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

1. Sampling Techniques and Procedures for Measuring the Prevalence of Bilharziasis

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A survey of the prevalence of bilharziasis has been made in the Egypt-49 Project Area, part of the Beheira province of Egypt with an area of 422 km² and a population of nearly 250 000 in 552 villages. The area has been classified into four divisions—Rural (Agricultural), Urban (Industrial), Reclamation (Resettlement) and Control, and subdivided into 23 sections bounded by irrigation canals or drains. Between April 1962 and March 1963, 11 944 individuals from 2573 households in 96 villages were examined.

An over-all 5 % two-stage cluster sample was obtained in each division, except in the Reclamation Division, where, because of the sparse population, a 10 % systematic sample was used. The age and sex distributions of the samples were representative of those of the population as a whole. Larger villages tended to be over-represented, but there is no evidence that bilharziasis prevalence is related to village size.

Bilharziasis was diagnosed by the detection of eggs in faeces or urine; details of the procedures are given. Examination of single samples, as in this study, leads to an underestimate of the extent of infection, by about 20 % for S. mansoni *infections and about 13 % for* S. haematobium; *this fact has to be borne in mind in interpreting the prevalence data obtained.*

This first paper of a series describes the sampling design and techniques employed in obtaining baseline data on the distribution of bilharziasis in the project area, in relation to various determinants. Detailed descriptions and discussions are provided where necessary, in order that identical methods may be employed in future assessments of control measures. Our chief concern has been to develop adequate but simple methods that give reproducible results under local field conditions.

Two teams, each consisting of one medical officer and two technicians, were employed initially and a further team was added later. The teams operated from three centres, the project central laboratories just outside the project area in Alexandria and two field laboratories, one in Kafr el Dawar town and one in the Abis area. Together they examined, on an average, 1000 faeces and urine samples a month, and the survey, which started on 29 April 1962, was completed on 6 March 1963. This was within the planned period of one year and included the examination of 11 944 individuals from 2573 households in 96 villages covered by the sample.

SAMPLING PROCEDURE

Area of the survey

The project area (Fig. 1), previously described by Unrau et al. (1965), was chosen after reconnaissance in 1959 by the senior author (MF) of several locations in the Nile Valley and Delta in which both *Schistosoma haematobium* and *S. mansoni* were

* The Egypt-49 Project is a pilot project jointly sponsored by the Government of the United Arab Republic, WHO and UNICEF. The main objectives are to evolve a methodology for the effective and economical control of bilharziasis under Egyptian conditions and to develop the project to serve as a field demonstration and training centre.

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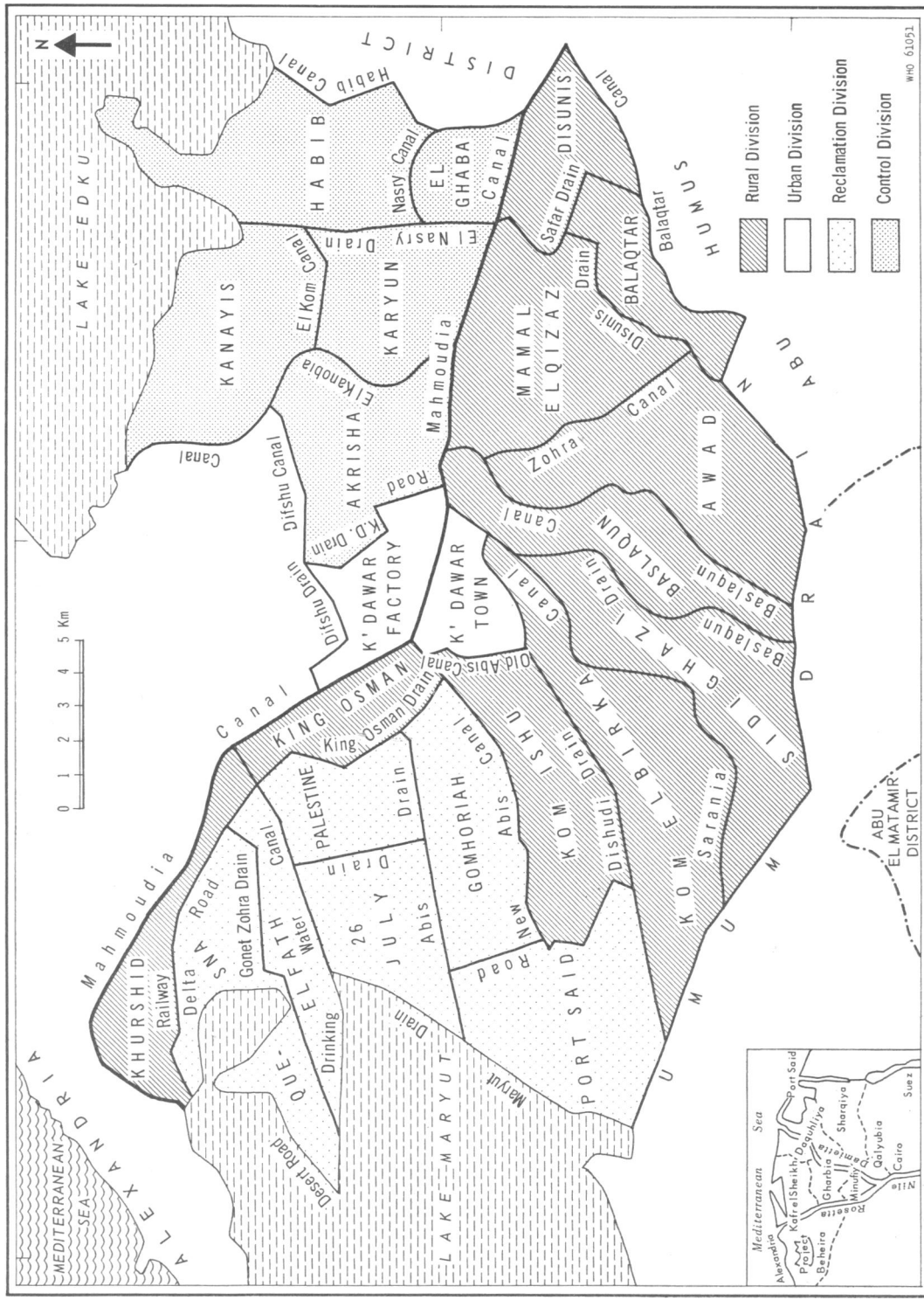


FIG. 1
LOCATION OF THE PROJECT AREA AND ITS FOUR DIVISIONS AND 23 SECTIONS

TABLE 1

AREA, POPULATION AND NUMBER OF VILLAGES IN PROJECT DIVISIONS AND SECTIONS

Project Area (422 km² 225 574 552 villages)

Rural Division (205 km² 91 582 351 villages)				Urban Division (18.5 km² 72 897 41 villages)				Reclamation Division (108 km² 17 746 33 villages)				Control Division (90.5 km² 43 369 127 villages)			
Section	Area (km²)	Pop.	No. of villages	Section	Area (km²)	Pop.	No. of villages	Section	Area (km²)	Pop.	No. of villages	Section	Area (km²)	Pop.	No. of villages
Disunis	12.5	6 543	28	Kafr el Dawar factory	10.5	48 539	25	Quesna	17.3	4 075	5	Habib	18.5	6 220	19
Balaqtar	11.3	3 530	24					El Fath	11.4	2 728	7	El Ghaba	6.8	3 036	10
Mamal el Qizaz	26.7	15 742	48	Kafr el Dawar town	8.0	24 358	16	Palestine	12.9	4 780	6	Kanayis	20.2	7 997	20
Awad	31.6	8 804	54					26 July	18.7	3 500	1	Karyum	18.8	8 141	37
Baslaqun	20.7	14 213	38					Gomhoriah	20.9	1 228	10	Akrisha	26.2	17 975	41
Sidi Ghazi	26.6	12 583	42					Port Said	26.8	1 435	4				
Kom el Birka	29.9	8 506	45												
Kom Ishu	22.0	6 890	35												
Khurshid	13.4	7 319	19												
King Osman	10.3	7 432	18												
Approximate sample size		4 600				3 650				1 800				2 150	

endemic and where no snail-control measures had been undertaken and no significant chemotherapy used. It covers 422 km² (approx. 100 000 feddans) of the two irrigation districts of El Raml and Kafr el Dawar, in the Beheira province of the Nile Delta. It has a population of nearly 250 000 in 552 villages. It constitutes a reasonable epidemiological entity, with distinctive and characteristic features.[1]

The boundaries of the area were defined on a 1: 25 000 scale map and the area was divided into *four divisions*: Rural (Agricultural), Urban (Industrial), Reclamation (Resettlement) and Control, based on distinctive features in relation to population characteristics and environmental factors (physical, social and biological). Maps existed which were sufficiently detailed and accurate to enable the four divisions to be divided into *23 sections*, with their boundaries demarcated by irrigation canals or drains.

The first three divisions served as the operational area; the Control Division, as the name indicates, constituted the reference or comparison area.

Table 1 indicates the area, population and number of villages in each division and section of the project area. This is based on a list of villages for each section, with the population as enumerated in the 1960 National Census, adjusted up to the first quarter of 1962.

Fundamental domains and strata

Although the four divisions constitute the fundamental *domains* of our study, it was considered necessary to establish the prevalence of bilharziasis at sectional levels in order to evaluate experimental control measures envisaged in certain sections. It was therefore decided to utilize the sections as *strata* for the purposes of sampling within each division.

Taking into consideration the results of a preliminary survey carried out in the area during January to March 1962, as well as other factors, including cost (American Public Health Association, 1954), it was decided that the over-all sampling fraction should be 5% for each stratum, except in the Reclamation Division. In this division it was decided to draw a 10% systematic sample, for two reasons: (*a*) most of the new settlers in the division arrived during the last ten years from provinces of Egypt with lower rates of bilharziasis, especially of *S. mansoni* infection, than that expected for the project area as a whole and (*b*) the division has a relatively sparse population.

[1] For further details of the distinctive features of the different divisions, see the paper on page 293 of this issue.

The populations and the sizes of the expected sample in the four divisions are shown in Table 1.

Selection of 5 % cluster samples

A two-stage cluster sample was drawn from each section (stratum) as follows.

(1) A cumulative list of the population was prepared for each stratum, the village populations being listed in the same order as in the *Village Register*. A random sample (Fisher & Yates, 1957) of villages (first-stage units), representing 20% of the section's population, was selected, with a probability proportional to the size of their population. The last selected village was included in the sample if the total population of the selected villages thereby came closer to 20% of the total population of the section; otherwise it was excluded.

(2) It was not considered necessary to form substrata of villages classified into size groups. However, whenever a village with a population of 1500 or over came into the sample, it was split into smaller units. A visit was made to the village by the sanitary engineer, who estimated the population of each block of houses and, using these figures, split up the village into units of approximately equal size. The border of the units was, as far as possible, drawn in the east-west direction, with each unit containing less than 1500 persons.

(3) A sketch map was prepared of each first-stage unit selected, showing the location of every household (dwelling) in it. The definition of household adopted for the 1960 National Census of Egypt was also used here.[1] The households were numbered consecutively in a spiral pattern and the numbers painted on the doors.

(4) A 25% sample of households (second-stage units) was randomly selected from each of the selected first-stage units marked on the map. All persons in the selected households were eligible for examination.

Thus each domain of study consisted of a number of sections (strata) and the sample, drawn in two stages as described, provided a stratified 0.05 (0.25 × 0.20) probability sample of the domain.

[1] A building or a part of a building which has one or more separate entrances, from outside or inside the building, and is fit for human habitation, whether occupied or not at the time of the Census. The household may be a separate building or may comprise one or more flats consisting of one or more rooms. The household may be, e.g., a hut, a tent, a bungalow or a boat. It may be inside a place which is not itself a dwelling, e.g., the living quarters of a guard with his family in an institution.

Selection of systematic sample in Reclamation Division

A systematic 10% sample was selected separately from each section in the Reclamation Division. A complete list of the households in all the villages in the section was prepared and the dwellings were numbered consecutively. One household was then selected at random from the first ten on the list; all other households whose serial numbers ended in the same digit as the first household were included in the sample. As in the other divisions, all persons in a selected household were eligible for examination.

Preliminary study, record forms and method of handling data

Some indication of the epidemiological situation in the area was sought through an exploratory field survey conducted in two sections (Khurshid and King Osman) of the Rural Division in January to March 1962. The importance of such preliminary studies has often been stressed (Yates, 1960; Gordon, 1963), yet they are too frequently neglected. The initial survey provided useful information on the variability of many factors influencing the prevalence of infection and the rates of infection to be expected, and enabled appropriate sample sizes and procedures to be chosen. Moreover, it enabled the technicians to become conversant with the field procedure and techniques and established the adequacy of the tentative record forms. Not least, it showed the desirability of a preliminary educational programme to gain the co-operation of villagers in order to reduce non-response to a minimum and enabled the procedures for collection and transport of samples to be standardized and survey schedules finalized.

The main field survey was started on 29 April 1962 and was completed on 6 March 1963. Two record forms were used. A " Household Form " requested information on the name, sex, age, relationship to head of household and occupation (or school) of each member of the household. An " Individual Form " (Fig. 2) provided for the recording of detailed information on each person studied. Instructions and explanatory notes for the completion of these forms and on methods of checking records were provided for field personnel.

The completed forms were serially numbered and the data edited, coded and transferred to IBM 8D column punch cards. Cards were checked and the data tabulated by means of data-processing equipment.

FIG. 2

INDIVIDUAL INFORMATION FORM FOR BILHARZIASIS PREVALENCE SURVEY

I

Division .....

Section .....

Village .....

Household number .....

Individual number .....

II

Name .....

Age Sex | 1 M | 2 F |

Religion | 1 M | 2 Chr | 9 Other |

Marital status | 1 S | 2 M | 3 Prev. M | 9 No inf. |

III. Occupation

None or other	0
Landowner	1
Farmer	2
Farm labourer	3
Fishing	4
Boatman	5
Water carrier, washerman	6
Domestic servant	7
Skilled labourer	8
Other manual	9
Clerical	X
Professional	Y

IV. Education

Preschool age	0
School (attending school)	1
age (not attending school)	2
Does not read or write	3
Reads only	4
Reads and writes	5
Primary	6
Preparatory	7
Secondary	8
Higher	9
No information	X

V. Housing, Sanitation

Type	Stone, redbrick	1
	Mud, mudbrick	2
	Other	3
Latrine	Present and used	1
	Present, not used	2
	Not present	3
Stable	Present, separate	1
	Present, not separate	2
	Not present	3
Water supply	Drain	1
	Canal	2
	Lake	3
	Well	4
	Pump	5
	Piped	6
	Other	7
Swimming	Drain	1
	Canal	2
	Lake	3
	Other	4
	Not swimming	5

Washing clothes and utensils	Drain	1
	Canal	2
	Lake	3
	Well	4
	Pump	5
	Piped	6
	Other	7
Washing cattle	Drain	1
	Canal	2
	Lake	3
	Well	4
	Pump	5
	Piped	6
	No cattle	7
Fishing	Drain	1
	Canal	2
	Lake	3
	Other	4
	None	5

VI. Examination of stool

Collected

date .....

hour .....

Examined

date .....

hour .....

Stool consistency

Formed 1
Mushy 2
Liquid 3

S. mansoni

Pos. 1
Neg. 2

Ova No./s...

Smear + 1 1

Smear + 2 2

Sedimentation + 3

S. haematobium

Pos. 1
Neg. 2

Ova No./s...

Ancylostoma

Pos. 1
Neg. 2

Ascaris

Pos. 1
Neg. 2

Trichuris

Pos. 1
Neg. 2

Oxyuris

Pos. 1
Neg. 2

Taenia

Pos. 1
Neg. 2

Hetrophyes

Pos. 1
Neg. 2

Other (specify)

.....

Pos. 1
Neg. 2

Other (specify)

.....

Pos. 1
Neg. 2

VII. Examination of urine

Collected

date .....

hour .....

Examined

date .....

hour .....

Haematuria

Mild	1
Moderate	2
Severe	3

S. haematobium

Pos.	1
Neg.	2

Ova/smear

S. mansoni

Pos.	1
Neg.	2

Ova/smear

VIII. Previous treatment for bilharziasis

Not received	1
Received	2

Last course received year .....

Complete	1
Not complete	2

Recorded by

Date Signature

I-IV .....

V .....

VI-VII .....

VIII .....

TABLE 2
AGE AND SEX DISTRIBUTION OF POPULATION IN THE PROJECT AREA, 1962 [a]

Age-group (years)	Number			Percentage distribution			Cumulative %
	Males	Females	Total	Males	Females	Total	Total
<1	3 440	3 295	6 735	3.0	2.9	3.0	3.0
1-4	16 034	14 485	30 519	14.2	12.9	13.5	16.5
5-9	18 906	18 280	37 186	16.7	16.3	16.5	33.0
10-14	15 323	14 667	29 990	13.5	13.0	13.3	46.3
15-19	9 607	9 064	18 671	8.5	8.1	8.3	54.6
20-24	6 959	7 950	14 909	6.2	7.1	6.6	61.2
25-29	7 223	9 388	16 611	6.4	8.3	7.4	68.6
30-34	7 690	7 776	15 466	6.8	6.9	6.9	75.5
35-39	8 512	7 517	16 029	7.5	6.7	7.1	82.6
40-44	5 667	4 822	10 489	5.0	4.3	4.6	87.2
45-49	4 165	3 870	8 035	3.7	3.4	3.5	90.7
50-54	3 580	3 522	7 102	3.2	3.1	3.1	93.8
55-59	1 895	2 111	4 006	1.7	1.9	1.8	95.6
60-64	2 031	2 626	4 657	1.8	2.3	2.1	97.7
65-69	650	882	1 532	0.6	0.8	0.7	98.4
70-74	707	1 184	1 891	0.6	1.1	0.8	99.2
>74	702	1 044	1 746	0.6	0.9	0.8	100.0
Total	113 091	112 483	225 574	100.0	100.0	100.0	

[a] UAR Population Census 1960 (with minor adjustments for subsequent changes).

Representativeness of sample

The representativeness of the sample is indicated by the close correspondence between the age and sex distributions of the sample and those of the population as a whole (Tables 2 and 3). A χ^2 test showed that the difference in age distribution between the total population and the sample is not statistically significant. By coincidence the number of males and females examined was identical.

Similar breakdown of the data for the four project divisions showed insignificant differences between the age and sex distributions of their populations and those of the samples. There was therefore no need to apply any corrections in the inter-stratum and inter-domain comparisons of prevalence rates.

It is desirable here to refer briefly to a comprehensive cross-sectional bilharziasis survey conducted in Egypt during the early 1930s, under the auspices of the Rockefeller Foundation, in co-operation with the Department of Public Health of the Government of Egypt (Scott, 1937). The aim was to obtain information on the proportion of people infected with *S. haematobium* or *S. mansoni* and their distribution in different parts of the country, in contrast to our objective of obtaining base-line data for a specific area to enable the changes brought about by subsequent control measures to be assessed.

The data recorded by Scott cannot be utilized to evaluate any change in the situation without taking into account the corrections he applied to the original data. The need for corrections arose from the sampling procedures used in his house-to-house surveys, in which nearly 40 000 persons were examined from 125 villages throughout the entire country. Scott's preliminary estimates, which were restricted to the "rural" portions of the general

TABLE 3
AGE AND SEX DISTRIBUTION OF SAMPLE EXAMINED FOR PREVALENCE OF BILHARZIASIS IN THE PROJECT AREA

Age-group (years)	Number examined			Percentage distribution			Cumulative %
	Males	Females	Total	Males	Females	Total	Total
<1	178	175	353	3.0	2.9	3.0	3.0
1-4	844	867	1 711	14.1	14.5	14.3	17.3
5-9	1 082	1 001	2 083	18.1	16.8	17.4	34.7
10-14	828	804	1 632	13.9	13.5	13.7	48.4
15-19	513	441	954	8.6	7.4	8.0	56.4
20-24	295	398	693	4.9	6.7	5.8	62.2
25-29	299	467	766	5.0	7.8	6.4	68.6
30-34	406	438	844	6.8	7.3	7.1	75.7
35-39	361	345	706	6.0	5.8	5.9	81.6
40-44	387	318	705	6.5	5.3	5.9	87.5
45-49	249	203	452	4.2	3.4	3.8	91.3
50-54	226	186	412	3.8	3.1	3.4	94.7
55-59	114	89	203	1.9	1.5	1.7	96.4
60-64	118	130	248	2.0	2.2	2.1	98.5
65-69	37	59	96	0.6	1.0	0.8	99.3
70-74	25	33	58	0.4	0.5	0.5	99.8
>74	10	18	28	0.2	0.3	0.2	100.0
Total	5 972	5 972	11 944	100.0	100.0	100.0	

population and did not adequately represent districts with different prevalence rates, had therefore to be adjusted.

Scott (1937) applied systematic corrections to the figures obtained by his sampling procedures. Therefore, any comparison with data from subsequent surveys in the country, similarly conducted but not duly weighted for methods of sampling, is impossible. We have, through the sampling design of our limited surveys, eliminated the need for such adjustments, and as long as techniques for the examination of urine and faeces remain identical, comparisons of data in order to evaluate control measures should be statistically valid without the need for corrections.

Over-representation of larger villages

As explained earlier, the first-stage units (in the Rural, Urban and Control Divisions) were selected with a probability proportional to their population. The second-stage units have been selected from each first-stage unit at a constant sampling fraction; therefore, the persons living in the larger first-stage units had a larger probability of being included in the sample. However, this is unlikely to have biased the calculated prevalence rates, since there is no clear relationship between prevalence of bilharziasis and size of village.[1]

Rate of " non-response "

Arrangements to revisit households were made in case of non-response, especially to examine young children; of a total sample of 12 055 persons, 11 944 were examined, an overall " non-response " rate of 0.9%.

Of the 111 persons not examined, 26 were infants who were not able to produce specimens. Other non-respondents included 15 soldiers away on duty. Ten

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

persons were in hospital, 14 had left the village and 7 died during the period of the survey. For 39 persons (mostly infants and young children) the reason for non-response is not available and in the case of six individuals record forms were inadvertently not completed.

Reliability of estimates

In this study two kinds of investigation are involved. One consists in the description of the characteristics of the population (enumerative investigation) and here we have limited our computations to the confidence limits for the prevalence of bilharziasis in the four divisions. The statistical procedures are those discussed by Cochran (1953). The other kind of investigation may be called analytical, since it endeavours to determine relationships within the population and underlying causal factors that may have led to certain observed differences. In this case, we determine whether two or more sets of observations can be regarded as drawn from the same infinite population, and the simple random-sampling formulae have been applied.

TECHNIQUES EMPLOYED IN DIAGNOSIS OF BILHARZIASIS

General

Bilharziasis can be diagnosed by the detection of eggs in urine, faeces, rectal snips and in liver biopsy or by immunobiological tests. There is no doubt that the *specificity* and *sensitivity* of diagnostic techniques are of paramount importance, but in epidemiological field surveys *simplicity* and *uniformity* are no less significant (Beaver, 1961; Jachowski & Anderson, 1961). We did not intend to evaluate the different methods of urine and faeces examination available but rather to adopt a method judged best suited to local field conditions, the skill of the technicians and the purpose of our study. The judgement of suitability was based on a preliminary examination, during the exploratory phase, of urine and faeces, utilizing a variety of techniques, including egg counts.

Details of techniques to be adopted have been clearly and unambiguously laid down to establish a standard procedure for use in any future evaluation of control programmes.

Collection of samples

Samples of faeces were collected in thick paper cartons of 250-ml capacity, and samples of urine in screw-capped 250-ml bottles, duly numbered and handed over the day before collection to the heads of the households and collected the next morning. The importance of the correct identification of the source of the samples was stressed to villagers by the medical officer and technicians, who visited the village together, during both the distribution of containers and the collection of samples. Checks were made in the early stages of the survey to ensure that the samples related to the individuals concerned; the repeatability of the general pattern of the age- and sex-specific rates of infection in individual divisions and sections (to which reference will be made later) provided a reliable indication that samples were not being wrongly identified.

The samples of urine and faeces *voided early in the morning* were collected and transported in specially designed wooden boxes (Fig. 3) each holding 42 samples, which were convenient to carry and considerably reduced fly nuisance. Samples reached the laboratory between 10 a.m. and 11 a.m. and examinations were completed by 2 p.m. each day.

Procedure for examination of faecal samples

In the examination of faeces a combination of two methods was used: (*a*) two direct faecal smears (Beaver, 1949, 1950 [without the precise measurements of smear density with a photometer]) and (*b*) concentration by gravity sedimentation in a 0.5% aqueous solution of glycerol. Details of the procedures, in which the technicians were well grounded in advance, were issued to them and are reproduced below.

Direct faecal smear

(1) Place one drop of saline on the centre of the slide (25 mm × 75 mm).

(2) With a toothpick select 2 mg (about 2 mm^3) of " pure " faeces, i.e., avoid non-faecal elements.

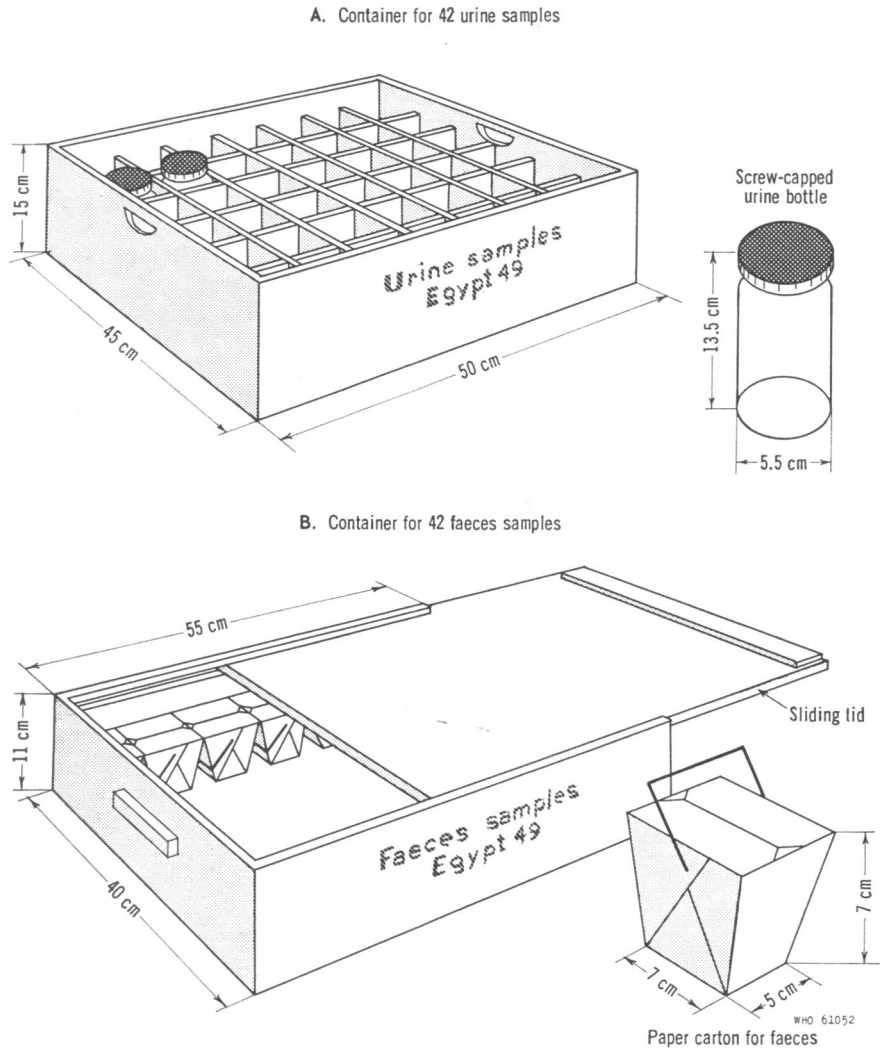
(3) Stir the sample into the saline (0.85% sodium chloride), making an even suspension without spreading the saline.

(4) Drag coarse matter, e.g. fibres, seeds, sand, to the edge of the suspension and remove it.

(5) Cover with a 22 mm × 22 mm cover-glass.

(6) If the preparation is satisfactory in all respects, examine it; if not, discard it. No time should be wasted on a preparation that can only yield doubtful results if negative. A satisfactory smear is one that is of uniform density and contains the maximum of observable faecal elements without obscuring an object within the size-range of those being searched

FIG. 3
WOODEN CONTAINERS FOR TRANSPORTING URINE AND FAECES TO THE LABORATORIES



for. The smear must not cause the cover-glass to tilt or contain large air bubbles.

(7) Examine the entire preparation systematically, in successive adjacent swaths, with the low power (100×) of the microscope. Questionable objects may require inspection under higher magnification, but in properly prepared smears schistosome and other helminth eggs can be accurately identified and counted under low power.

(8) Record the number observed in the smear (2 mg) and note this number as "ova per smear" (Ova No./s) on the survey form.

(9) Record the consistency of stools as (*a*) formed, (*b*) mushy or (*c*) liquid.

If the first smear is negative, a second smear is prepared and examined in exactly the same way. If the second smear is also negative, a further sample of faeces is examined by the sedimentation method.

Sedimentation procedure

(1) Thoroughly comminute 10 g of stool in 200 ml of a 0.5% solution of glycerol in water.

(2) Pour through two layers of surgical gauze (two-ply) into a conical sedimentation glass (300-ml capacity).

(3) Allow to sediment for 30 minutes and then decant the supernatant.

(4) Resuspend the sediment in 0.5% glycerol, allow to sediment for 20 minutes, and again decant the supernatant.

(5) Resuspend a third time in 0.5% glycerol, allow to stand for 10 minutes and decant the supernatant.

(6) Remove sediment from the bottom layer with a pipette, transfer two drops to a slide, add a 22 mm × 22 mm cover-glass and systematically examine the entire preparation; count the eggs under the cover-glass and record the result as (Ova No./s) on the form.

A negative report should not be made until the entire sediment has been examined.

Procedure for examination of urine samples

(1) Shake urine well before pouring 150 ml into a conical flask (300-ml capacity).

(2) Leave for 20 minutes to allow sediment to settle out.

(3) Transfer two drops of sediment with a pipette to a slide (50 mm × 75 mm) and cover with a 22 mm × 22 mm cover-glass.

(4) Examine the whole field under low power, counting the ova in the area covered by the cover-glass; record the number on the form.

A negative report should not be made until the entire sediment has been examined.

Infections detected in relation to techniques employed

Of the 11 944 faecal samples examined, 2723 (22.8%) were found positive. Of the positive *S. mansoni* infections, 44.2% were detected in the first smear, 3.8% in the second and 49.1% by sedimentation. In the remaining 2.9% of cases this record was inadvertently not made. This indicates that the use of faecal smears alone would have led to half of the *S. mansoni* infections being missed; on the other hand, the detection of nearly half of these infections by faecal smear meant that less time was consumed than if sedimentation alone had been used. When ova were not detected in the first smear, comparatively few were found in the second.

A single case of *S. mansoni* infection was detected in urine only and 34 infections were detected both in faeces and in urine, mostly among children in the younger age-groups. Of the 3077 *S. haematobium* infections, 3050 were detected by the urine-sedimentation technique, four in faeces only and 23 both in faeces and in urine, over 50% of these in the youngest age-group. The possibility of urinary contamination of faeces in the latter case (especially in females) has to be borne in mind.

Assessment of missed cases

An important consideration in the selection of a method to be used in a field survey, unless this is very limited in scope, is the time and cost involved; even accuracy has to be sacrificed to a certain extent on this account. No one technique will ensure that all cases of bilharziasis will be discovered by the examination of a single specimen of urine or faeces. In order to assess the proportion of cases discovered by the examination of a single specimen in the survey to the proportion discoverable by repeated examination, urine and faeces were collected from 90 individuals on seven consecutive days and examined by exactly the same techniques employed during the survey.

No positive cases were detected after the examination of the third-day samples and it was concluded that at least three successive examinations of faecal and urinary samples from the same individuals are necessary if the maximum number of cases is to be detected by the present techniques. It was noted that such repeated examinations would have increased the number of detected *S. mansoni* infections by 25% and those of *S. haematobium* infections by 15.2%, i.e., 79.7% of those positive for *S. mansoni* and 86.8% of those positive for *S. haematobium* were detected on the first examination. This has to be borne in mind in interpreting the data obtained on the prevalence of bilharziasis in the project area.

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RÉSUMÉ

Dans ce premier article d'une série d'études sur l'épidémiologie des infections à *Schistosoma haematobium* et *S. mansoni* dans la région du projet pilote entrepris dans la partie nord-ouest du delta du Nil sous les auspices du Gouvernement de la République Arabe Unie, de l'OMS et du FISE, les auteurs exposent les techniques d'échantillonnage et les méthodes d'examen et d'analyse utilisées pour établir les taux de prévalence des infections bilharziennes.

Dans la région du projet vivent près de 250 000 habitants répartis en 552 villages, sur 422 km². L'échantillonnage a été effectué par randomisation, de façon que tous les individus aient la même chance d'y figurer, et en deux étapes. Le premier stade a consisté en une sélection de villages représentant 20% de la population; le second en une sélection de 25% des familles des villages choisis, dont tous les membres ont été examinés. Finalement, les examens ont donc porté sur 5% de la population, sauf dans une zone de peuplement où, en raison de la faible densité de population, un échantillon correspondant à 10% des habitants a été systématiquement soumis à l'enquête. Cette méthode assure une représentativité très satisfaisante des échantillons sous le rapport du classement par groupes d'âge ou par sexe. La participation des plus grands villages tendait à être trop forte du fait que les villages choisis au premier stade l'ont été avec une probabilité proportionnelle à leur population, mais il n'est apparu aucun lien entre la prévalence de la bilharziose et l'importance des villages.

Les méthodes de diagnostic de la bilharziose sont décrites en détail, afin d'assurer une uniformité lors de l'estimation des taux de prévalence avant et après l'application des mesures de lutte visant à diminuer la transmission de l'infection: examen direct des selles, répété en cas de résultat négatif, et examen après sédimentation, pour la recherche de *S. mansoni*; examen poussé du sédiment urinaire, pour la mise en évidence de *S. haematobium*. Sur 11 944 échantillons de selles, 2723 (22,8%) étaient positifs pour *S. mansoni*, les résultats étant obtenus dans la proportion de 44,2% des cas lors du premier examen, 3,8% lors du second, et 49,1% après sédimentation. On décela d'autre part 3077 cas d'infections à *S. haematobium*, dont 3050 par sédimentation de l'urine, 4 par l'examen des selles, et 23 à la fois par l'examen des selles et de l'urine. L'examen de prélèvements uniques entraîne une sous-évaluation de l'étendue de l'infection d'environ 20% pour les infections à *S. mansoni* et d'environ 13% pour celles à *S. haematobium*.

Les auteurs soulignent que les corrections nécessaires doivent être faites avant de comparer les informations obtenues par la méthode d'échantillonnage; des enquêtes menées en Egypte ont montré que la prévalence des deux formes de bilharziose peut varier non seulement d'un district à un autre, mais aussi entre villages d'une région donnée, éloignés seulement de quelques kilomètres.

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