



Communicable Disease Unit  
Regional Program on Parasitic & Neglected Diseases

# **Control of Soil-Transmitted Helminth Infections in the English- and French-Speaking Caribbean:**

**Towards World Health Assembly Resolution 54.19**



**(Kingston, Jamaica, 15–17 May 2007)**

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## Introduction

Globally, over 2 billion people are infected by schistosomes and soil-transmitted helminths, of which 300 million suffer severe morbidity or permanent impairment. These worm infections disproportionately affect the poor, particularly children. They also cause anemia and adversely affect children's growth and development, which contributes significantly to cognitive problems, school absenteeism and poor scholastic performance. In response to this, the 54th World Health Assembly in 2001 put forth a resolution which urged endemic countries to promote preventive measures, ensure treatment and mobilize resources for control of schistosomiasis and soil-transmitted helminthiasis. Subsequently, resolution 54.19 was endorsed by every single Member State. The resolution urges Member States to ensure access to essential drugs against schistosomiasis and soil-transmitted helminth (STH) infections with the goal of treating at least 75% and up to 100% of all school-age children at risk of morbidity by 2010. In addition to chemotherapy, preventative measures such as improving access to safe water, sanitation and health education are also encouraged.

STH infection rates are particularly high among women and children living in poor communities, indigenous communities, migrant workers, fishers, and those living in rural areas and peri-urban slums. PAHO/WHO estimates that 20-30% of those living in Latin America and the Caribbean are infected with one of several intestinal helminths and/or schistosomiasis. The prevalence of intestinal worms in slums often reach 50% and up to 95% in some Amerindian tribes. With up to 1/3 of the Region's workforce infected with worms, this group of parasites also lowers the work capacity of adults and is among the main causes of anemia among women of child-bearing age.

## The Caribbean Context

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Existing evidence on the prevalence of STH in the Caribbean subregion suggests that there is a lower burden of worms in the Caribbean than in the rest of Latin America. However, there does appear to be a difference across the Caribbean subregion which may be a reflection of differences in socio-economic status, access to safe water, sanitation and primary health care. In the Caribbean STH prevalence appears to be higher in certain countries, such as Guyana, Belize, and Jamaica. St. Lucia is the only country in the Caribbean that is currently reporting schistosomiasis infection.

However, an accurate estimate of STH and/or schistosomiasis burden is difficult to determine. STH infections are not subject to compulsory reporting in most countries, and are not perceived as major public health problems. Most of them do not lead to epidemiologic emergencies and consequently attract little attention from the media and the public sector. Also, for many of the countries in the Caribbean subregion, very few recent research studies, surveys or prevalence studies exist and often the most recent data available is over 20 or 30 years old.

Historically, STH control was an important health priority in the Caribbean. Its importance as a health program has decreased due to improved water sanitation in all urban and most rural areas

and increased accessibility of cheap, effective, anti-helminthic drugs, which permits the population to self-medicate the illness. In the Caribbean, helminth infections are more likely to be an indicator of other social and economic problems, such as poverty, inaccessibility to health care or disruption of health care services.

## Workshop Objectives

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The workshop's general objective was to advocate towards WHA 54.19 (2001) goal. Specifically:

- ✓ Raise the awareness of WHA 54.19 among the Caribbean countries and the 2010 goal to deworm 75% to 100% of school-age children at risk for worm infection and morbidity
- ✓ Provide a forum for interchange on current deworming activities in each country attending the workshop
- ✓ Provide an opportunity for countries to lay the ground work for the development of national plans of action for deworming of at-risk school-age children
- ✓ Present an overview of technical resources available to each country from PAHO/WHO and other partners in the region

## Section I: STH Infections and the Health of School-Age Children

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A series of technical presentations were offered to highlight the impact of STH infections among school age children and the rationale of focusing control efforts in this group.

### Epidemiology of Soil-Transmitted Helminths among School-Age Children

*Ralph Robinson (UWI-Jamaica, Professor of Parasitology)*

Infection with STHs is caused when eggs are ingested from contaminated soil or contaminated water sources in the case of *Ascaris* and *Trichuris*, or ingestion of larvae from contaminated soil and water sources in the case of *Ancylostoma*. Infection with hookworms and *Strongyloides* occurs when the larvae actively penetrate the skin, usually penetrating the skin between the toes.

Recent estimates suggest that *Ascaris lumbricoides* has the highest rate of global infection, followed by *Trichuris trichiura* and hookworms (*Ancylostoma duodenale* and *Necator americanus*) (see Table 1).

**Table 1: Global STH Infections**

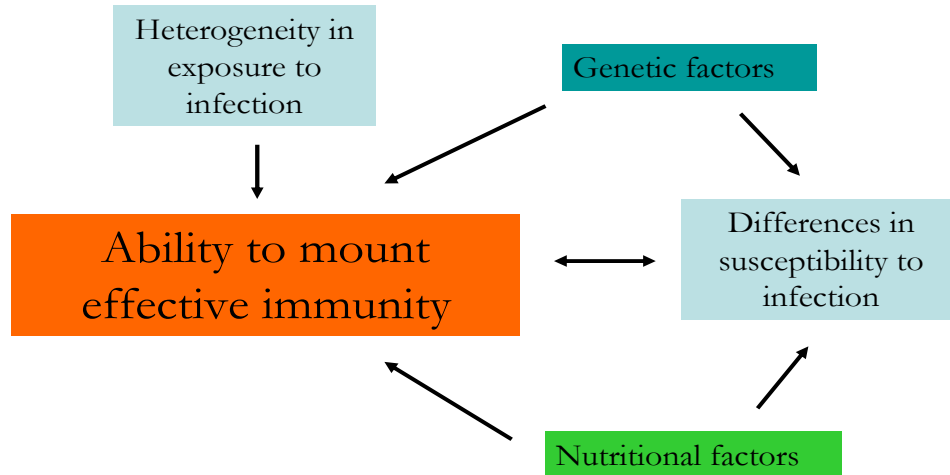
Disease	Number Infected
Ascariasis	1,221,000,000
Trichuriasis	795,000,000
Hookworm	740,000,000

In Latin America and the Caribbean, *Trichuris* is the most prevalent STH infection with an overall prevalence of 19% and approximately 100 million persons infected (de Silva et al., 2003). *Ascaris* follows closely with a prevalence of 16% infecting more than 80 million people (de Silva et al). Hookworms have the lowest prevalence rate at 10% infecting about 50 million people (de Silva et al.). Of these infections de Silva and colleagues estimate that more than 30 million children under the age of 15 harbor *Trichuris*, *Ascaris* infection occurs in approximately 25 million and hookworms infect approximately 10 million children.

**STH infections have four main epidemiological features:**

- 1. They have aggregated distributions in human communities:** For the major STH infections, worm burden exhibits a highly aggregated distribution. The majority of the infected population has a low level of worm burden; a few infected hosts harbor a disproportionately large worm burden and are referred to as ‘wormy’ individuals (Anderson & May, 1991). The aggregation of parasites in a few wormy individuals has consequences with regard to the population biology of the helminths and the public health consequences of the host. Heavily infected individuals are simultaneously at the highest risk of disease and are a major source of environmental contamination. A feature that may help to explain aggregation is that individuals tend to be predisposed to heavy or light infections, which is discussed below.
- 2. Predisposition to heavy infections:** There is evidence that some individuals are predisposed to heavy (or light) STH infections; however, the underlying cause of such predisposition is slowly being understood. It is thought to be a combination of heterogeneity in exposure to infection or differences in susceptibility to infection, and the ability to mount effective immunity. In addition, genetic and nutritional factors also influence both susceptibility and immunity (see Figure 1).

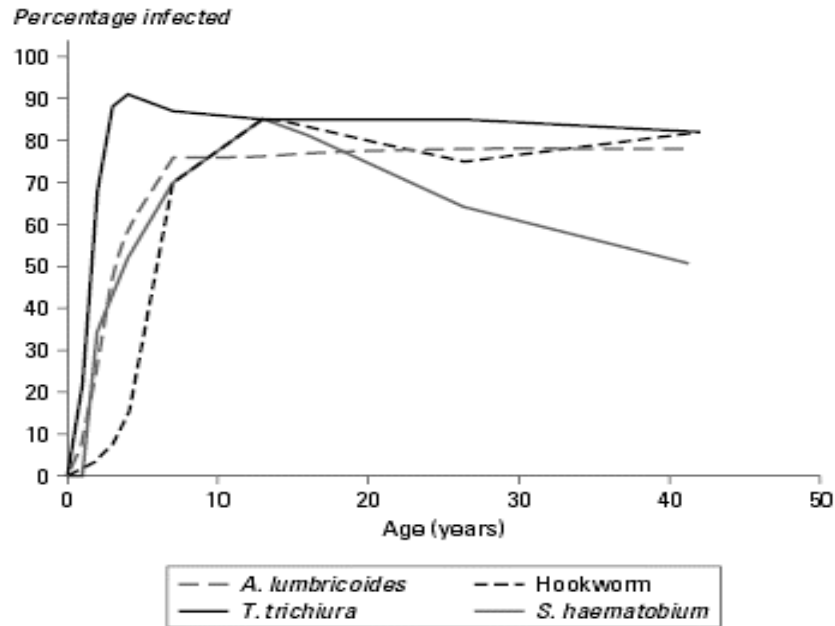
**Figure 1: Causes of Predisposition to STH Infection**



A well-used example of predisposition with *Trichuris* is demonstrated in a comparison between initial worm burden (determined by antihelminthic expulsion), and the worm burden acquired by the same subjects following 17 months of re-infection (Bundy 1986). Individuals who were intensely infected at first observation tended to reacquire heavy worm burdens during the 17 month period of re-infection, while individuals who were initially lightly infected tended to reacquire light infections. Given this, it is most important to treat the most heavily infected individuals to have significant/substantial impact on STH prevalence in a community.

- 3. Convex age-intensity profiles:** The age-dependent patterns of infection-prevalence are generally similar among the major species of soil-transmitted helminths. They exhibit a rise in childhood to a relatively stable asymptote in adulthood. As presented in Figure 2, the maximum prevalence of *Ascaris* and *Trichuris* is usually attained before 5 years of age, compared with the maximum prevalence of hookworm infections which is usually attained in adolescence or in early adulthood.

**Figure 2: Prevalence of Infection by Age**

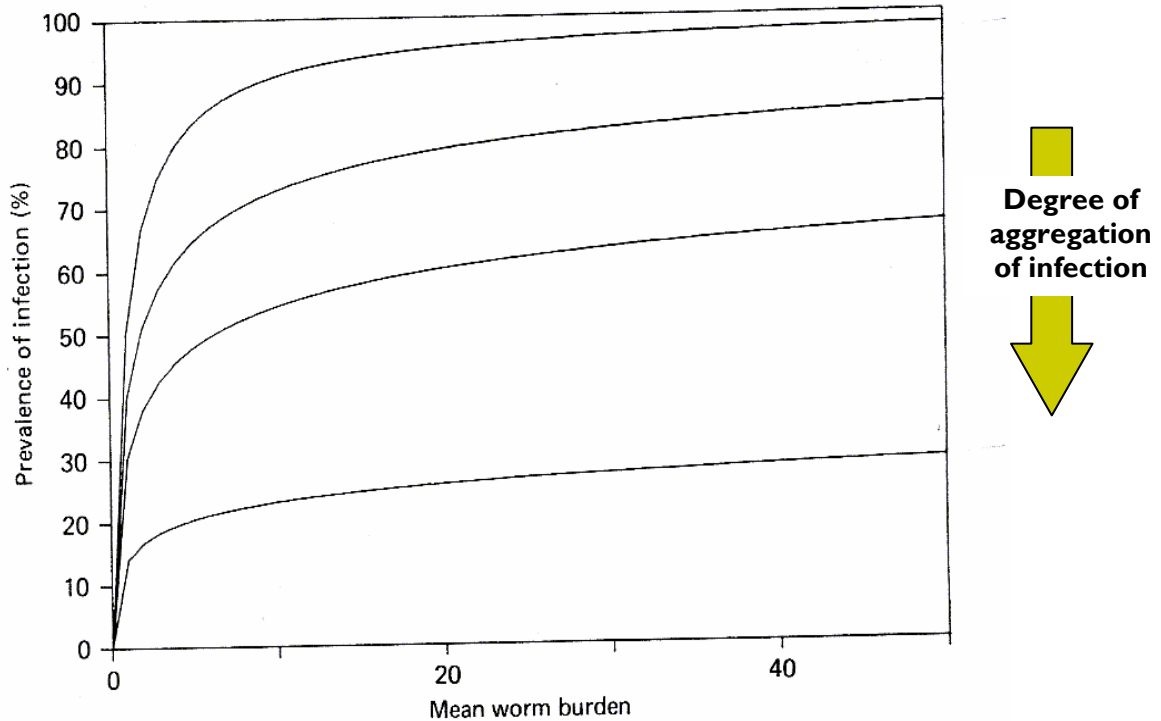


Source: Bundy, 1995

This can tell us who is likely to be infected; however, the profile does not provide any information on infection intensity, or morbidity, to which intensity is linked. In order to understand the relationship between prevalence and disease, we need to investigate the association between prevalence and intensity.

The relationship between prevalence and mean intensity of STH in communities is not linear – in fact it is markedly non-linear (see Figure 3). This is another consequence of aggregation and as such large reductions in average intensity by using, for example, mass chemotherapy may have little impact on prevalence.

**Figure 3: Prevalence Intensity Profiles**

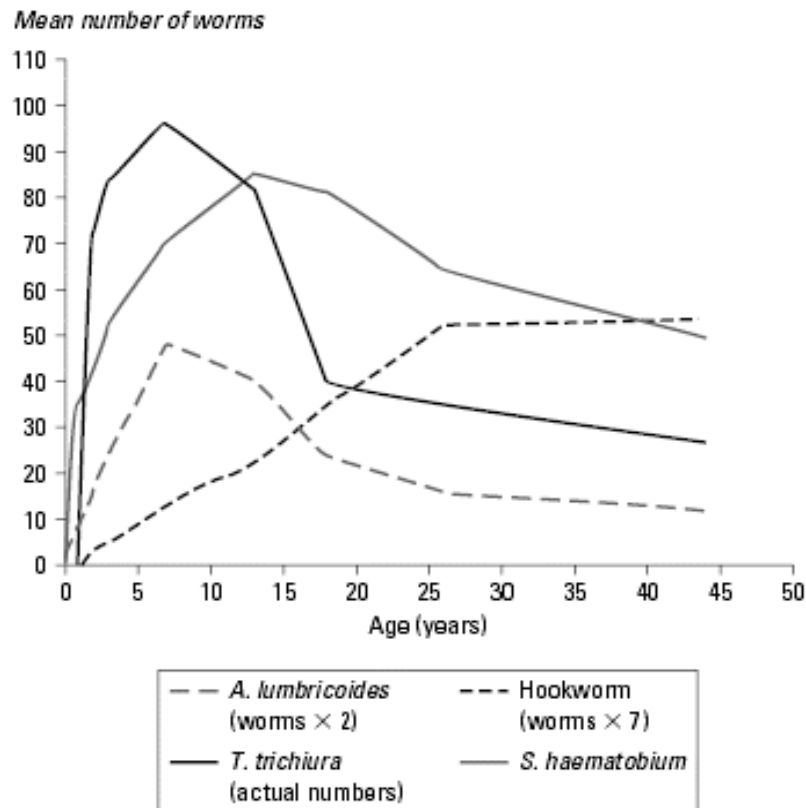


Source: Bundy, 1995

Because intensity is linked to morbidity, the age-intensity profiles provide a much clearer understanding of which populations are vulnerable to the different helminths.

For infections with *Ascaris* and *Trichuris*, for example, the age-intensity profiles are typically convex in form, with the highest intensities in children 5 to 15 years of age (see Figure 4). In contrast, the age-intensity profile for hookworm exhibits considerable variation, although intensity typically increases with age until adulthood and then plateaus. The profile indicates that the highest levels of *Ascaris* and *Trichuris* are seen in children under the age of 15, so it is important to target these children for treatment.

**Figure 4: Age-Intensity Profiles**



Source: Bundy 1995; reproduced and modified from Hotez, Ardra and others 2005.

**4. Re-infection following chemotherapy:** The last of the 4 main epidemiological features of human STH infection is the existence of rapid reacquisition of infection following chemotherapy. People of all ages rapidly reacquire infection following treatment and the rate of re-infection is specific to the species of helminth and varies from 1 to 3 years with the common STHs. The time it takes for an individual to achieve the pre-intervention prevalence is referred to as the “return time”. The rate of re-infection depends on 4 factors:

- The life expectancy (L) of the species of STH. Short lived helminths re-infect more rapidly.
- The force of transmission ( $R_0$ ) within a given community. STHs with high  $R_0$ s re-infect more rapidly.
- The efficacy of treatment (h)
- The population coverage per unit time (g)

Species of helminths with the shortest life expectancies also have the shortest return times. Therefore STHs, such as *Trichuris* and *Ascaris* which have short life expectancies, are also most difficult to control in populations.

## Effects on Growth and Development

*Susan Walker (UWI-Jamaica, Professor of Child Development)*

Existing evidence suggests that soil-transmitted helminths impair childhood growth and development by decreasing food intake of the host, leading to an increase in nutrient loss. STHs also decrease nutrient absorption and nutrient utilization in those who are infected. A high worm burden has been shown to be associated with stunting among pre-school aged children. However, evidence is inconclusive on whether deworming has a significant impact on growth and development, as the following examples will demonstrate. Some studies have found that deworming has a positive impact on weight and/or wasting, while others find either no significant relationship or a modest relationship. Generally, there is no impact or small benefit on height following deworming. The benefits of deworming are usually more pronounced in those with high intensity infections, and less prominent in those with low intensity infections.

A study from Guatemala of 246 Children aged 7-12 found a baseline prevalence of 91% for *Ascaris* (75% moderate to high intensity) and a prevalence of 82% for *Trichuris* (mostly light intensity infections) (Watkins & Pollitt, 1996). Children were given treatment with albendazole at baseline and again at 12 weeks. Six months following treatment there was a modest gain in weight observed (180g) and no benefit to height. Stoltzfus et al. (2004) conducted a study in Zanzibar with 459 children aged 6 to 71 months. 38% of these children were stunted and 33% had evidence of mild wasting. Following treatment with mebendazole, a 62% reduction in mild wasting was observed in children less than 30 months of age. There was no impact reported on stunting in older children.

Few controlled intervention trials have examined the relationship between STH infections and impaired cognitive function and school performance. However, existing studies suggest that cognitive function and school performance are impaired in heavy trichuriasis and hookworm infections. STHs also decrease school attendance, and by extension can decrease a child's level of educational achievement.

In Kenya, a study by Kremer found that primary school children who were dewormed and received health education had improved primary school attendance by 7-14%, and absenteeism was reduced by 25%. There were improvements in the height-for-age ratio, but not the weight-for-age ratio. Deworming also reduced worm burden in un-treated children attending other nearby schools. In another study on cognitive function in school-aged children by Nokes et al (1992), they found that those children with *Trichuris* infections who received treatment saw benefits to 3 out of 8 cognitive tests in comparison with those who were not treated. However, another Zanzibar study by Stoltzfus et al (1997) found no benefits to motor or language development following deworming. The 1996 study in Guatemala by Watkins & Pollitt (discussed above) also found no benefits to reading, vocabulary or school attendance among those who were treated.

Hookworm infections have been shown to have a negative affect on health by contributing to iron-deficiency anemia, and the amount of blood loss in those infected is correlated with worm load. A study from India found anemia in pre-school children aged 2 to 6 was reduced due to the removal of hookworms and the provision of iron tablets. In addition, pre-school class absenteeism was reduced by 20%.

In summary, the benefits of mass deworming as a standalone intervention is unlikely to have significant benefits to school performance for most children. But, it may have modest benefits to weight gain. Deworming should be integrated into a package of services aimed at improving the health of school age children including improved nutrition, hygiene education and improvements in school facilities and infrastructure.

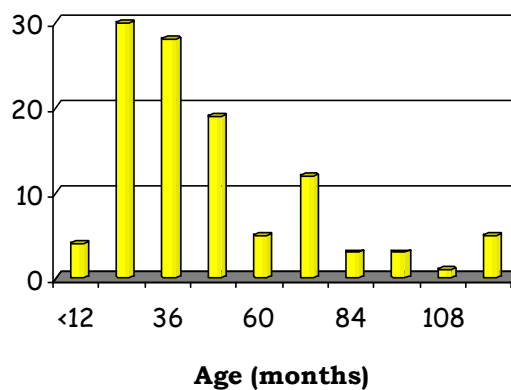
## Surgical Manifestations of *Ascaris*

*Carolyn Pinnock (Bustamante Hospital for Children – Jamaica, Pediatric Surgeon)*

In Jamaica, soil-transmitted helminths are endemic with prevalence rates for *Trichuris trichiura* at 42-47% and 15-37% for *Ascaris lumbricoides* for both rural and urban school age children. Of this, 1% is found to have a heavy worm burden (Wong 1994).

Data from the Bustamante Hospital for Children in Jamaica from January 1999-December 2005 found 117 patients, 62 girls and 55 boys, were diagnosed and coded as having ‘worm infestation.’ Infections are more common during the rainy season and among children 12 to 60 months of age (see Figure 5). Diagnosing worm infections in patients is not always straightforward since the acute obstructive symptoms can mimic many diagnoses. Surgery to either diagnose or treat soil-transmitted helminths is a last resort.

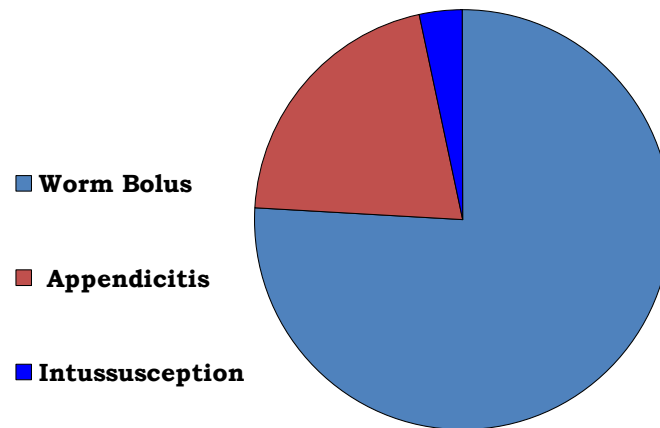
**Figure 5: Age Distribution of Infections**



Of these patients, 50 were admitted to the general medical ward, 37 to the infectious diseases ward (isolation) and 29 were admitted to general surgical wards. The majority of cases were initially diagnosed as worm bolus, followed by appendicitis and a small percentage as

intussusceptions (Figure 6). Worm bolus mimics the symptoms of appendicitis, bowel perforation, intussusception, ileo-caecal valve obstruction, terminal ileitis and volvulus.

**Figure 6: Initial Diagnosis of Patients**



Investigations to confirm the initial diagnosis included abdominal radiographs (63%), direct visualization (36%), testing stool with ova, cysts and parasite exam (20%) and ultrasound (13%). This is much more efficient and cost-effective than diagnosing by surgery. A history of recent (<1 week) passage of worms should be sought in all patients with acute abdominal signs. Furthermore, a plain x-ray can be helpful in making the diagnosis of a worm infestation or obstruction.

Several treatment options exist depending on the severity of the case. Children with worm bolus obstruction are treated with rehydration and upper GI decompression (NPO, +/- NGT). Once the acute obstructive symptoms are resolved, oral antihelminthic medication can be administered. Gastrografin has been used to desiccate the worm bolus which reduces the risk of a partial obstruction becoming a full obstruction. Hypertonic saline enemas have also been used to pass worms and prove to reduce the length of the obstructive episode and overall hospital stay. All of these options are good alternatives to surgery, although some are more expensive than others.

When it comes to reducing the worm burden it is cheaper to treat high-risk groups than to test individually when patients present at the hospital. Prophylactic 'deworming' is an effective means of reducing the worm burden in school-age children and school-based programs are a good way to reach target population.

## Section II: Tools for the Development of National Deworming Plans of Action

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### Subregional Priorities

*Chris Fredrickson (CAREC-Trinidad)*

PAHO/CAREC's subregional priorities for STH control in the Caribbean were presented taking into consideration the unique STH profile in the Caribbean and resource constraints. In particular, the following three priorities were outlined:

- (1) determining high-risk areas and populations
- (2) determining of parasite burden in high-risk areas
- (3) developing of plans of action and best approach for each area.

Given that for many Caribbean countries current data on at-risk populations are not available, an important first step is to determine if a country has an at-risk population and where it is. Certain populations which are traditionally considered to be at risk may be a good place to start analysis; these include populations with poor access to potable water and appropriate sanitation, children and women living in poverty, fishers, and in the case of Suriname, Guyana and Belize, indigenous/native/first nation populations. These populations are generally concentrated in rural areas, areas with limited access to health services or unorganized/unstable settlements. Information which may be useful in determining populations at-risk may be available from national census data (for the distribution and location of indigenous or poor communities), water and sanitation service distribution records and planning and land use departments.

A second regional priority is to determine the parasite burden of the populations at-risk. To accomplish this, it may be useful to enlist the help of public health clinics or universities which may have recent survey data, schools which may have recent survey data, or NGOs, church organizations, PAHO/WHO and other aid organizations which may also have data available. If data does not exist, a rapid appraisal can be conducted using tools readily available from PAHO/WHO such as Kato-Katz kits, SIP software (software for data analysis) and questionnaires. More detail on rapid appraisals will be discussed below under the section 'Methods of identifying and estimating at-risk populations.'

Once the population-at-risk has been defined and initial parasite burden has been determined, countries can start to develop plans of action to treat STH infections and improve control interventions. This can include improvements in water and sanitation, which is an expensive intervention, but sustainable. It is important to determine the best drug delivery treatment mechanism and how drug distribution activities or deworming programs can be piggy backed onto existing programs for mutual benefit, and best uses of available resources.

## Resources Available for Effective Deworming in the Caribbean

*John Lindo (UWI-Jamaica, Professor Parasitology/ PAHO/WHO, Consultant)*

Resources available to Caribbean countries to develop and implement effective deworming programs were outlined, particularly resources for conducting rapid appraisals. These resources include: Kato-Katz kits, laboratory diagnostic support, educational material and drug donation options.

1. Kato-Katz kits: the most common method for analyzing stool samples is the Kato-Katz method. It is a rapid test which requires low technology, little technical training and can be used in the field. The method does not need fresh stools and is an excellent tool for quantitatively assessing the success of deworming treatments.

The Kato-Katz test kit includes a nylon or plastic screen, plastic spatula and a template with a hole. In addition to the test kit, microscope slides, newspaper or glazed tile, cellophane cover slips soaked in glycerol-malachite green solution, fresh stools and gloves are needed. Details on the preparation of slides can be found at [www.tropeduweb.ch/parasitology\\_method\\_PDF/8\\_stool\\_Kato-Katz.pdf](http://www.tropeduweb.ch/parasitology_method_PDF/8_stool_Kato-Katz.pdf).

After the slides are prepared, they should be read relatively quickly. With *Ascaris* and *Trichuris*, Kato-Katz smears need to be read one or two hours after preparation and the eggs remain visible for several months. Hookworms must be examined within 30 minutes and are not visible after one hour. Schistosomes should ideally be examined within 24 hours and eggs remain visible for several months. The intensity of infection can be categorized into light, medium or heavy as follows:

**Table 2: Intensity of Infection Based on Eggs per Gram of Stool (epg)**

	Light	Medium	Heavy
<b>Ascaris</b>	1–4999 epg	5000–49,999 epg	≥50,000 epg
<b>Trichuris</b>	1–999 epg	1,000–9,999 epg	≥10,000 epg
<b>Hookworm</b>	1–1,999 epg	2,000–3,999 epg	>4,000 epg
<b>Schistosoma mansoni</b>	1–99 epg	100–399 epg	≥400 epg

A limited number of Kato-Katz kits are available through PAHO/WHO to countries which are planning surveys. Kits are also available for purchase in Europe and Brazil at a cost of \$45/kit; a kit will test 800 samples which is enough for eight schools.

2. Several sources of laboratory diagnostic support for Kato Katz training and quality control exist in the Caribbean. The following institutions can provide laboratory training and support in designing and implementing a survey:
  - ✓ Caribbean Epidemiological Centre (CAREC) – Dr. Christian Fredrickson
  - ✓ The Parasite Research Group at the University of the West Indies – Mona Campus – Dr John Lindo and Dr. Ralph Robinson
  - ✓ Department of Life Sciences at the University of the West Indies – St. Augustine Campus – Dr. Dave Chadee
  - ✓ Windward Islands Research & Education Foundation (WINDREF), St. Georges Grenada – Professor Calum MacPherson and Trevor Noel
  
3. There are many sources of educational material readily available online which maybe useful in implementing school health and community based interventions. At [www.who.int/wormcontrol](http://www.who.int/wormcontrol), resources are available in French and English. Several NGOs are also actively involved in regional deworming programs and can be potential partners for developing school health programs. These include the Vitamin Angel Alliance, which is a non-profit organization fighting malnutrition and childhood blindness by providing nutritional supplements, vitamin A supplementation, micronutrient supplementation and deworming, and health education ([www.vitaminangels.org](http://www.vitaminangels.org)). In addition, Plan International and Save the Children implement school health and nutrition programs in the region which include deworming activities and may be potential partners for collaboration. Many universities in the Caribbean are also in a position to assist in the design and adaptation of deworming plans and/or school based health and nutrition programs.
  
4. Four drugs are available for treating STH (albendazole, mebendazole, pyrantel and levamisole) while only one is available for schistosomiasis (praziquantel). There are several drug donation programs which countries may be eligible to apply for. Albendazole is available at no cost through certain NGOs and can also be purchased through PAHO/WHO at discounted prices. Johnson and Johnson have recently launched a mebendazole donation program which is a competitive process several countries in the region have entered. Praziquantel can also be purchased at discounted prices through PAHO/WHO and donations of limited quantities may be available through WHO headquarters. The Regional Program is available to provide technical assistance to countries in their applications for drug donations or in the procurement of drugs.

## Methods of Identifying and Estimating At-Risk Populations

*Steven K. Ault (PAHO/WHO, Regional Advisor)*

There are several groups which are known to be at risk of worm infection or morbidity from soil-transmitted helminths and/or schistosomiasis. These include women, adolescent girls and

children in poor communities, indigenous populations, shanty-town and slum dwellers, institutionalized populations and certain occupational groups (i.e., irrigation workers, migrant agricultural laborers, fishers, refuse workers and rubbish-pickers).

It is necessary to assess the current STH situation and determine which populations are at risk before a deworming strategy can be developed. If recent data is not available, a rapid appraisal of worm prevalence and burden will provide the necessary information. The most technical skill is required by the microscopists who will need to prepare and read a Kato-Katz slide. To do a national survey, a simple sampling frame has been developed: divide the country into different ecological areas and carry out a survey in each area. Based on the results of the survey, a strategy can be developed. The steps involved in a rapid appraisal are outlined in more detail below.

- 1.** Divide country or region of country into basic ecological zones of transmission (e.g. mountain, highland, lowland, periurban). These can be divided based on climate, humidity, and ecology or soil type.
- 2.** Sample 200 to 250 school children in each ecologically homogenous zone (i.e., climate, humidity, ecology, soil type).
  - a. Choose 5 schools randomly (public, private) in the health districts in each ecological zone.
  - b. In each school, choose 50 children from any of the primary school upper classes (where infection rates are usually higher), but preferably 3rd year students (i.e. in 3rd grade).
- 3.** Take a stool sample from each child and examine for parasite eggs and larvae using the Kato-Katz method. Details for collection of data at data stations are outlined in the WHO manual “Helminth Control in School-age Children: A guide for managers of control programs”, pages 21-23 ([http://www.who.int/wormcontrol/documents/helminth\\_control/en/index.html](http://www.who.int/wormcontrol/documents/helminth_control/en/index.html)). Record this data on WHO forms which are available in the aforementioned WHO manual (see annexes 2-5 in “Helminth Control in School-age Children”).
- 4.** Evaluate and map accumulated data using free SIP (Survey for Intestinal Parasites) software and HealthMapper software of WHO.
- 5.** Categorize infection by prevalence (high, medium, low) and intensity of infection (see pages 24-26 in “Helminth Control in School-age Children”).
- 6.** Publish the survey results.
- 7.** “No Survey without Service.” All children and schools included in the survey should be treated as necessary. Refer ill children to appropriate health services. Later, treatment programs should include non-enrolled school age children as well as those enrolled in school.

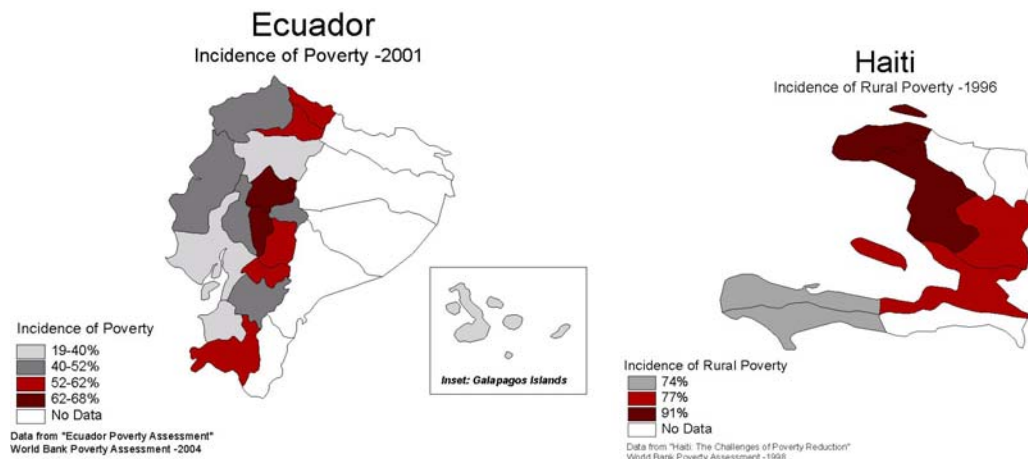
Several sources can be tapped to assist with a rapid appraisal of worm distribution, prevalence and burden, and to provide additional information on the current STH situation. These include the following:

- ✓ Review of literature: can include, but is not limited to, recent peer-reviewed papers, books, university theses, reports from the UN, NGOs, other foundations, development banks and churches.

- ✓ Hospital and clinic records can also provide information on worm infections and can include: data on hospitalization, surgical manifestations, MCH (Maternal and Child Health) and IMCI (Integrated Management of Childhood Illness) records, data on screening of food-handlers and health workers
- ✓ Screening surveys for parasites of new military recruits may be useful, which also ties the infection to a geographical location
- ✓ Other existing parasitological survey data
- ✓ Serological testing data which may be available
- ✓ Other rapid field surveys may provide information such as KAP (Knowledge Attitude Practice) studies on hygiene, food-handling, or water and sanitation surveys
- ✓ USAID health and nutrition surveys
- ✓ FAO (Food and Agricultural Organization) and WFP (World Food Program) surveys on nutrition, hunger, food security, water safety and sanitation, worms

Poverty maps are emerging as interesting tools that can also be used as proxies for STH infection. Poverty maps can be used to identify potential populations at risk. These maps can illustrate various characteristics which describe living standards, describe incidence of poverty, give information on percentage of underweight children, infant and child mortality, the Human Development Index, sanitation and water supply coverage and housing quality. These measures can be used to make inferences on populations and areas which may be burdened with worms. Several organizations have poverty maps available, such as the World Bank, other development and regional banks, UNICEF, WFP, FAO, UNDP and bilateral development agencies. Maps may also be available through national data and statistics offices, national economic development agencies, and universities and online at [http://earthtrends.wri.org/povlinks/poverty\\_map.php](http://earthtrends.wri.org/povlinks/poverty_map.php). Below are two maps on incidence of poverty in Ecuador and Haiti which can be used to target survey areas or treatment areas (Figure 7).

**Figure 7: World Bank Poverty Assessment**



## Opportunities for Integration of Deworming into School Health Programs

*Monica Palak (PAHO/WHO – Consultant)*

PAHO's strategy for neglected disease control takes an integrated, intersectoral, interprogrammatic and multidisease approach which seeks to secure the sustainability of interventions. An integrated approach takes advantage of the geographic overlap of disease (ex. malaria, S/STH, Lymphatic Filariasis), their common risk factors and the presence of other disease prevention and control programs at the local level. School-based integrated interventions can benefit pre-school aged children and women, and schools are excellent entry points for extending treatment and education to the community.

There are three key components of any school based STH control programs. They should include drug treatment to decrease worm burden, reduce morbidity and provide immediate improvements in child health. A school based program should also include interventions to improve sanitation to control transmission by reducing soil and water contamination. Lastly, a health education component is integral to any school-based program and should encourage healthy hygiene behavior to reduce transmission and re-infection.

Deworming can be integrated within the health sector by piggy-backing onto micro-nutrient supplementation programs (vitamin A, iron or iodine), food and milk distribution programs (macro-nutritional supplements), pre-school immunization programs, pre-natal and maternal health clinics, family planning clinics and TB, malaria and leprosy/skin disease screening programs, to name a few.

Opportunities also exist for interprogrammatic integration of deworming programs into other health programs such as:

- ✓ COMBI (Communication for Behavioral Impact) projects targeting dengue, malaria, etc
- ✓ PAHO/WHO's Health-Promoting Regional Schools Initiative
- ✓ Healthy markets, healthy municipalities
- ✓ Food safety and zoonoses prevention
- ✓ Eco-clubs and primary environmental care

Several opportunities also exist for intersectoral integration of deworming into existing projects. For example deworming can be integrated into micro-credit projects which include maternal and child health education components. It can also be integrated with rural development projects which include the promotion of home gardens/orchards for income & micronutrient deficiencies (vitamin A, iron, zinc), education programs which include the promotion of school gardens and environmental programs. Education programs can provide primary and secondary curriculum reform including basic sanitation, nutrition, health promotion and violence

prevention. Environmental programs can provide safe water systems and excreta disposal systems.

Several examples of integrated interventions from the region exist. In Belize's southern districts, a project is being developed which integrates micronutrient supplementation, deworming, vector-control, ecotourism, cultural tourism, micro-enterprise/micro-credit and agro-forestry techniques. The project is being targeted to an area where a recent STH survey found high prevalence of *Ascaris*, *Trichuris* and hookworms among children. The expected outcomes of the project include improved maternal and child health, empowerment, improvements in the environment and economic development.

A recent PAHO mission identified opportunities for synergy between national filariasis and soil-transmitted helminth control programs in Haiti. In response to this a pilot intervention is being developed to piggy-back the National Lymphatic Filariasis Program onto school-based deworming programs, thereby using the school to reach the entire community.

In Honduras, a project is being implemented which uses an integrated multi-disciplinary approach to improve morbidity and mortality indicators in mother and child health in rural areas. Deworming will be added to existing nutritional interventions, health promotion and education interventions being implemented by existing MOH programs and international collaborators. This project will use existing MCH and primary health care infrastructure allowing for capacity building and training of personnel.

## Six Key Components of a National Deworming Plan

*Monica Palak (PAHO/WHO – Consultant)*

Outlined below are 6 key components of a deworming plan, and they are also available in more detail at [http://www.who.int/wormcontrol/newsletter/en/PPC4\\_eng.pdf](http://www.who.int/wormcontrol/newsletter/en/PPC4_eng.pdf). These 6 steps may not be necessary for all programs and there is some overlap.

### **Step I: Collaboration**

Deworming through schools falls under the responsibility of both the education and health ministries, and the success of a program is reliant on strong collaboration between these two ministries. It is important to arrange meetings between these two groups to develop the plan, develop a joint timetable for training sessions and reach a consensus on budget responsibilities. Collaboration with local NGOs, faith-based groups, the private sector and the international community will also prove beneficial to the success of a school-based program. The sustainability of any school health program will be enhanced by active community involvement and support from parents, the community, and ministries of health, education, environment, water and sanitation and others.

## Step 2: Rapid Appraisal

It is necessary to assess the current STH situation; if recent data is not available, a rapid appraisal will provide the necessary information. The steps and tools required for a rapid appraisal have been discussed in detail under the section ‘Methods of identifying at-risk groups.’

## Step 3: Making a Plan

Following the situational analysis and once the prevalence and intensity of infection in each school and each area has been determined, a plan can be developed. The intensity of infection will determine how often children and at-risk groups should be dewormed. The following two tables outline the WHO’s recommended treatment strategy for STH infections and schistosomiasis.

**Table 3: WHO Recommended Treatment Strategy for STH**

Category	Prevalence	Action in Schools	Action in Community
<b>High</b>	≥ 70%	Treat all SAC 2-3 times each year	Treat Pre-SAC and women of child bearing age whenever they have contact with health services
<b>Moderate</b>	≥ 50% to < 70%	Treat all SAC at least once a year	
<b>Low</b>	≤ 50%	Treat only symptomatic individuals	Treat only symptomatic individuals

**Table 4: WHO Recommended Treatment Strategy for Schistosomiasis**

Category	Prevalence	Action in Schools	Action in Community
<b>High</b>	≥ 50% intestinal schistosomiasis	Treat SAC once a year	Praziquantel should be available in dispensaries for treatment of suspected cases. High risk groups should be treated
<b>Moderate</b>	≥10% to <50% Intestinal schistosomiasis	Treat SAC once every two years	Praziquantel should be available in dispensaries for treatment of suspected cases
<b>Low</b>	<10% infected with intestinal schistosomiasis	Treat SAC twice during primary schooling	

#### **Step 4: Ordering the Drugs**

To determine the number of drugs to order, take into account whether you need to treat both STH and schistosomiasis, the size of the target group and the frequency of treatment. Four drugs are available for treating STH, albendazole, mebendazole, pyrantel and levamisole. Albendazole and mebendazole are the lowest cost drugs at less than \$0.02 US. Praziquantel is the only drug available for schistosomiasis and the correct dose is calculated on the basis of body weight or height. The cost of a praziquantel tablet is less than \$0.10 US.

WHO recommends that children under the age of 1 should not be treated for either STH infections or schistosomiasis because they are unlikely to be infected and the safety of the drugs for this age group has not been fully assessed. With STH infections, it is safe to treat children from the age of 1 onwards and also safe to treat pregnant women (after the first trimester); for schistosomiasis, praziquantel is safe from the age of 1 onwards. However, children under 5 years are unlikely to be heavily infected with schistosomiasis; serious infection usually begins from age 6 onwards. Although in areas highly endemic for schistosomiasis, this may not be the case and 1 to 5 year olds might need treatment.

#### **Step 5: Training**

Training of health personnel and teachers is key to the success of school based deworming programs. Teachers are important partners since they are usually trusted community members. Thirty-five to forty teachers can be trained in half a day to administer drugs and educate children about worms. A trained teacher can deworm 200 children in a day. There are tools readily available for running teacher training workshops. Schools are excellent points to treat non-enrolled children and pre-school aged children.

#### **Step 6: Monitoring and Evaluation**

Appropriate data collection and evaluation of programs is important. At a minimum, coverage data should be collected to track how many children are treated. This allows one to budget and ensure that the correct quantities of tablets are available for the next round of treatment. Coverage data can be collected by using class lists and marking children who receive medication (doses and drug); non-enrolled children can be recorded separately.

A second rapid appraisal can be conducted 2-3 years into the program to evaluate the impact of the intervention and report back to donors if necessary. It is important to remember that prevalence does not always drop dramatically if the sanitation for the community does not improve (due to continuing re-infection in the environment). However, this does not mean the program is failing. The intensity of infection is the more important indicator, as the fewer worms a person has, the less serious the disease. Other basic data on each child can also be collected such as age, weight, height, hemoglobin levels, etc.

## Section III: Draft National Deworming Plans of Action

Every country presented a situational analysis of the schistosomiasis and/or soil-transmitted helminth profile based on the most current data available. Following the presentations on resources available for parasite surveys and key components in the development of national plans of action, participants broke into small working groups and drafted a plan of action of the steps necessary for the implementation of a deworming program. Where deworming policy or plans exist, countries updated the plan or policy, were asked to extend coverage or consider the roles of partners such as Ministry of Education (MOE), NGOs and UN agencies (CAREC, PAHO/WHO). Most countries followed the WHO guidelines for setting up a deworming plan which has 6 key components. A summary of each country's situational analysis and draft plan is presented below.

### Guyana

#### Situational Analysis

Guyana is located in South America and has a population of 750,000. The country is divided into ten regions. The hinterland and reverain communities, where indigenous populations live, have poor environmental and sanitations conditions. In some cases, homes have no running water and pit latrines and stand pipes are commonly used. Morbidity data for 2004 and 2005 for a group of diseases is presented in Table 5 below.

**Table 5: Morbidity in Guyana, 2004–2005**

<b>Diseases</b>	<b>2004</b>	<b>2005</b>
<b>Respiratory Tract Infections</b>	19,266	18,382
<b>Acute Diarrheal Disease</b>	8,626	9843
<b>Symptoms, Signs and Abnormal Clinical Findings</b>	6,954	8,263
<b>Skin Disorders</b>	5,889	5307
<b>Worm Infestations</b>	4,329	4,332

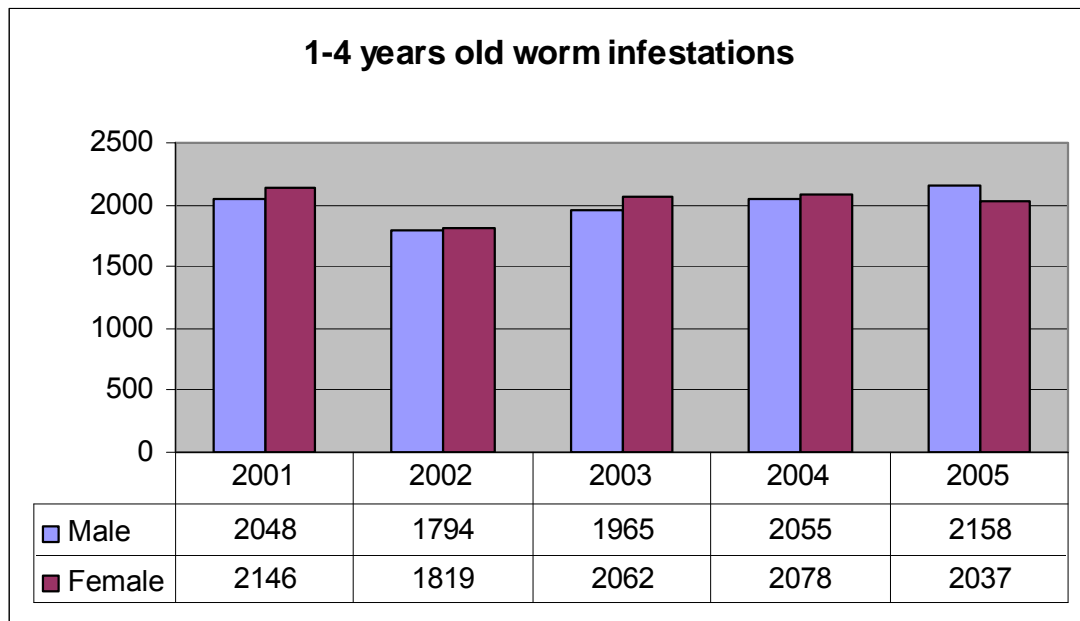
In 2001, 1 case of mortality due to worm infection in a pre-school aged child was reported, one case in 2002 in a person over the age of 65 was reported, one case in 2003 in a pre-school aged child was reported and one fatal case in a person aged 45-64 was reported. In 2005 no cases of death due to worm infestation was reported. Although mortality associated with worms is low, morbidity is seen across all age groups and females appear to be infected at a slightly higher rate than males. Table 6 outlines worm infestations among children aged 0 to 19, from 2001 to 2005.

**Table 6:  
Summary of Worm Infestations in Children under the Age of 19 (2001–2005)**

Category	Under 1 year	1–4 years	5–14 years	15–19 years
Estimated population	17,000	90,000	178,165	66,922
Worm infestations	857	20,162	24,555	6311
% of population infected	5	22	14	9

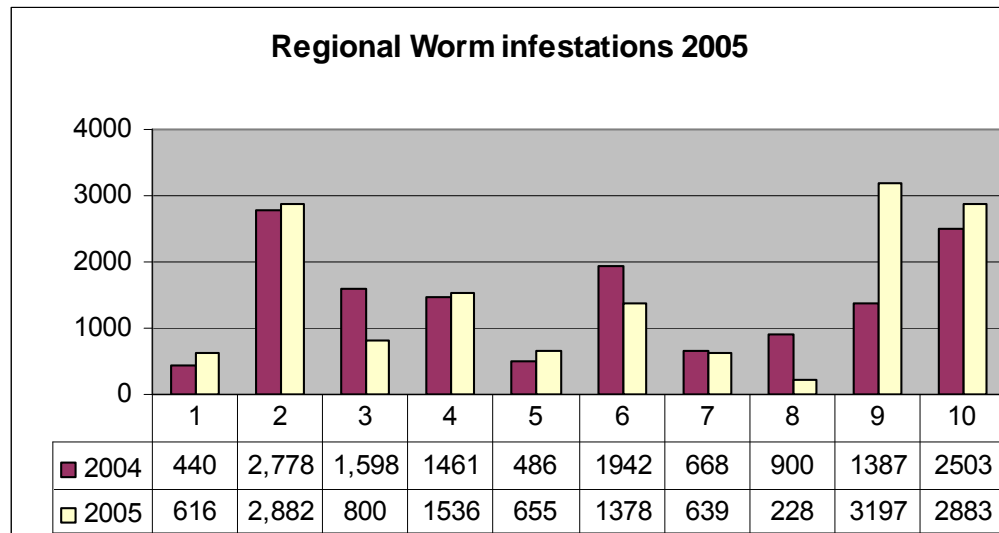
Children under 5 years of age have the highest rate of worm infections as outlined in Figure 8.

**Figure 8: Reported cases of Worm Infestations in Children 1 to 4 Years by Age Group and Gender**



Examining regional infestations of worms (Figure 9) indicates that regions 2, 6, 9 and 10 had the highest frequency of infection in 2004 and 2005. Regions 1, 7, 8 and 9 are the hinterland regions and have “difficult” terrain and it may be challenging to collect data from these regions.

**Figure 9: Regional Infestations in Regions 1–10**



Currently, Guyana is implementing an IMCI strategy. IMCI is a PAHO/WHO/UNICEF strategy for the reduction of childhood mortality and morbidity under 5 years of age. The strategy takes a holistic approach to child health, focusing on the most common causes of mortality and morbidity. It provides basic skills to health workers for clinical assessment, classification of diseases and immediate health care or referral skills. It teaches and implements care at the lowest, front-line level of health care, the health centers and health posts.

IMCI clinical guidelines indicate administering albendazole as a single dose in clinics if hookworm/whipworm is a problem in children in the area, and if a child has not had a dose in the previous 6 months. If albendazole is not available, mebendazole can be used. In pregnant women antihelminthics can be used after the first trimester of pregnancy; mebendazole (500mg) single dose or 100mg twice daily for 3 days or a single dose of albendazole (400mg). Worm treatment is also given to elderly persons based on clinical signs and symptoms. IMCI guidelines state a school health program should deworm children every 6 months.

In Guyana there is a need to do studies to determine the burden and type of worm infestations in selected regions. There is also a need to build technical capacity of national labs and personnel to help determine the causative agents of infection.

## **DRAFT NATIONAL PLAN OF ACTION**

The goal of the plan is to reduce the prevalence and morbidity of worm infestations in children under 5 years of age, school age children, pregnant women and other high risk groups.

### **Step I: Collaboration**

Collaboration is important and will be sought from the following partners:

- ✓ Government ministries: Ministry of Education, Amerindian Affairs, Health, Public Works and it is important to involve the Ministry of Education and the Chief Executive Officer.
- ✓ Health personnel: Minister of Health (MOH), Permanent Secretary, Chief Medical Officer (CMO), Epidemiologists, Health Educator, Senior Health Visitors, Regional Health Officers, Lab personnel
- ✓ NGOs and Community leaders
- ✓ Headmistresses in schools and teachers
- ✓ International health agencies such as PAHO, UNICEF and other UN agencies.

## **Step 2: Rapid Appraisal**

Existing information on helminth infections by age group, gender, region and high-risk zones need to be reviewed and re-evaluated. A rapid appraisal in five selected schools in the hinterland and coastal areas should be conducted to determine burden in primary and secondary schools. It is important to ensure the capacity of the national lab to do stool testing with Kato-Katz kits; this will involve training of lab personnel. The national policy on deworming for Maternal and Child Health/Family Health may need to be reviewed and include other high risk groups as necessary following the rapid appraisal.

## **Step 3: Making a Plan**

The plan must be developed with major stakeholders. Once the prevalence and intensity analysis is complete, target groups and the appropriate treatment schedule can be determined following WHO guidelines and the IMCI policy. IMCI suggests deworming twice a year for pre-school and school-age children, and other at risk groups are given antihelminthic medication according to the essential drug list. Pregnant women will be dewormed once during pregnancy after the first trimester and older adults based on clinical signs and stool testing.

## **Step 4: Ordering the Drugs**

After deciding on what drugs to order and how much is needed, a request for funds will be placed by the Ministry of Health to the Ministry of Finance for 2008. The order for drugs will be placed to the procurement department of the MOH and properly stored upon delivery until they are needed.

## **Step 5: Training**

Appropriate training will be provided for senior health visitors, community health workers and lab personnel. Some challenges anticipated for health workers include parental consent, refusals, letters to be given to the children, management of the side effects of drugs and line listing of children receiving drugs, side effects, etc.

## Step 6: Monitoring and Evaluation

Monitoring and evaluation will include annual evaluation of the impact of antihelminthics in target groups. Coverage data will be recorded as the number of children enrolled in primary and secondary schools and those receiving deworming drugs. Non-enrolled children will also be recorded, as well as the number of refusals. Growth and development monitoring will be measured according to Caribbean nutrition standards. The number of pregnant women dewormed will also be recorded and the impact will be evaluated measuring hemoglobin results and changes in level of anemia at the start and end of pregnancy. Funds for the deworming plan will be solicited from PAHO/WHO and other UN agencies.

## Anguilla

### Situational Analysis

Anguilla has a total area of 35 square miles with a population in 2007 estimated at 13,677. The annual birth rate is 14.0/1000, infant mortality rates are 19.6/1000 and life expectancy is 77.5 years. There is one secondary school in Anguilla with two campuses and an overall population of 1062 students. There are eight primary schools (six public and two private schools) which accounts for approximately 1640 students.

School health services are designed to assess students' health status, promote health, prevent health problems, provide emergency care, ensure access to healthcare and identify and manage barriers to students' learning. Anguilla's school health program started in 1992 with only one school nurse. In 1999, an additional school health nurse was recruited to strengthen the workforce, however, in 2001 one of the school nurses retired from the service reducing the number back to one. In 2003 a new school nurse was recruited to ensure institutional strengthening. So there are two school health nurses for some 2700 students in the education system. In Anguilla, School Health Services are under the responsibility of the Department of Education, not the Health Department. The existing school health programme for controlling soil transmitted helminths focuses primarily on school children at the kindergarten level (5 year olds). In 2006 there were 245 students registered in kindergarten, up slightly from 2005 when 228 students were registered in kindergarten.

According to school health data no cases of helminth infection were observed in 2006, one case was reported in 2005, three cases in 2004 and three cases in 2003. In 2006, hospital data indicates that of 188 students who were tested (the majority were 5 years old), two students tested positive for worms, one 8 year old tested positive for *Entamoeba coli* and one 12 year old tested positive for *Trichuris trichiura*. One 5 year old was unable to be identified. In 2003, 177 five year olds were tested and 6 positive results were recorded. One tested positive for *Taenia sp.*, four tested positive for *Entamoeba coli* and one tested positive for *Endolimax nana*. All positive cases are referred to a physician with a lab report and school health records. A repeat stool test is carried out by the physician to confirm findings.

Health promotion and education sessions are carried out at various primary schools as part of the school health program. Health education is also delivered by the media via press releases, newspapers and radio programs. Information is also disseminated at parent-teacher meetings. Other control and prevention measures include annual school inspections, submission of annual

reports with recommendations to the education department and treatment of all students at the kindergarten level once annually.

Constraints to prevention and control activities include limited manpower and a lack of current data available. In addition, no policy is in place for intestinal helminth prevention and control and there is a lack of available resources. The development and implementation of a national policy for intestinal helminth prevention and control is necessary and the capacity to undertake epidemiological, medical and operational research needs to be strengthened. Health information systems in the country also need to be strengthened.

## **DRAFT NATIONAL PLAN OF ACTION**

### **Step 1: Collaboration with the following partners will be sought**

- ✓ Ministry of Health Personnel: Permanent Secretary Health, health planner, director of health services (HAA), commissioner of social development, principal Environmental Health Officer, community nursing coordinator (HAA), epidemiologist/surveillance officer (HAA), coordinator health promotion & nutrition (HAA), senior medical technologist (HAA)
- ✓ Ministry of Education Personnel: Permanent Secretary of Education, Chief Education Officer, school health nurses, guidance counselors, principals of primary schools
- ✓ NGOs, UN organizations and other community groups such as school boards, parent teacher's association, Anguilla Christian Council, Environmental Club, the Social Security Board and the CAREC Office (Trinidad)

### **Step 2: A Rapid Appraisal will be planned for the country**

An important first step is to examine existing data from community nurses, school health nurses, senior medical technologists, food handler records and migrant worker medical records. A national survey targeting school-age children can be done (as necessary) in 4 schools from the 8 primary schools in the country.

### **Step 3: Making a Plan**

After evaluating the survey findings, recommendations on treatment can be made according to the prevalence of STH in school-age students. All students entering kindergarten should continue to be screened and treated if positive.

### **Step 4: Ordering Drugs**

Albendazole and mebendazole can be procured from the Eastern Caribbean Drug System (St. Lucia) as required. The government can cover the costs for drugs and additional support will also be solicited from PAHO/WHO and the social security board.

## Step 5: Training

Training of lab personnel in Kato-Katz method will be necessary as well as in record management to facilitate follow up. Nurses will also need to be trained to do screening and collection of stool samples. Environmental health officers will be trained to carry out surveillance and implement sanitation measures to control STH transmission. Funds will need to be allocated to meet training needs.

## Step 6: Monitoring and Evaluation

Data collected will be analyzed to determine the intensity of STH infection and evaluate the effectiveness of the deworming program on an annual basis. Assessment of data collected from other high risk groups such as food handlers and migrant workers will also be conducted and control interventions will be developed for this group in particular.

## Barbados

### Situational Analysis

Barbados has a population of 279,912 and 20% of the population is under 15 years of age. There are 80 government primary schools with 26,627 children enrolled. There are also 28 private nursery and pre-schools with 3313 children enrolled.

Several factors influence STH prevalence, infection and the reduction of infection in Barbados such as improved housing, improved sanitation and sanitary facilities, a safe water supply and health education.

The following two tables provide information on the prevalence of parasite infections from 2002 to 2006. Table 7 outlines the number of positive samples and Table 8 outlines the type of parasite detected in the positive tests.

**Table 7: Number of stool samples tested and number of positives for ova cysts and parasites, 2002–2006**

<b>Year</b>	<b>Number of stool samples tested</b>	<b>Number positive for ova, cyst and parasites</b>	<b>Percent positive</b>
<b>2002</b>	1487	43	2.9%
<b>2003</b>	1427	26	1.8%
<b>2004</b>	1532	19	1.2%
<b>2005</b>	1120	7	0.6%
<b>2006</b>	1078	11	1.0%
<b>Total</b>	<b>5636</b>	<b>106</b>	<b>1.9%</b>

**Table 8: Types of ova, Cyst, and Parasites, 2002–2006**

Type of Organism	Number of Positives					
	2002	2003	2004	2005	2006	Total
<b>Strongyloides stercoralis</b>	6	1	4	2	4	<b>17</b>
<b>Trichuris trichiura</b>	3	6	3	1	1	<b>14</b>
<b>Hookworm</b>	5	-	1	-	-	<b>6</b>
<b>Ascaris lumbricoides</b>	1	-	-	-	-	<b>1</b>
<b>Non pathogens</b>	13	11	8	-	3	<b>35</b>
<b>Other</b>	15	8	3	4	3	<b>33</b>
<b>Total</b>	<b>43</b>	<b>26</b>	<b>19</b>	<b>7</b>	<b>11</b>	<b>106</b>

Strategies for dealing with intestinal helminth infections in Barbados include regular check-ups and evaluation of children up to age five. The general practice unit provides services to all age groups. Health services are available at no cost and community health nurses and environmental officers make home visits as necessary. There is also the provision of toilets for proper disposal of feces, health education programs in schools and easy access to antihelminthic drugs.

## **DRAFT NATIONAL PLAN OF ACTION**

### **Step I: Collaboration**

The following are potential collaborators in Barbados:

- ✓ Ministry of Health is the department responsible for primary health care and partners within the ministry can include: the environmental health department, national drug service, public health nursing, health education/promotion, laboratory technicians and pediatricians.
- ✓ The Ministry of Education, School Boards and PTA are other important collaborators
- ✓ Other government agencies such as Social Transformation
- ✓ PAHO/WHO/CAREC
- ✓ The University
- ✓ NGOs, such as the Lions Club

- ✓ Community Groups
- ✓ Pharmaceutical companies (donations)
- ✓ Also, the approval of the Ethical Committee will be necessary prior to implantation of the plan.

## **Step 2: Rapid Appraisal**

The statistical office can be utilized to map high risk areas for sample selection using indicators such as sanitation, water, housing and income distribution maps. Survey data can be collected from adult food handlers who must give a stool sample in order to receive a certificate for work. For the rapid appraisal, schools can be selected from a representative number of rural and urban sites; 500 students will be surveyed from 10 schools (50 from each school). A consent and questionnaire form can be distributed to collect information on passing worms, self medication and levels of sanitary facilities available.

After determining logistics of specimen collection, transportation and examination methods, samples can be collected at schools and transported by a community nurse. A laboratory at Winston Scott Polyclinic can perform the analysis with the appropriate training for laboratory and field personnel in the Kato-Katz method. The survey results can be mapped in collaboration with the university and the MOH epidemiologist.

## **Step 3: Drafting a Plan**

Utilizing the rapid appraisal results to determine the population most at risk, a treatment strategy according to WHO recommendations can be developed to conduct deworming in schools and clinics. This will be accomplished by consultation with stakeholder groups in the MOH, MOE, school board and in rural and urban development. The Parent Teacher Association should also be consulted and a draft 5 year plan and budget articulated. The budget should include costs associated with administration and antihelminthic drugs. In addition health education materials will be needed, workshops and community school meetings will be necessary to communicate the impact of helminth infections on health and public education on the importance of sanitation. Further consultation sessions and feedback will be necessary before the plan is finalized and implemented.

## **Step 4: Ordering the Drugs**

The final drug selection will be based on the prevalence of parasite species (albendazole/mebendazole) and will be calculated as the number of drugs needed based on target population and how frequent treatment will be necessary. PAHO/WHO's assistance can be solicited for the procurement of the drugs in collaboration with the national drug service who may be able to provide storage assistance. Opportunities available for drug donations will also be explored. Drug distribution and administration must be considered and polyclinics and schools will be key partners.

## **Step 5: Training**

Training will be necessary for nurses on the collection and transport of specimens and to recognize the side effects of medication and how to appropriately deal with them. Teachers and

principals should be trained to recognize health indications of worm infestation and on the importance of sanitation in reducing worm infection and transmission.

## Step 6: Monitoring and Evaluation

Monitoring and evaluation activities will include the collection of coverage data by public health nurses, monitoring sanitation by environmental health officer and a parasitological survey 2 to 3 years after deworming (the number of schools will be determined based on budget).

## St. Vincent & the Grenadines

### Situational Analysis

St. Vincent and the Grenadines (SVG) is a multi-island state consisting of thirty islands, inlets and cays with a total land area of 345 square miles. The island state has a population of 106,253 of which 91% live on the mainland of St. Vincent. The Natural Growth Rate has fallen over the past few years from 2.8 to 2.4 per 1000, infant mortality has dropped from 22.4 to 18.1 per 1000 live births and life expectancy had risen by 7.8 years from 68.6 to 74.4 over the last 20 years.

Ninety-five percent of households have access to drinking water compared to 51% in 1980. Chronic non-communicable diseases are the main cause of mortality and morbidity, while drug abuse, violence and HIV/AIDS are presenting a challenge to health care delivery. Immunization coverage is at 100% for all diseases covered by the EPI (expanded program on immunization) program. The country is presently benefiting from improved sanitation and a better quality of life, and as a result, soil-transmitted helminths are not as wide spread today as they were 20 years ago.

However, STH are found in SVG and are usually linked to a lack of sanitation and poverty. Patients present with symptoms including diarrhea, abdominal pain, general malaise and weakness; no complaints have recently been reported on impaired learning or growth. The school health program, which monitors worm infestation in school aged children, screens all anemic children and found that 90% of the results were negative for STH. Due to the small numbers of positive smears, no recent research has been implemented in this area, although surveillance is ongoing. The following table presents a summary of all positive smears recorded by the national laboratory between 2001 and 2006.

**Table 9: Total number of Stool Samples Screened by Year and Number of Positives**

Year	Total screened	Total no. of positives	No. of <i>E. coli</i>	No. of hookworm	No. of <i>Trichuris</i>	No. of <i>Ascaris</i>	No. of Strongyloids	No. of <i>Giardia</i>
2001	2725	398	204	75	27	4	40	48
2002	2719	342	175	74	20	4	25	44
2003	2119	52	0	17	2	1	15	17
2004	2090	92	47	13	0	1	19	12
2005	2223	98	44	16	5	5	16	12
2006	2047	110	84	15	1	2	8	0

Soil-transmitted helminths are not a serious public health problem in St. Vincent and the Grenadines; the incidence rate of soil-transmitted helminths is 0.2 per thousand. However, school aged children continue to be screened as well as adults who present the signs and symptoms of worm infestation. IEC (information education communication) programs continue through the Health Promotion Unit in the Ministry of Health and the Environment.

## Trinidad and Tobago

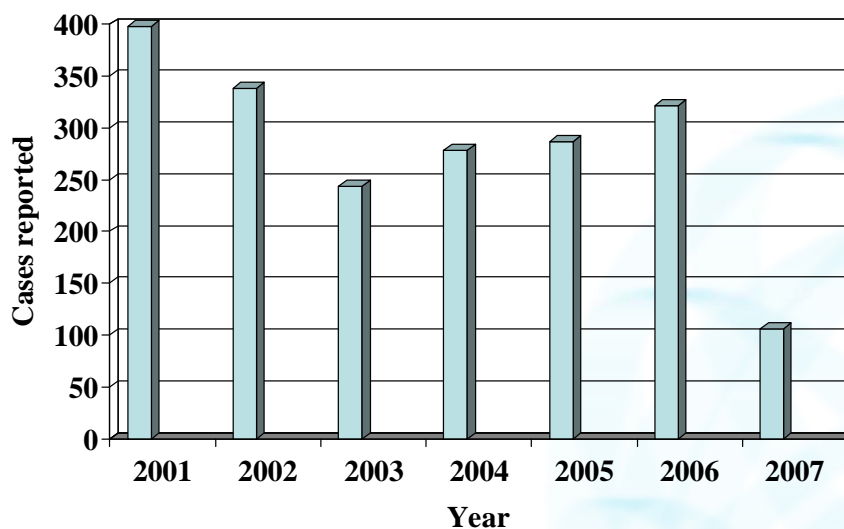
### Situational Analysis

Trinidad and Tobago is a twin-island state and the most southerly Caribbean island. The population is estimated at 1.3 million; 30% of the population is under 15 years of age, 64% between 16 and 65 years and 6% over the age of 65.

STH infections often go undiagnosed because signs are often non-specific and do not always suggest a parasitic infection. There are no accurate data on the number of clinical cases of soil-transmitted helminths that occur each year in Trinidad and Tobago. Serologic testing for the detection of antibodies is not widely used and laboratory tests for the diagnosis are not requested for most patients. Instead, if a diagnosis is made, it is usually done on clinical assumptions and treated.

Very little recent data is available for Trinidad and Tobago. Results from a study by Rawlins *et al* in 1990 found in a small population of school children (n=50) seroprevalence positive rates ranging from 54% in 5-7 year olds to 87% in 12-13 year olds. Based on some of the available data at CAREC, there was an average of 7 cases of helminth infections per week during the period of 2000 to 2005.

**Figure 10: Helminth Infections Reported to CAREC by Trinidad MOH**



Trinidad and Tobago needs to establish a system whereby key data are collected by responsible parties at the national level and at all levels of healthcare. This data should then be reported annually to PAHO/WHO so that progress towards the 2010 target can be measured more effectively.

## **DRAFT NATIONAL PLAN OF ACTION**

### **Step 1: Collaboration with the following partners will be sought**

- ✓ Ministry of Education: linkages with the school supervisors for logistics and to facilitate the various activities
- ✓ Ministry of Health, including the:
  - ✓ EPI Coordinator- discussions to piggyback with immunization program
  - ✓ Chief Nursing Officer - school health nurses linkages
  - ✓ Epidemiologist(s)- report analysis, comments and evaluation
  - ✓ National Surveillance Unit - data collection, compilation and distribution
  - ✓ Pediatrician(s) - for opinion and concurrence
  - ✓ UWI (University of the West Indies) – assist in the research element of the program
  - ✓ Health Education/Promotion – assist in the preparation and distribution of
  - ✓ Laboratory Director – will be dealing with the logistics of collection
  - ✓ PAHO/WHO/CAREC
  - ✓ Environmental sanitation department – public health inspectors
  - ✓ WASA (Water and Sewerage Authority)
  - ✓ Local NGOs – community groups, Parent Teacher Associations, etc
  - ✓ International NGOs such as Vitamin Angel Alliance and pharmaceutical companies (for drug donations)

### **Step 2: Rapid Appraisal**

The mapping of high risk areas will be used to assist sample selection; the statistical office will also assist with developing sample size and cohort samples from census data. Twenty schools will be selected at random for the rapid appraisal with an equal number of rural and urban schools; 500 students will be surveyed, 50 from each school. Partnership with the Ministry of

Education, School Boards, Community Groups and the PTA will be sought for the rapid appraisal, as well as the approval of the ethics committee.

Equipment and training will be provided for laboratory and field personnel and the logistics of specimen collection, transportation and examination of samples will be determined. The Kato-Katz method will be used for assessing worm burden and the survey results will be mapped.

### **Step 3: Making a Plan**

If needed, the assistance of a consultant from PAHO/CAREC will be sought to develop the plan. The rapid appraisal results will be used to determine a treatment strategy for STH infections according to WHO recommendations. The survey will identify high-risk areas or populations to target for intervention. Consultation sessions with stakeholder groups including the MOH Health Promotion Unit, MOE, Communication Unit and development adaptation will be planned. The plan will be drafted and a budget will be developed for further consultation with stakeholder groups and finalization.

### **Step 4: Ordering Drugs**

The quantity of drugs needed will be based on the target population and how frequently treatment will be needed. The final drug selection will be based on the parasite species present. PAHO/WHO's assistance will be sought for the procurement of drugs and the timely delivery of drugs. Drug distribution and administration will need to be finalized and may be facilitated by nursing staff, hospitals, community health centers and schools.

### **Step 5: Training**

Training will be provided to nurses, teachers and community leaders through workshops, community participation and PTA school meetings. Health workers and lab technicians will also be trained in the Kato-Katz method.

### **Step 6: Monitoring and Evaluation**

Coverage data will be collected and the impact of treatment will be measured by a follow-up parasitological survey 2 to 3 years after implementation of the deworming plan.

## **Jamaica**

### **Situational Analysis**

Dr. San San Win presented results from a study of gastrointestinal parasitic infections conducted in Annotto Bay, a community in the parish of St. Mary, Jamaica. Annotto Bay is situated on the eastern side of the mouth of the Wag Water River. It is intersected by 3 sluggish rivers which form swamps in the neighborhood. Most of the area has had a piped water supply since 1934. The main sources of employment are the St. Mary Banana Estate, as well as fishing to a smaller extent. The population is over 16,700 and at the time of the study 412 were under the age of 9. Stool samples were collected randomly from children below the age of 9 years from the community and 38 questionnaires were distributed to parents.

Of the samples collected 64.7% of stools contained ova/cyst of one or more of 3 helminth species. The prevalence was age dependent, with infection occurring most commonly in pre-school aged children (Table 10). The prevalence rates of *Ascaris* and *Trichuris* were markedly age dependent. The overall prevalence of *Ascaris* was 56.7% among the 2 to 3 year age group and the prevalence was 48.3% in the 4 to 5 year age group. Worm infestation was more prevalent in low income families sharing pit latrines and an outdoor stand pipe

**Table 10: Prevalence of Worm Infestation by Age of Children**

Age (year)	N	No. of subjects worm positive	No. of subjects worm negative	Prevalence of worm positive
0-1	22	16	6	72.7
2-3	16	13	3	81.2
4-5	19	12	7	63.1
6-7	19	10	9	52.6
9-9	9	4	5	44.4
Total	85	55	30	64.7

Young children are more susceptible to infestation than the older age groups and *Ascaris lumbricoides* was found to be the most prevalent intestinal parasite. Poor sanitation, lack of water supplies, lack of education on personal and environmental hygiene by parents are all related to high incidence rates. Following the study, a deworming program was implemented in primary schools and the construction of 100 latrines was completed by the Netherlands project. Health education to the community was also implemented.

## DRAFT NATIONAL PLAN OF ACTION

### Step 1: Collaboration will be sought with the following partners

- ✓ Ministry of Education and the Ministry of Health: including Medical Officers of Health, DMOs, Epidemiologists, Environmental health inspectors Community health aids. Public Health Nurses, Health educators,
- ✓ PTA, School Board of Directors, Guidance Counselors teachers administrators, school principals, parents
- ✓ Community: community leaders, community members
- ✓ Other partners and collaborators: PAHO/WHO, UNESCO, UNICEF, PATH, PALS, churches, support of political representatives, Philanthropic groups, pharmaceutical distributors

### Step 2: Rapid Appraisal

Existing published studies and epidemiological and demographic data sets show 10 to 12 prevalence studies over the last 34 years, and studies suggest that prevalence is higher in rural

areas. A national parasitological survey with a simple sampling frame can be implemented with 5 primary schools with 50 children from each school. Kato-Katz tests will be conducted and WHO's school form and child form will be used by the survey team.

### **Step 3: Making a Plan**

Survey results on prevalence and intensity of infection in each school and each area will be used to draft a plan of action. Parasite species, demographical, social and environmental factors and geographical distribution of STHs will all be taken into consideration when drafting the plan. A report to stakeholders will be made via meetings with the MOH and the MOE, PTA, community leaders, PAHO and others. The WHO guidelines will be used for appropriate deworming action in terms of drug choice, frequency of treatment and target populations.

### **Step 4: Ordering the Drugs**

Albendazole is the recommended drug available for treating STH and expected sources for donation and purchase include PAHO, Lasco, Rotary, Lions Club, the MOH and MOE, NGOs and others. Delivery, storage and distribution of drugs may be facilitated by the regional hospitals/health departments (centers) and schools. Cold packs/ice and igloos will be used for the transportation of drugs.

### **Step 5: Training**

Training will be necessary on the Kato-Katz method, and it is estimated that training for 8 people and can be done at the UWI parasite research labs in one day. Orientation will also be offered to PTA members, school boards, the MOH, the MOE, community leaders and representatives, health educators, public health inspectors, community health aides and public health nurses. Training vehicles will include workshops, community and school meetings, PowerPoint presentations, flyers, posters and practical demonstrations.

### **Step 6: Monitoring and Evaluation**

Coverage data will be collected by public health nurses and public health inspectors, school principals and school nurses. Parasitological analysis and evaluation will be conducted by the medical officers of health and parish health teams (i.e. lab techs, public health nurses, public health inspectors). The parasitological analysis will be repeated in 5 years. With the help of nutritionist, growth and development of children will be assessed using indicators such as age, weight, height and hemoglobin levels as necessary.

## **St. Lucia**

### **Situational Analysis**

St. Lucia is a 238-square-mile island located southeast of Barbados. In 2006, the population of the country was 167,698. Gastroenteritis is the most common syndrome that causes a person to seek medical attention. However, not everyone admitted has a stool sample collected for lab investigation and not every outpatient follows his/her doctor's advice and brings a stool specimen to a lab. St. Lucia has two public health programs that oblige persons to submit stool for lab investigation; they are the Health Certification of Food Handlers (about 6000 persons

tested) and the Prenatal Care Program (about 3000 persons tested). The laboratories on the island process the stool of persons from these programs and persons with symptoms that require stool analysis to make a diagnosis. The communicable diseases profile indicates that the southern part of the island and the working population have more pathogens diagnosed than children. This may be due to the fact that parents can buy worm medicine over the counter and people deworm regularly. However, public health investigations are focused on schistosomiasis and not STH; therefore existing data may not be a true reflection of the situation.

Helminth prevention programs have been discontinued in St. Lucia for more than 25 years. In 2005 the International American University in collaboration with the Ministry of Health undertook an EPI study of intestinal parasites using a retrospective study of stool sample data at all the laboratories in St. Lucia. The study analyzed data collected over a 4 year period (2002 to 2005); for the period analyzed 1952 positive stools were identified. Persons in the 0 to 10 age group had the lowest helminth percentage and *Taenia solium* and *Ascaris* were most common, their contribution ranged from 6% and 4%. Eleven to twenty years old were more affected by *Taenia solium* (25%), *Schistosomiasis* (23%) and *Trichuris* (22%). Hookworms were the most common helminths making up 35 to 45% of all helminths identified annually; males tend to be infected by hookworms at a higher rate than females. Females are infected with *Ascaris* more than men with a 9 to 18% annual diagnosis, and 6% to 12% annual diagnosis of *Trichuris trichiura*. Persons in the 21 to 30 age group had the highest percentage of helminth infections: 30% *Ascaris*, 30% *Trichuris* and 28% Hookworm.

The island is divided into 8 regions and the southern end of the island recorded the highest STH burden, 38% in Region 5, 26% in Region 6, 9% in Region 4. Fifteen percent was recorded for Castries in the north of the island. In terms of specific helminths, Region 5 had the highest percentage of hookworm, *Ascaris* and *Strongyloides*. Region 6 also had high percentage of hookworm and *Ascaris*, followed by Castries in the north.

The outcome of the investigation suggests that infection with helminths is not a significant public health problem for school age persons but is more of a concern among the working population. However, it is not clear whether this is a reflection of the low number of school aged children being tested. Additional testing of at risk populations may reveal more positive samples which would indicate a bigger problem. It is also possible that children are less exposed to contaminated soil or water sources which may prevent infection.

## **DRAFT PLANS OF ACTION**

### **Step 1: Collaboration with the following partners will be sought**

- ✓ Political directorate of the Minister of Health and Education and Permanent Secretary must approve the project
- ✓ Ministry of Education; the Chief Education Officer (permission to survey in school) and teachers to help collect samples and documentation
- ✓ Ministry of Communication and Social Services (pit latrine and safe water installation (inform of project for later input)

- ✓ Ministry of Health - PNO, FNP, community health aides, chief medical officer, SMO, DMO, environmental health officers, lab managers, other health personnel such as pediatricians
- ✓ University for stool testing
- ✓ Community – principals, teachers, PTA (inform on project and make them shareholders; no project without their participation)
- ✓ Health educators, Community Peer Educators-for HIV/AIDS
- ✓ Establishment of a Ethical Committee to review project
- ✓ Other partners and collaborators: NGOs, faith-based groups, service clubs, private sector
- ✓ UN agencies such as PAHO and UNICEF
- ✓ Local drug companies
- ✓ Farmers Association: when expanded to other risk groups such as farmers

## **Step 2: Rapid Appraisal**

Existing published studies and epidemiological and demographic data sets conducted in the last 5 years will be used to locate communities at risk. Hospital records, lab records, 2005 Laboratory Data study and a 1980s UWI study will also be used, as well as national reports of diarrheal diseases. Census data and poverty maps will be used to locate communities with poor communities with poor sanitation and water supply. A national parasitological survey will be implemented using a simple sampling frame. The country will be divided by ecological area and both STH and schistosomiasis will be surveyed for. Census data and poverty maps will be used to locate communities with poor sanitation and water supply. A helminth or sanitation questionnaire may be used to assess lifestyle and behavioral risk. An appropriate number of schools will be selected, perhaps one per district in high risk areas (6 schools initially).

To conduct the rapid appraisal, Kato-Katz kits will be needed as will software and training for data analysis, laboratory support and training in collection of specimens. The results will be reviewed and recommendations will be made based on WHO guidelines.

## **Step 3: Making a Plan**

Survey results will provide information on prevalence and intensity of infection in each school and each area. This can be reported to stakeholders and the results can be mapped. WHO guidelines will be used to determine an appropriate plan of action for deworming including drug choice, frequency of treatment and populations to target for treatment. Drugs will be administered by nurses at schools as per WHO guidelines.

#### **Step 4: Ordering Drugs**

There are four recommended drugs available for treating STH (albendazole, mebendazole, pyrantel and levamisol), and praziquantel for schistosomiasis. Donations will be sought from various sources such as Bryden & Sprotts drug agent, PAHO/WHO, UNICEF, WFP and the French cooperation. Quality control testing, delivery, storage and distribution of the pills will be facilitated by the Public Health Department.

#### **Step 5: Training**

Training will be necessary for lab personnel on the Kato-Katz technique. School nurses, public health nurses and family nurse practitioners will also receive training via various training vehicles.

#### **Step 6: Monitoring & Evaluation**

Coverage data will be collected by public health nurses, family nurse practitioners and school health nurses, surveillance officers, statistical officers, monitoring and evaluation officers and others. School children enrolled in school and those not enrolled will be treated, along with other target populations. Parasitological impact will be evaluated by a second rapid appraisal. Growth and development may also be evaluated using the following indicators: age, weight, height, hemoglobin levels, and school attendance.

## **Grenada**

### **Situational Analysis**

Grenada, Carriacou and Petit Martinique have a population of 100,000. Data on worm infestation has not been collected, however, a quick review of hospital lab records of stool test results from March 2005 to May 2007 found 21 positive Strongyloides tests, 6 cases of hookworm infection and 2 positive cases of Trichuris. These samples were collected from hospital admissions and food handlers who require a test for certification. Although this is a relatively small number of positives, this does not reflect the true STH profile in Grenada.

No formal school health program exists; emphasis is instead placed on immunization and eye health. Culturally, routine deworming is accepted and drugs are readily available. There are limited resources available, but there is a need to have a basic survey done in underprivileged areas, among sanitation workers and agricultural workers to assess the true STH profile.

## **DRAFT NATIONAL PLAN OF ACTION**

### **Step 1: Collaboration will be sought from the following partners:**

- ✓ Ministry of Health and the Environment: Director of community services, chief community health nurse, personnel from microbiology lab at General Hospital, health educator, chief pharmacist, chief environmental health officer, district medical officers, pediatricians
- ✓ Ministry of Education: chief education officer, school principals, teachers
- ✓ St. George's University
- ✓ National water and sewage authority
- ✓ Community groups, members of PTA, church groups and NGOs
- ✓ International agencies: PAHO, CAREC and other agencies

### **Step 2: Rapid Appraisal**

Lab records from the General Hospital from the past 5 years can be reviewed to assess the worm situation. Data on age, sex, and type of helminth found in stool can also be obtained from this source. A national survey should be done to get an accurate picture of the situation in Grenada. The survey can be conducted in twelve schools, 6 in mountainous areas (for example, Mt. Rich, Birchgrove, Vincennes, New Hampshire, Mt. Moritz and one school from Carriacou) and 6 from the costal areas (for example, Victoria, Sauteurs, Gouyave, Marquis, Grand Anse and a school on coastal area of Carriacou). Children in stage 2 may be included in the survey since they would still be in school 2 years later when a follow-up survey would be done.

### **Step 3: Formulation of Plan**

A report will be compiled that describes the prevalence and intensity of infection in each school and each area should be made available to all stakeholders. The WHO recommended treatment strategy will be followed when developing a plan. The inclusion of health and hygiene education is of paramount importance.

### **Step 4: Ordering the Drugs**

Albendazole and Mebendazole will be used and treatment will be done twice a year as per WHO guidelines. The target population will include school age children, pregnant women, and patients attending dermatology clinics. An estimate of the number of patients which will require treatment will be needed in order to calculate number of tablets needed. Test kits will also be needed for measuring hemoglobin levels.

### **Step 5: Training**

Public health nurses and district nurses will need to be trained in the administration of anthelmintics and in the monitoring for possible side effects. Lab personnel will require

training in use of Kato-Katz method which can be facilitated by Dr. Calum McPherson. Health education personnel will also need some training in the design of appropriate leaflets and charts.

## **Step 6: Monitoring and Evaluating**

Coverage data on the number of students treated will be collected by school teachers, as will as the hemoglobin levels. Public health nurses and district nurses should record the number of pregnant women treated along with their hemoglobin levels. Dermatologists should record the number of patients seen (age, sex, hemoglobin levels, stool test result, address and diagnosis). Information should be sent to the epidemiology department at the Ministry of Health for processing. To assess impact, another rapid assessment should be done in the same areas after two years, on the same students tested initially.

## **St. Kitts and Nevis**

### **DRAFT PLAN OF ACTION**

#### **Step 1: Collaboration with the following partners will be sought**

- ✓ Ministry of Health Personnel: Permanent Secretary Health, Health Planner, Chief Medical Officer, Director of Community Health Services, Director of Community Health Nursing, Chief Environmental Health Officer, Epidemiologist, Health Educator, Nutritionist, Lab Technician.
- ✓ Ministry of Education Personnel: Permanent Secretary Education, Chief Education Officer, Guidance Counselors, Principals of Primary Schools
- ✓ NGOs: Parent Teacher's Association, Peace Corps Volunteers (attached to MOH/MOE)
- ✓ Resource Personnel such as Dr. Sam Rawlins/UWI St. Augustine

#### **Step 2: Rapid Appraisal**

Existing lab data from food handlers' records and migrant workers medical records will be examined and a plan for a rapid appraisal will be developed. A national survey targeting school-aged children needs to be developed in 8 schools as a pilot (5 in St. Kitts and 3 in Nevis).

#### **Step 3: Making a Plan**

The survey findings targeting school-age children will be evaluated and action will be taken according to the prevalence of STH based on WHO guidelines. Recommendations for selective treatment will include that all new students entering kindergarten should be screened and treated if positive. Assessment of data collected from other high risk groups such as food handlers and migrant workers will be carried out and a treatment program will be developed for STH control as necessary.

#### Step 4: Ordering the Drugs

Based on the drugs recommended by WHO for STH treatment, the government will be asked to cover the cost of drugs and PAHO/WHO will be expected to also provide support. Procurement of drugs will be facilitated by the Eastern Caribbean Drug system.

#### Step 5: Training

Training of lab technicians in Kato-Katz method will be necessary, as will training in record management to facilitate follow-up action. Training of nurses will also be necessary to do screening and collection of stool samples, as well as training of EHOs to carry out surveillance and implement sanitation measures to control transmission of STH and allocation of funds to meet training needs will be necessary.

#### Step 6: Monitoring & Evaluation

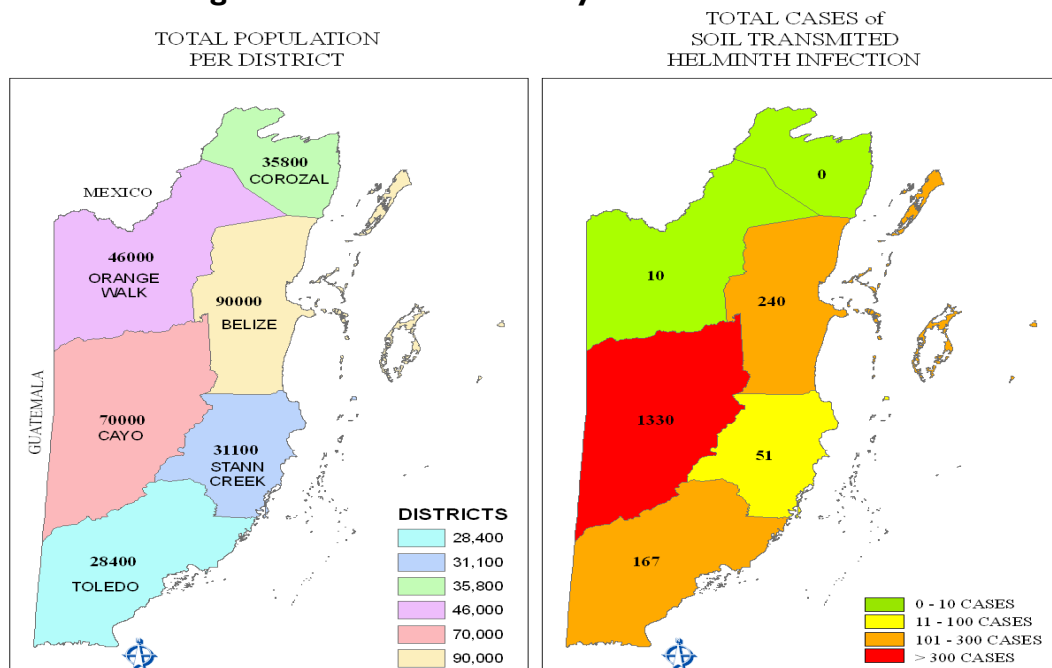
Collected data will be analyzed to determine the intensity of STH infection. The deworming program will be evaluated and assessed for effectiveness on an annual basis.

### Belize

#### Situational Analysis

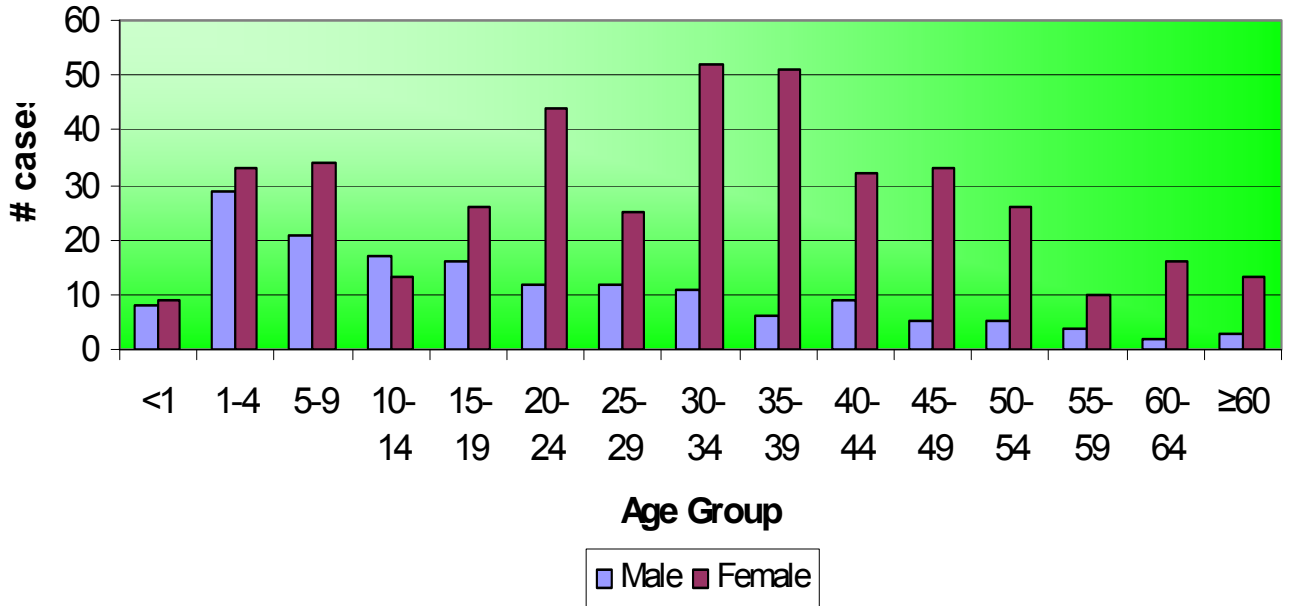
Belize is 8,867 square miles and in 2006 had a population of 301,300. The country is 49.4% rural and 50.6% urban. Belize has 54 notifiable communicable diseases and STHs do not fall under this list. Recent data (2006) from the Public Laboratories regarding STH infection is available and presented below.

**Figure 11: STH Infection by District in Belize**

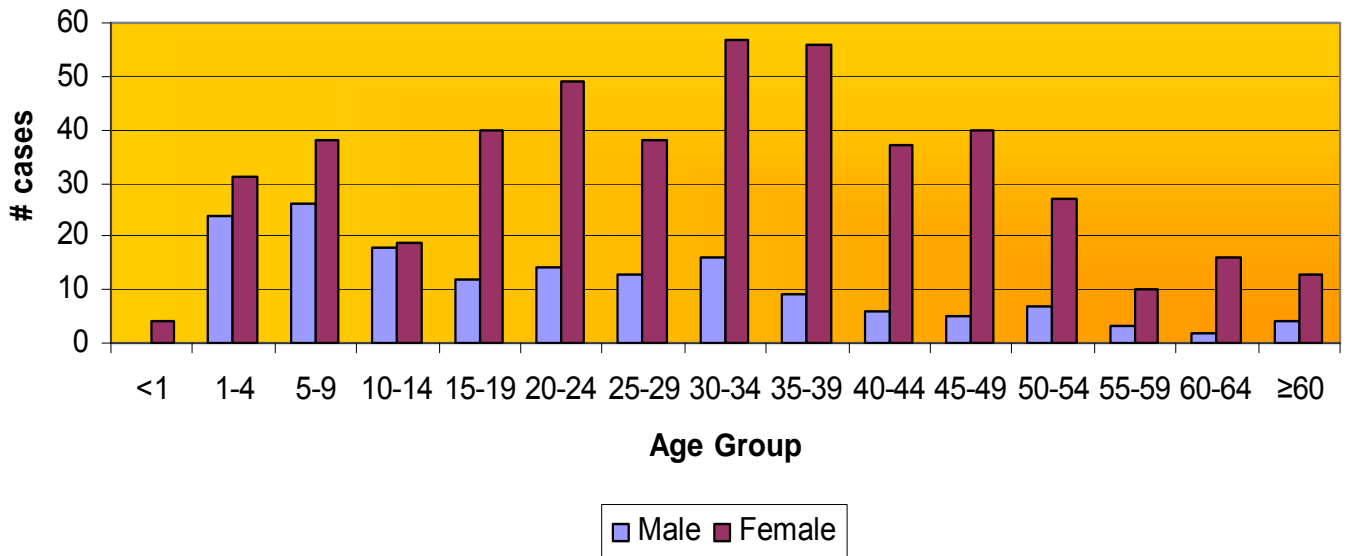


Data on *Ascaris*, *Trichuris* and hookworm infections are available for 2006 disaggregated by age and sex. These are presented in the following three figures.

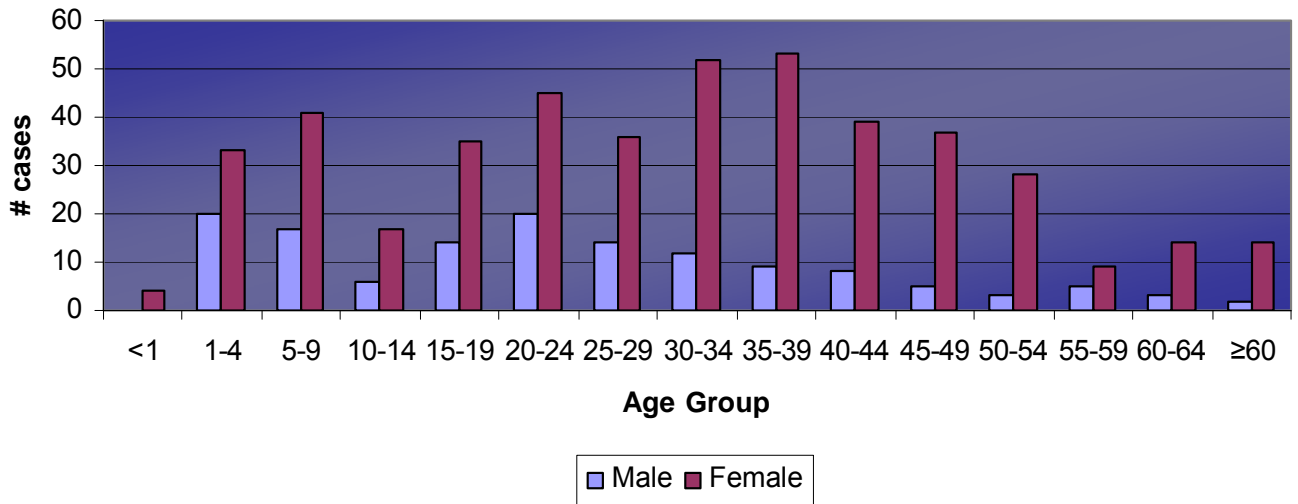
**Figure 12: *Ascaris lumbricoides* Infections by Age and Sex (2006)**



**Figure 13: *Trichuris trichuria* Infection by Age and Sex (2006)**

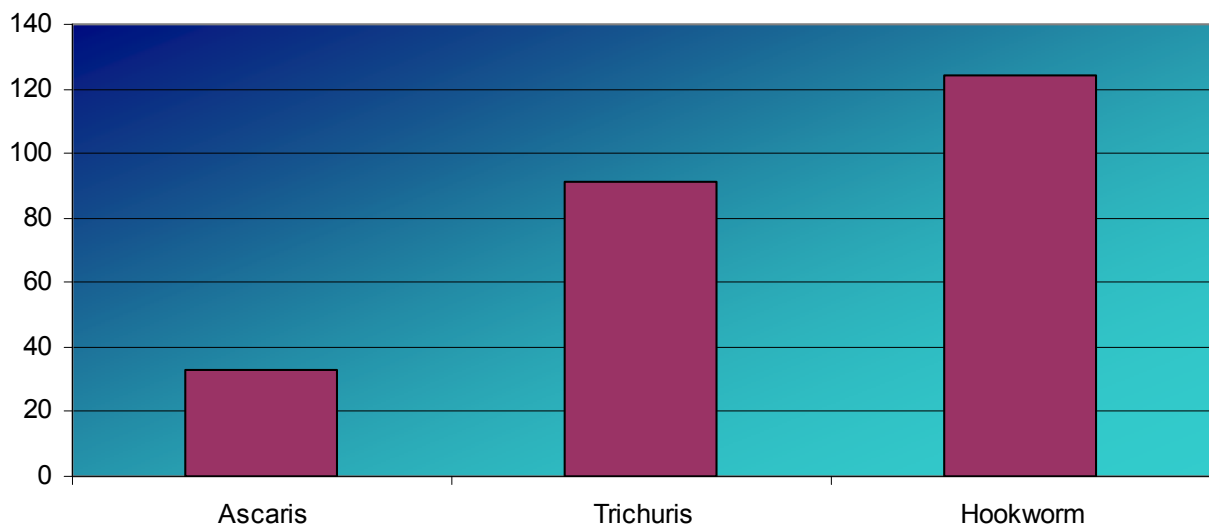


**Figure 14: Hookworm Infections by Age and Sex (2006)**



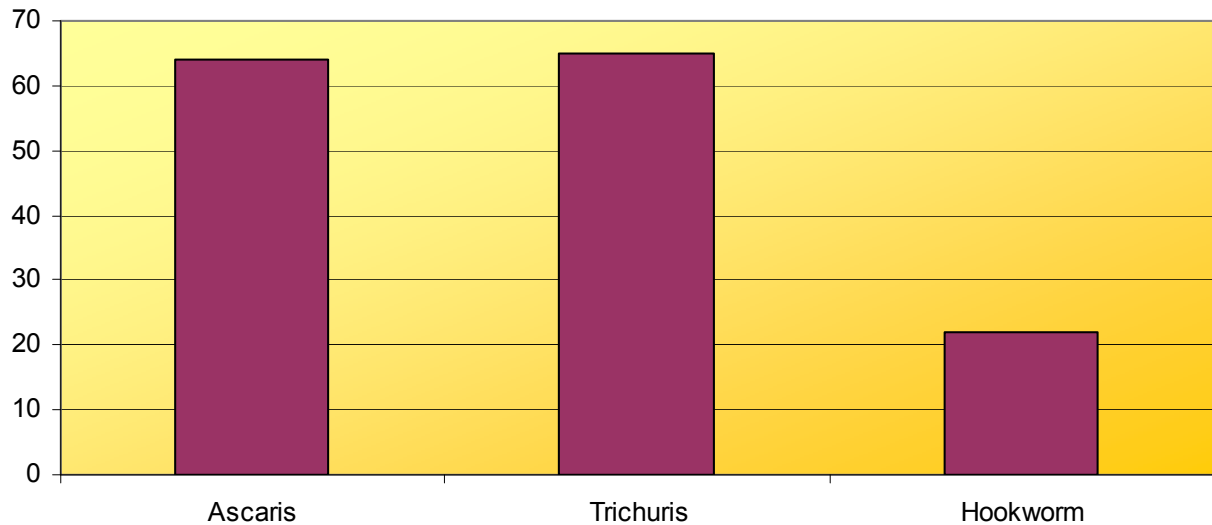
Data on STH infection is also available disaggregated by district. There were no cases reported in Corozal district which is 24.9% urban and 75.1% rural, poverty (in 2002) is 26.1% and 60.8% of the population has access to the sewer system. Ten cases were reported in Orange walk district, 8 cases of Ascaris, one trichuris and one hookworm case. The district is 34.1% urban and 65.9% rural with a 2002 poverty rate of 34.9% and 40.1% of the population has access to the sewer system. 248 positive cases were reported in Belize district which is 79.4% urban and 20.6% rural with a poverty rate (2002) of 24.8% as seen in figure 15. 89.6 % of the population has access to the sewer system.

**Figure 15: STH Infection in Belize District (2006)**



In Cayo district 1349 cases of STH infection were found, 451 cases of *Ascaris*, 449 of *Trichuris* and 449 of hookworm. The population is 57.3% urban and 42.7% rural with 27.4% living in poverty in 2002. 56.1% of the population has access to the sewer system. Stann Creek district reported 51 positive cases, 8 *Ascaris* cases, 34 *Trichuris* cases and 9 hookworm cases. Toledo district reported 167 cases of STH infection (Figure 16). The population is 18% urban and 82% rural with a poverty rate of 79%. Only 24.8% of the population has access to the sewer system in Toledo district.

**Figure 16: STH Infection in Toledo District**



There are several limitations to the data presented. Physicians do not order stool tests for all suspected cases, stool samples are taken primarily from food handlers and only data from the public laboratories are represented by this data.

In 2005, a baseline parasitological survey in Stann Creek and Toledo examined a total of 500 stool samples from primary school children aged 5 to 12 randomly selected from 10 schools, 50 students randomly selected from each school. Of the total of 500 stool samples examined, 306 (61.2%) were infected by soil-transmitted helminths. Females (62.23%) were generally more infected than males (59.91%). STH infections were highest in 10 to 12 year olds in both males and females. *T. trichiura* had the highest overall infection rate of 40.2%, hookworm infection rate was 22% and *A. lumbricoides* was 24.6%. In addition, 84 (16.8%) of the subjects were infected by two or more soil-transmitted helminths. Of these, 64 had double infections and 20 had triple infections. The table below shows the overall intensity of the infections.

**Table 11: Overall Intensity of Infection**

AGE (years)	Overall Prevalence	Light Intensity (%)	Moderate Intensity (%)	Heavy Intensity (%)
5–9	56.6%	178 (47.1%)	30 (7.94%)	6 (1.59%)
10—12	71.3%	74 (60.7%)	13 (10.7%)	5 (4.1%)

## Belize

### DRAFT NATIONAL PLAN OF ACTION

#### Justification

Data from district laboratories show different patterns of infection and predominant parasites per district. Laboratories in Cayo, Belize, Stann Creek and Toledo showed relatively higher cases of infection, northern districts show very few infections and Belize District showed *Trichuris* and Hookworm infections as the most common. In Cayo and Stann Creek *Trichuris* infections were the most common and in Toledo *Ascaris* and *Trichuris* were most common. Data show varying levels of poverty and sanitation per district suggesting that deworming needs may also vary by district.

After analyzing the results of the 2005 baseline survey and other data available, including poverty maps, additional surveys can be implemented to clarify STH prevalence in the remaining districts. Several partners can be involved to share project goals, objectives, activities and expected results including: PAHO/WHO, other UN agencies, University of Belize, NGOs, community groups, parent-teacher groups and international NGOs.

The goal of the draft plan is the improved health and school performance of school age children in Belize.

#### Objectives

1. To treat 75% of school age children (both in and out of school) with antihelminthic chemotherapy using treatment strategies appropriate to the epidemiologic situation in each district
2. To provide micronutrient supplementation for 75% of school age children to complement deworming activities
3. To implement Community Health Education and Health Promotion in 80% of primary schools (both urban and rural) to educate school-age children on the linkages between STH transmission and personal hygiene, sanitation, and the environment

#### Major Project Activities

- ✓ Train teachers to provide micronutrient supplements to children on a daily basis
- ✓ Establish community outreach programs to promote and provide micronutrient supplementation among non-enrolled SAC, utilizing community nurse aides, Rural Health Nurses, and Public Health Nurses
- ✓ Health Education Plan developed to educate SAC on the linkages between STH transmission and personal hygiene, sanitation, and the environment and to promote improved hygiene and sanitation practices, including production of health education materials. This will include support from HECOPAB and School Boards & Teachers

- ✓ Health education plan implemented in primary schools by community health educators and teachers
- ✓ Hire consultant or project coordinator to supervise project activities, and hire a consultant to work with HECOPAB and school boards to develop and coordinate implementation of the health plan

### **Monitoring & Evaluation**

- ✓ Rural health nurses and public health nurses to collect data on the number of school aged children receiving antihelminthic drugs and micronutrient supplements to calculate coverage
- ✓ Rural health nurses and public health nurses to collect information on number of households reached with micronutrient supplementation to estimate coverage among out of school youth
- ✓ Health educators to collect information on number of schools adopting the health education plan and teaching the material to estimate coverage
- ✓ Parasitological survey conducted to determine the prevalence of STH infections and heavy STH infections in the community and to assess other health outcomes (e.g. anthropometric, nutritional)
- ✓ Possibly surveillance of STH or nutritional information

The budget should include money for capacity-building (training of teachers, health educators, rural health nurses and public health nurses), antihelminthic drugs (procurement and distribution), recruitment of consultants, publications (educational materials), supplies, monitoring and evaluation (rapid appraisals, materials for data collection on drug distribution, outreach, etc).

## **Haiti**

### **Situational Analysis**

Haiti is on the western side of the island of Hispaniola covering an area of 27,750 square kilometers. The Dominican Republic occupies the eastern part of the island covering an area of 48,730 square kilometers. The island is bordered on the north by the Atlantic Ocean and the south by the Caribbean Sea. The climate alternates between two rainy seasons and two dry seasons every year and the temperature varies between 20°C and 35 °C.

The population is about 65% rural and 35% urban. Of the total population, 40% are under the age of 15 (3.2 million) and 15% are less than 5 years of age (1.24 million). Women of childbearing age represent about 45% of the population, or 3.6million. All Haitians speak Creole and 10% to 15 % also speak French. Unemployment in the cities is high at about 70% and about 55% of the population is illiterate. In 1999, only 46% of the population had access to potable

water and 60% to 80% of the population lives in poverty. In Haiti, 1% of the population possesses 44% of the total wealth in the country.

The birth rate is 34/1000 and annually there are 282,000 live births, of which one quarter are delivered in a hospital or health centre; the remaining are under the care of a traditional birth attendant. Infant mortality is 87/1000 live births. Life expectancy for men is 52.8 years and 56.1 years for women.

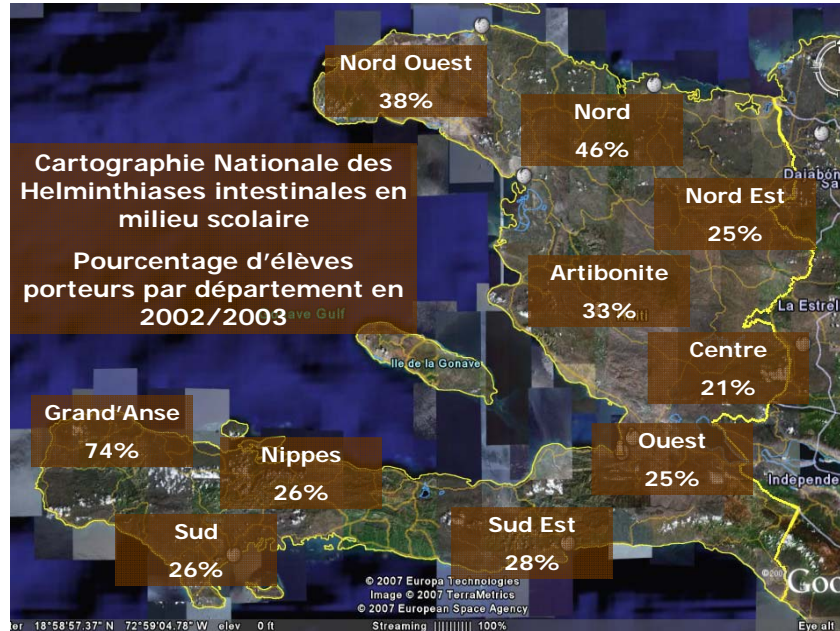
There is a severe shortage of qualified health personnel in Haiti. There is one doctor for every 7,143 inhabitants. Port-au-Prince has about 1/3 of the national population and 70% of the medical personnel; therefore, the rural areas are severely under serviced by health personnel.

Principal causes of morbidity and mortality include acute diarrhea, gastro- enteritis, acute neonatal infections, respiratory infections, malaria, malnutrition, tuberculosis, HIV and intestinal helminthiases. Sixty-two percent of the population suffers from malnutrition with a 24% caloric deficiency per day per person. Vaccine coverage for those under one year of age is as follows: DPT 52% Polio 53%, BCC (36%) and 48% for measles among children over the age of 1.

An investigation of STH prevalence with students in Haiti was developed and implemented from April 2002 to January 2003 with the support of the World Food Program and the French Cooperation. The study divided each department into rural and urban areas and in each department two urban schools and five rural schools were selected to be surveyed. Five thousand seven hundred and ninety three students were surveyed between the ages of 2 and 20, the average age being ten. Forty-seven percent were under the age of 10 and 53% over the age of 10. There were 49.4% women, 50.6% men and 49.7% urban and 50.3% rural.

Global prevalence of parasites in Haiti was found to be 34.2% (1981 positives) and the prevalence is higher in rural areas (38.4%) than in urban areas (30%). The most common parasite infection is *Ascaris* (27%), followed by trichocephale (7.3%), hookworm (3.8%), *Taenia nana* (2%), *Taenia solium* (0.3%) and Anguillales (0.2%). There is a difference in infection across departments in the country; in Grand Anse prevalence among school aged children/students is 74% compared with 21% in the Centre department (see Figure 17).

**Figure 17: National Prevalence of STH Infections in 2002/2003**



## **DRAFT NATIONAL PLAN OF ACTION**

The general objective of a national plan would be to lower the prevalence of STH infections in children to a level where they no longer present a public health problem.

### **Specific Objectives**

- ✓ Reduce morbidity and mortality associated with STH infections in children aged 5 to 14.
- ✓ Improve the nutritional status of school aged children and control risk factors for STH infection to improve the sanitary status of children aged 5 to 14.
- ✓ For children aged 6 months and up, offer preventive chemotherapy (albendazole), vitamin A supplementation and vaccination.
- ✓ Provide health and hygiene education and prevention education to mothers, women of child-bearing age and those who take care of children.

## **Strategy**

- ✓ Eliminate human reservoirs of parasites.
- ✓ Communication for behavior change (COMBI)
- ✓ Promotion of purification and usage of potable water in schools and families
- ✓ Intersectoral collaboration and partnerships

## **Activities**

1. The creation of a national counsel for the orientation and coordination of the project
2. Elaboration of the national action plans to fight STH infections
3. Mobilization of national and international resources to implement activities
4. Development and formation of educational tools and communication tools

## **Implementation**

Training for health personnel on Kato-Katz and other methods of measuring STH infections will be conducted. Education will be provided to parents and to those in charge of children on methods/measures for the control of STH infections. Implementation of the plan will include mass drug administration of antihelminthics to children. Personal hygiene practices will also be promoted along with increasing access to potable water, improved sanitation in the school and the home environment.

## **Monitoring**

The number of health personnel and teachers trained will be measured, as well as the number of coordination meetings that are held. Coverage data will be collected as well as the number of meetings held to sensitize the community and parents.

## **Evaluation**

Impact on the reduction of STH prevalence based on reports of activities and monitoring will be assessed. There will also be an investigation on the knowledge, attitudes and practices of parents and children. The prevalence of anemia and malnutrition will also be evaluated. Findings will be reported and distributed to stakeholders.

## Bahamas

### Situational Analysis

The Bahamas are made up of 700 islands and cays which are located 50 miles off the coast of Florida in the southwest Atlantic Ocean. Of these 700 islands, 29 of the islands are inhabited with two major population centers: new providence-Nassau and Grand Bahama. The last census reported 316, 298 inhabitants and 28.4% of the population as under the age of 15. The national per capita income is \$21,531. The most important economic activities are tourism and tourism-related commerce. In 1999, adult literacy was reported at 95.7%.

The government is committed to the protection and promotion of the health of the people of the Bahamas. There is universal access to all essential social services including health, education and housing. In 2001, the Bahamas living conditions survey reported the national poverty rate at 9.3%, almost 3% lower than the USA.

Education is compulsory for all children ages 5 to 15. There are 220 schools (excluding preschools); 157 public, 52 private and 11 special needs schools. In 2006, the national student population was 69,485 of which 50,947 were in public schools, half at the primary school level, and the remaining 18, 538 in private schools.

In the Ministry of Health, the department of public health emphasizes primary health care, and the public hospital authority is responsible for secondary and tertiary health care. School health service is provided by the MOH in conjunction with the ministry of education. The goal is to ensure the health of school age children thus enabling them to obtain maximum benefits from their education and achieve their full potential. School health includes both preventive and curative medicine; there is no policy on helminth control in school health programs.

There is a focus on health promotion and education including nutrition-weight management clinics and health school initiatives, adolescent health, HIV/AIDS/STD prevention, substance abuse prevention, health and family life education, and violence and injury prevention.

Private schools require a compulsory thorough physical examination (blood work, urinalysis, stool exam, vision screening and hearing screening) by a physician and an updated immunization status for entry into primary schools.

There is one major laboratory in Nassau at the Princess Margaret Hospital (PMH) which receives all samples from the hospital and all the community clinics in Nassau and the Family Islands. Private school clients also use government laboratory and private labs. The frequency of pathogens in stool specimens from the PMH lab from 2002–2006 are presented in Table 12.

**Table 12: Frequency of Pathogens, 2002–2006**

<b>Pathogen</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
<b>Ascaris</b>	24	7	9	5	2
<b>Trichuris</b>	18	9	0	1	5
<b>Hookworms</b>	1	1	0	0	0
<b>Strongyloid Larva</b>	1	2	0	1	0

It is difficult to assess whether this is indeed a true picture of the helminth situation in the Bahama, since data is incomplete and no data is reported from the private labs. There are no actual helminth prevalence studies in the Bahamas or parasitology surveys; therefore, there is a need for a pilot project. Although no prevalence data exists there are anecdotal findings available that may provide some interesting information. Some community clinics report visits for ‘worms seen in the stool.’ These people receive empirical treatment but stools are not routinely sent to be tested. These are usually people from the lower socioeconomic strata and this is commonly reported in the community clinics used by the Haitian community. There used to be compulsory stool testing for all food handlers in order to receive a health certificate, however, this policy has been discontinued because of the low yield of positive results.

Bahamians will routinely visit the community clinics for immunization and also for deworming. Children are regularly dewormed by parents with antihelminthic chemotherapy. Antihelminthics are easily accessible over the counter and are quite affordable (3USD). Drug companies actively market the drugs to consumers. Zentel (albendazole) is marketed to be used twice yearly – ‘treat the whole family including family pets.’ It is recommended for the treatment of single and mixed intestinal parasites. In children over 2 years, a single dose of 20 mls is sufficient, in children 1-2 years, a single dose is 10 mls. There are also myths regarding children’s health which are common in the Bahamas and several symptoms are equated with worms. These include ‘picking the nose;’ grinding the teeth at night, white eyes, eating too many sweets and abdominal pain.

Since antihelminthics are readily available over the counter they are not routinely prescribed in community clinics. Therefore, requests to the Bahamas national drug agency has decreased from January 2003 to November 2004 (when 6723 bottles were ordered), November 2004 to July 2006 (when 3434 bottles were ordered), August 2006 to present (2007 bottles ordered to date).

The soil in the Bahamas is calcium based, high in pH (7) with little neutral soil, which may mitigate against helminths in the soil. However, there is a need for soil analysis to explore this and assess if helminthes can live in soils with high pH.

### **The Haiti Challenge in the Bahamas**

Due to the economic challenges in Haiti, there has been a mass migration of Haitians to many countries, including the Bahamas. In 2003, Bahamian authorities estimated 60,000 Haitians were living illegally in the Bahamas. The number migrating to the Bahamas has increased over the years due to the pull of a better life, economic opportunity and the existing local Haitian

communities, which have been established over the years. The Haitians tend to live together in low-cost housing and shantytowns.

## **Conclusions**

If evidence suggests that decreasing worm load improves school performance and productivity, enhances memory and increases the immune response, priority should be given to developing a prevalence study in SAC in the Bahamas. There should also be an implementation of a pilot project using the primary school system as entry points for parasite control studies. A study could also compare the prevalence of helminthes within the inner cities and with the Haitian community.

The archipelagic nature of the Bahamas makes it difficult to develop community services and social programs that service everyone equally, especially because of the uneven distribution of population and transportation within and between the islands. Promotional campaigns must be targeted evenly across the islands and developing interventions will require coordinated efforts by the ministries involved.

The new Health Minister believes that devoting resources to health improvements can be a powerful means of aiding economic growth and mitigating poverty. Healthier children have enhanced cognitive function and higher school attendance allowing them to become educated, higher earning adults. Improving the health of nations is a powerful instrument integral to promoting the wealth of nations.

## **DRAFT NATIONAL PLAN OF ACTION**

### **Step 1: Collaboration**

Meetings must be held with the MOH and the MOE and should include the following personnel from the MOH. Maternal and child health coordinator, pediatric committee, school health nurses, surveillance unit/department of health information, public health nurses, community nurses, health education department, supervisor lab services, director of public health/executive management committee, the Chief Medical Officer/Permanent Secretary/Minister of Health and a PAHO/WHO representative. Within the MOE the following personnel should be included: planning officer, chief education officer, public and private school principals and the PTA. In addition, other ministries and agencies should be involved including: the Bahamas drug national agency, clinic pharmacists, drug companies, water and sewage, departments of statistics, immigration, social services, environmental health, as well as private pediatricians (PPO). The medical association of the Bahamas and PAHO office in the Bahamas should also be collaborators.

### **Step 2: Rapid Appraisal**

Rapid Appraisal will include the following:

- 1.** Collection of baseline parasitology data from lab with total numbers of samples, age, sex
- 2.** Poverty survey data to delineate areas that need to be surveyed

3. Collection of lab data from school age children and primary school children from private schools
4. Lab training in Kato Katz method to technicians to determine the prevalence and intensity of worm burden
5. Preliminary survey of stool and full blood count in 15 schools: 5 public and 5 private schools, both on New Providence (Region 1) and 5 schools in Exuma (Family Islands – Region 3). This will determine the prevalence of STH and anemia, particularly in Bain’s town inner city and Carmichael road (a Haitian informal settlement). Clinical records over the last year will be reviewed from the Fleming Street clinic and two Carmichael Road clinics and compared with results from south beach health clinic (a large specialty clinic). This will provide a determination of cumulative prevalence.

### **Step 3: Making a Plan**

Implementation of a pilot project will focus on a school-based integrated intervention. The target group will be 4 to 5 year olds (i.e. entry to primary school), Haitian communities and other at-risk groups identified in the rapid appraisal. The primary school health system will serve as an entry point and the existing educational infrastructure will be used. The maternal and child health coordinator and school health nurses will be involved at every stage of the process.

Existing private school entry requirements will be used as a model and extended to public schools. With private schools, parents are responsible for the collection and transportation of stool samples to the lab. For public schools, school health nurses would be responsible for ensuring the collection and transportation of specimens to the lab for testing. The existing pediatric protocol can be modified to do stool testing, deworming and immunization at the same visit to the community clinic before entry to primary school. For this to work, private pediatricians would have to agree to the proposed plan. The final report on prevalence and intensity of infection in each school/area will be used to adopt WHO guidelines for dosage and timing of treatment. Albendazole (Zentel) will be used as a drug of choice since it is low cost, available to community clinics from the Bahamas national drug agency and is easy to administer.

### **Budget should include funds for the following activities:**

1. Baseline data collection, government vehicle use/fuel/vehicle maintenance; training of laboratory technicians, allowances for the data collection team, data entry and analysis
2. Workshops for community health nurses/school health nurses/health care providers
3. Health education costs including materials, public service announcements, handouts, radio and TV ads
4. Procurement of anti-helminthic drugs
5. Monitoring and evaluation: production of forms/duplication of forms/distribution and collection of forms

#### **Step 4: Ordering the drugs**

The Bahamas National drug agency will be used as the source of timely drug procurement; the director will be involved to ensure timely availability and procurement/distribution. Drug companies and wholesale companies can also be involved to ensure procurement of large amounts of drugs in a timely fashion.

#### **Step 5: Training**

Health providers will need training and education on the collection and transportation of samples of stool and blood and amendments of any protocols. School health nurses and community nurses will need training on collection and transportation of specimens. Lab personnel will need training in Kato-Katz method. Health education and promotion involving the community, school children and the PTA will be conducted as well as workshops with all stakeholders.

#### **Step 6: Monitoring and Evaluation**

Monitoring and evaluation activities will include the following:

- 1.** Evaluation of data collected by public health nurses/school health nurses
- 2.** Determination of the number of positive stool samples, types of worms identified, number of anemic samples and number of children treated
- 3.** Use of a register or tally book to collect and collate data at community clinics
- 4.** Liaise with Bahamas national drug agency to facilitate drug procurement
- 5.** Use of PHIS to collect data
- 6.** Clinical audit of data on FBC results
- 7.** Clinical audit on monitoring of growth and developmental milestones and documentation
- 8.** Clinical audit on appropriate prescription of anemia, correct prescribing of anti-helminths
- 9.** Quality control in lab technique
- 10.** Coverage data from private pediatricians
- 11.** Collection of data from other agencies: water and sewage, environmental health, agriculture, and social services (non-enrolled school children)
- 12.** Evaluate the need for a second rapid appraisal after 2 to 3 years

All results will be communicated to the relevant authorities and will be discussed with policy-makers.

## Section IV: Recommendation and Action Points

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Several action points and recommendations came out of the discussions over the three day workshop. This meeting provided an opportunity for countries to update the Regional Program on the STH situation among school age children and other at-risk groups in their countries. Among the findings of the workshop was the need to conduct assessments of the prevalence and intensity of these infections in the various countries in order to determine in a systematic way whether or not there is need for implementing new programs or scaling up existing ones. They are outlined below:

- 1.** Country representatives will expand on the draft outline national plans of action into full national programs, with assistance from the Regional Program where necessary. These draft national plans will explore opportunities for integrating deworming into existing or planned school based health initiatives and other health initiatives such as maternal and child health initiatives.
- 2.** Representatives will meet with key policy makers and colleagues within the Ministry of Health of their countries to assess their need for rapid assessments of the burden of soil transmitted helminths. The Regional Program will offer technical assistance to countries conducting these assessments as necessary.
- 3.** A rapid assessment will be conducted in St Mary which is the poorest parish in Jamaica, to determine the burden of soil-transmitted helminth infections and the need for a control program.
- 4.** The Regional Program will work through the CARICOM Council for Human and Social Development (COHSOD) to strengthen advocacy at the policy level for subregional activities on the control of soil transmitted helminths.
- 5.** A follow up meeting is to be held after one year to assess the progress of programs within countries.
- 6.** Over the next year, the Regional Program will also be undertaking a number of activities in the Caribbean to further assess the situation in individual countries, increase awareness among policy makers and offer technical support to countries which currently have deworming programs and those who are interested in planning such programs. A letter has been drafted and sent to the Chief Medical Officers of every country represented at the workshop (see Annex 4).