



St. George's
University

Report:

PAHO/WHO Preparatory Meeting on Epidemiological Data Needed to Plan Elimination of Schistosomiasis in the Caribbean



(St. George, Grenada, 13–14 December 2007)

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Objectives

General Objective

Meet and interchange with national authorities and schistosomiasis specialists to gauge the level of interest and estimate the time frame and resources needed for elimination of schistosomiasis in the Caribbean.

Specific Objectives

- ✓ Identify and understand existing schistosomiasis surveillance and control program actions in endemic countries and formerly-endemic countries in the Caribbean.
- ✓ Gather existing data useful to map the current prevalence of schistosomiasis and Praziquantel treatment coverage in endemic countries.
- ✓ Identify the necessary epidemiological and ecological data still needed to plan for schistosomiasis elimination in the Caribbean.

Background

Schistosomiasis is a global health problem in the developing world, approximately 200 million people are infected and more than 650 million live in endemic areas.

Schistosomiasis is a disease of the poor who live in conditions that favor transmission. Schistosomiasis is also an insidious disease, poorly recognized at early ages and disabling to men and women during their most productive years. Rarely fatal, but strongly linked to diarrhea, pain, fatigue, hemoglobin deficit, under nutrition, and reduced exercise tolerance; schistosomiasis' effects are not negligible for those who are infected and live in endemic areas where recurring infections are possible.

Schistosomiasis is caused by schistosomes, which are parasitic trematode worms. Five species infect humans: *Schistosoma mansoni*, *Schistosoma japonicum*, *Schistosoma mekongi*, *Schistosoma intercalatum*, and *Schistosoma haematobium*. *Schistosoma* infections occur through direct contact with fresh water that harbors free-swimming larval forms of the parasite. Free-swimming larva, known as *cercariae*, are able to penetrate human skin to cause infection.

S. mansoni remains endemic in parts of Brazil, Venezuela, and the Caribbean. Schistosomiasis causes deep acute and chronic morbidity among infected people. Acute schistosomiasis occurs 14-84 days after contact with contaminated water. The clinical presentation of acute schistosomiasis includes fever, headache, generalized myalgias, right-upper quadrant pain and bloody diarrhea. Up to 70 percent of people infected with *S. mansoni* also report respiratory symptoms. Chronic schistosomiasis can be presented through gastrointestinal, liver, neurologic, and/or genitourinary pathologies.

Schistosomes can live inside their host for years. Schistosomiasis results from the host's immune response to schistosome eggs for their antigens trigger a granulomatous reaction. Granulomas destroy the ova but result in fibrotic depositions in the host tissues. These develop at sites where

eggs accumulate the most: intestine and liver for *S. mansoni* and *S. japonicum* infections and the genitourinary tract for *S. haematobium*. Neural pathologies are also known to occur when schistosome eggs accumulate in the host's central nervous system. Higher prevalence of epilepsy and transverse myelitis are observed in communities where schistosomiasis is endemic.

Schistosomiasis is one of ten tropical diseases targeted for control by the *Special Program for Research and Training in Tropical Diseases* of the United Nations Development Program (UNDP), the World Bank, and the World Health Organization (WHO). Control and elimination of schistosomiasis and other neglected tropical diseases is essential to ensure the promotion and protection of international human rights treaties and the "right to the highest attainable standard of physical and mental health." The 54th World Health Assembly set a goal of annually treating at least 75 percent of school-age children at risk of infection with soil-transmitted helminths (STHs) and schistosomes, and the World Health Organization's *Global Plan to Combat Neglected Tropical Diseases 2008-2015* includes schistosomiasis as one of the neglected diseases that will initially be targeted with intensified efforts.



Summary of Presentations

Background and Objectives of Schistosomiasis Control at the Global and Regional Levels

Background on Schistosomiasis in the Latin American and Caribbean Region in the Context of Neglected Tropical Diseases Control

Disability Adjusted Life Years (DALYs) are a useful unit that takes morbidity into account. DALYs measure the years of life that are lost due to disability and/or premature death. The group of diseases known as “neglected tropical diseases” (NTDs) is responsible for the loss of 56.6 million DALYs. Among them, schistosomiasis causes the loss of 10.4 million DALYs.

NTDs are labeled as such because they are not perceived as a significant problem. These diseases are commonly left out of public health agendas and receive limited funding. NTDs are not usually subjected to mandatory notification or cause epidemiological emergencies. In addition, these diseases are not lucrative for the private sector, thus they generate limited interest for drug and vaccine development.

In Latin American and the Caribbean NTDs cause high burden of morbidity and disability. Co-infections are common and result in a higher combined burden of disease. NTDs keep people in poverty and impede the achievement of the United Nation’s Millennium Development Goals.

Schistosomiasis is endemic in up to eight countries; these are Santa Lucia, Suriname, Guadalupe, Martinique, Dominican Republic, Puerto Rico, Venezuela, and Brazil. It is estimated that 1-3 million people are infected, the majority of which reside in NE Brazil and Venezuela. Moreover, it has been estimated that 25 million or more are at risk of disease. Despite these estimates, it is thought that prevalence and morbidity have decreased in historically endemic countries. New studies are needed to determine the actual epidemiological situation of schistosomiasis in Latin America and the Caribbean.

Children, adolescents, pregnant women and some agricultural workers are at greater risk of being infected by schistosomes. Since co-infection with soil-transmitted helminths is common, this allows a multi-disease focus strategy for prevention and control.

Schistosomiasis is currently being evaluated for potential elimination in the Caribbean.

World Health Assembly Resolution 54.19 and Role of PAHO/WHO

The hallmark clinical manifestation of schistosomiasis and soil-transmitted helminth infections is blood and nutrients loss. Blood loss leads to iron deficiency anemia, which greatly contributes to growth retardation, stunting, wasting, reduced cognition, and poor school performance and attendance.

In 2001, the World Health Assembly's resolution 54.19 was approved by consensus of WHO member states. Resolution 54.19 endorses regular antihelminthic treatment of high-risk groups living in areas where soil-transmitted helminths have public health consequences. Resolution 54.19 mainly targets school-age children (SAC), ages 6-15, in addition to other groups at-risk such as: women of child bearing age, indigenous populations, ethnic minorities, shanty-town dwellers, AIDS patients, orphans and elderly, institutionalized population and certain occupational groups.

In addition to endorsing administration of antihelminthic therapy, Resolution 54.19 also endorses implementation of plans for basic sanitation and adequate safe water supply. It also promotes access to safe water, sanitation and health education through intersectoral cooperation. WHA 54.19 endorses that any development activity that favors the emergence or spread of parasitic diseases is accompanied by preventive measures.

To support WHA 54.19 PAHO/WHO must provide advocacy in public forums and facilitate development of partnerships. PAHO/WHO also provides technical cooperation to Ministries of Health and other implementing partners. Technical cooperation includes surveys, resistance monitoring, drug donations when possible, procurements training, and resource mobilization. PAHO/WHO also aids in collection of SAC coverage data reported annually to WHO Geneva. Furthermore, PAHO can monitor and evaluate, and promote operational research and sustainability.

Successful Control and Elimination Programs in other WHO Regions and in Brazil

Schistosomiasis in Brazil

Schistosomiasis presents a difficult public health problem in Brazil. The prevalence estimates range between two and a half to six million infected people. Schistosomiasis' severe form of infection yields 900 admissions to hospitals per year. This produces large medical care expenses and reduces productivity by 30 percent. Between 2002 and 2005, 129 patients were seen with severe forms of schistosomiasis: 75 patients were observed with hepatosplenic forms and 54 patients with neuroschistosomiasis.

Schistosomiasis control has been proven difficult in Brazil due to the wide distribution of intermediate hosts and the complexity of the transmission cycle. Low availability of dwellings with potable water and sewerage systems, and insufficient health education of the population at risk of infection also halt the advance of schistosomiasis control. Additionally, the low sensitivity of diagnostic methods and cure rate of drugs add to the problem. Other local issues that have negatively impacted the control of schistosomiasis in Brazil include unsatisfactory involvement of the municipalities, insufficient assistance provided to control activities, and inadequate use of data obtained through control programs.

Despite the high prevalence of schistosomiasis, Brazil has taken measures that have contributed to the reduction of the morbidity and mortality of the diseases. About 12.5 million treatments have been administered between 1977 and 2005. In addition, the risk of infection has been reduced through environmental sanitation. 934,449 dwellings received benefits regarding sanitary improvements between 1977 and 2005. Since the rural population has decreased from 69 percent in

1940 to 21 percent in 1999 the risk of exposure due to migration has also decreased. Moreover, there have been improvements of diagnosis and therapy.

Chemotherapy aids greatly in reducing the burden of schistosomiasis infection. It decreases the intensity of infection and prevalence, reverses the enlargement of liver and spleen and resolves anemia. Furthermore, chemotherapy resolves hepatic fibrosis, prevents the rise of cases with hepatosplenic form, and eliminates blood in feces.

Successful Schistosomiasis Control Program in Africa

In Africa and Latin America, environmental conditions favor the growth of schistosomiasis' intermediate snail host, *Biomphalaria* and *Schistosoma mansoni* is or has the potential to become a public health problem in many areas. These areas commonly feature altitude less than 2000 meters and rainfall greater than 900 mm per year.

Large water bodies such as lakes, rivers, irrigated lands, and dams are also key for schistosomiasis transmission and epidemiology, particularly in Africa. Heterogeneity of host factors including: genetic and immunological make-up, nutritional status, and age and gender, vastly influence the likelihood of exposure, transmission, infection, disease and outcome. Human behavior and socio-economic status greatly increase the risk of exposure particularly in poor communities.

Mathematical models of transmission dynamics show that mean intensity of infection is a key parameter in determining transmission and rates of infection over time. The prevalence of eggs found in feces peaks between the ages of 15 and 20. There is also, a strong association between water contact and rate of re-infection. This association is strongest between the ages of 8 and 11.

Control measures concentrate on reducing morbidity and mortality through chemotherapy, and on the use to molluscicides to reduce snail populations. Additionally, prevention of contamination of potential transmission sites and exposure protection are essential for schistosomiasis control. Other control measures include, access to safe water, and ventilated improved pit latrines.

A single dose of Praziquantel is safe and efficient. School based strategies have been shown to reduce transmission and morbidity through the reduction of bladder and kidney pathology.

Political support at the local village, district, national, and international levels is essential for the success of control programs. Integration with other control programs and assessment of the safety of drug combinations are also important factors that must be taken into account.

Evidence of the effectiveness of targeted mass community-based treatment has been seen in Egypt. Between 1988 and 2001, Egypt has vastly reduced the prevalence of both *Schistosoma mansoni* and *Schistosoma hematobium*.

The main objectives of the *Schistosomiasis Control Initiative* (SCI) are to encourage the development of a sustainable schistosomiasis control program in sub-Saharan Africa and to reach at least 75 percent of school-aged children and other high risk groups with chemotherapy. SCI also aims to reduce schistosomiasis related morbidity in high risk groups, to reduce prevalence and intensity of

schistosomiasis infections and to reduce the burden due to intestinal helminths in the targeted situations.

In 2002, the National Bilharzia Control Program in Uganda aimed to reduce morbidity due to schistosomiasis and soil-transmitted helminths by mass annual distribution of Praziquantel and Albendazole to school-aged children and to high-risk communities in endemic areas. The program was integrated with STHs and vitamin A campaigns. After three rounds of chemotherapy, hookworm prevalence was reduced to close to zero.

In total, SCI has administrated over 43 million treatments for schistosomiasis and STHs in 6 sub-Saharan countries. It is estimated that over 20 million people have been cured from these infections. Regular annual treatments will be required to prevent re-infection.

Situation Analysis of Schistosomiasis in Endemic Countries and Formerly-Endemic Countries

Suriname

Schistosomiasis cases were first confirmed in Suriname in 1911. The only species of schistosome is *Schistosoma mansoni*. In Suriname, schistosomiasis only occurs in coastal areas associated with shell ridges. Various studies have been performed to determine the prevalence rate; in 1974 prevalence rates as high as 45 percent were reported in Saramacca.

Between 1973 and 1983 a phase 1 control program was launched in Saramacca to reduce schistosomiasis prevalence. Surveys were conducted from 1997 to 2001 to determine prevalence rates in Saramacca, Commewijne, Paramaribo, and Wanica en Coronie. The highest prevalence shown in this study was 5 percent in Saramacca.

Although at low prevalence rates, schistosomiasis is still endemic in Suriname. Prevalence varies between certain areas and age groups. General prevalence in study areas ranges from 0.3 to 4.7 percent, and it is significantly higher in the 15–40-year-old age group. High prevalence is also associated with occupational activities such as fishing and agriculture.

Suriname recommendations for schistosomiasis control and elimination include intense information campaigns, adequate treatment of infected people, and monitoring of people living in endemic areas through stool samples. Additionally surveillance, reduction of water contamination, and avoidance of contact with contaminated water are key elements for schistosomiasis control. This will be accomplished by better disposal of feces and construction of latrines. Reporting systems at the local and national level, reinforcement of infrastructure in order to trace *Schistosoma* infections, and improving health worker's tools and education are also included in the recommendations.

St. Lucia

The majority of St. Lucia's rivers are located in the Southern area of the island; therefore this area is affected by schistosomiasis the most. Past records show that schistosomiasis in St. Lucia has been

reduced but it is still more prevalent than Malaria. *Schistosoma mansoni* is the most identified parasite in St. Lucia with an incidence rate of 6 cases per 100,000 in 2007. Socio-economic status, environmental conditions and life style characteristics like contact with water, mode of fecal disposal and river activities are contributor factors of infection.

Since 1995, 106 cases have been reported. Although the risk of schistosomiasis is low in St. Lucia, it is still important to check the prevalence of the diseases with a screening program. Control strategies should be placed for the elimination of the disease. The priorities for the control strategies are health education, supply of drinking water, access to adequate healthcare facilities, prompt diagnosis and treatment, management of the environment and control of intermediate hosts.

Puerto Rico

First cases of schistosomiasis in Puerto Rico were reported in 1904. Since then the prevalence of schistosomiasis in Puerto Rico has fluctuated between 9.9 percent in the 1940s and 10 to 30 percent positive in the 1950s. In the 1950s the areas with highest prevalence were Jayuya, Cieba, Río Piedras, Patillas, Guayama, and Caguas. In 1957 it was noted that the snail population was directly related to infection prevalence, and that multiparasitism was a common feature.

Recent studies have shown that there are no new serologic or parasitological cases in children. Also shown was an age specific decrease. Also, no new clinical cases have been detected. For these reasons, Puerto Rico is on good grounds to eliminate schistosomiasis.

Antibody detection assays such as FAST-ELISA and IMMUNO-BLOT feature high specificity and sensitivity. These assays are useful for monitoring areas where transmission is low. As worm burden and egg load decrease, microscopy methods become insensitive, therefore antibody detection assays are the best screening tool. Immunodiagnostic technology is also cost-effective.

Issues on Surveillance, Endemicity, and Morbidity

Surveillance System for Communicable Disease and NTDs in the Caribbean

The Caribbean Epidemiology Centre (CAREC) serves 21 member countries in the English-Speaking Caribbean. CAREC is public health information, service and consulting organization dedicated to improving the capability of member countries in epidemiology, laboratory technology and related public health disciplines through technical cooperation, service, training, and research. CAREC is divided into two divisions: laboratory and epidemiology.

The mission of the laboratory division is to strengthen National Laboratory capabilities by providing microbiology reference and referral services. In addition, the laboratory division provides training and appropriate research for surveillance and control of communicable diseases. Its major program areas are vaccine preventable diseases, vector-borne diseases, HIV/AIDS/STDs, diarrheal diseases including food-borne illness, mycobacterial diseases, antibiotic resistance monitoring and quality assurance.

The epidemiology division collects, collates, and analyses data obtained via national surveillance systems on communicable and chronic diseases, and injury data. Analyzed data and findings are widely disseminated for policy and program formulation, decision-making, public health action, and evaluation of control measures.

CAREC and CAREC member countries have developed and promoted a regional Communicable Diseases surveillance system. The purpose is to generate information for policy development, planning, and evaluation. Data collected includes weekly reporting of syndromes, hospital ward notifications, four-weekly reporting of specific diseases, outbreak reports, quarterly and annual HIV/AIDS/STI reports, quarterly tuberculosis reports, and annual leprosy reports. Laboratory surveillance data is also collected.

Neglected Tropical Diseases (NTDs) are not detected in the present surveillance system. NTDs have low priority politically and therefore there is no funding. The current challenge is to determine the present status of these diseases in areas where they were historically important.

There are different surveillance method options for NTDs surveillance. Some of these include active case detection using surveys, passive case detection using clinics and hospitals, and snail surveillance. Methods of active case detection include using combined surveys for Helminths or other communicable diseases and selecting sensitive, more specific, populations. Passive surveillance through screening of samples from patients admitted into hospital and clinics for reasons other than schistosomiasis, or through screening of blood bank samples. Snail surveillance is important in order to determine if the habitat is still suitable for snails.

Surveillance of NTDs in the Caribbean is going to require external assistance and funding.

Challenges of Detection and Measurement of Schistosomiasis Morbidity

Schistosomiasis causes low mortality but daily morbidity. Morbidity due to hepatosplenomegaly and hematuria are only the tip of the disease/disability iceberg. Lasting pain, diarrhea, and under nutrition are strongly associated with schistosomiasis and contribute to its morbidity.

The health burden due to schistosomiasis is changing based on a better appreciation of the impact of sub-clinical morbidities. Schistosomiasis' burden can be measured through infection prevalence rates, infection intensity, mortality, specific morbidity, and most of all disability. The impetus for earlier DALY rankings was to quantify disability in order to provide a utilitarian comparison across all possible disease control strategies.

Schistosomiasis means hemoglobin deficits. Anemia does not have to be severe in order to be disabling, mild "chronic disease" anemia is significant in terms of its duration, income and birth outcomes. Schistosomiasis reduces average Hemoglobin levels to less than 12 gm/dL. These levels are associated with 3 to 5 percent reduction in work output, and 60 percent reduction in peak workload capacity. Furthermore, under nutrition does not have to be severe to be disabling, even minimal disability is highly significant in a rural poverty setting where undernutrition has multiple causes.

Current strategies for schistosomiasis control include annual drug treatments. Annual drug treatments reduce most forms of severe morbidity, but do not reverse all chronic morbidity and do not reliably reduce transmission. The next challenge is reducing transmission of schistosomiasis and preventing infection.

Molecular monitoring of pre-patency in snails is a large-scale application needed for schistosomiasis control. Advantages of molecular monitoring include greater specificity of schistosome species identification, greater sensitivity in detecting snail infection, increased ability to detect effective water contamination by schistosome eggs. Molecular monitoring provides greater statistical power to detect significant increases or decreases in transmission. Molecular monitoring also decreases the dependence on participation by local population, and is amenable to automation and high-throughput testing. Aside from schistosomiasis/snail control programs, it is important to explore integrated NTD control.

Cuba: [Part I](#) [Part II](#)

In 1985 the first case of imported schistosomiasis was recorded in Cuba. By 1999, 90 cases of imported schistosomiasis had been recorded. However, no autochthonous human cases have been reported in Cuba.

Cuba may be at high risk for introduction of schistosomiasis because it hosts different species of *Biomphalaria* snails. Three species of snails have been considered as potential host for *Schistosoma mansoni*, these are widely distributed in the country. Furthermore, due to Cuba's geographical location, the island is a frequent stop for migratory birds that seek refuge, and even a nesting place. Birds migrate from North America to the South and then back. Dissemination of eggs or young snails by migratory birds could introduce *Biomphalaria glabarata* to Cuba.

Moreover, the existence of human cases in the Caribbean and South American countries that have increased collaboration with Cuba increases the risk of introduction.

To prevent introduction of schistosomiasis the following recommendations should be considered: strengthening of the Cuban epidemiological surveillance system for schistosomiasis, increases systematic surveys of *Biomphalaria* snails, prompt treatment and control of imported cases, and stronger measures to avoid contamination of artificial lakes with sewers.

Recommendations

1. The group agreed that schistosomiasis is an important public health problem in the Latin American and the Caribbean but that the scope of the problem is unrecognized.
2. Due to the similarities between the distribution and diagnosis of schistosomiasis and STHs, the group concluded that their surveillance and control efforts should be coordinated.
3. The group proposed the formation of a *Regional Alliance for Schistosomiasis Elimination and STH Control in the Caribbean*, for which PAHO could serve as Secretariat.
4. The first task of the Regional Alliance is to conduct mapping of schistosomiasis distribution in the Caribbean.

5. It was concluded that this proposal be presented for approval at the Chief Medical Officers Council meeting during the 2008 meeting of the Caribbean Health Research Council (CHRC), scheduled for 24–26 April in Paramaribo, Suriname.
6. It was recommended that PAHO take the lead in coordinating the formation of the Regional Alliance and future activities, including the development of timelines and priorities.
7. The participants of the meeting pledged their full support to fulfill these recommendations.

Action Points Suggested for PAHO/WHO

1. Collect additional epidemiological and environmental, historical, and current data.
2. Obtain locations of primary schools and numbers of students in endemic countries.
3. Obtain protocols for schistosomiasis and STH surveillance from other areas of low endemicity, or develop such protocols.

Next Steps

Coordinate two new meetings. The following were proposed:

- ✓ **A meeting in Suriname:** The main objective is to sensitize the CMOs (Chief Medical Officers of Health) of the Caribbean of our plans to eliminate schistosomiasis in conjunction with the control of soil-transmitted helminths. The CMOs of CARICOM (Caribbean Community) meet annually in March or April ahead of the annual Caribbean Health Research Council (CHRC) meeting. This year the meeting is in Paramaribo, Suriname.
- ✓ **A meeting in Brazil:** Dr. Katz invited the group to attend an International Symposium on schistosomiasis in August 2008 in Salvador, Bahia, Brazil, where the topic should also be discussed.

Acknowledgements

St. Georges University, Windward Islands Research and Education Foundation (WINDREF), Pan American Health Organization / World Health Organization, Office of the Eastern Caribbean Countries (PAHO/OECC)

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Annexes

Annex I: Agenda

Day 1: Thursday, 13 December 2007

Introduction

- 08:30 – 9:00 Registration of Participants
- 09:00 – 09:45 **Opening Session** and Remarks of Officials, Chaired by C. Macpherson, SGU/ Windward Islands Research and Education Foundation / WINDREF
- ✓ Welcome and Introduction of Meeting Participants (C. Macpherson)
 - ✓ Minister of Health Grenada – Hon. Senator Ann David-Antoine
 - ✓ Provost of St. George’s University – Allan Pensick
 - ✓ CAREC, PAHO/WHO – Christian Fredrickson
 - ✓ Regional Program on Parasitic and Neglected Diseases – María Rebollo
- 09:45 – 10:00 **Review of Workshop Objectives** (M. Rebollo, PAHO HQ and C Macpherson, SGU/WINDREF)

Background and Objectives of Schistosomiasis Control and the Global and Regional Levels

- 10:00 - 10:15 **Objectives of World Health Assembly Resolution 54.19 with Respect to Schistosomiasis Control** (M. Rebollo)
- 10:15 - 10:25 **Background on Schistosomiasis Control in LAC Region in the Context of the NTDs** (M. Rebollo)
- 10:25 – 10:30 **Background on Schistosomiasis Control in the Caribbean in the Work of CAREC** (C. Macpherson, Caribbean Epidemiology Centre / CAREC)

10:30 - 10:45 Coffee/Tea Break

Successful Control and Elimination Programs in Other WHO Regions and in Brazil

(Chair: L.J. Lindo, UWI)

- 10:45 – 11:15 **Schistosomiasis Control in Brazil** (N. Katz, Oswaldo Cruz Foundation / FIOCRUZ, Brazil)
- 11:15 – 11:45 **Successful Schistosomiasis Control and Elimination Programs in Africa** (C. Macpherson, SGU/WINDREF)
- 11:45 – 12:15 **Discussion of the Morning Presentations** (*Coordinator:* J. Lindo)

12:15 - 13:30 Lunch (1.25 hours)

Situation Analysis of Schistosomiasis in Endemic Countries and Formerly-Endemic Countries

(National Officials or Country Representatives) (Chair: C. Frederickson, Caribbean Epidemiology Centre / CAREC)

- 13:30 – 14:15 **Situation Analysis of Schistosomiasis in Suriname**
- 14:15 – 15:00 **Situation Analysis of Schistosomiasis in St. Lucia**
- 15:00 – 15:45 **Presentation of Surveillance Systems for Schistosomiasis in Formerly-Endemic Countries: The Case of Puerto Rico** (G. Hillyer, US Centers for Disease Control and Prevention / CDC)
- 15:45 – 16:00 Discussion of the afternoon presentations (*Coordinator:* C. Frederickson, CAREC)

16:00 – 16:20 Coffee/Tea Break

- 16:20 – 17:00 **Observations/Comments of CDC Staff on Situation Analysis in Countries Collaborating with CDC Globally** (P. Wilkins, W. Secor)
- 19:30 – 21:00 **Social Event and Cocktails**

Day 2: Friday, 14 December 2007

Issues on Surveillance, Endemicity, and Morbidity (*Chair: C. King, Case Western University*)

- 9:00 – 9:20 **Surveillance Systems for Communicable Diseases and NTDs in the Caribbean** (C. Fredrickson, CAREC)
- 9:20 – 9:45 **Comments on Schistosomiasis Surveillance in Areas of Low Endemicity** (N. Katz, Oswaldo Cruz Foundation / FIOCRUZ; P. Wilkins and W. Secor, US Centers for Disease Control and Prevention / CDC; G. Hillyar, University of Puerto Rico / UPR)
- 9:45 – 10:15 **Challenge of Detection and Measurement of Schistosomiasis Morbidity** (C. King, Case Western University)
- 10:15 – 10:30 **Discussion**

10:30 – 10:45 *Coffee/Tea Break*

Data Gaps and Resources Needed to Fill the Gaps (*Chair: W. Secor, CDC*)

- 10:45 – 12:00 **Round Table Discussion by Participants: Identification and Listing of Data Gaps and Resources Needed to Fill the Data Gaps** (*Coordinator: W. Secor, CDC; Note-takers: C. Fredrickson, M. Rebollo*)

12:00 – 13:30 *Lunch*

- 13:30 – 14:30 **Round Table Discussion by Participants: Identification and Listing of Data Gaps Resources Needed to fill the Data Gaps, continued from prior to lunch**

- 14:30 – 15:30 **Informal Panel on Institutional Resources Available to Address Data Gaps in the Region** (*Coordinator: N. Katz*)

F.A. Nunez, IPK	P. Wilkins, CDC
J. Lindo, UWI	G. Hillyer, UPR
C. Macpherson, SGU	N. Katz, FIOCRUZ
C. King, Case Western	

15:30 – 15:45 *Coffee/Tea Break*

- 15:45 – 16:45 **Discussion for Development of Conclusions and Recommendations** (*Coordinator: CDC*)
- 16:45 – 17:45 **Preparation of Conclusions, Recommendations and Next Actions** (prepared by C. Macpherson with M. Rebollo, C. Fredrickson)
- 17:45 – 18:00 **Presentation of Conclusions, Recommendations and Next Steps** (C. Macpherson)
- 18:00 **Closure** (M. Rebollo, C. Macpherson)

Annex II: List of Participants

Naftale Katz, PhD
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Oswaldo Cruz Foundation (CPqRR/FIOCRUZ)
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Head of Parasitology Department
Pedro Kourí Institute for Tropical Medicine (IPK)
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John Lindo, PhD
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George Hillyer, PhD
Professor and Director
Laboratory of Parasite Immunology and Pathology
Department of Pathology and Laboratories
University of Puerto Rico (UPR)

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Countries invited but unable to attend

- ✓ Dominican Republic
- ✓ Guadeloupe
- ✓ Martinique
- ✓ Venezuela