

Survey for intestinal parasitic worms (Soil Transmitted Helminths) at Chea and Sasaghana, Marovo Island, Solomon Islands: building capacity for communities to decide next steps

Emeritus Professor Rick Speare^{6,5}, Humpress Harrington², Dr David MacLaren⁴, Tommy Esau¹, Esau Kekeubata¹, Nobo Harrington³, Dorothy Esau¹, Ben Speare⁶

¹ Atoifi Adventist Hospital, Atoifi, Malaita, Solomon Islands

² College of Health Science, Pacific Adventist University, Atoifi Campus, Solomon Islands

³ Chea, Western Province, Solomon Islands

⁴ College of Medicine and Dentistry, James Cook University, Cairns, Australia

⁵ College of Public Health, Medicine and Veterinary Sciences, James Cook University, Cairns, Australia

⁶ Tropical Health Solutions, Townsville, Australia

9 February 2016

Contact details:

Atoifi Health Research Group STH management and interventions – Humpress Harrington; 8663100; humpress.harrington@gmail.com

STH surveys and public health aspects - Prof Rick Speare – rickspeare@gmail.com; +61 438117817.

Local East Kwaio issues and community relations - Esau Keukebata; 8616324;

Social science and public health aspects – Dr David MacLaren; david.maclaren@jcu.edu.au

Executive Summary and Recommendations

A survey of 201 residents of the villages of Chea and Sasaghana on Marovo Island for intestinal parasitic worms in January 2016 found hookworm in 17 residents, a prevalence of 8.5%. Most infections (15) were in the light category but one person each had an infection in the medium and heavy categories (1% of those tested). Males and females had the same levels of infection. Hookworm infection occurred in all age groups except for children under 5 years of age. The species of hookworm in these villages will be determined by DNA studies in Australia with results expected by May 2016. No roundworm or whipworm were found.

These results indicate that hookworm is present in Chea and Sasaghana. The absence of hookworm in children under 5 years of age suggests that transmission may have recently decreased. An elimination program to stop transmission is recommended.

Atoifi Health Research Group (AHRG) obtained albendazole and distributed this worm treatment the week after the survey to about 550 children and adults from both villages. AHRG has also agreed to assist both communities by provision of health education and expert advice if requested, including assistance with preparation of funding applications for toilets and water tanks.

We recommended the following actions be taken:

1. Administration of albendazole to all residents (except pregnant women in the first 3 months of pregnancy); repeat this treatment to all residents in June 2016.
2. Families that currently lack formal toilets be encouraged and assisted to acquire these.
3. When people are working in their gardens and need to defaecate, they bury their faeces.
4. The STH survey be repeated in January 2017 along with a survey of other major villages/settlements on Marovo Island.

Tropical Health Solutions has produced a video describing the story of conducting the STH survey and training on Marovo Island. This will be made available for general access on YouTube in March 2016.

1. Background

Intestinal parasites are a health problem in the Solomon Islands. Soil transmitted helminths (STH) are a group of parasitic worms that live in the intestine and transmit when the soil becomes contaminated with human faeces. STH are particularly common where toilet facilities are not available and washing of hands is not commonly done.

The Solomon Islands has three common STH; roundworm (*Ascaris lumbricoides*), hookworm and whipworm (*Trichuris trichiura*). These appear to be widespread throughout the nation, although the type of STH and intensity of infection can vary between communities. Recently, a fourth STH, *Strongyloides stercoralis*, has been identified in Solomon Islands. *Strongyloides* has been found in children on Guadalcanal and Auki.

The Atoifi Health Research Group (AHRG), based at Atoifi Adventist Hospital are interested in working with local communities to stop transmission of STH. AHRG wishes to develop a program where each village determines what strategies they should use to improve sanitation. AHRG sees its role as providing evidence to assist in decision making by each community. STH surveys are part of this process. If prevalence of STH is high, this can be used by the community in their application for funding for toilets. It will also indicate if community wide treatment with albendazole is needed. Repeat surveys are useful for monitoring the effects of improvements in sanitation.

As part of this outreach program to control transmission of STH, AHRG has since 2011 worked with villages in East Malaita to conduct STH surveys (Harrington et al 2015). The populations in these villages have hookworm with prevalences between 20% and 30% and about 5% with moderate-heavy intensity of infection. The species of STH, the prevalence (percent of people infected) and the intensity of infection (number of worms) is not predictable and varies between villages. Surveys are required to determine the STH situation in a village.

AHRG has provided individual treatment to infected people as well as offering community wide administration of albendazole to all residents in these three villages. The team has also assisted these communities to develop proposals for obtaining toilets. The assistance has included discussions to determine what sort of toilet is the most appropriate for the community and technical expertise in assembling and writing funding proposals.

In 2014 communities on Marovo Island, Western Province requested information on STH. In January 2015 presentations on STH were given by members of the AHRG to the villages of Chea and Sasaghana. Village leaders then requested an STH survey in their villages. The STH survey, combined with training and education for 26 community members from Chea and Sasaghana, was conducted from 5-10 January 2016.

The aims of the survey were to:

1. Determine the prevalence and intensity of STH at Chea and Sasaghana;
2. Evaluate possible sources of infection with STH on Marovo Island, including the possibility of transmission from animals;
3. Work with the communities to determine how the AHRG team can provide assistance in controlling transmission of STH;

4. Increase the community's understanding of STH and control strategies relevant to Marovo Island by providing training in STH survey techniques and health education.

2. Methods

Population

A list of residents of Chea and Sasaghana was made prior to the survey to determine the number of people and families in each village, their gender and their ages. Each person was assigned a code to preserve anonymity. The code identified family and individual within that family. The codes were used for labelling specimens. The master sheet with codes and names was used in determining treatment for individuals and families.

From each village the planned target number of people to be surveyed was 100. The populations were approximately 500 in Chea and 300 in Sasaghana. After discussion with the community it was agreed that for each family one male, one female and a child would be asked to provide a faecal sample. The participants were chosen from the list of names assembled during the community census.

During the survey each selected person was visited in their home and asked if they were willing to participate. Parents gave permission for their children. Written consent with a signature was requested. When this was given, each individual was provided with a 70 ml faecal collection container marked with the individual's code only. Faecal containers were left at the public toilets in each village and collected twice a day by the Atoifi team.

Laboratory methods

STH were detected using the Kato Katz technique with a 47.1 mg mould (Katz et al 1972). Each slide was examined within 1 hour of preparation to detect and count hookworm eggs and other STH. Each positive record was checked by an experienced microscopist to verify the diagnosis and about 10% of negative slides were re-examined.

Results were entered into an Excel file and eggs per gram (epg) calculated by multiplying the Kato Katz count by 24. Intensity of infection was graded as light, medium and heavy using the standard WHO criteria (Table 1).

Table 1: World Health Organization criteria for intensity of STH infection based on eggs per gram (epg) of faeces.

STH	Light	Medium	Heavy
Hookworm	1 - <2000	2000 - <4000	≥4000
Roundworm	1 - <5000	5000 - <50000	≥50000
Whipworm	1 - <1000	1000 - <10000	≥10000

3. Results

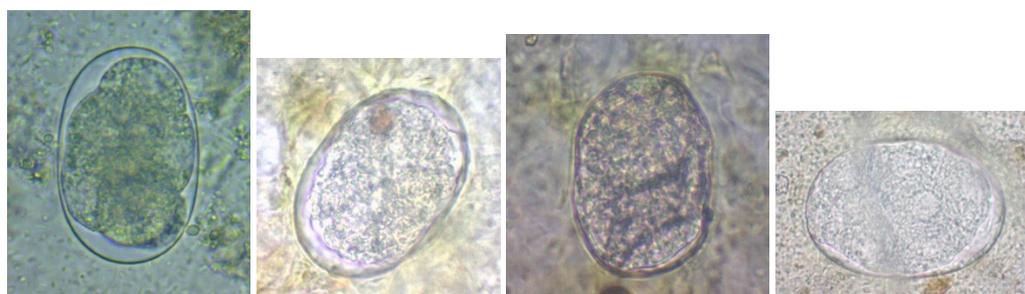
Only 200 people were asked to provide specimens with 5 refusals. Additional samples were provided voluntarily by others (Table 2). A total of 201 specimens were tested, divided between 100 males, 97 females and 4 with gender not recorded (Table 2).

Table 2. STH survey results for Chea and Sasaghana for January 2016.

Village	Population available	Number participating	Number with STH	STH %
Chea	240	125	11	8.8%
Sasaghana	310	76	6	7.9%
Total	550	201	17	8.5%

Prevalence and intensity of STH. Only hookworm was detected (Fig 1); no roundworm or whipworm were found. Seventeen people were infected with hookworm, giving an overall prevalence of 8.5%. Of the 17 people, 14 had a light infection (<2000 eggs per gram of faeces), one had a medium infection (2540 egg) and one had a heavy infection (4152 egg). This makes the percent of the population with medium-heavy infection 1%.

Species of hookworm: People can be infected with three different species of hookworm. The species of hookworm cannot be determined from the appearance of the eggs as all species look the same. The species will be determined by DNA studies in Australia at the University of Melbourne. Results are expected by May 2016. Note: All species of hookworm have the same lifecycle and are killed by the same treatment. Therefore, from a community point of view, finding out the actual species of hookworm does not make any difference to community level programs. However, from our research group point of view, finding out the actual species of hookworm helps to understand what is happening in the Solomon Islands and tells us if domestic animals could possibly be involved.

Figure 1. Microscope pictures of eggs of hookworm found during survey of Chea and Sasaghana.

Gender and Age. The prevalence of hookworm was similar in males and females (8.0% and 8.2% respectively). Age was available for 197 participants. Prevalences across age groups varied from zero in under 5 years and the 60-69 year group to 27.3% in 50-59 year group (Table 3). The absence of hookworm in very young children may indicate that transmission has stopped or is very low in these villages. An individual hookworm can live in a person for 10-15 years.

Table 3. Prevalence of hookworm by age group for Chea and Sasaghana.

Age group (yrs)	Number tested	Number with hookworm	Percent
<5	24	0	0.0%
5-9	45	5	11.1%
10-14	23	2	8.7%
15-19	9	1	11.1%
20-29	25	1	4.0%
30-39	20	2	10.0%
40-49	20	1	5.0%
50-59	11	3	27.3%
60-69	11	0	0.0%
70+	9	1	11.1%
Total	197	16	

When the results were combined into larger age group categories, prevalence in children (<15 years) was 7.6% (7/92), in young adults (15-39 years) 7.4% (4/54) and in older people (>39 years) 9.8% (5/51).

Information on toilets. Most families have formal toilets that were constructed over the last two years. However, not all families have a formal toilet. People in both villages use these formal toilets, defaecate into the mangroves and sea and sometimes defecate in the bush close to their gardens.

Animal surveys. Faeces of two dogs were examined. Both dogs had hookworm eggs (Fig 2). A puppy had a heavy infection (6312 epg). Although the species of hookworm causing these infections is most likely *Ancylostoma caninum*, the dog hookworm, an accurate identification can only be determined by DNA studies in Australia. For hookworms in dogs, *A. caninum* does not infect people while some strains of *A. ceylanicum* can infect people. Hence, determining the species of hookworm in dogs on Marovo Island is important for human health.

Figure 2. Microscope picture of a hookworm egg from a puppy with a heavy infection.

4. Discussion

Residents of Chea and Sasaghana have hookworm, but no other STH. Hookworm is a serious STH and particularly can cause anaemia in children and pregnant women as well as those who have a diet deficient in iron. Although the prevalence of infection is not high and the majority of cases are in the light category, there are cases of medium to heavy intensity in about 1% of the population.

A very interesting result is that the prevalence of hookworm in children under 5 years is zero. If there has been no program to deworm under 5s, this result may indicate that transmission has stopped over the last five years.

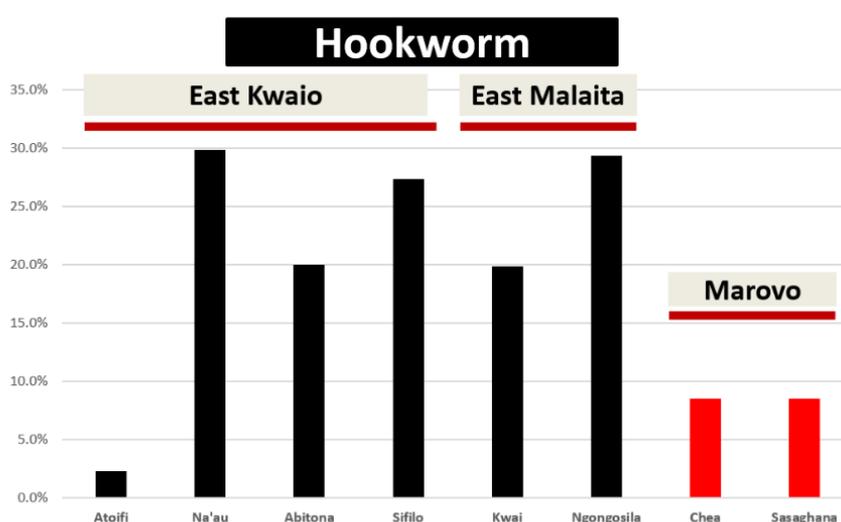
Comparison with other STH surveys in Solomon Islands

The AAH team have conducted similar STH surveys in East Malaita. Marovo Island has a lower prevalence of hookworm than these East Kwaio villages (Fig. 3). The islands of Kwai and Ngongosila had all three major STH (hookworm, roundworm, whipworm) while the other East Kwaio village surveys found mainly hookworm with only occasional cases of roundworm or whipworm.

This illustrates that each village has its own profile of STH. It may be possible to put “related” villages into groups and assume that the results of a STH survey in one village will indicate the prevalence of STH in the other village. However, the AHRG STH team would advise caution with this approach (Harrington et al 2015).

Figure 3. Prevalences of hookworm in villages surveyed by AAH STH team.

Prevalence of hookworm in STH surveys done by Atoifi Health Research Group

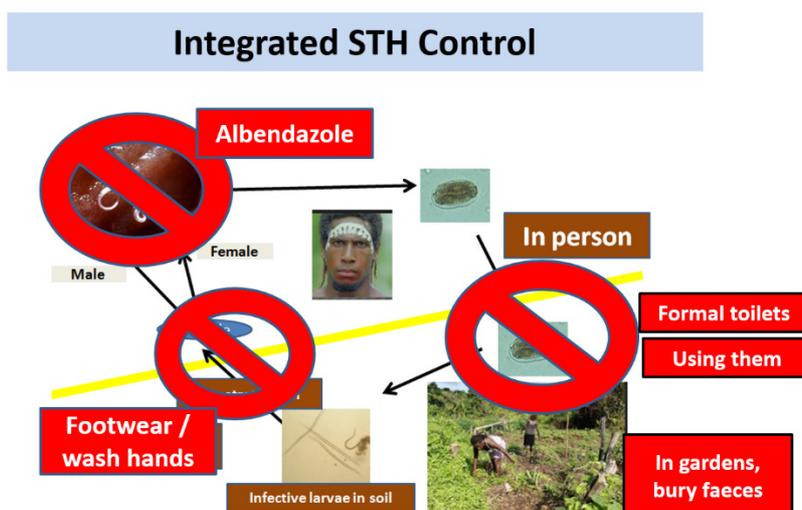


Control of Hookworm

The best STH control uses an integrated model that attempts to eliminate STH by attacking them at multiple points in their life cycles (Fig. 4). The key points of attack are:

1. Kill worms in the intestines by using effective treatment
2. Prevent contamination of soil by defecating in formal toilets
3. Prevent STH juveniles developing to the infective stage by burying faeces in soil (if formal toilet is unavailable) or making the ground as dry as possible
4. Prevent infective stages of STH from entering the body. For hookworm, wearing shoes will help while roundworm and whipworm can be prevented by washing hands and any food eaten raw (eg, cucumber).

Figure 4. Integrated control of STH can be used to eliminate hookworm one village at a time.



Albendazole is the recommended treatment for controlling STH, particularly roundworm and hookworm (Horton 2000; WHO 2012). It is safe for children and adult except in the first 3 months of pregnancy. It can be used in whole of community treatment to control and eliminate STH (Montresor et al 2008).

Community Meetings about Next Steps

These results were presented to each community separately in their village churches on 9 January 2016. Rick Speare gave a presentation in English using a Powerpoint lecture and this was translated into Marovan and Pijin by Humpress Harrington. The presentation took 45 minutes and was followed by extensive question and answer sessions that lasted up to 2 hours. At the end of these meetings both communities had decided that they wanted to eliminate hookworm from their villages and that they wanted a repeat survey in January 2017 to evaluate the effectiveness of their planned actions.

Recommendations

The following recommendations were developed by the AHRG team based on the community discussions.

Recommendation 1: Albendazole should be offered to all members of Chea and Sasaghana (except women in the first 3 months of pregnancy). This should be repeated in 6 months.

The first round of albendazole was obtained the week after the survey from the Ministry of Health by Humpress Harrington and forwarded to Marovo Island. Members of the STH team then administered albendazole to approximately 550 children and adults at Chea and Sasaghana; 239 from Chea and 308 from Sasaghana. The next treatment should be in June 2016.

Recommendation 2: Families who currently do not have suitable formal toilets should be encouraged or assisted to obtain them.

Recommendation 3: When in the garden, residents of Chea and Sasaghana should bury their faeces in small holes and cover them with soil.

Recommendation 4: The STH survey should be repeated in January 2017 along with an initial STH survey of other major villages/settlements on Marovo Island.

Health Promotion and Health Education

During this survey Tropical Health Solutions (www.tropicalhealthsolutions.com) produced a video telling the story of how the AHRG STH team does STH surveys. This was filmed and edited by Ben Speare. It will be made available on YouTube for general use and in digital format to individuals on request to Rick Speare (rickspeare@gmail.com).

Literature Cited

Harrington H, Bradbury R, Taeka J, Asugeni J, Asugeni V, Igeni T, Gwalaa J, Newton L, Fa`anuabae CE, Kilivisi FL, Esau D, Flores A, Ribeyro E, Liku D, Muse A, Asugeni L, Telene J, Shield J, MacLaren DJ, Massey PD, Muller R, Speare R. Prevalence of soil transmitted helminths in remote villages in East Kwaio, Solomon Islands. *Western Pacific Surveillance and Response Journal* 2015;6(3):51-58.

Horton J. Albendazole: a review of anthelmintic efficacy and safety in humans. *Parasitology* 2000;121:S113-S132.

Katz N, Chaves A, Pellegrino J. A simple device for quantitative stool thick-smear technique in schistosomiasis mansoni. *Rev Inst Med Sao Paulo* 1972;14(6):397-400.

Montresor A, Cong DT, Sinuon M, Tsuyuoka R, Chanthavisouk C, Strandgaard H, Velayudhan R, Capuano CM, Le Anh T, Tee Dato AS. Large-scale preventive chemotherapy for the control of helminth infection in Western Pacific countries: six years later. *PLoS Neglected Tropical Disease* 2008;2:e278.

World Health Organization. Eliminating soil transmitted helminthiases as a public health problem in children. Progress Report 2001-2010 and Strategic Plan 2011-2020. WHO; Geneva. 2012.