school and recreational facilities are conveniently located in the villages. Nearly 90% of the inhabitants have access to a protected water supply (77.5% with taps in their houses). Medical aid is provided through three rural health centres and three village health centres. The former provide out-patient and in-patient care and the latter only out-patient services, with particular emphasis on endemic diseases. Landless farmers and others mostly from Beheira, Manofia and Dekahlia, but also from other provinces, including Upper Egypt and the suburbs of Alexandria, have settled here. Most of the new settlers are enthusiastic about a new start in life.

One-third of the total population examined (11 944 persons) is engaged in farming and another 14.3% are "farm labourers", i.e., nearly half of the population does agricultural work. Another one-third belongs to the groups "skilled" and "other manual" workers. The clerical profession accounts for 3.3% of the population examined, while each of the other occupational groups comprises less than 2%.

The population distribution in terms of occupation varies greatly among the four divisions. The Reclamation Division is almost exclusively composed of farmers and farm labourers. The Rural and Control Divisions are also predominantly composed of persons engaged in agriculture, whereas in the Urban Division 75% of the population belongs to the groups "skilled" and "other manual".

OVER-ALL PREVALENCE RATES, CONFIDENCE LIMITS AND ESTIMATED NUMBER OF INDIVIDUALS INFECTED

Over-all rates of infection in the project area and in each of the four divisions are given in Table 1. These data, computed from the results of the examination of population samples, are naturally subject to sampling errors. Confidence limits corresponding to 95% probability have therefore been calculated; they are given in Table 2.

Significant differences are evident in the prevalence rates of *S. haematobium*, *S. mansoni* and mixed infections and in "bilharziasis" (either type of infection) between some of the divisions. Rates are highest

TABLE 1
ESTIMATED OVER-ALL PREVALENCE OF BILHARZIASIS BY DIVISION

Division	No. examined	Persons infected with						Prevalence of "bilharziasis" (a + b − c)	
		S. haematobium (a)		*S. mansoni* (b)		both types (c)			
		No.	%	No.	%	No.	%	No.	%
Rural	4 222	1 164	27.6	916	21.7	563	13.3	1 517	35.9
Urban	3 594	458	12.7	499	13.9	204	5.7	753	21.0
Reclamation	1 831	544	29.7	262	14.3	149	8.1	657	35.9
Control	2 297	911	39.7	1 047	45.6	592	25.8	1 366	59.5
Total project area	11 944	3 077	25.8	2 724	22.8	1 508	12.6	4 293	35.9

TABLE 2
ESTIMATED PREVALENCE RATES OF BILHARZIASIS WITH 95 % CONFIDENCE LIMITS

Division	Prevalence (%)			
	S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Rural	27.6 ± 4.1	21.7 ± 6.2	13.3 ± 3.4	35.9 ± 5.9
Urban	12.7 ± 5.1	13.9 ± 8.7	5.7 ± 4.0	21.0 ± 9.7
Reclamation	29.7 ± 4.7	14.3 ± 3.6	8.1 ± 2.8	35.9 ± 4.9
Control	39.7 ± 4.7	45.6 ± 9.7	25.8 ± 5.3	59.5 ± 7.6

in the Control Division and lowest in the Urban Division; this is not unexpected, in view of the environmental differences already described and which will be further discussed later. That there are also significant local variations between sections within each division is shown in Table 3. Differences also occur between adjacent villages and even between different sections of one village when there are different transmission sites. Such differences are more marked for *S. mansoni* than for *S. haematobium*.

On the basis of these prevalence rates, estimates of the total number of persons infected in each division have been made (Table 4).

It was stated in Part 1 [1] that if several samples of urine and faeces from each individual are examined, a certain proportion of cases judged negative from the first sample is subsequently found to be positive. The percentages by which the uncorrected figures should be increased to account for missed cases are 25.0% for *S. mansoni* infection, 15.2% for *S. haematobium* infection, 36.1% for mixed infections, and 13.8% for "bilharziasis". Applying these corrections to the data in Tables 1 and 4, which are based on the examination of a single specimen, we obtained the data shown in Table 5. No such correction has been applied in the analysis of rates by age and sex in the discussions that follow and this should be borne in mind in their interpretation. However, the over-all conclusions based on the uncorrected data remain valid as base-line statistics for the evaluation of changes in prevalence rates so long as the same sampling and examination techniques are followed.

[1] See page 290 of this issue.

TABLE 3
ESTIMATED PREVALENCE OF BILHARZIASIS BY DIVISIONS AND SECTIONS [a]

Division	Section	No. examined	Persons infected with						Prevalence of "bilharziasis"	
			S. haematobium		*S. mansoni*		both types			
			No.	%	No.	%	No.	%	No.	%
Rural	Mamal el Qizaz	843	257	30.5	83	9.8	60	7 1	280	33.2
	Awad	419	95	22.7	87	20.8	59	14.1	123	29.4
	Baslaqun	670	166	24.8	88	13.1	55	8.2	199	29.7
	Sidi Ghazi	429	49	11.4	74	17.2	34	7.9	89	20.7
	Kom el Birka	395	111	28.1	140	35.4	69	17.5	182	46.1
	Kom Ishu	379	163	43.0	171	45.1	113	29.8	221	58.3
	Disunis	318	93	29.2	58	18.2	35	11.0	116	36.5
	Balaqtar	170	68	40.0	108	63.5	58	34.1	118	69.4
	Khurshid	252	60	23.8	47	18.7	27	10.7	80	31.7
	King Osman	347	102	29.4	60	17.3	53	15.3	109	31.4
	Total	4 222	1 164	27.6	916	21.7	563	13.3	1 517	35.9
Urban	Kafr el Dawar Town	1 344	254	18.9	327	24.3	139	10.3	442	32.9
	Kafr el Dawar Factory	2 250	204	9.1	172	7.6	65	2.9	311	13.8
	Total	3 594	458	12.7	499	13.9	204	5.7	753	21.0
Reclamation	El Fath	281	52	18.5	26	9.3	15	5.3	63	22.4
	Quesna	356	98	27.5	76	21.3	35	9.8	139	39.0
	Palestine	442	148	33.5	92	20.8	54	12.2	186	42.1
	26 July	408	146	35.8	24	5.9	20	4.9	150	36.8
	Gomhoriah	135	52	38.5	25	18.5	14	10.4	63	46.7
	Port-Said	209	48	23.0	19	9.1	11	5.3	56	26.8
	Total	1 831	544	29.7	262	14.3	149	8.1	657	35.9
Control	Akrisha	973	317	32.6	331	34.0	175	18.0	473	48.6
	Kanayis	373	156	41.8	241	64.6	125	33.5	272	72.9
	Karyun	418	214	51.2	225	53.8	152	36.4	287	68.7
	Habib	274	112	40.9	175	63.9	83	30.3	204	74.5
	El Ghaba	259	112	43.2	75	29.0	57	22.0	130	50.2
	Total	2 297	911	39.7	1 047	45.6	592	25.8	1 366	59.5
Total for the project area		11 944	3 077	25.8	2 724	22.8	1 508	12.6	4 293	35.9

[a] See the map on page 282 for the location of each section.

TABLE 4
ESTIMATED NUMBER OF PEOPLE WITH BILHARZIASIS IN EACH DIVISION

Division	Population	Number of people infected with			Number of people with "bilharziasis"
		S. haematobium	*S. mansoni*	both types	
Rural	91 562	25 300	19 900	12 200	32 900
Urban	72 897	9 300	10 100	4 200	15 300
Reclamation	17 746	5 300	2 500	1 400	6 400
Control	43 369	17 200	19 800	11 200	25 800
Total project area	225 574	57 100	52 300	29 000	80 400

TABLE 5
CORRECTED ESTIMATED PREVALENCE OF BILHARZIASIS [a]

Division	Population	Persons infected with						Prevalence of "bilharziasis"	
		S. haematobium		*S. mansoni*		both types			
		%	No.	%	No.	%	No.	%	No.
Rural	91 562	31.8	29 100	27.1	24 800	18.1	16 600	40.7	37 300
Urban	72 897	14.6	10 600	17.4	12 700	7.8	5 700	24.1	17 600
Reclamation	17 746	34.2	6 100	17.9	3 200	11.0	2 000	41.2	7 300
Control	43 369	45.7	19 800	57.0	24 700	35.1	15 200	67.6	29 300
Total project area	225 574	29.7	65 600	28.5	65 400	17.2	39 500	40.9	91 500

[a] Rates estimated in Table 1 corrected for proportion found positive in three examinations on consecutive days, as indicated in the text.

AGE DISTRIBUTION OF BILHARZIASIS

Prevalence rates have been tabulated by single years of age for children aged 0-14 years (Table 6). These children form 46.3% of the population in the project area and constitute the most vulnerable age-group for both *S. haematobium* and *S. mansoni* infections. After the age of 14 years the prevalence rates for both types of infection tend to decrease; this is true both in the project area as a whole and in the four divisions.

Table 7 analyses the prevalence rates for all persons examined by five-year age-groups and by sex for the entire project area; in Tables 8-11 similar information is given for each of the four divisions separately.

The semi-logarithmic graph in Fig. 1, based on Table 6, shows the age distribution of schistosome infections in children aged 0-14 years. The first part of the curve, up to about 8 years of age, shows a rapid increase in prevalence, followed by a certain degree of levelling; this age-group (0-8 years) should therefore constitute the most sensitive one for the observation of the earliest evidence of interruption of, or interference with, transmission. Moreover, the lower the age the more sensitive an index should be provided.

It is of interest to note that our data on infection in children up to 4 years old do not confirm Morley-Smith & Gelfand's (1958, 1960) suggestion, based on studies in Southern Rhodesia, that such children "acquired some resistance or passive immunity" from mothers who have, or have suffered from, bilharziasis (*S. haematobium*) and that after the age of 3 or 4 years this resistance is

TABLE 6

AGE DISTRIBUTION OF PREVALENCE OF BILHARZIASIS IN CHILDREN IN THE PROJECT AREA

Age (years)	No. examined	Number with				Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"bilharziasis"	*S. haematobium* infection	*S. mansoni* infection	mixed infection	"bilharziasis"
0	353	9	4	2	11	2.5	1.1	0.6	3.1
1	343	28	23	9	42	8.2	6.7	2.6	12.2
2	393	41	31	19	53	10.4	7.9	4.8	13.5
3	499	46	51	22	75	9.2	10.2	4.4	15.0
4	476	67	63	30	100	14.1	13.2	6.3	21.0
5	493	113	80	50	143	22.9	16.2	10.0	29.0
6	470	146	90	65	171	31.1	19.1	13.8	36.4
7	364	138	80	56	162	35.0	20.3	14.2	41.1
8	425	165	112	75	202	38.8	26.4	17.6	47.5
9	301	126	82	66	142	41.9	27.2	21.9	47.2
10	476	214	146	102	258	45.0	30.7	21.4	54.2
11	212	94	79	53	120	44.3	37.3	25.0	56.6
12	411	196	142	113	225	47.7	34.5	27.5	54.7
13	280	132	86	61	157	47.1	30.7	21.8	56.1
14	253	112	89	56	145	44.3	35.2	22.1	57.3
Total	5 779	1 627	1 158	779	2 006	28.2	20.0	13.5	34.7

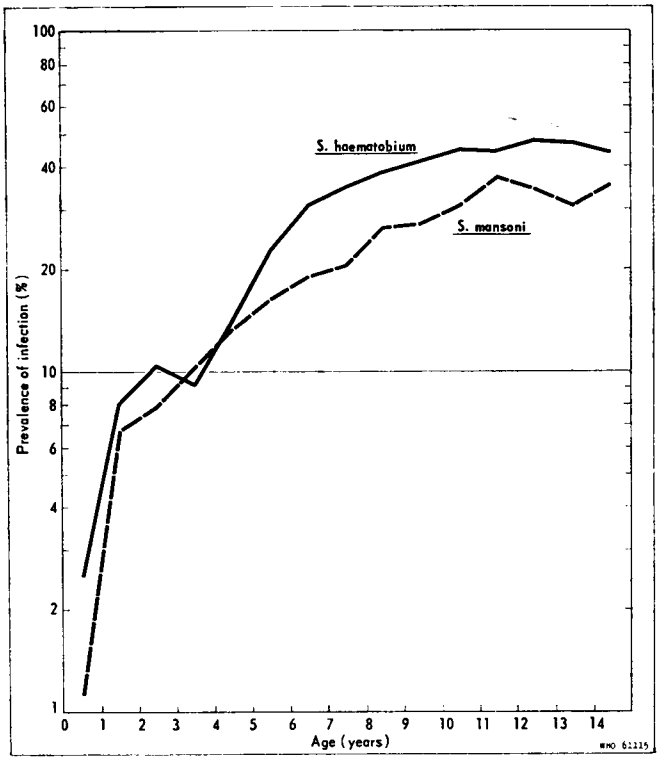


FIG. 1

AGE DISTRIBUTION OF PREVALENCE OF SCHISTOSOMAL INFECTION BY SINGLE YEAR OF AGE IN THE AGE-GROUP 0-14 YEARS

TABLE 7

AGE AND SEX DISTRIBUTION OF BILHARZIASIS IN THE PROJECT AREA

Age-group (years)	Sex	No. examined	Persons infected with						Prevalence of "bilharziasis"	
			S. haematobium		*S. mansoni*		both types			
			No.	%	No.	%	No.	%	No.	%
0-4	M	1 022	78	7.6	81	7.9	36	3.5	123	12.0
	F	1 042	113	10.8	91	8.7	46	4.4	158	15.2
	Total	2 064	191	9.3	172	8.3	82	4.0	281	13.6
5-9	M	1 082	371	34.3	239	22.1	178	16.5	432	39.9
	F	1 001	317	31.7	205	20.5	134	13.4	388	38.8
	Total	2 083	688	33.0	444	21.3	312	15.0	820	39.4
10-14	M	828	424	51.2	318	38.4	238	28.7	504	60.9
	F	804	324	40.3	224	27.9	147	18.3	401	49.9
	Total	1 632	748	45.8	542	33.2	385	23.6	905	55.5
15-19	M	513	233	45.4	191	37.2	117	22.8	307	59.8
	F	441	158	35.8	123	27.9	74	16.8	207	46.9
	Total	954	391	41.0	314	32.9	191	20.0	514	53.9
20-24	M	295	104	35.3	97	32.9	56	19.0	145	49.2
	F	398	101	25.4	97	24.4	49	12.3	149	37.4
	Total	693	205	29.6	194	28.0	105	15.2	294	42.4
25-29	M	299	77	25.8	84	28.1	41	13.7	120	40.1
	F	467	91	19.5	108	23.1	48	10.3	151	32.3
	Total	766	168	21.9	192	25.1	89	11.6	271	35.4
30-34	M	406	85	20.9	110	27.1	47	11.6	148	36.5
	F	438	70	16.0	92	21.0	39	8.9	123	28.1
	Total	844	155	18.4	202	23.9	86	10.2	271	32.1
35-39	M	361	77	21.3	96	26.6	41	11.4	132	36.6
	F	345	71	20.6	70	20.3	36	10.4	105	30.4
	Total	706	148	21.0	166	23.5	77	10.9	237	33.6
40-44	M	387	70	18.1	81	20.9	27	7.0	124	32.0
	F	318	52	16.4	76	23.9	26	8.2	102	32.1
	Total	705	122	17.3	157	22.3	53	7.5	226	32.1
45-49	M	249	36	14.5	65	26.1	22	8.8	79	31.7
	F	203	30	14.8	36	17.7	13	6.4	53	26.1
	Total	452	66	14.6	101	22.3	35	7.7	132	29.2
50-54	M	226	49	21.7	57	25.2	22	9.7	84	37.2
	F	186	31	16.7	41	22.0	15	8.1	57	30.6
	Total	412	80	19.4	98	23.8	37	9.0	141	34.2
55-59	M	114	21	18.4	29	25.4	10	8.8	40	35.1
	F	89	17	19.1	26	29.2	11	12.4	32	36.0
	Total	203	38	18.7	55	27.1	21	10.3	72	35.5
60+	M	190	36	18.9	47	24.7	18	9.5	65	34.2
	F	240	41	17.1	40	16.7	17	7.1	64	26.7
	Total	430	77	17.9	87	20.2	35	8.1	129	30.0
Total	M	5 972	1 661	27.8	1 495	25.0	853	14.3	2 303	38.6
	F	5 972	1 416	23.7	1 229	20.6	655	11.0	1 990	33.3
	Total	11 944	3 077	25.8	2 724	22.8	1 508	12.6	4 293	35.9

TABLE 8

AGE AND SEX DISTRIBUTION OF BILHARZIASIS IN THE RURAL DIVISION

Age-group (years)	Sex	No. examined	Persons infected with						Prevalence of "bilharziasis"	
			S. haematobium		*S. mansoni*		both types			
			No.	%	No.	%	No.	%	No.	%
0-4	M	300	21	7.0	23	7.7	11	3.7	33	11.0
	F	335	37	11.0	24	7.2	16	4.8	45	13.4
	Total	635	58	9.1	47	7.4	27	4.3	78	12.3
5-9	M	366	132	36.1	89	24.3	66	18.0	155	42.3
	F	353	111	31.4	73	20.7	48	13.6	136	38.5
	Total	719	243	33.8	162	22.5	114	15.9	291	40.5
10-14	M	286	158	55.2	112	39.2	90	31.5	180	62.9
	F	306	139	45.4	90	29.4	62	20.3	167	54.6
	Total	592	297	50.2	202	34.1	152	25.7	347	58.6
15-19	M	215	101	47.0	66	30.7	44	20.5	123	57.2
	F	160	65	40.6	46	28.8	26	16.3	85	53.1
	Total	375	166	44.3	112	29.9	70	18.7	208	55.5
20-24	M	120	49	40.8	34	28.3	23	19.2	60	50.0
	F	148	38	25.7	35	23.6	21	14.2	52	35.1
	Total	268	87	32.5	69	25.7	44	16.4	112	41.8
25-29	M	92	28	30.4	25	27.2	16	17.4	37	40.2
	F	154	37	24.0	33	21.4	23	14.9	47	30.5
	Total	246	65	26.4	58	23.6	39	15.9	84	34.1
30-34	M	126	24	19.0	22	17.5	9	7.1	37	29.4
	F	138	23	16.7	24	17.4	14	10.1	33	23.9
	Total	264	47	17.8	46	17.4	23	8.7	70	26.5
35-39	M	109	26	23.9	34	31.2	16	14.7	44	40.4
	F	120	23	19.2	23	19.2	15	12.5	31	25.8
	Total	229	49	21.4	57	24.9	31	13.5	75	32.8
40-44	M	136	32	23.5	28	20.6	10	7.4	50	36.8
	F	116	18	15.5	18	15.5	6	5.2	30	25.9
	Total	252	50	19.8	46	18.3	16	6.3	80	31.7
45-49	M	77	9	11.7	15	19.5	7	9.1	17	22.1
	F	82	12	14.6	9	11.0	4	4.9	17	20.7
	Total	159	21	13.2	24	15.1	11	6.9	34	21.4
50-54	M	82	18	22.0	23	28.0	9	11.0	32	39.0
	F	81	9	11.1	16	19.8	5	6.2	20	24.7
	Total	163	27	16.6	39	23.9	14	8.6	52	31.9
55-59	M	66	15	22.7	15	22.7	6	9.1	24	36.4
	F	41	8	19.5	9	22.0	5	12.2	12	29.3
	Total	107	23	21.6	24	22.4	11	10.3	36	33.6
60+	M	96	13	13.5	16	16.7	4	4.2	25	26.0
	F	117	18	15.4	14	12.0	7	6.0	25	21.4
	Total	213	31	14.6	30	14.1	11	5.2	50	23.5
Total	M	2 071	626	30.2	502	24.2	311	15.0	817	39.4
	F	2 151	538	25.0	414	19.2	252	11.7	700	32.5
	Total	4 222	1 164	27.6	916	21.7	563	13.3	1 517	35.9

TABLE 9

AGE AND SEX DISTRIBUTION OF BILHARZIASIS IN THE URBAN DIVISION

Age-group (years)	Sex	No. examined	Persons infected with						Prevalence of "bilharziasis"	
			S. haematobium		*S. mansoni*		both types			
			No.	%	No.	%	No.	%	No.	%
0-4	M	384	18	4.7	13	3.4	7	1.8	24	6.3
	F	332	23	6.9	11	3.3	3	0.9	31	9.3
	Total	716	41	5.7	24	3.4	10	1.4	55	7.7
5-9	M	341	49	14.4	39	11.4	28	8.2	60	17.6
	F	319	64	20.1	43	13.5	27	8.5	80	25.1
	Total	660	113	17.1	82	12.4	55	8.3	140	21.2
10-14	M	251	70	27.9	67	26.7	40	15.9	97	38.6
	F	238	54	22.7	40	16.8	19	8.0	75	31.5
	Total	489	124	25.4	107	21.9	59	12.1	172	35.2
15-19	M	127	31	24.2	34	26.8	15	11.8	50	39.4
	F	124	18	14.5	17	13.7	8	6.5	27	21.8
	Total	251	49	19.5	51	20.3	23	9.2	77	30.7
20-24	M	82	13	15.9	16	19.5	6	7.3	23	28.0
	F	113	18	15.9	19	16.8	8	7.1	29	25.7
	Total	195	31	15.9	35	17.9	14	7.2	52	26.7
25-29	M	98	9	9.2	15	15.3	4	4.1	20	20.4
	F	147	7	4.8	22	15.0	3	2.0	26	17.7
	Total	245	16	6.5	37	15.1	7	2.9	46	18.8
30-34	M	144	13	9.0	29	20.1	8	5.6	34	23.6
	F	134	8	6.0	20	14.9	4	3.0	24	17.9
	Total	278	21	7.6	49	17.6	12	4.3	58	20.9
35-39	M	126	11	8.7	21	16.7	6	4.8	26	20.6
	F	92	7	7.6	12	13.0	2	2.2	17	18.5
	Total	218	18	8.3	33	15.1	8	3.7	43	19.7
40-44	M	124	7	5.6	14	11.3	2	1.6	19	15.3
	F	85	6	7.1	14	16.5	2	2.4	18	21.2
	Total	209	13	6.2	28	13.4	4	1.9	37	17.7
45-49	M	74	6	8.1	15	20.3	3	4.1	18	24.3
	F	52	1	1.9	9	17.3	1	1.9	9	17.3
	Total	126	7	5.6	24	19.0	4	3.2	27	21.4
50-54	M	51	1	2.0	5	9.8	—	—	6	11.8
	F	44	7	15.9	7	15.9	3	6.8	11	25.0
	Total	95	8	8.4	12	12.6	3	3.2	17	17.9
55-59	M	18	1	5.6	2	11.1	1	5.6	2	11.1
	F	17	1	5.9	5	29.4	—	—	6	35.3
	Total	35	2	5.7	7	20.0	1	2.9	8	22.9
60+	M	38	10	26.3	7	18.4	3	7.9	14	36.8
	F	39	5	12.8	3	7.7	1	2.6	7	17.9
	Total	77	15	19.5	10	13.0	4	5.2	21	27.3
Total	M	1 858	239	12.9	277	14.9	123	6.6	393	21.2
	F	1 736	219	12.6	222	12.8	81	4.7	360	20.7
	Total	3 594	458	12.7	499	13.9	204	5.7	753	21.0

TABLE 10

AGE AND SEX DISTRIBUTION OF BILHARZIASIS IN THE RECLAMATION DIVISION

Age-group (years)	Sex	No. examined	Persons infected with						Prevalence of "bilharziasis"	
			S. haematobium		*S. mansoni*		both types			
			No.	%	No.	%	No.	%	No.	%
0-4	M	154	9	5.8	7	4.5	3	1.9	13	8.4
	F	180	8	4.4	5	2.8	2	1.1	11	6.1
	Total	334	17	5.1	12	3.6	5	1.5	24	7.2
5-9	M	181	84	46.4	28	15.5	23	12.7	89	49.2
	F	164	59	36.0	18	11.0	12	7.3	65	39.6
	Total	345	143	41.4	46	13.3	35	10.1	154	44.6
10-14	M	124	76	61.3	30	24.2	20	16.1	86	69.4
	F	124	50	40.3	16	12.9	11	8.9	55	44.4
	Total	248	126	50.8	46	18.5	31	12.5	141	56.9
15-19	M	67	42	62.7	25	37.3	17	25.4	50	74.6
	F	53	20	37.7	9	17.0	5	9.4	24	45.3
	Total	120	62	51.7	34	28.3	22	18.3	74	61.7
20-24	M	26	8	30.8	7	26.9	3	11.5	12	46.2
	F	60	16	26.7	8	13.3	4	6.7	20	33.3
	Total	86	24	27.9	15	17.4	7	8.1	32	37.2
25-29	M	40	14	35.0	9	22.5	4	10.0	19	47.5
	F	64	14	21.9	6	9.4	3	4.7	17	26.6
	Total	104	28	26.9	15	14.4	7	6.7	36	34.6
30-34	M	54	17	31.5	9	16.7	7	13.0	19	35.2
	F	92	22	23.9	15	16.3	8	8.7	29	31.5
	Total	146	39	26.7	24	16.4	15	10.3	48	32.9
35-39	M	60	19	31.7	5	8.3	3	5.0	21	35.0
	F	66	19	28.8	10	15.2	4	6.1	25	37.9
	Total	126	38	30.2	15	11.9	7	5.6	46	36.5
40-44	M	80	20	25.0	16	20.0	6	7.5	30	37.5
	F	50	10	20.0	9	18.0	5	10.0	14	28.0
	Total	130	30	23.1	25	19.2	11	8.5	44	33.8
45-49	M	48	9	18.8	9	18.8	3	6.3	15	31.3
	F	25	5	20.0	2	8.0	—	—	7	28.0
	Total	73	14	19.2	11	15.1	3	4.1	22	30.1
50-54	M	41	11	26.8	5	12.2	1	2.4	15	36.3
	F	20	4	20.0	2	10.0	1	5.0	5	25.0
	Total	61	15	24.6	7	11.5	2	3.3	20	32.8
55-59	M	12	—	—	2	16.7	—	—	2	16.7
	F	7	1	14.3	1	14.3	—	—	2	28.6
	Total	19	1	5.3	3	15.8	—	—	4	21.1
60+	M	16	3	18.8	5	31.3	2	12.5	6	37.5
	F	23	4	17.4	4	17.4	2	8.7	6	26.1
	Total	39	7	17.9	9	23.1	4	10.3	12	30.8
Total	M	903	312	34.6	157	17.4	92	10.2	377	41.7
	F	928	232	25.0	105	11.3	57	6.7	280	30.2
	Total	1 831	544	29.7	262	14.3	149	8.1	657	35.9

TABLE 11

AGE AND SEX DISTRIBUTION OF BILHARZIASIS IN THE CONTROL DIVISION

Age-group (years)	Sex	No. examined	Persons infected with						Prevalence of "bilharziasis"	
			S. haematobium		*S. mansoni*		both types			
			No.	%	No.	%	No.	%	No.	%
0-4	M	184	30	16.3	38	20.7	15	8.2	53	28.8
	F	195	45	23.1	51	26.2	25	12.8	71	36.4
	Total	379	75	19.8	89	23.5	40	10.6	124	32.7
5-9	M	194	106	54.6	63	42.8	61	31.4	128	66.0
	F	165	83	50.3	71	43.0	47	28.5	107	64.8
	Total	359	189	52.6	154	42.9	108	30.1	235	65.5
10-14	M	157	120	71.9	109	65.3	88	52.7	141	84.4
	F	136	81	59.6	78	57.4	55	40.4	104	76.5
	Total	303	201	66.3	187	61.7	143	47.2	245	80.9
15-19	M	104	59	56.7	66	63.5	41	39.4	84	80.8
	F	104	55	52.9	51	49.0	35	33.7	71	68.3
	Total	208	114	54.8	117	56.3	76	36.5	155	74.5
20-24	M	67	34	50.7	40	59.7	24	35.8	50	74.6
	F	77	29	37.7	35	45.5	16	20.8	48	62.3
	Total	144	63	43.8	75	52.1	40	27.8	98	68.1
25-29	M	69	26	37.7	35	50.7	17	24.6	44	63.8
	F	102	33	32.4	47	46.1	19	18.6	61	59.8
	Total	171	59	34.5	82	48.0	36	21.1	105	61.4
30-34	M	82	31	37.8	50	61.0	23	28.0	58	70.7
	F	74	17	23.0	33	44.6	13	17.6	37	50.0
	Total	156	48	30.8	83	53.2	36	23.1	95	60.9
35-39	M	66	21	31.8	36	54.5	16	24.2	41	62.1
	F	67	22	32.8	25	37.3	15	22.4	32	47.8
	Total	133	43	32.3	61	45.9	31	23.3	73	54.9
40-44	M	47	11	23.4	23	48.9	9	19.1	25	53.2
	F	67	18	26.9	35	52.2	13	19.4	40	59.7
	Total	114	29	25.4	58	50.9	22	19.3	65	57.0
45-49	M	50	12	24.0	26	52.0	9	18.0	29	58.0
	F	44	12	27.3	16	36.4	8	18.2	20	45.5
	Total	94	24	25.5	42	44.7	17	18.1	49	52.1
50-54	M	52	19	36.5	24	46.2	12	23.1	31	59.6
	F	41	11	26.8	16	39.0	6	14.6	21	51.2
	Total	93	30	32.3	40	43.0	18	19.4	52	55.9
55-59	M	18	5	27.8	10	55.6	3	16.7	12	66.7
	F	24	7	29.2	11	45.8	6	25.0	12	50.0
	Total	42	12	28.6	21	50.0	9	21.4	24	57.1
60+	M	40	10	25.0	19	47.5	9	22.5	20	50.0
	F	61	14	23.0	19	31.1	7	11.5	26	42.6
	Total	101	24	23.8	38	37.6	16	15.8	46	45.5
Total	M	1 140	484	42.5	559	49.0	327	28.7	716	62.8
	F	1 157	427	36.9	488	42.2	265	22.9	650	56.2
	Total	2 297	911	39.7	1 047	45.6	592	25.8	1 366	59.5

lost. We find, on the other hand, that there is a progressive rise in the frequency of both *S. haematobium* and *S. mansoni* infections from birth onwards. Both types of infection were not infrequently eucountered among infants (under one year old). Of the 353 infants in our random sample, 2.5% were found positive for *S. haematobium* and 1.1% for *S. mansoni*. The youngest case of *S. haematobium* infection was noted in a 6-month-old boy and that of *S. mansoni* in a 4-month-old girl, both in the Rural Division. Morley-Smith & Gelfand's view was, however, based on the examination of only 27 children under 4 years old who were taken to a clinic for various reasons.

Fig. 2 and 3 are based on the age and sex distribution rates of bilharziasis recorded in Tables 7-11. The rates of infection reach maxima in the age-group 10-14 years, which constitutes 13.3% of the population in the project area. This is true for both sexes and in all four divisions, in respect of all the four rates determined—namely, *S. haematobium*, *S. mansoni* and mixed infections and " bilharziasis " (infection with either species of schistosome). The difference in prevalence rates in the Reclamation Division between the age-groups 10-14 years and 15-19 years is statistically significant only for *S. mansoni* infection (χ^2 for *S. haematobium* = 0.002, $P > 0.95$; χ^2 for *S. mansoni* = 4.0, $P < 0.05$; χ^2 for mixed infection = 1.8, $P > 0.1$; χ^2 for " bilharziasis " = 0.5, $P > 0.3$).

Age-specific data have been broken down individually for the 23 sections; irrespective of the over-all levels of infection, the characteristic age-prevalence structure is invariably one of preponderant infection in early years, with the peak occurring during late childhood or early adolescence, followed by a progressive decline among adults up to about 40 years old and a levelling off, leaving a hard core of 30% of individuals in late adult and old age who retain infection.

This general pattern corresponds with that found in previous comprehensive surveys in Egypt, by

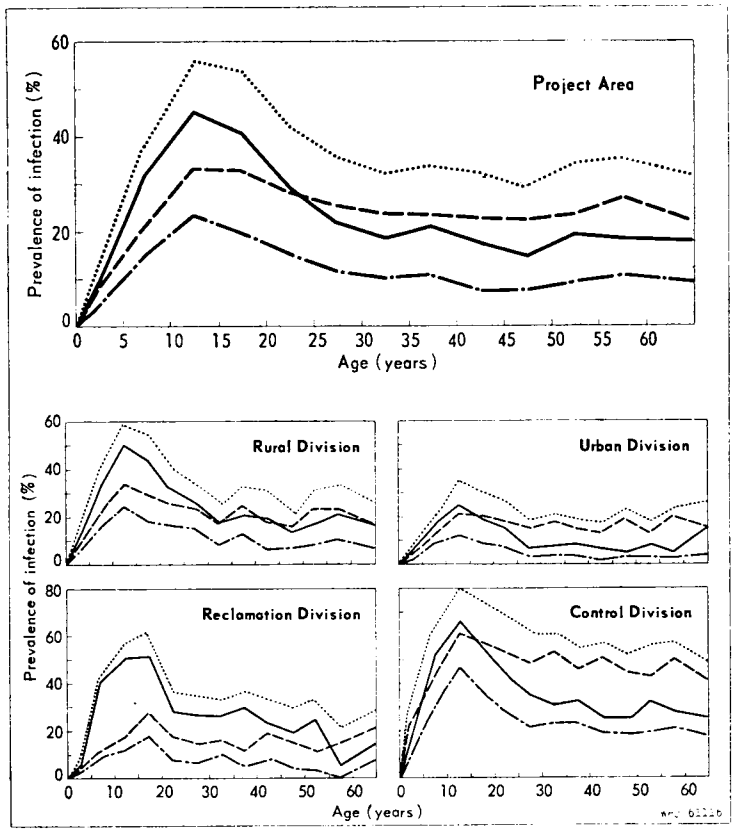
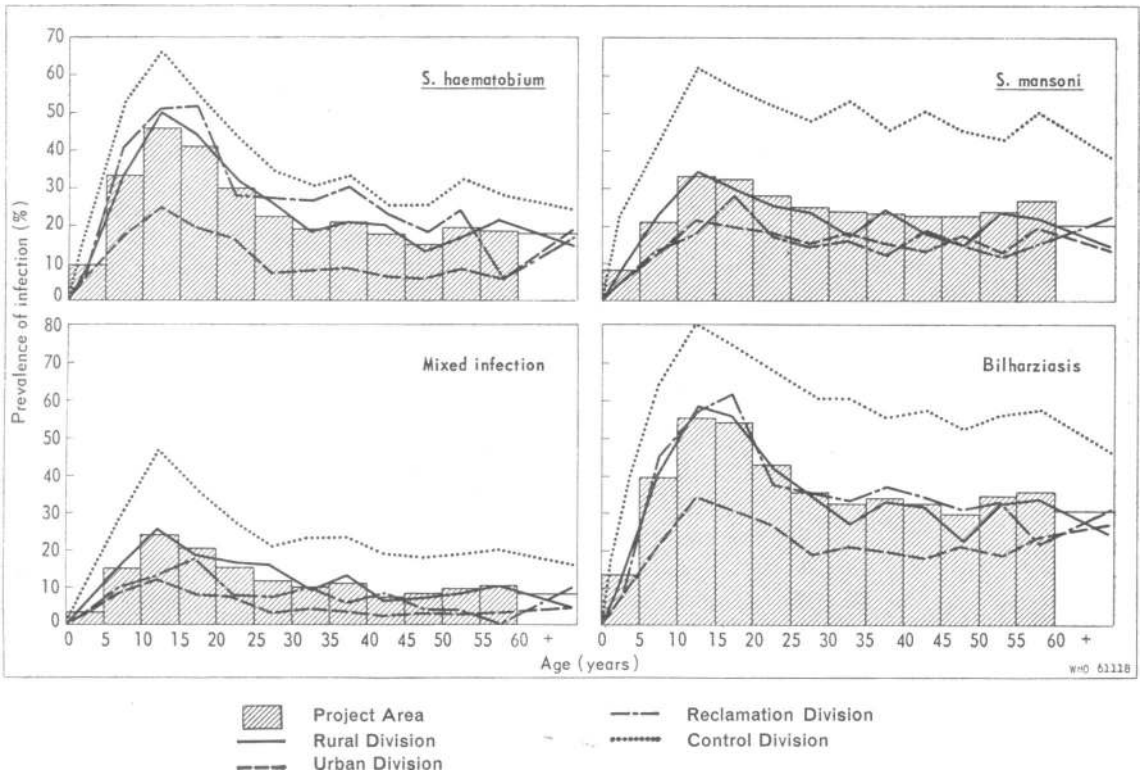


FIG. 2
AGE DISTRIBUTION OF PREVALENCE OF BILHARZIASIS IN THE PROJECT AREA AND IN ITS FOUR DIVISIONS

FIG. 3

FREQUENCY DISTRIBUTION OF BILHARZIASIS BY TYPE OF INFECTION IN THE PROJECT AREA AND ITS FOUR DIVISIONS



Scott (1937) and Farag Rizk.[1] That this appears to be a universal feature of bilharziasis, irrespective of the species of the schistosome or the seasonal pattern of transmission, is shown by reports from widely separated areas (Greany (1952), Sudan; Scott (1942), Venezuela, for *S. mansoni*; Pesigan et al. (1958), Philippines, for *S. japonicum*). Exceptions to this pattern are few and far between.

In our area, where *S. haematobium* and *S. mansoni* co-exist, the usual pattern, though obvious for both species of infection, is less marked for *S. mansoni* than for *S. haematobium*. The age-prevalence of *S. mansoni* in the project area more closely resembles that observed by Scott (1942) for *S. mansoni* in Venezuela and by Pesigan et al. (1958) for *S. japonicum* in the Philippines. It could be argued that man develops resistance against infection more quickly for the more host-specific and probably more ancient *S. haematobium* infection than for *S. mansoni* or *S. japonicum*. Or the effect may be due to a reduced degree of interference with the excretion of eggs in intestinal bilharziasis, because of its wider distribution in the intestinal mucosa, the resulting scarring of tissue not being extensive enough to prevent egg excretion to the same extent as in infection with *S. haematobium*, which involves a comparatively smaller mucosal surface of the urinary bladder. It should, however, be pointed out that the rather sudden fall generally noted in *S. haematobium* infection may not support the contention that fibrosis is the main process involved, and confirmation of the suggestions on the basis of egg-counts should be sought. The phenomenon has been observed in recent studies by Kloetzel (1962) in Brazil. In any case, the observed decline may be due, at least in part, to an immunological defence mechanism which

[1] Farag Rizk (1956) *The problem of schistosomiasis in Egypt*, mimeographed document issued by the Division of Endemic Diseases, Ministry of Health, Cairo, United Arab Republic.

either prevents reinfection (premunition) or partially destroys the worms or inhibits egg-laying, after infection has lasted for some years.

That the observed decline in infection rates is not simply a function of age is borne out by the fact that adults who have not previously been infected succumb as readily as children in the endemic areas. Evidence of this ranges from the historical records of the outbreak of marked haematuria among Napoleon's armies in Egypt in 1799-1801 (Sandwith, 1905) to the experiences of Turkish seasonal labourers who contracted infection in the Kamechlie and Tell Abied endemic foci of the Syrian Jezireh (Farooq, unpublished data). The epidemic outbreak of *S. japonicum* infection in 1944-45 involving 1700 soldiers of the United States forces (Wright, 1950) and that among an Australian airfield-construction squadron in Leyte (Dakin & Connellan, 1947) are other well-known examples.

Irrespective of the process that determines the general pattern of prevalence in relation to age, our data indicate that *S. mansoni* infection is acquired more slowly than *S. haematobium* infection during childhood and that it is a more persistent infection among adults. The long period of doubt as to whether resistance to schistosome infection is acquired as a result of continued infection in endemic areas seems to be reaching an end and the emphasis has now passed to the study of the mechanism of acquired resistance (Sadun, 1963).

Antigen-antibody reactions in immunodiagnosis raise the question whether resistance may be acquired as a result of infection by one species counteracting infection by the other, i.e., by cross-resistance between species of schistosome. *Prima facie* the pattern of age-prevalence for *S. haematobium* and *S. mansoni* infections in the project area appears to be the same as would be expected if these species occurred alone. However, it is proposed to analyse the data separately in order to examine this question in detail.

SEX DISTRIBUTION OF PREVALENCE OF BILHARZIASIS

Examination of Tables 7-11 shows that the four infection rates calculated are higher in males than in females for all age-groups except the youngest (0-4 years). In this group the rates in the project area as a whole are significantly higher among females for *S. haematobium* and bilharziasis (either infection) ($\chi^2 = 6.0$, $P < 0.02$; $\chi^2 = 4.07$, $P < 0.05$, respectively). The differences in respect of *S. mansoni* and mixed infections are, however, not significant ($\chi^2 = 0.35$, $P > 0.50$; $\chi^2 = 0.85$, $P > 0.30$, respectively). Both Scott's (1937) and Farag Rizk's [1] data lead to similar conclusions. Moreover, Greany (1952), in the Sudan Gezira, found that, of 716 girls and 770 boys aged 0-5 years, 6.4% and 3.4%, respectively, were infected with *S. haematobium*; Blair (1956) observed in Southern Rhodesia that among 1673 girls and 1881 boys aged 1-5 years, 40.1% and 30.9%, respectively, had a similar infection. Blair suggested that the difference might be due to the fact that in Southern Rhodesia girls accompany their mothers to water-courses at an early age; this has also been observed in the project area.[2]

Except in the youngest age-group, the preponderance of bilharziasis infection among males is a generally observed phenomenon. However, there are variations from the general pattern the extent of which depends mainly on the water-contact activities of different groups as determined by local customs and social mores.

OCCUPATIONAL DIFFERENCES IN PREVALENCE RATES

Our data show that the occupational composition of the population contributes appreciably to the observed differences in infection rates between the four divisions. These differences seem to depend on the extent to which a particular occupation involves contact with water (Table 12).

The highest bilharziasis rates are among fishermen (60.4%) and boatmen (52.0%), though the total number mainly engaged in these two occupations is relatively small (0.6% of the population); the difference in the infection rates between these two groups is not statistically significant. The brunt of the infection, in terms of the total number infected, is borne by farmers and farm labourers, who together constitute 48.0% of the population. Farmers have a significantly higher rate of infection than farm labourers, who are mostly seasonal workers ($\chi^2 = 38.5$, $P < 0.001$ for one degree of freedom, based on figures for " bilharziasis").

Only a few individuals are engaged as water carriers or washermen, but those who are have a high rate of infection (47.8%). Among those listed as manual labourers, the majority are engaged as factory hands in the textile industry and are under regular medical care at the factory hospital; most of them live in large housing schemes with a pro-

[1] Farag Rizk, *op. cit.*

[2] See the paper on page 377 of this issue.

TABLE 12

PREVALENCE OF BILHARZIASIS BY OCCUPATION

Occupation	No. examined	Number with				Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"	*S. haematobium* infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Farmer	4 029	1 472	1 353	786	2 039	36.5	33.6	19.5	50.6
Farm labourer	1 713	539	426	252	713	31.5	24.9	14.7	41.6
Landowner	222	59	52	32	79	26.6	23.4	14.4	35.6
Fisherman	48	17	25	13	29	35.4	52.1	27.1	60.4
Boatman	25	12	5	4	13	48.0	20.0	16.0	52.0
Water carrier and washerman	23	7	11	7	11	30.4	47.8	30.4	47.8
Domestic servant	47	13	9	7	15	27.7	19.1	14.9	31.9
Skilled labourer	409	90	79	42	128	22.0	19.3	10.3	31.3
Other manual	3 457	446	398	172	671	12.9	11.5	5.0	19.4
Clerical	389	62	43	25	80	15.9	11.1	6.4	20.6
Professional	109	24	27	13	38	22.0	24.8	11.9	34.9
None or other	1 473	336	296	155	477	22.8	20.1	10.5	32.4
Total	11 944	3 077	2 724	1 508	4 293	25.8	22.8	12.6	35.9

tected water supply. It is reasonable, therefore, to expect that the lowest rates would be recorded among them.

Although there is a higher proportion of farmers in the Reclamation Division (80.8%) than elsewhere, they are mostly new settlers from less heavily infected provinces, whereas the farmers in the Rural and Control Divisions belong to old-established farming communities in the highly endemic regions of the Nile Delta. There is a higher proportion of farmers in the Control Division (56.4%) than in the Rural Division (26.8%). This preponderance of the most vulnerable occupational group and the lower general standard of living in the area seem to be the main reasons for the high rates of bilharziasis in the Control Division.

In the Urban Division, which has considerably lower rates of infection than the other three divisions, the low rates are due to a different distribution of various occupational groups. Both farmers and farm labourers have at least as high prevalence rates in the Urban Division as in the other divisions.

As noted earlier, the over-all prevalence rate of bilharziasis for the whole project area is higher for males than for females. Table 13 shows that the

TABLE 13

PREVALENCE OF BILHARZIASIS BY OCCUPATION AND SEX

Occupation and sex	No. examined	Prevalence (%) of			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Farmer and farm labourer					
Males	2 900	38.9	34.7	20.8	52.8
Females	2 842	31.1	27.2	15.3	43.0
Total	5 742	35.0	31.0	18.1	47.9
All other occupations					
Males	3 072	17.4	15.9	8.1	25.1
Females	3 130	17.0	14.6	7.1	24.6
Total	6 202	17.2	15.2	7.6	24.8
Total					
Males	5 972	27.8	25.0	14.3	38.6
Females	5 972	23.8	20.6	11.0	33.3
Total	11 944	25.8	22.8	12.6	35.9

TABLE 14
PREVALENCE OF BILHARZIASIS AMONG MUSLIMS

Division	No. examined	Total with				Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"	*S. haematobium* infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Rural	4 184	1 159	911	560	1 510	27.7	21.8	13.4	36.1
Urban	3 447	450	493	201	742	13.1	14.3	5.8	21.5
Reclamation	1 810	534	260	147	647	29.5	14.4	8.1	35.7
Control	2 290	911	1 044	592	1 363	39.8	45.6	25.9	59.5
Total	11 731	3 054	2 708	1 500	4 262	26.0	23.1	12.8	36.3

higher prevalence rate for males, as far as separate *S. haematobium* and *S. mansoni* infections are concerned, relates only to the occupational group "farmers and farm labourers". The difference in the prevalence rates by sex is statistically significant in this group, whereas for all other occupations combined, the prevalence rates for males and females do not show a significant difference.

RELATIONSHIP OF BILHARZIASIS RATES TO RELIGION, EDUCATIONAL ATTAINMENT, MORES AND HABITS

The interplay of certain basic human factors determines the epidemiological pattern of bilharziasis in an endemic area. Important among those are poverty, ignorance, religion, and cultural and social mores of the people.

Pollution and contact with infected water take place in connexion with agricultural practices but also to a considerable extent during recreational and domestic activities that are inevitable under conditions of low standards of living. Lack of adequate educational and recreational facilities bring people, children in particular, much more in contact with the infection in hot climates, where it is not only refreshing and pleasant to play in water but often is the sole outlet for excess energy.

An analysis of the data in relation to religion, educational status and domestic water-contact (swimming and washing clothes, utensils and cattle) is presented below. The environmental determinants of such contact are described in Part 3 of this series [1] and studies pertaining to the duration and extent of water-contact in relation to social and religious activities are discussed elsewhere.[2]

Religion

Bilharziasis is one of the few diseases in which religion appears to play a significant role. It is considered adequate here to classify the data in respect of the two main religious groups (predominantly Muslims, with a small proportion (1.7%) of Christians) in the area (Tables 14 and 15). The observed differences in rates for *S. haematobium* and *S. mansoni* infections and for "bilharziasis" (either infection) are highly significant ($\chi^2 = 24.6$, 28.0 and 42.2, respectively; $P < 0.001$ for one degree of freedom).

Most of the Christian population lives in the Urban Division. For this division a further analysis by age shows significantly lower rates for Christians in each age-group, the percentage distribution by age of the examined population showing no difference. A difference is also evident on analysing the figures by size of locality. For localities with more than 400 inhabitants the prevalence rate for the Muslim population was 19.4% (number examined 2009) and for the Christian population 6.7% (number examined 119). Similarly significant differences in rates are found between the two religious groups, when analysing data by occupation and by degree of literacy.

Education

The educational status of the examined population by sex and by division is shown in Table 16. The 21 persons for whom this information was not

[1] See the paper on page 319 of this issue.

[2] See the paper on page 377 of this issue.

TABLE 15. PREVALENCE OF BILHARZIASIS AMONG CHRISTIANS

Division	No. examined	Total with				Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"	*S. haematobium* infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Rural	38	5	5	3	7	13.2	13.2	7.9	18.4
Urban	147	8	6	3	11	5.4	4.1	2.0	7.5
Reclamation	21	10	2	2	10	47.6	6.5	9.5	47.6
Control	7	0	3	0	3	0	42.9	0	42.9
Total	213	23	16	8	31	10.8	7.5	3.8	14.6

TABLE 16. DISTRIBUTION OF EXAMINED POPULATION BY EDUCATIONAL LEVEL AND BY SEX

Educational level	Number of people					Percentage distribution				
	Project area	Division				Project area	Division			
		Rural	Urban	Reclamation	Control		Rural	Urban	Reclamation	Control
Males										
Preschool age	1 278	380	473	189	236	21.4	18.4	25.5	21.0	20.7
School age, attending school	840	246	416	131	47	14.1	11.9	22.4	14.6	4.1
School age, not attending	964	387	124	160	293	16.2	18.7	6.7	17.8	25.7
Does not read or write	1 798	740	335	350	373	30.2	35.8	18.1	39.0	32.7
Read and writes	958	297	427	60	174	16.1	14.4	23.0	6.7	15.3
Primary or higher education	122	18	80	8	16	2.0	0.8	4.3	0.9	1.4
Total	5 960	2 068	1 855	898	1 139	100.0	100.0	100.0	100.0	100.0
Females										
Preschool age	1 277	411	404	223	239	21.4	19.1	23.3	24.1	20.7
School age, attending school	402	105	252	36	9	6.7	4.9	14.5	3.9	0.8
School age, not attending	1 287	512	270	227	278	21.6	23.9	15.6	24.5	24.0
Does not read or write	2 862	1 096	719	426	621	48.0	51.1	41.4	46.0	53.7
Reads and writes	120	21	78	12	9	2.0	1.0	4.5	1.3	0.8
Primary or higher education	15	1	12	2	0	0.3	0.1	0.7	0.2	0
Total	5 963	2 146	1 735	926	1 156	100.0	100.0	100.0	100.0	100.0
Both sexes										
Preschool age	2 555	791	877	412	475	21.4	18.8	24.4	22.6	20.7
School age, attending school	1 242	351	668	167	56	10.4	8.3	18.6	9.2	2.4
School age, not attending	2 251	899	394	387	571	18.9	21.3	10.9	21.2	24.9
Does not read or write	4 660	1 836	1 054	776	994	39.1	43.6	29.4	42.6	43.3
Reads and writes	1 078	318	505	72	183	9.0	7.5	14.1	3.9	8.0
Primary or higher education	137	19	92	10	16	1.2	0.5	2.6	0.5	0.7
Total	11 923	4 214	3 590	1 824	2 295	100.0	100.0	100.0	100.0	100.0

TABLE 17
PREVALENCE OF BILHARZIASIS BY OCCUPATION AND BY EDUCATIONAL LEVEL

Occupation and educational level	No. examined	Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Farmer and farm labourer					
Preschool age	1 173	17.0	15.6	8.0	24.6
School age, attending	300	53.0	27.7	23.3	57.3
School age, not attending	1 430	53.8	38.5	27.9	64.4
Does not read or write	2 610	30.3	33.3	16.3	47.3
Reads and writes	216	41.7	40.7	21.8	60.6
Primary or higher education	2	0	50.0	0	50.0
Total	5 731	35.0	31.0	18.1	47.9
All other occupations					
Preschool age	1 382	7.6	5.0	2.7	9.8
School age, attending	942	23.0	14.6	9.9	27.8
School age, not attending	821	36.1	27.3	17.8	45.7
Does not read or write	2 050	15.6	18.1	7.0	26.7
Reads and writes	862	13.0	14.8	5.0	22.9
Primary or higher education	135	9.6	9.6	3.0	16.3
Total	6 192	17.2	15.2	7.5	24.9

recorded are not included, and the various levels of education are merged into one group (primary or higher education) on account of the small numbers involved.

It is obvious that the literacy level varies greatly with sex. In the whole project area, 62.5% of adult males were unable to read and write, whereas for females this percentage was 95.5%; 4.2% of males and 0.5% of females had received at least primary education. Almost one-half (46.6%) of all school-age boys attend school, but only 23.8% of the girls do so.

The four divisions show characteristic differences in educational level. As expected, the level is highest in the Urban Division, where the majority of adult males are literate and where more than three-quarters of the boys and almost one-half of the girls attend school. The Reclamation Division has the lowest literacy rate. The Control Division has the lowest school-attendance rate—14% of boys and 3% of girls of school age.

For the total project area the bilharziasis prevalence rate for adult males is 45.6% for those who neither read nor write, 32.2% for those who read and write and 18.0% for those with primary or higher education. For boys of school age, the rate is 64.5% for those not attending school and 39.2% for those attending. These differences are observed in each of the four divisions.

For *S. haematobium* infection the over-all rates follow the general relationship, except that in the Urban Division the level is the same for males who read and write and for those who have had primary or higher education; in the Control and Reclamation Divisions there appear to be no differences in prevalence rate between persons who read and write and those who do not. With minor exceptions, the tendency for educational level and presence of the infection to be inversely related is seen also for *S. mansoni* infection and for mixed infections.

Earlier it was shown that the prevalence rates were higher for farmers and farm labourers than for other occupational groups: in order to separate the effects of occupation and literacy on prevalence rates, Table 17 has been computed; it gives the over-

all prevalence rates for the main literacy groups separately for agricultural and non-agricultural occupations. This shows that the relationship between literacy and bilharziasis is not so clear cut when those examined are classified by occupation. Among farmers and farm labourers, literate adults show higher prevalence rates than illiterate ones (60.6% and 47.3%, respectively); for all other occupations, the situation is reversed (22.9% and 26.7%), and literate adults in all occupations have higher rates of infection than persons with at least primary education (16.3%). These differences are statistically significant. The rates of infection for school-age children are higher for those not attending school than for those attending school, whatever the occupational category; these differences also are statistically significant.

Therefore, it is concluded that not only literacy rates but the educational levels attained have a bearing on the degree of endemicity in the population groups examined. Likewise, the fact whether children attend or do not attend school influences the infection rates among them.

Swimming habits

Enquiries were made about the swimming habits of the individuals examined. In no activity is a person so thoroughly exposed to schistosome infection as in swimming. This therefore constitutes one of the most important activities involved in the transmission of bilharziasis. Of the total sample examined, 1939 or 16.2% (25.7% of males and 6.8% of females) swim frequently. The proportions of such individuals according to age-group are shown in Table 18; the highest proportion of regular swimmers is found among the 10-19 years age-group among males and in the 5-14 years age-group among females. The great majority of the 1939 people who swim regularly do so in canals; only 69 persons swim in other waters, mostly lakes. In Table 19 the figures are analysed by division; it is seen that very few persons (3.1%) in the Urban Division swim; in the other three divisions the proportion ranges between 18.9% and 25.7%.

TABLE 18
SWIMMING HABITS IN THE PROJECT AREA

Age-group (years)	Regular swimmers			
	Number		Percentage	
	Males	Females	Males	Females
0-4	22	23	2.2	2.2
5-9	289	136	26.7	13.6
10-14	380	80	45.9	10.0
15-19	209	32	40.7	7.3
20-24	85	22	28.8	5.5
25-29	68	25	22.7	5.4
30-34	83	22	20.4	5.2
35-39	90	17	24.9	4.9
40-44	114	12	29.5	3.8
45-49	71	13	28.5	6.4
50-54	65	6	28.8	3.2
55-59	28	8	24.6	9.0
60+	28	11	14.7	4.6
Total	1 532	407	25.7	6.8

TABLE 19
DISTRIBUTION OF EXAMINED POPULATION BY SWIMMING HABITS AND BY DIVISION

Swimming habits	Number of people					Percentage distribution				
	Project area	Division				Project area	Division			
		Rural	Urban	Reclamation	Control		Rural	Urban	Reclamation	Control
Swimmers: in canals	1 870	801	109	470	490	15.7	18.9	3.0	25.7	21.3
Swimmers: other waters	69	67	1	0	1	0.6	1.6	0.1	0	0.1
Non-swimmers	9 798	3 245	3 466	1 329	1 758	82.0	76.9	96.4	72.6	76.5
Not stated	207	109	18	32	48	1.7	2.6	0.5	1.7	2.1
Total	11 944	4 222	3 594	1 831	2 297	100.0	100.0	100.0	100.0	100.0

TABLE 20
PREVALENCE OF BILHARZIASIS IN SWIMMERS AND NON-SWIMMERS

Swimming habits	No. examined	Prevalence (%) of			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Swimmers					
Males	1 532	46.9	44.1	27.7	63.4
Females	407	39.6	42.3	25.6	56.3
Total	1 939	45.4	43.7	27.2	61.9
Non-swimmers					
Males	4 440	21.2	18.4	9.7	30.0
Females	5 565	22.6	19.0	9.9	31.6
Total	10 005	22.0	18.8	9.8	30.9

Sex-specific prevalence rates of bilharziasis in relation to swimming habits are given in Table 20. In respect of both species of schistosome, the infection rates are more than double among swimmers than among those who do not swim. Considerably higher infection rates among swimmers are observed in all four divisions. It is noteworthy that male and female non-swimmers have very similar infection rates.

Household washing : clothes and utensils

The number of people engaged in washing clothes and utensils and the places where washing is done are shown in Table 21.

TABLE 21
HOUSEHOLD WASHING ACTIVITIES OF MALES AND FEMALES

Activity and place	Number engaged		
	Males	Females	Total
Washing			
in drain	2	20	22
in canal	99	1 618	1 717
in piped water	39	2 268	2 307
in other water	0	1	1
Not washing	5 832	2 065	7 897
Total	5 972	5 972	11 944

Household washing is predominantly an activity of females; only 140 males (mostly children) were engaged in it (2.5% of the male population), compared with 3907 females (65.4%). This therefore constitutes a major domestic water-contact activity among women, who gather at certain convenient and easily accessible watercourses or public water taps and spend long hours, as the opportunity is also provided for social contacts and village gossip. There are highly significant differences in infection rates between those engaged in washing and those who are not (Table 22).

Since this activity is only rarely undertaken by males, detailed analysis has been confined to females only. In Table 23 the number of females is classified by division and, where they are engaged in washing, by the source of water used. Canals are the most common source in the Rural and Control Divisions and piped-water supplies in the Urban and Reclamation Divisions.

Table 24 analyses the prevalence of bilharziasis by place of washing in each division. Females washing clothes and utensils in canals have significantly higher infection rates than those who use piped water; this is true in each of the four divisions.

In order to examine whether a different age distribution may have brought about this characteristic difference between the two groups, the bilharziasis rates for females washing clothes in canals and in piped water have been computed by age-group (Table 25). For the project area as a

TABLE 22
PREVALENCE OF INFECTION IN RELATION TO WASHING OF CLOTHES AND HOUSEHOLD UTENSILS (FEMALES ONLY)

Activity	Females infected with						Prevalence of "bilharziasis"	
	S. haematobium		*S. mansoni*		both types			
	No.	%	No.	%	No.	%	No.	%
Washing	1 019	26.1	954	24.4	494	12.6	1 479	37.8
Not washing	397	19.2	275	13.3	161	7.8	511	24.7
Total	1 416	23.7	1 229	20.6	655	11.0	1 990	33.3

whole, the difference is observed for all age-groups. However, when the data are broken down by division, the picture is seen to be more complex.

In the Rural Division, the highest prevalence rates are found in females washing in canals, except in the age-group 15-19 years. In the Urban Division females washing in canals have much higher infection rates than those washing in piped water. In the Reclamation Division higher rates are also generally found among females washing in canals. In the Control Division no difference can be demonstrated between the two groups. A more intensive study of the time spent and the time of day when these and other water-contact activities take place in the different areas should clarify some of the observed discrepancies; such studies are currently under way.

Washing cattle

Farmers take pride in keeping their cattle clean. They are washed during any time of the day, more often during summer (when transmission is at its height) than in winter. Young boys and women are generally engaged in this activity. A total of 1638 males (27.4%) and 1166 females (19.5%) in the sample examined reported participating. The prevalence of bilharziasis in those who regularly wash cattle and in those who do not is shown in Table 26.

The differences between the two categories are highly significant for *S. haematobium* and *S. mansoni*

TABLE 23
DISTRIBUTION OF FEMALES EXAMINED BY DIVISION AND BY DOMESTIC WASHING ACTIVITIES

Activity	Number of females					Percentage distribution				
	Project area	Division				Project area	Division			
		Rural	Urban	Reclamation	Control		Rural	Urban	Reclamation	Control
Washing										
in drain	20	19	0	1	0	0.3	0.9	0	0.1	0
in canal	1 618	812	153	190	463	27.1	37.8	8.8	20.5	40.0
in piped water	2 268	599	965	420	284	37.9	27.8	55.6	45.2	24.6
in other water	1	0	1	0	0	0.1	0	0.1	0	0
Not washing	2 065	721	617	317	410	34.6	33.5	35.5	34.2	35.4
Total	5 972	2 151	1 736	928	1 157	100.0	100.0	100.0	100.0	100.0

TABLE 24

DEPENDENCE OF PREVALENCE RATES OF BILHARZIASIS ON SOURCE OF WATER FOR WASHING UTENSILS (FEMALES ONLY)

Source of water for washing clothes and utensils	No. examined	Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	" Bilharziasis "
Project area					
Drain	20	0	25.0	0	25.0
Canal	1 618	34.9	35.4	20.1	50.2
Piped water	2 268	20.0	16.5	7.4	29.1
Total [a]	5 972	23.7	20.6	11.0	33.3
Rural Division					
Drain	19	0	26.3	0	26.3
Canal	812	31.5	25.5	16.3	40.8
Piped water	599	23.5	18.4	10.0	31.9
Total [a]	2 151	25.0	19.2	11.7	32.5
Urban Division					
Drain	0	—	—	—	—
Canal	153	35.3	62.7	25.5	72.5
Piped water	965	10.7	9.6	3.3	17.0
Total [a]	1 736	12.6	12.8	4.7	20.7
Reclamation Division					
Drain	1	0	0	0	0
Canal	190	34.7	40.5	21.1	54.2
Piped water	410	26.9	4.5	2.9	28.6
Total [a]	928	25.0	11.3	6.1	30.2
Control Division					
Drain	0	—	—	—	—
Canal	463	40.8	41.7	24.8	57.7
Piped water	284	34.2	53.9	22.5	65.5
Total [a]	1 157	36.9	42.2	22.9	56.2

[a] Females not engaged in washing are included in the totals.

TABLE 25

PREVALENCE RATES OF BILHARZIASIS FOR PERSONS WASHING CLOTHES AND UTENSILS IN CANAL AND PIPED WATER, BY AGE (FEMALES ONLY)

Number examined and infection		Age-group and source of water											
		5-9 years		10-14 years		15-19 years		20-29 years		30 years and over		Total [a]	
		Canal	Piped	Canal	Piped	Canal	Piped	Canal	Piped	Canal	Piped	Canal	Piped
Project area													
Number examined		155	90	300	382	173	242	316	521	668	1 030	1 618	2 268
S. haematobium	(%)	52.3	26.7	53.0	31.2	48.0	28.5	28.8	18.0	22.6	14.4	34.9	20.0
S. mansoni	(%)	44.5	10.0	43.3	16.0	36.4	21.5	33.9	17.1	29.9	15.9	35.4	16.5
Mixed infection	(%)	32.3	4.4	29.7	9.4	24.3	12.0	17.4	7.7	13.5	5.7	20.1	7.4
Bilharziasis	(%)	64.5	32.2	66.7	37.7	60.1	38.0	45.3	27.4	39.1	24.6	50.2	29.1
Rural Division													
Number examined		66	16	166	96	87	59	161	128	332	300	812	599
S. haematobium	(%)	43.9	18.8	49.4	43.8	41.4	44.1	28.6	21.1	19.0	14.3	31.5	23.5
S. mansoni	(%)	27.3	25.0	38.0	18.8	26.4	33.9	26.1	17.2	18.4	15.3	25.5	18.4
Mixed infection	(%)	22.7	6.3	25.3	14.6	14.9	20.3	19.3	9.4	9.3	7.0	16.3	10.0
Bilharziasis	(%)	48.5	37.5	62.0	47.9	52.9	57.6	35.4	28.9	28.0	22.7	40.8	31.9
Urban Division													
Number examined		36	51	28	181	12	108	19	235	57	387	153	965
S. haematobium	(%)	63.9	21.6	57.1	17.1	8.3	14.8	10.5	9.4	21.1	5.9	35.3	10.7
S. mansoni	(%)	75.0	7.8	64.3	9.9	58.3	7.4	63.2	11.5	54.4	9.3	62.7	9.6
Mixed infection	(%)	50.0	5.9	39.3	4.4	8.3	5.6	10.5	3.8	12.3	1.6	25.5	3.3
Bilharziasis	(%)	88.9	23.5	82.1	22.7	58.3	16.7	63.2	17.0	63.2	13.7	72.5	17.0
Reclamation Division													
Number examined		33	21	36	69	16	36	29	91	71	203	190	420
S. haematobium	(%)	45.5	47.6	44.4	39.1	56.3	30.6	24.1	24.2	26.8	21.2	34.7	26.9
S. mansoni	(%)	42.4	—	36.1	1.4	43.8	5.6	37.9	3.3	40.8	6.4	40.5	4.5
Mixed infection	(%)	30.3	—	25.0	1.4	25.0	2.8	13.8	3.3	18.3	3.4	21.1	2.9
Bilharziasis	(%)	57.6	47.6	55.6	39.1	75.0	33.3	48.3	24.2	48.3	24.1	54.2	28.6
Control Division													
Number examined		20	2	70	36	58	39	107	67	208	140	463	284
S. haematobium	(%)	7.0	—	64.3	52.8	63.8	41.0	33.6	34.3	27.4	27.9	40.8	34.2
S. mansoni	(%)	50.0	50.0	51.4	66.7	44.8	56.4	39.3	55.2	38.0	49.3	41.7	53.9
Mixed infection	(%)	35.0	—	38.6	36.1	41.4	25.6	16.8	23.9	18.8	17.9	24.8	22.5
Bilharziasis	(%)	85.0	50.0	77.1	83.3	67.2	71.8	56.1	65.7	46.6	59.3	57.7	65.5

[a] Girls under 5 years of age are included in the totals.

TABLE 26

PREVALENCE OF INFECTION IN RELATION TO WASHING OF CATTLE

Activity	Persons infected wit						Prevalence of "bilharziasis"	
	S. haematobium		*S. mansoni*		both types			
	No.	%	No.	%	No.	%	No.	%
Washing	1 103	39.3	1 111	39.6	646	23.0	1 568	55.9
Not washing	1 974	21.6	1 613	17.6	862	9.4	2 725	29.8
Total	3 077	25.8	2 724	22.8	1 508	12.6	4 293	35.9

infections, mixed infection and " bilharziasis " for the project area as a whole; similar significant differences are found in all four divisions.

The distribution of persons engaged in this activity by the source of water used in washing was shown in Table 27. A total of 2857 persons, 24% of all those examined, washed cattle, mainly in canals.

Since the washing of cattle is predominantly performed by farmers and farm labourers, and as it has been shown earlier that these workers have higher prevalence rates than other occupational groups, an analysis has been made of prevalence rates of agricultural workers according to whether or not they were engaged in washing cattle. In this analysis, the Urban Division has been omitted, since very few persons in this division wash cattle. A very limited number of females in the Reclamation Division engaged in this activity.

TABLE 27

CATTLE-WASHING ACTIVITIES OF MALES AND FEMALES

Activity and place	Number engaged		
	Males	Females	Total
Washing cattle			
in drain	16	16	32
in canal	1 638	1 166	2 804
in piped water	9	12	21
Not washing	3 604	3 878	7 482
Not stated	705	900	1 605
Total	5 972	5 972	11 944

TABLE 28

PREVALENCE OF BILHARZIASIS IN MALE AND FEMALE FARMERS AND FARM LABOURERS IN RURAL DIVISION

Activity and source of water	Males					Females				
	No. examined	Percentage with				No. examined	Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"		*S. haematobium* infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Washing cattle										
in drain	14	0	28.6	0	28.6	13	0	23.1	0	23.1
in canal	641	41.7	36.8	22.0	56.5	481	29.3	27.7	16.2	40.7
in piped water	4	25.0	25.0	25.0	25.0	6	33.3	50.0	33.3	50.0
Not washing cattle	594	30.1	24.4	15.8	38.7	663	29.0	22.0	13.9	37.1

TABLE 29

PREVALENCE OF BILHARZIASIS IN MALE AND FEMALE FARMERS AND FARM LABOURERS IN CONTROL DIVISION

Activity	No. examined	Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Males					
Washing cattle in canal	429	51.5	65.5	39.2	77.9
Not washing cattle	334	41.6	44.0	26.0	59.6
Females					
Washing cattle in canal	401	43.6	52.1	28.7	67.1
Not washing cattle	374	36.9	37.7	22.2	52.4

In the Rural Division, where a few people washed cattle in drains or with piped water, the prevalence rates were as shown in Table 28. For males the rates are higher for those washing cattle in canals than for those not washing cattle. Females, however, have the same prevalence rates for *S. haematobium* infection whether they regularly wash cattle or not, but for *S. mansoni* the prevalence rate is higher for the group washing cattle. The number of persons washing cattle in drains or with piped water is too small to permit any relevant conclusions to be drawn.

For the Control Division, analysis has given the results shown in Table 29. For both sexes, the prevalence rates are higher in those washing cattle.

In the Reclamation Division, however, the differences in rates are not so marked for males (Table 30). It should be borne in mind that the farmers in this division are recent settlers from different parts of Egypt with differing levels of bilharziasis endemicity; this accounts for the rather erratic general pattern in this and other aspects noted in this division of the project area. In time a more stable pattern, as in the old-established Rural and Control Divisions, will no doubt evolve under undisturbed conditions.

TABLE 30

PREVALENCE OF BILHARZIASIS IN MALE FARMERS AND FARM LABOURERS IN RECLAMATION DIVISION

Activity	No. examined	Percentage with			
		S. haematobium infection	*S. mansoni* infection	Mixed infection	"Bilharziasis"
Washing cattle	306	34.3	20.6	12.4	42.5
Not washing cattle	479	37.0	15.0	9.0	43.0
Total	785	35.9	17.2	10.3	42.8

RÉSUMÉ

Dans ce deuxième article, les auteurs examinent les données obtenues concernant la prévalence des infections à *Schistosoma haematobium* et à *S. mansoni* dans la région du projet de lutte contre la bilharziose et dans les différents secteurs — rural et agricole, urbain et industrialisé, de peuplement et de défrichage, et témoin — qu'on peut y considérer. Les caractéristiques de la population (âge, sexe, activité, religion, coutumes, etc.) qui ont une influence sur les taux d'infection sont analysées pour l'ensemble de la région et pour chaque secteur.

L'enquête a fourni des taux globaux non corrigés de prévalence de la bilharziose de 59,5% dans la zone témoin, 35,9% dans les secteurs ruraux et de peuplement, 21% dans le secteur urbain. La prévalence augmente rapidement chez les enfants de 0 à 14 ans, puis tend à s'abaisser jusqu'à 40 ans pour se maintenir ensuite aux environs de 30%; le groupe d'âge 0-8 ans devrait fournir le groupe le plus sensible pour l'évaluation de l'efficacité des mesures de lutte. L'infection à *S. mansoni* s'acquiert plus lentement que l'infection à *S. haematobium* au cours de l'enfance et elle persiste plus longtemps chez les adultes. Les taux d'infection sont plus élevés dans le sexe masculin, sauf dans les groupes d'âge les plus jeunes. Chez les enfants d'âge scolaire, ils sont en raison inverse de la fréquentation scolaire. Si l'on tient compte de la catégorie professionnelle, les fermiers et les travailleurs agricoles, qui constituent 48% de la population, avec des taux d'infection respectifs de 50,6% et 41,6%, présentent le plus grand nombre d'infections; les taux d'infection sont les plus élevés chez les pêcheurs (60,4%) et les bateliers (52,0%).

Les musulmans, en raison des ablutions rituelles auxquelles ils sont tenus et qu'ils pratiquent surtout dans les canaux d'irrigation, présentent des taux d'infection plus de deux fois supérieurs à ceux des chrétiens. La même différence existe, pour les deux infections, entre les sujets qui pratiquent la natation et les autres, entre les femmes qui lavent le linge, surtout dans les canaux, et celles qui n'ont pas ce genre d'activité. On note également chez les jeunes garçons et les femmes qui, dans les fermes, sont chargés de laver le bétail des taux d'infection significativement plus élevés. Mais les bains et la natation représentent le facteur le plus important d'exposition à la maladie.

REFERENCES

Blair, D. M. (1956) *Bull. Wld Hlth Org.*, **15**, 203

Dakin, W. P. H. & Connellan, J. D. (1957) *Med. J. Aust.*, **1**, 257

Greany, W. H. (1952) *Ann. trop. Med. Parasit.*, **46**, 250

Kloetzel, K. (1962) *Amer. J. trop. Med.*, **11**, 472

Morley-Smith, F. M. & Gelfand, M. (1958) *Cent. Afr. J. Med.*, **4**, 287

Morley-Smith, F. M. & Gelfand, M. (1960) *Cent. Afr. J. Med.*, **6**, 447

Pesigan, T. P., Farooq, M., Hairston, N. G., Jauregui, J. J., Garcia, E. G., Santos, A. T., Santos, B. C. & Bessa, A. A. (1958) *Bull. Wld Hlth Org.*, **18**, 345

Sadun, E. H. (1963) *Ann. N. Y. Acad. Sci.*, **113**, 418

Sandwith, F. M. (1905) *The medical diseases of Egypt*, London, Henry Kimpton, vol. 1

Scott, J. A. (1937) *Amer. J. Hyg.*, **25**, 566

Scott, J. A. (1942) *Amer. J. Hyg.*, **35**, 337

Wright, W. H. (1950) *Bull. Wld Hlth Org.*, **2**, 581