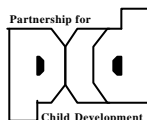


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GUIDELINES FOR THE EVALUATION OF SOIL-TRANSMITTED HELMINTHIASIS AND SCHISTOSOMIASIS AT COMMUNITY LEVEL

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1. Background

1.1 Introduction

The World Health Organization (WHO) estimates that more than one billion of the world's population is chronically infected with soil-transmitted helminths and 200 million are infected with schistosomes. The high prevalence of these infections is closely correlated with poverty, poor environmental hygiene and impoverished health services.

Morbidity due to soil-transmitted helminthiasis and schistosomiasis is relatively easy to control if with simple intervention measures. Children and pregnant women are particularly vulnerable to soil-transmitted helminthiasis which decreases work capacity¹ and fitness and especially in the case of children influences their nutritional status causing growth retardation² and reduced learning ability³.

WHO has developed a clear policy for the control of soil-transmitted helminthiasis and schistosomiasis. This has resulted in the establishment of several major control programmes and in the development of *Partnership for Child Development*. The Partnership has brought together donors, countries, agencies and institutions to explore ways of improving the health and education of school-age children in developing countries through control of soil-transmitted helminths and schistosomes.

In 1996 WHO recommended that any programme aimed at controlling morbidity due to soil-transmitted helminthiasis should begin with a baseline survey⁴. The same advice applies in the case of schistosomiasis.

- Baseline surveys provide a sound basis for estimating the present status and the need for intervention in a population.
- Baseline surveys produce essential data to guide the development of control programmes at national, regional or district levels.
- Follow-up surveys monitor the impact of a control programme.

WHO assigns great importance to baseline and follow-up surveys of soil-transmitted helminthiasis and schistosomiasis and assists Member States in planning and implementing control activities.

1.2 Aims of the manual

This manual has been compiled to **assist** health planners at national, regional or district levels in the organization, management and evaluation of surveys on soil-transmitted helminthiasis and schistosomiasis for the development and implementation of control activities.

The aims of the manual are:

- to offer a systematic approach for collecting and reporting data;
- to improve comparability of data collected in a wide range of environments;
- to encourage health planners in developing countries to use standard measurements as a basis for planning and evaluating control programmes for soil-transmitted helminthiasis and schistosomiasis.

To achieve these aims the manual provides:

- guidelines on a rational and economic sampling design suitable for evaluating soil-transmitted helminthiasis and schistosomiasis infections and organizing appropriate control measures;
- a description of practical procedures for sample collection;
- information about the logistics which are necessary for conducting an appropriate survey.

The manual is offered to facilitate the work of health planners. The manual should be considered as guide and it will be necessary to adapt the suggestions given here to the specific social and epidemiological situations in individual country/area.

1.3 Information on soil-transmitted helminthiasis

1. Prevalence and distribution

- Population at risk: 2 billion people
- Population infected: more than 1 billion

2. Major soil-transmitted helminths

Ascaris lumbricoides: infected people with associated morbidity 250 million, annual mortality 60,000

Trichuris trichiura: infected people with associated morbidity 46 million, annual mortality 10,000

Ancylostoma duodenale and *Necator americanus* (hookworms):
infected people with associated morbidity 151 million,
annual mortality 65,000

3. Infections are associated with

- Poverty and poor living conditions
- Inadequate sanitation and water supplies
- Soil quality and climate
- Poor personal and environmental hygiene
- Poor health awareness

4. Infection manifestations

- Hookworms cause blood loss and are one of the major contributors to iron deficiency anaemia.
- Soil-transmitted helminth infections cause malnutrition, anaemia and growth retardation as well as higher susceptibility to other infections.
- Soil-transmitted helminths are highly aggregated in the population, with many individuals harbouring a few worms while a smaller proportion harbours disproportionately large worm burdens. Field studies demonstrate that 70% of the worms occur in 15-30% of the people.⁵ Whilst the group of heavily infected people is a minority, it suffers most of the consequences of the infections and is also the major source of infection for the community.

Burden of diseases

Infections reduce work capacity and impede concentration. In children, infection reduces cognitive development and increases absenteeism from school. Infections also increase maternal and foetal morbidity and mortality.

6. Treatment⁶

Four drugs are recommended by WHO for treatment:

- albendazole 400 mg
- levamisole 2.5 mg/kg
- mebendazole 500 mg
- pyrantel 10 mg/kg

All are well-known, safe and effective drugs that have been used widely in recent years for the treatment of *A. lumbricoides*, *T. trichiura* and hookworms.

A single dose oral anthelmintic treatment can also be given to pregnant and lactating women, but, as a general rule, drugs should not be given in the first trimester of pregnancy.⁷

Three strategies are recommended for the use of chemotherapy in the treatment of infections of soil-transmitted helminthiasis in the community.

- UNIVERSAL population level application of anthelmintic drug in which the community is treated irrespective of age, sex, infection status or other social characteristic
- TARGETED group level application of anthelmintic drug where the group may be defined by age, sex or other social characteristic, irrespective of infection status
- SELECTIVE individual level application of anthelmintic drug where selection is based on diagnosis of current infection

1.4 Information on schistosomiasis

1. Prevalence and distribution

- Population at risk: 500-600 million people
- Population infected: over 200 million people

2. Schistosomes

<i>Schistosoma haematobium</i>	(urinary schistosomiasis)
<i>Schistosoma mansoni</i>	(intestinal schistosomiasis)
<i>Schistosoma japonicum</i>	(intestinal schistosomiasis)
<i>Schistosoma mekongi</i>	(intestinal schistosomiasis)
<i>Schistosoma intercalatum</i>	(intestinal schistosomiasis)

120 million are symptomatic and up to 20 million suffer the severe consequences of the infection; annual mortality: 20,000

3. Infections are associated with

- poverty and poor living conditions
- inadequate sanitation and water supply
- development of water resource (without consideration of health impact)
- poor health awareness

4. Infection manifestations⁸

- *Schistosoma haematobium* infection is associated with haematuria
- *Schistosoma mansoni* chronic infection leads to liver fibrosis and cirrhosis in a large proportion of untreated individuals
- mortality is mostly due to bladder cancer associated with urinary schistosomiasis and with cirrhosis and portal hypertension associated with intestinal schistosomiasis
- in most endemic areas, the highest intensities of infection are found in children between 5-15 years of age
- the geographical distribution of the infection and of severe morbidity may be very localized (**focal** distribution).

5. Treatment⁶

Two drugs are presently available and are recommended for treatment:

- praziquantel 40 mg/kg body weight: active against all schistosomes
- oxamniquine 15-30 mg/kg body weight in two divided doses active only for *S. mansoni*

1.5 Diagnosis

Parasitological diagnosis of soil-transmitted helminthiasis and schistosomiasis is made by analyzing stool or urine samples for presence of eggs.

The use of the WHO *Bench Aids for the Diagnosis of Intestinal Parasites*⁹ is suggested as a reference for laboratory technicians.

1.5.1 Stool examination

The **Kato-Katz technique**⁹ enables the diagnosis of soil-transmitted helminthiasis and intestinal schistosomiasis. The technique consists of a microscopic examination of a fixed quantity of faecal material; this enables a semi-quantitative diagnosis based on the number of eggs in faeces. This is a useful indirect measure of the worm burden; usually the greater the egg count the greater the number of female worms present.

1.5.2 Urine examination

The **filtration technique**¹⁰ consists of a microscopic examination of a filter used to collect the eggs of *Schistosoma haematobium* from 10 ml of urine. Haematuria is an important sign of urinary schistosomiasis in endemic areas. Macro- and micro-haematuria may be detected by visual observation or with the aid of a reagent strip. Indirect diagnosis, using a reagent strip, has been shown to be highly sensitive and specific in endemic areas.¹¹ For both filtration and reagent strip techniques the time required for examination allows rapid identification of positive cases.

2. The Survey

The survey provides information concerning the burden of soil-transmitted helminthiasis and schistosomiasis in a community, and enables judgement to be made as to the need for intervention. Data collected from children attending schools are generally representative of the situation in the community.

It is recommended that in all phases of surveys and implementation of control programmes existing health structures should be utilized and personnel should be involved where possible. Surveys may be organized by health planners of Ministries of Health (MoH), nongovernmental organizations (NGOs), universities and other institutions, to collect data at national, regional and district levels.

On the basis of the results of the survey, potential interventions include anthelmintic treatment, nutritional supplementation, appropriate sanitation and information, education and communication (IEC) strategies.

2.1 Planning

The planning phase should include a careful statement of the aim of the survey and should comprise a collection of any relevant demographic and epidemiological data already available. Sources of this information could be literature reviews, if available, and reports from MoHs or peripheral health services.¹²

It is important, during this phase, to plan transportation and supply procurement with realistic accuracy. the success of control measures depends on extremely thorough planning.

Permission to examine population groups must be obtained, usually from a peripheral, regional or national health authority. If school populations are to be examined, the school authorities should also be approached and the purpose of the study explained to them. Individuals to be surveyed must be informed about the purpose of the study (in the case of children, the parents or guardians). Their approval of the programme should be obtained to ensure full cooperation.

Following the principle of “**no survey without service**”, the team should be equipped for the treatment of positive cases of schistosomiasis and soil-transmitted helminths and other diseases sometimes diagnosed during the actual survey. If the prevalence and intensity of infections are high and universal/targeted treatment is the indicated strategy, every child in the school should be treated, even if only one class is surveyed.

2.1.1 The team

A team composed of 1 team leader, 2 laboratory technicians and 1 auxiliary worker should be sufficient to collect data on both soil-transmitted helminths and schistosomes from at least 50 schoolchildren per day.

Tasks and responsibilities of team members:

The team leader is responsible for

- training the team and explaining the survey objective to the community leaders and the local health and school personnel
- organizing the practical procedure for the data collection
- checking the forms (at the end of each day)
- the quality control of the work of the laboratory technicians
- preparing reports for health authorities and population involved
- organizing and delivering treatment for the schools or the communities being investigated

The laboratory technicians are responsible for:

- collecting the samples
- labeling the stool/urine containers
- preparing and reading the slides
- recording the results

The auxiliary worker (who can usually be recruited from the local dispensary) is responsible for:

- a clean working environment
- the continued availability of
 - clean containers
 - clean slides
 - other material for Kato-Katz and filtration
- cleaning or safe disposal of contaminated material

2.1.2 Sampling

The target population of the survey could be:

Primary-school children

They are the ideal target group because:

- schools are accessible
- the peak of prevalence of schistosomiasis and soil-transmitted nematodes (except hookworms) is to be found in this age group⁵
- this age group suffers from nutritional deficiencies because children are undergoing a period of intense physical and mental development
- experience shows there is generally good compliance from children and parents.

The data collected from this age group can be used to assess not only whether soil-transmitted helminthiasis and schistosomiasis threaten the health of school-age children, but also as a reference for evaluating the need for community intervention.

In order to obtain comparable data from different control programmes it is suggested that where possible, third year primary school classes (9-10 years old schoolchildren) should be surveyed.

Entire population

Surveys can also be organized with the entire population of a target area. Whilst the data collected in this way are usually more informative (especially for hookworm) than data collected in schools, more difficulties may be encountered, including:

- sub-optimal sampling strategies^{13 14}
- difficulty in reaching adult males who may be away from home during the day
- persuading adults to provide samples
- container identification among the members of the same family, where the literacy rate is low.

For these reasons, this manual will focus on school surveys.

2.1.3 Sample size

The following considerations have to be taken into account when determining the size of the survey:

- available resources (time, funds and personnel)
- objective of the data collection
- the sampling methodology.

When a survey is organized to assess the need for control measures, 200-250 individuals should be an adequate sample for each ecologically homogeneous area in order to evaluate prevalence and intensity.¹⁵

For example, if the area is homogeneous regarding climate, humidity, ecology and soil, a sample of 8 randomly selected classes of 30 children should provide sufficient data to plan appropriate control measures.

If different climatic and geographical zones are present in the country, a separate sample of the same size (250 individuals) must be selected in each zone.

When research is conducted to evaluate parameters other than prevalence and intensity of infection (i.e. impact of control measures on weight or haemoglobin concentration), a larger sample size will be required.

2.2 School survey management

2.2.1 Meetings with people involved in the survey

It is important to establish contact with the local health and education authorities to obtain permission to visit and treat the population and to obtain support for the survey. Contacts should be established at central, regional, district and village levels and should involve both health and school personnel.

Regular meetings with those involved should be organized to clarify the purpose of the survey, the advantages for the population, the relevance of the diseases investigated, and to provide information, education and communication (IEC) strategies. At the same time, community support should be sought in order to design sustainable strategies for subsequent action.

Similar meetings should be organized at the end of the survey to provide information on preliminary results and possible intervention measures.

2.2.2 Selection of classes

To obtain reliable data, the sampling has to be carried out using a list of all schools in the area (including private institutions).

The steps in the sample selection are:

- select districts (or provinces) from the national list
- select schools from the list of all state and private schools in each selected district
- select one class in each selected school and examine all the children present.

1. Selecting the districts

When the survey area consists of ecologically different zones (e.g. a coastal region at low altitude, a high altitude area, a dry region and a forested area), it is recommended that districts from each ecological stratum are selected since this significantly influences the transmission of soil-transmitted helminthiasis.¹⁶

The sample size specified above (250 people) is intended for an evaluation of prevalence and intensity of infection in a homogeneous situation. If different homogeneous zones are present in the area, the same sample size should be used for each zone.

In each ecologically homogeneous area, the districts could be selected using lottery methods, putting the name of each district in a separate piece of paper and drawing one at random out of a hat.

2. Selecting the schools

Information on the number children enrolled in each school is usually not available; thus lottery methods should be applied again.

When information about the number of schoolchildren enrolled in each school is available, it is possible to utilize sampling with probability proportional to size (PPS). This method allows every school the chance of being selected, which is greater for those schools with large numbers of schoolchildren enrolled.¹⁴

3. Selecting the classes

It is suggested that the team make an appointment to arrive at the selected school in the morning. The team leader should introduce the team to the school staff and explain the aim of the survey. It is recommended that a letter of introduction explaining the details of the survey is sent to the school authority prior to the day of the survey. Urine specimens for filtration should preferably be collected between 10 a.m. and 2 p.m.⁸

A class (40-50 children) should be selected among the third year classes (9-10 year old schoolchildren) using a table of random numbers or a lottery method. If only one class of this age group is present that class has to be selected. If the number of children present in the selected class is lower than 35, a second class should be selected and all children in both classes examined.

2.2.3 Practical organization of stool and urine samples collected

General information on the school (Annex 4.1) should be collected in order to better interpret the results of the parasitological evaluation. Each child should receive two containers one for urine the other for a faecal sample. It is important, during the distribution of the containers, to indicate the amount of stool needed and to demonstrate how to introduce it into the container using a wooden stick.

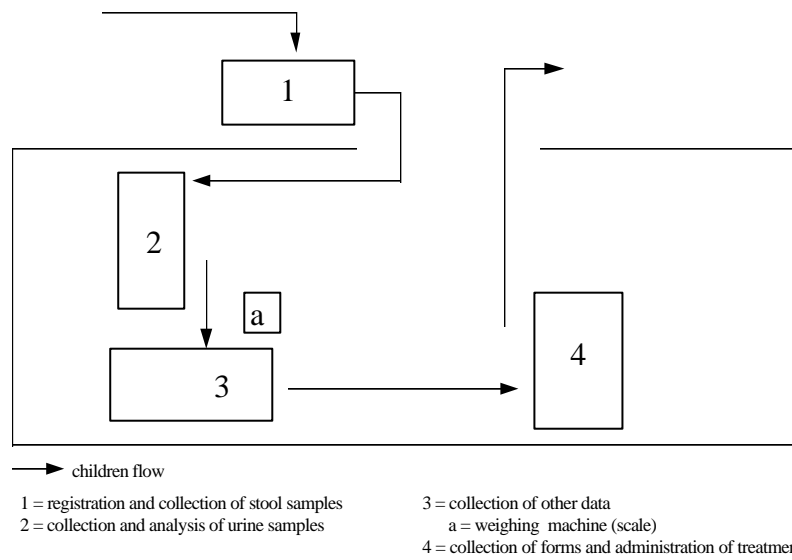
The stool containers should be distributed to the schoolchildren either the day before collection, or on the same day. There is normally no difference in the rate of samples returned between the two methods of container distribution and the second option simplifies the work since only one visit to each school is needed. The cultural appropriateness of this approach must be tested before the start of the survey.

The simplest way to collect data and specimens is to organize a flow of children through stations where specific data are collected. It is useful to provide each child with a form (Annex 4.1). Each child should pass through all stations carrying his form. The person responsible at each station will fill in the appropriate section and the form will be collected at the final station.

The team leader is responsible for checking that the forms are correctly filled in at the end of each day.

2.2.4 Flow diagram for the collection of data in schools

An example for the practical procedure is presented in the following diagram:



The children go through 4 stations:

- “registration station” where name, class, age and sex are registered on the form and the stool containers collected and marked with ID of the child
- “urine station” where urine samples are collected and analyzed for visible haematuria or with the aid of a reagent strip, and the results marked on the form
- “weighing station” where children are weighed and the weight is marked on the form
- “treatment station” where the forms are collected and checked for correct filling in, and anthelmintic treatment is given to the children

It is important to allocate an ID number to each child and to mark it on both the container and the form: this will permit identification of the child should any special therapy be needed.

At this stage, the samples should be transferred to the laboratory and the Kato-Katz examination performed.

2.2.5 Collecting further data

In areas where data on schistosomiasis are completely absent, the parasitological survey might not be sufficient to evaluate correctly the parasitological situation. In order to better estimate the prevalence of schistosomiasis, given its focal distribution and its linkage to water resources, it will be necessary to associate the parasitological survey with the Rapid Assessment Method¹⁷ (RAM) that is based on questionnaires.

The school rank obtained with RAM will allow for a better interpretation of the parasitological results, since only high (or low) prevalence schools could be selected by chance.

According to the resources available and the possible future use of the data, other variables could be collected at this stage:

- anthropometrical data¹⁸
- nutritional data^{19 20}
- behavioural/cognitive data.³

Collection of these data is possible in the context of an intestinal parasite survey and allows a better understanding of the morbidity associated with soil-transmitted helminthiasis.

If additional data are collected, the number of team members will need to be increased. It is also important to obtain practical support for the registration process from the school personnel.

2.2.6 Organizing laboratory examinations

WHO recommends the Kato-Katz quantitative method and urine filtration or the aid of reagent strips for microhaematuria as the standard methods for evaluating prevalence and intensity of soil-transmitted helminthiasis and schistosomiasis in endemic communities.

These methods present several advantages:

- no electricity or special equipment is needed other than a microscope, the Kato-Katz kit, the urine filter or the reagent strips; the methods can be used anywhere
- most material for the Kato-Katz (templates, slides) and urine filtration (filter holders) may be reused after very thorough washing
- for urine filtration or for the reagent strips for haematuria, the diagnosis is performed in the presence of the child and treatment, if needed, given immediately
- with the Kato-Katz kits, the preparation of slides can start immediately after stool collection and, in tropical climates, the first slides are usually ready for reading when the last samples have been prepared.

Kato-Katz method

It is advisable to collect all samples in the morning and to process and examine them during the same day. This makes the daily routine easier, reduces the quantity of containers and slides needed since they can be cleaned at the end of each day and reused, and prevents the hatching of hookworm eggs. For an estimation of *S. mansoni* eggs, it is advisable to perform a second reading after 24 hours.

Filtration

The excretion of *S. haematobium* eggs follows a circadian rhythm with a peak around noon. Therefore, urine specimens for filtration should preferably be collected between 10 a.m. and 2 p.m.

Reagent strips for haematuria

This method is simple and consists of dipping the reagent strip in the urine sample, waiting for a little less than 1 minute, and comparing the reagent strip with a colorimetric scale. As the haematuria does not follow a set rhythm, the strips can be used at any time.

Visible haematuria

This is an important sign of urinary schistosomiasis. The number of children presenting visible blood in the urine must be registered because this is an indicator of heavy infection.¹¹ If a person shows visible haematuria, in an area endemic for *S. haematobium*, there is no need for further diagnostic investigation of that person.

2.2.7 Health and safety of team members

It is recommended that team members wear rubber gloves during the collection and microscopical examination of faecal and urine specimens. Any material contaminated with stools or urine should be soaked in sodium hypochlorite solution before cleaning for re-use or disposal.

2.2.8 Quality control

Quality control should be undertaken to verify the consistency of the microscopic readings during the survey, and it is particularly important for the Kato-Katz technique.

Before the survey, a day should be spent evaluating the consistency of egg counting among laboratory technicians: a simple method consists of preparing 10 slides and comparing the reading of each slide by each laboratory technician with that of the team leader. A discrepancy of up to 5-10% for egg counts is normal, but if the discrepancy is larger the reasons must be identified and corrected. If one of the microscopists presents readings which are consistently different to those of the others in the team, he/she must be excluded from the team.

Each day during the survey, the team leader should read 10% of the slides of each microscopist without prior knowledge of the result. In the case of a discrepancy larger than 10%, the slide should be discussed by the two readers, and further slides examined to avoid repeated errors.

3. Analysis of the Results

WHO provides a software (SIP-SURVEY) for data entry and analysis of intestinal parasitic infections which can be obtained from the Division of Control of Tropical Diseases, Schistosomiasis and Intestinal Parasites Unit, World Health Organization, 1211 Geneva 27, Switzerland.

3.1 Draft report

Survey findings must be reported to the local authorities as soon as data are available and a report should be handed over by the team leader before leaving the zone. This report may be a simple summary containing the number of persons examined, the number of positive cases, the mean intensity of infections and the number of persons treated during the survey.

3.2 Final report

A more detailed final report of the survey has to be sent to the local health and school authorities as soon as the data have been analyzed. This report has to be simple enough to be understood by non-experts; it has to contain a simple analysis and evaluation of the data collected, and should comment on the preventive and control measures to be adopted.

3.2.1 Indicators

The relevant parameters to guide the decision-making process for the control of soil-transmitted helminthiasis and schistosomiasis are:

- prevalence of infections
gives information on the number of infected people in a population
- intensity of infections

gives information on the severity of an infection.

The following formula is used to calculate the **prevalence** of infection in a community:

$$\text{Prevalence} = \frac{\text{Number of subjects testing positive}}{\text{Number of subjects investigated}} \times 100$$

It is important to calculate:

- *the prevalence of each parasite species*
to be able to select treatment strategies and drugs accordingly
- *Cumulative prevalence of soil-transmitted helminthiasis infections (the prevalence of infection with at least one soil-transmitted helminthiasis)*
this indicator is useful when deciding whether or not to implement universal treatment
- *the prevalence of multiple infections*
as there may be possible synergic effects of infections.

It is important to note that the “real” prevalence of soil-transmitted helminthiasis in a community is higher than that calculated when using the Kato-Katz method. This underestimation must be taken into consideration when evaluating the results, but it does not necessarily reduce the quality of the information collected or its application in the planning and monitoring phases.

The units for measuring the intensity of infection at the individual level are “eggs per gram of faeces” (epg) and the “eggs for 10 ml of urine” (when using reagent strips, the intensity can only be estimated approximately). With the Kato-Katz technique, the measure of epg is obtained by multiplying the number of eggs counted on the slide by a multiplication factor. This factor varies according to the size of the template used. WHO recommends the use of a template holding 41.7 mg of faeces in which case the multiplication factor to obtain epg is 24.

The intensity of infection at community level could be expressed in:

- mean epg
- classes of intensity

The mean epg is calculated as an arithmetic mean :

$$\text{arithmetic mean} = \frac{\sum epg}{n}$$

$\sum epg$ is the sum of each individual epg and is divided by n , the number of subjects investigated.

Or by geometric mean :

$$\text{geometric mean} = \exp \frac{\sum \log (epg + 1)}{n} - 1$$

$\sum \log (epg + 1)$ is the sum of the logarithm of each individual epg, one egg is added to each count to permit calculation of the logarithm in case of $epg = 0$

Classes of intensity ⁸⁻²¹

Presentation of the results in classes of intensity allows the proportion of individuals suffering severe consequences to be quantified. Since the first objective of any control programme is the reduction of the proportion of highly infected individuals, this indicator is extremely important for the selection of the control measures, and in monitoring the results of the programme.

The thresholds proposed for use by a WHO Expert Committee in 1987 for the classes of intensity for each helminth in stools are the following, but flexibility in setting threshold may be necessary:

	light intensity infections	moderate intensity infections	heavy intensity infections
<i>A. lumbricoides</i>	1-4,999 epg	5,000-49,999 epg	\$50,000 epg
<i>T. trichiura</i>	1- 999 epg	1,000- 9,999 epg	\$10,000 epg
hookworms *	1-1,999 epg	2,000- 3,999 epg	\$ 4,000 epg
<i>S. mansoni</i> <i>S. japonicum</i>	1- 99 epg	100- 399 epg	\$ 400 epg

* For hookworm infections the degree of severity varies not only according to the number of worms present but also to the age, species and nutritional intake of iron. Fixed categories were not defined by the 1987 WHO Expert Committee. The above categories are given according to the faecal loss of haemoglobin found by Stoltzfus *et al.*²² in African children infected mainly with *N. americanus*, and are given as a possible example:

- Light intensity infections are related to a loss of less than 2 mg of haemoglobin per gram of faeces
- Heavy intensity infections correspond to a loss of more than 5 mg of haemoglobin per gram of faeces.

The classes of intensity proposed for urinary schistosomiasis are the following:

	light intensity infections	heavy intensity infections
<i>S. haematobium</i>	<50 egg/10 ml	\$50 egg/10 ml or visible haematuria

3.2.2 Data presentation

The following tables give an example of how data could be presented in the final report. The example chosen refers to a control programme involving schoolchildren.

Sample description

Number of children investigated

school	male	female	total
XXX	27	13	40
YYY	21	12	33
.....			
TOTAL	48	25	73

Age

Mean age	9.8
Mean age male	10
Mean age female	9.5

Prevalence data

The data have to be presented by region, by district and by school

Soil-transmitted helminthiasis	prevalence
<i>A. lumbricoides</i>	46 %
<i>T. trichiura</i>	11.9 %
hookworms	69.9 %
Any infection	75.4 %
double infection	34.1 %
triple infection	3.8 %

Schistosomiasis	prevalence
<i>S. mansoni</i> (or <i>S. japonicum</i> or <i>S. mekongi</i>)	11.6 %
<i>S. haematobium</i>	49.2 %

Intensity

The data have to be presented by region, by district and by school

Soil- transmitted helminthiasis	mean epg	
	arithmetic	geometric
<i>A. lumbricoides</i>	106	87
<i>T. trichiura</i>	544	487
hookworms	125	97

Soil-transmitted helminthiasis	heavy intensity
<i>A. lumbricoides</i> \$ 50,000 epg	1%
<i>T. trichiura</i> \$ 10,000 epg	-
hookworms \$ 4,000 epg	2%
TOTAL	3%

Schistosomiasis	heavy intensity
<i>S. mansoni</i> \$ 400 epg	2%
<i>S. haematobium</i> \$ 50 eggs /10 ml or individuals with visible haematuria	5%

3.3 Community diagnosis and treatment

The results obtained from a school survey can be used to classify the community into categories for diagnosis and treatment. Local conditions will influence how the classification is carried out. One system involving three categories is set out below as an example of how to proceed.

Soil-transmitted helminthiasis

Community category	cumulative prevalence	percentage of heavy intensity infections
I high prevalence high intensity	ANY	\$ 10%
II high prevalence low intensity	\$50 %*	< 10%
III low prevalence low intensity	< 50 %	< 10%

*WHO recommends mass treatment when more than 50% of the community are positive for soil-transmitted helminthiasis and schistosomiasis .

In areas where **hookworm infections are endemic** (prevalence > 20-30 %) and where anaemia is prevalent, communities should be classified in **category I**.

For communities in **category I**, universal treatment is recommended. The whole community is treated irrespective of age, sex, infection, status, or other social characteristics. The treatment should be organized once a year. The efficacy of this measure is higher if the whole population is treated simultaneously. Women of childbearing age, pre-school and school-age children suffer more from morbidity related to the infections, so they must be treated more intensively (two or three times a year). Communities within category I usually have extremely low standards of sanitation: reduction of transmission through interventions based on information, education and communication (IEC) strategies, and improvements in sanitation and water supply will be a long-term aim.

For communities in **category II**, targeted treatment is recommended. The groups identified for treatment are women of childbearing age, pre-school and school-age children. Treatment must be organized at least once a year. These communities usually also have insufficient standards of sanitation but reduction of transmission may be obtained by implementing information, education and communication (IEC) strategies and supporting the improvement of sanitation.

For communities in **category III**, case management is the recommended measure, i.e. the treatment of positive cases diagnosed by the health units. Information, education and communication (IEC) strategies have a great impact on this category and should be extensively implemented.

Schistosomiasis⁸

category		prevalence
I	high prevalence	≥ 50%
II	moderate prevalence	20% < 50%
III	low prevalence	< 20%

For communities in **category I**, universal treatment is recommended. The whole community is treated irrespective of age, sex, infection status, or other social characteristics. Treatment campaigns must be conducted once a year. The efficacy of the measure is higher if the whole population is treated simultaneously.

In areas where the prevalence of high intensity infection (visible haematuria for *S. haematobium*) is over 15% schoolchildren may be given treatment twice a year for added benefit.

For communities in **category II**, targeted treatment is recommended. The groups identified for treatment are school-age children, and the treatment can be organized every 1-2 years.

For communities in **category III**, screening schoolchildren is the recommended measure, and positive cases must be selected for treatment by haematuria or urine filtration. The treatment can be organized every two years.

In all categories, information, education and communication (IEC) strategies and improving sanitation have a great impact and should be extensively applied.

Non-enrolled school-age children

An effort has to be made to control infections in school-age children who are not attending school. In countries with a low school enrollment, this group forms a large section of the school-age population. Programme managers must ensure that all necessary resources are available for such children before they are invited to participate.

When the village population is informed in advance of the date of school treatment and all school-age children are invited to receive treatment at school, a relevant portion of non-enrolled school-age children may be included in the intervention.

3.4 Evaluation of control measures

It is suggested that the programme is evaluated 2 years after the start of drug distribution.

Presentation of the results by class of intensity allows for the quantification of the proportion of individuals suffering severe consequences of the infection.

The first objective of any control programme is the reduction of the proportion of highly infected individuals, because this will be accompanied by a reduction in morbidity.

The difference between the percentage of individuals with heavy intensity infections for each parasite species before and after treatment is extremely important when monitoring the results of the control programme.

Ideally, after intervention the percentage of individuals in those classes should be near to 0.

The impact of control programmes for soil-transmitted helminthiasis and intestinal schistosomiasis can be expressed as the percentage fall in arithmetic or geometric mean egg per gram (epg) counts. If data on epg before and after several treatments have been collected, the difference between the two means should be expressed as a percentage of the mean epg before treatment.

$$\% \text{ epg reduction} = \frac{\text{mean epg before treat.} - \text{mean epg after treat.}}{\text{mean epg before treatment}} \times 100$$

The impact of control programmes for urinary schistosomiasis can be expressed with similar formula but:

- when using urine filtration for diagnosis, the number of egg/10 ml is used instead of epg
- when using reagent strips, the percentage of visible haematuria is used as the equivalent of heavy intensity of infection

4. Annexes

4.1 Forms

SOIL-TRANSMITTED HELMINTHIASIS AND SCHISTOSOMIASIS SCHOOL SURVEY	
SCHOOL FORM	
School _____	
Date ___/___/___ Region _____ District _____	
Total number of forms collected _____ from no. _____ to no. _____	

I Composition	
Total number of schoolchildren _____ Number of girls* _____	
Number of classes _____ Number of teachers _____	

II Water	
Is there a source of water in the school?	Yes-No
Type of water source _____	
Presence of water sources close to the school	Yes-No
Type of water source _____	

III Sanitation	
Presence of latrines in the school	Yes-No
Condition _____	

IV Health	
Nearest health structure: Type _____ Distance _____ Km	

<hr/>	
V Treatment	
Number of children treated for soil-transmitted helminthiasis	_____
Number of children treated for schistosomiasis	_____

* If the number of girls is significantly lower than the number of boys, alternative approaches should to be implemented in order to treat this group

Child form

The following form is an example of a form which could be used in a soil-transmitted helminthiasis survey for collecting data on each child.

Part I should be completed when collecting stool samples.

Part II should be completed during the microscopic analysis of samples.

SOIL-TRANSMITTED HELMINTHIASIS AND SCHISTOSOMIASIS
SCHOOL SURVEY

CHILD FORM

I Personal data

ID Number _____ School (or village) _____

Name _____ - _____ - _____

Sex M-F _____ Age _____

other data (optional)

Weight __ __ , __ kg Height __ __ , __ cm Hb __ __ , __ g/dl

II Parasitological data

a) stool examination

Ascaris lumbricoides eggs/slide _____ eggs/gram _____

Trichuris trichiura eggs/slide _____ eggs/gram _____

hookworms eggs/slide _____ eggs/gram _____

Schistosoma mansoni eggs/slide _____ eggs/gram _____

(or *S. japonicum*

or *S. mekongi*)

other parasites identified _____ - _____ -

b) urine examination (urinary schistosomiasis)

Visible haematuria Yes -No

(If reagent strips are used)

Microhaematuria Yes-No

(If filtration is used)	
Presence of <i>S. haematobium</i> eggs	Yes -No
Number of eggs in 10 ml of urine	_____

4.2 List of materials and addresses

To collect data on 250 children, the following list of materials is suggested for a team of 3/4 people:

For collecting stool and urine samples

a	plastic containers 100 cc *	200 with covers for stools 200 for urine
b	marker pens	5

c paper

For analyzing specimens

d	microscopes (Objectives 10x)	2
e	kit for 500 Kato-Katz	1
f	microscope slides	200
g	glycerine	200 cc
h	green malachite powder	5 g
i	forceps	2
l	urine reagent strips (blood)	250
	or	
m	polycarbonate filters (12: m or 20 : m pore size)	250
n	filter holders for filtration	50
o	disposable gloves	100

For cleaning the material

p	brush	3
q	heavy-duty rubber gloves	3 pairs
r	bucket	2
s	powder soap	250g
t	Sodium hypochlorite (Bleach)	3 liters

For data registration

u	pencils	10
v	forms **	300

For treatment

w	mebendazole or albendazole***	
x	praziquantel 600 mg***	
y	scales (bathroom type for adults)	1

* The stool containers should be plastic to allow recycling, and should be large enough to allow the child to easily introduce a small quantity (10 g) of stool, using a wooden stick

** Examples of forms are reported in Annex 4.1

*** To treat not just the classes investigated but the entire school

Addresses

For item *e* above, contact

P&D Pesquisa e Desenvolvimento Ltd.

Av. Getulio Vargas 1810 / 7 andar
30112-021 Belo Horizonte, Minas Gerais (MG)
Brazil
Tel: (031) 281 73.00- Fax: (031) 281 44.47

The kit contains:

- 500 templates (reusable)
- 500 screens 250 micron
- 500 applicator sticks (reusable)
- 500 pieces of hydrophilic cellophane in glycerol malakite-solution

When finished

250 micron filter in nytrel - Y1 250HD.

120 cm roll can be bought from:

Sefar -Flytis- (see for item *m*)

hydrophilic cellophane can be bought from:

Societe Normande de Decoupage SA

72 rue des Cheneaux
F-76520 Ymare Boos - France
Tel: (33 2) 35 79 11 12
Fax: (33 2) 35 79 19 96

For items *d-f-i-l-o-w-x-y*, contact

IDA

P.O Box 37098
1030 AB Amsterdam
The Netherlands
Tel: +31 20 4033051 - Fax: +31 20 4031854

or for: *w-x-y*

UNICEF

Supply Division
Procurement and Assembly Centre
UNICEF Plads - Freeport
DK-2100 Copenhagen
Denmark
Tel: +35 27 35 27
Fax: +35 26 94 21

For item *m*

polycarbonate filters (20 : m pore size) ref. article 44046CS

Sefar -Flytis

rue Louis Minjard
F-42360 Panissières - France
Tel/fax: (33) 4 77 27 44 85

For item *n*:

Swinnex Filter Holder 13 mm Catalogue No. SX00 013 00

Millipore intertech

Ashby Road, PO Box 255
Bedford MA 01730
USA
tel +1 800 645 5476 ext 8895
fax +1 781 533 8630

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