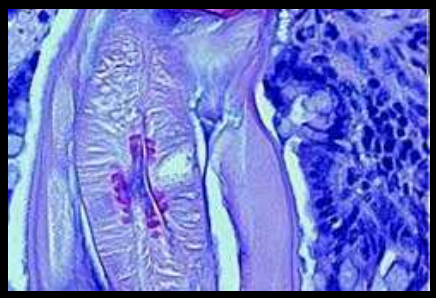

Review on the Epidemiological Profile of Helminthiases and their Control in the Western Pacific Region, 1997-2008

MVP/WPRO
29 April 2008

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Abbreviations

DEC	diethylcarbamazine
DOH	Department of Health
FBT	food-borne trematode
IEC	Information, education, and communication
LGU	Local governmental unit
LF	Lymphatic filariasis
MDA	mass drug administration
MOH	Ministry of Health
P/A/M	Province/Autonomous Region/Municipality (regarding China)
PacELF	Pacific Programme to Eliminate Lymphatic Filariasis
PIS	Pacific Island Survey (referring to a study performed by two WHO survey teams between 2001-2002 of 3,683 children attending 27 primary schools in 13 Pacific Island countries, as reported by Hughes et al. 2004)
STH	soil-transmitted helminths
STHCP	Soil-Transmitted Helminths Control Program
WHO	World Health Organization
UNICEF	United Nations Children's Fund

Forward

Neglected tropical diseases (NTD) affect large segments of the world population, mainly the poor and the hard to reach population groups where lack of access to health care and other services is already a problem. Although most of these diseases will not cause death, they will often result in debilitating complications, contributing to malnutrition and disabilities such as in the case of onchocerciasis (can cause blindness) and lymphatic filariasis (can cause elephantiasis).

NTD pathogens include viruses, bacteria, fungi, ecto-parasites and helminths. Most of these are diseases of poverty. Many will target primarily ethnic minorities, children and women in childbearing age. The World Health Organization is highly committed to addressing the NTDs. Prevention and control of NTDs can significantly contribute to the accomplishment of the Millennium Development Goals (MDG).

One of the key challenges is the lack of adequate data. NTDs are not subject to compulsory reporting. Available data seems to suggest that the highest disease burden is due to one group of NTD's, the soil-transmitted helminths (STH). It is estimated that more than 1.2 billion people might be infected with STHs and/or schistosomes in the Asia Pacific Region alone. STH infections cause morbidity by affecting nutritional status, growth and cognitive development in children. Some helminth infections are among the leading causes of anemia throughout the developing world.

Much less is known about the epidemiological profile of food born trematodes and cestodes. Indirect evidence provided by the veterinary public health sector suggests that the human public health dimension of these zoonotic infections may be underestimated.

A comprehensive review on the epidemiology of helminths in the Western Pacific Region (WPR) was conducted by the Western Pacific Regional Office of the World Health Organization. Data were collected through communications with WHO staff and country health officials, as well as through searches of online health databases and peer-reviewed publications. The profile for each country is divided into four categories of helminths: soil-transmitted helminths (Ascariasis, Trichuriasis and hookworm infections); food-borne trematodes (fascioliasis, chlonorchiasis, opisthorchiasis, and paragonimiasis); cestodes (taeniasis, cysticercosis, and echinococcosis); and schistosomes. Data from 1997 to 2008 were included in the review.

We expect this information to contribute to expanding our knowledge on the epidemiological profile of the aforementioned four worm categories. In doing so, it should raise the profile and level of attention needed to encourage effective public health interventions targeting a selected group of NTDs. Some countries and areas have already taken the lead in terms of collecting and sharing of information as well as engaging in control programs. Others will need to follow.

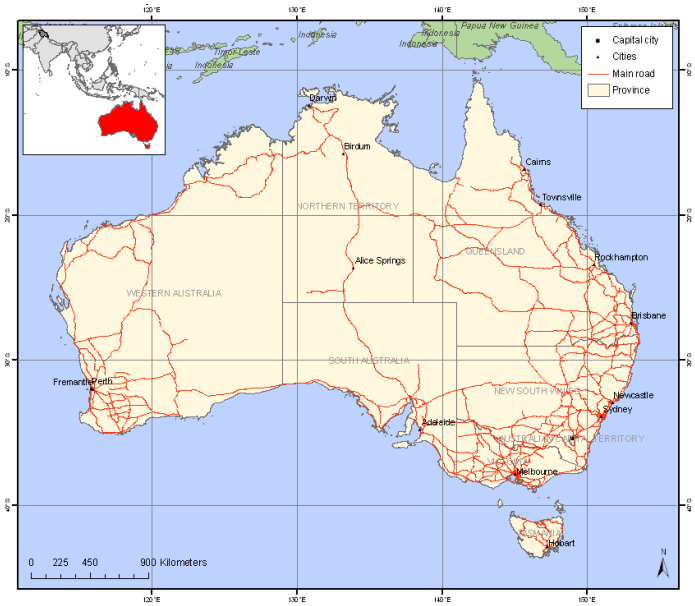
The current review is a "work in progress". Our expectation is that this will serve as the basis for a more extensive data bank on the four categories of helminths supporting the development of effective interventions as well as scaling up of existing ones. Efforts will be made to update the epidemiological profile of helminthiasis in the Western Pacific Region 1997-2008 as soon as more data become available.

Acknowledgement

The Western Pacific Regional Office of the World Health Organization wishes to acknowledge the valuable contributions of Ms Nicole Fox, a Fulbright scholar and an intern in the Malaria, Vectorborne and Other Parasitic Diseases unit of the Western Pacific Regional Office for compiling the information and preparing this review under the supervision of the Regional Advisor for Malaria, other Vectorborne and Parasitic Diseases.

Australia

As Australia is a developed country, helminth infection is primarily an affliction of marginalized populations and/or minority groups. Little information is available regarding the epidemiology of all types of helminths in Australia; however, what data are available indicate that further study of the prevalence and intensity of helminth infection in marginalized populations, especially aboriginal communities, is needed.



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
20,530,000	1,267	1,301	1,391	1,413	2,802	2,983	3,015	2,632	1,002	36.7

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data on soil-transmitted helminths were available from health officials from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

Information on the prevalence and distribution of STH in the country is limited. One study of 108 Aboriginees in north Western Australia found the following gastrointestinal helminths (including cestodes): *H. nana* (54.6%), *A. duodenale hookworm* (30.6%), *E. vermicularis* (6.5%), *T. trichiura* (2.8%), and *S. stercoralis* (1.9% - Reynoldson et al. 1997). While this may indicate that Aboriginal groups have a high prevalence of intestinal parasites, more research and surveillance needs to be conducted regarding the epidemiology STH in minority groups in Australia.

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from health officials from 1997-2008.

Status of Food-Borne Trematodes (Source: Published Data)

Paragoniumus is not common in Australia and poses no significant health threat (Hughes et al 2002). No other published data on food-borne trematodes were available from 1997-2008.

Status of Cestodes (Source: Official)

No data on cestodes were available from health authorities from 1997-2008.

Status of Cestodes (Source: Published Data)

The distribution of *E. granulosus* in Australia is greatly correlated to rainfall, prevalent in regions with temperatures of less than 30° C (86° F) and at least 25mm of rainfall for six months per year (Jenkins 2004). The disease is perpetuated through definitive wildlife hosts and domestic intermediate hosts. The regions most affected are eastern Victoria, New South Wales, Queensland, and the south-western corner of Western Australia (Jenkins 2004). Though echinoccosis is a notifiable disease in all States and Territories except New South Wales (where the majority of cases occur), human echinococcosis cases are historically underreported (Jenkins 2004). Approximately 80 to 100 new cases are diagnosed each year, including child cases (Jenkins 2004). Though Aboriginal infection rates are relatively unknown, the most recent national prevalence index indicated that the prevalence of echinococcosis in Aboriginees was 12.2 times higher than other rural populations (Jenkins 2004*).

In 2002, Tasmania announced the "provisional eradication" of *E. granulosus* after 30 years of hydatid control efforts (Jenkins 2004). This control was achieved in part because wildlife was never involved in transmission, and Tasmania, as an island, has control over animal movements (Jenkins 2004).

* data from 1996

Status of Schistosomes

Schistosomiasis is not endemic in Australia, and several studies have proved that Australian snails are unable to act as vectors of the disease (Hughes et al. 2002).

Brunei Darussalam

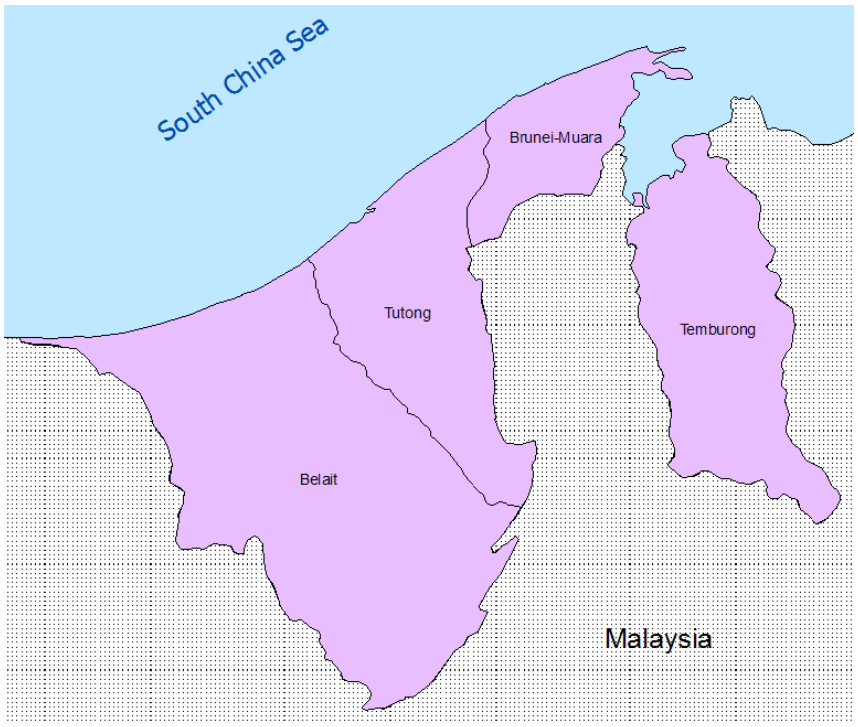


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Table 1*:* Population by Age Group

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382,000	40	37	35	33	75	67	47	29	6	26.2

Source: World Population Prospects: The 2006 Revision Population Database

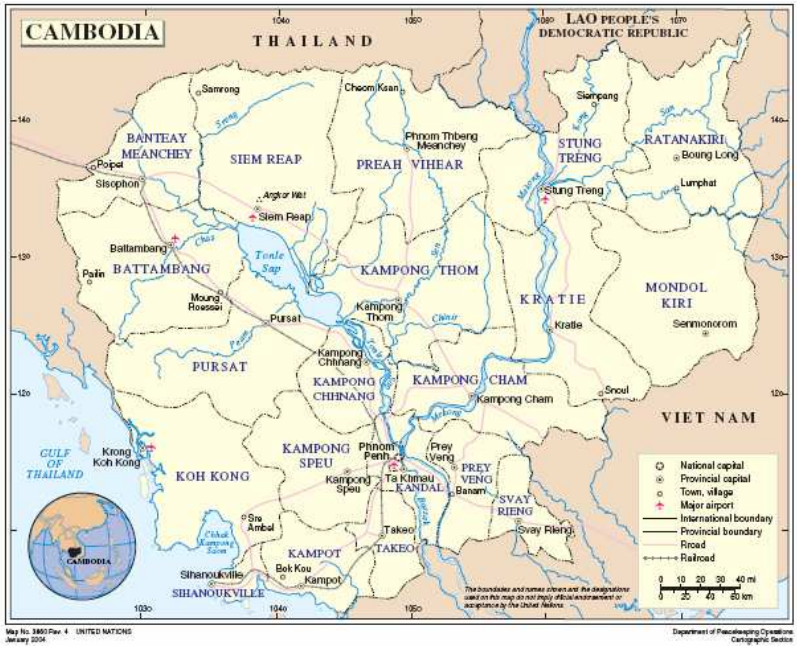
Country Situation

According to the Ministry of Health, helminth infection is not common in Brunei Darussalam and is not causing major health problems. As a result, there are currently no interventions in place to prevent helminth infection, nor any research being conducted on helminth prevalence throughout the country (Brunei MOH, personal communications, 2008).

No further data regarding soil-transmitted helminths, food-borne trematodes, or cestodes were available from the health authorities in Brunei Darussalam or independent research from 1997-2008. Schistosomiasis is not endemic to Brunei Darussalam (WHO 2006).

Cambodia

Soil-transmitted helminth infection and schistosomiasis are significant health problems in Cambodia. Within the last decade, however, Cambodia has instituted several helminth control programmes that have made significant progress in reducing the burden of these diseases. Data on food-borne trematodes and cestodes are scarce, and further epidemiological studies are needed to confirm the presence and prevalence of these helminths in Cambodia.



Map courtesy of the United Nations. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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14,197,000	1,690	1,674	1,848	1,738	2,637	1,676	1,336	864	293	20.1

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

Epidemiology

Approximately 1,300,000 preschool children and 2,775,000 school children are infected with soil-transmitted helminths (Montresor 2006).

Status of Soil-Transmitted Helminths (Source: Published Data)

Epidemiology

A survey of intestinal parasite infection, including food-borne trematodes, in 251 primary school children was conducted in Kampongcham in 2002. The infection rate was

approximately 57% in males and 51% in females. Ascaris was present in 26% of the cases, *Echinostoma sp.* 16%, hookworm 6%, and *Opisthorchis sp*. 4%, with nearly 17% of the samples exhibiting two different kinds of parasites (Lee et al. 2002). Another survey of 623 schoolchildren was conducted in Bat Dambang in 2004. The overall infection rate was 25.7% (roughly equal between boys and girls), with *Echinostoma sp.* (4.8%) and hookworm (3.4%) the most common. No positive cases of Ascaris or Trichuris were identified (Park et al. 2004).

Control Strategy

In 2002, Cambodia's Ministry of Health began a campaign to deliver antihelmintic drugs and health education to 75% of its population of 2.8 million school children twice a year (Sinuon et al. 2004). This intervention was incorporated into the existing national MDA for schistomiasis. The programme was initiated in two phases, and targeted all school children by the second phase between July 2003 and January 2004. The programme employs periodic MDA, training of health staff at central and peripheral level, and health education as key strategies (Crompton et al. 2003). Education kits containing mebendazole, Vitamin A, forms, educational material, books and educational games were to be distributed (Urbani and Palmer 2001). The programme was considered a very cost-effective and successful model for helminth control in developing countries (Sinuon et al. 2004)

In the two provinces endemic to schistosomiasis (see "Status of Schistosomes" below), a single dose of mebendazole was also combined with the MDA of praziquantel, reducing the prevalence of Ascaris from 74.5% to 10% and hookworm from 86% to 40% (Sinuon et al. 2007).

Status of Schistosomes (Source: Official)

MDA for schistosomiasis is given every year to approximately 80,000 individuals in the two endemic provinces of Kratie and Stung Treng (Montresor 2006). No new cases have been reported since 2006 (Montresor 2006). The Ministry of Health is planning to increase the interval between campaigns to two years.

Status of Schistosomes (Source: Published Data)

Before the Ministry of Health began universal chemotherapy with praziquantel in 1994, severe morbidity and mortality in Kratie and Stung Treng were common (Sinoun et al. 2007). Five years after this intervention was instituted, prevalence decreased from an average of 72% to less than 10% in four sentinel villages (Urbani and Palmer 2001).

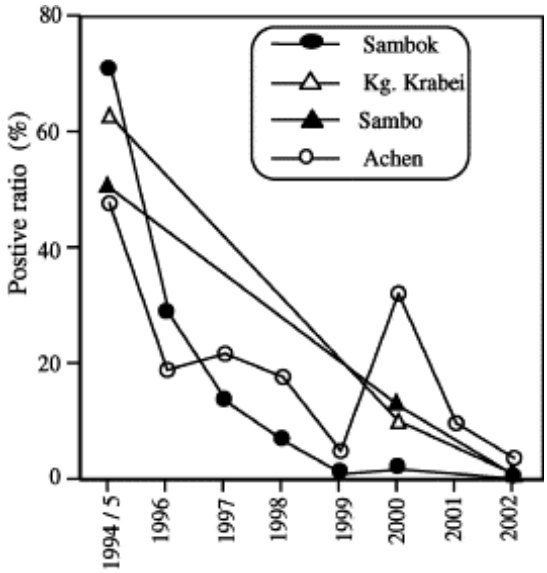
Throughout the 8 years that the programme continued, coverage reached between 62% and 82% of the population. Infection declined significantly as a result of the intervention, with 3 reported cases total in 2005 and no reports of severe morbidity (Sinuon et al. 2007; see Table 2 and Figure 1).

Table 2: Prevalence of Schistosoma mekongi in Stung Treng (estimated in villages randomly selected every year)

Year	*Coverage*	*Prevalence Survey (By Village)*			
		No. of villages surveyed	*No. of exams*	*No. of villages with active transmission (%)*	*Range of prevalence in positive villages (%)*
1997	64%	13	1033	11(85)	6-88%
1998	MDA not conducted due to lack of funding	6	401	9(83)	5.1-43.1%
1999	63%	8	676	5(62)	1.8-7.7%
2000	64%	13	849	10(76)	2-19.6%
2001	67%	13	1029	5(39)	1.4-7.2%
2002	62%	13	999	5(39)	1.3-4.5%
2003	Coverage not estimated	14	1573	0	-
2004	83.6%	8	905	0	-
2005	81.5%	10	1298	3(30%)	0.7-3.5%

Source: Sinoun et al. 2007

Figure 1: Change of prevalence of schistosomiasis mekong from 1994 to 2002 at villages in Kratie Province



Source: Ohmae et al. 2004

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from health authorities from 1997-2008.

Status of Food-Borne Trematodes (Source: Published Data)

No data on food-borne trematodes were available from independent research from 1997-2008.

Status of Cestodes (Source: Official)

No data on cestodes were available from health authorities from 1997-2008.

Status of Cestodes (Source: Published Data)

No data on cestodes were available from independent research from 1997-2008.

China

Country Situation

Helminth control efforts in China have been in existence since the 1950s, when schistosomiasis management became a priority. Currently, schistosomiasis is considered one of the three major infectious diseases in China (including HIV/AIDS and TB), and great efforts have been made to control the disease in recent years (MOH PDR China 2008).

The present strategy for control of parasitic diseases in China is to carry out comprehensive disease management approaches, with an emphasis on control of infectious sources (MOH PDR China 2008). At the country level, controlling soil-transmitted helminths and infection with *Clonorchis sinensis* have been prioritized. In addition to this national focus, different regions have identified other diseases as priorities for control: 1) echinococcosis, taeniasis, cysticercosis, trichinosis and leishmaniasis in western China; 2) soil-transmitted helminths in impoverished regions of central and eastern China; and 3) *Clonorchis sinensis* in Guangdong, Guangxi, Heilongjiang, Jilin and Liaoning provinces. Children, women, and ethnic minorities are the key populations to be targeted within all disease-specific interventions (MOH PDR China 2008).

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1,320,864,000	84,390	93,388	100,720	116,181	197,715	241,625	191,778	147,090	45,111	32.5

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

Epidemiology

According to the second national survey on major human parasitic diseases conducted in 2003, the infection rate of soil-transmitted helminths was 19.56%. The average rate of hookworm infection was 6.12%, Ascaris infection 12.72%, and Trichuris infection 4.63%. The standardized rate of hookworm, Ascaris, and Trichuris infections decreased by 60.72%, 71.29%, and 73.6% respectively since the first survey in 1990. Overall, these decreases translated to a decrease of 407 million infections (MOH PDR China 2008).

The degree of reduction varied greatly in different areas, and many severe epidemics still existed in some regions. The infection rate tended to increase gradually from the north to the south of the country (MOH PDR China 2008). However, the infection rates in Kiangsu, Guangdong, Shanghai and Zhejiang provinces/municipalities were significantly lower than many other central and southern Provinces/Autonomous Regions/Municipalities (P/A/M) due to large-scale control activities, local rapid economical development, and improvement in living standards of farmers (MOH PDR China 2008). In some less developed counties and townships in central and western China, the number of STH infections remained very high and difficult to decrease due to complicated natural, social, and behavioral factors (MOH PDR China 2008).

Control Strategy

According to a document created by the MOH and China CDC outlining control and prevention plans for 2006-2015, soil-transmitted helminths and food-borne parasitic diseases were considered major diseases that needed to be controlled. Monitoring sites in 22 provinces were set up study soil-transmitted parasitic diseases. Ten pilot projects (also referred to as *demonstration plots* by the MOH PDR China) of the integrated control programme for parasitic diseases, which included both STH and FBT, were carried out in ten high-risk regions in 2006 (MOH PDR China 2008).

In 2007, mid-term evaluations were conducted on the projects in 7 of the 10 demonstration plots, and the remaining 3 will be evaluated in 2008. In addition, some specialized research programmes will be carried out according to the epidemiological situations in these areas. In order to extend the impact of the integrated programme, 2 minority regions (Ma'erkang County of Sichuan Province and Yanji County of Jilin Province) were set as new demonstration plots in 2007. It was also recognized that training and surveillance needed to be strengthened in minority regions in order to improve control for these areas (MOH PDR China 2008).

Status of Soil-Transmitted Helminths (Source: Published Data)

Epidemiology

The 2003 national prevalence survey studied a total of 356,629 individuals from 31 Provinces/Autonomous Regions/Municipalities (P/A/M), recording 26 different helminth species (Zhongguo Ji Sheng 2005). From this survey, it was estimated that approximately 129 million individuals in China are infected with some form of STH (Zhongguo Ji Sheng). Of these infections, approximately 85.93 million were infected with Ascariasis, 29.09 million with Trichuriasis, and 39.3 million with hookworm. Comparisons with the first national survey (Xu et al. 1995) and another report on the prevalence of STH in China (de Silva et al.

2003) indicate that this is a significant decrease in the prevalence of STH in China (also documented by the MOH; see also Source: Official).

Control Strategy

In 2004, Mass Drug Administration (MDA) was initiated in 5 counties, and approximately 2 million people were treated every year as of 2006 (Montresor 2006). An additional 8 counties were added in 2007, totalling an MDA coverage of 3 million people. Universal MDA is planned to start in 2008 for all counties where infection exceeds 30% (Montresor 2006).

Status of Schistosomes (Source: Official)

Epidemiology

The control programmes put in place by the Chinese central government over the past five decades have resulted in a significant decrease of schistosomiasis infection, from around 11.6 million in the mid-1950s to 726,000 in 2004. The number of provinces endemic to schistosomiasis was also reduced from 12 to 7 (MOH PDR China). However, the most recent national sampling survey found that the prevalence of infection in endemic areas increased from 4.9% in 1995 to 5.1% in 2004. The highest prevalence rates were found in Hunan (4.2%), Hubei (3.8%), Jiangxi (3.1%) and Anhui (2.2%) provinces. Over 80% of current cases were found in lake and marshland regions of these provinces and Jiangsu (MOH PDR China 2008).

The reasons for the recent increase in prevalence are complex. Past efforts to control snail populations using chemical molluscicides or alteration of their habitats have resulted in environmental pollution and damage. Recent studies have found that using synchronous chemotherapy for humans and domestic animals is only temporarily effective, and can eventually result in high reinfection rates in man and domestic animals. Ecological changes in the environment, frequent flooding, and population movement have also contributed to an overall increase in snail habitat area and infection rate in humans (MOH PDR China 2008).

Control Strategy

In 2004, the State Council of China established a national programme for schistosomiasis control. According to the programme, infection in all endemic counties should be lower than 5% by 2008, and the level of infection should be less than 1% by 2015 (MOH PDR China 2008).

Taking into account recent studies that have identified cattle as the primary source of *S. japonicum* infection for snails and a limited lifespan of infected snails, the government has developed a comprehensive control strategy based on limiting and/or preventing the release of parasite eggs into the environment. Within this strategy, 1) a national law would confine livestock away from transmission areas; 2) bovines and most water buffalo would be replaced by tractors in agricultural activities; 3) livestock would be confined to pens and would not be allowed to pasture in marshlands where snail habitats exist; 4) excreta from humans and domestic animals would be recycled to produce methane for cooking; and 5) in the Poyang Lake area, fishermen would be required to use containers to prevent excreta from being poured into the water (MOH PDR China 2008).

Schistosomiasis control activities are currently integrated into general governmental development policies, which include transforming agricultural practices and activities to make

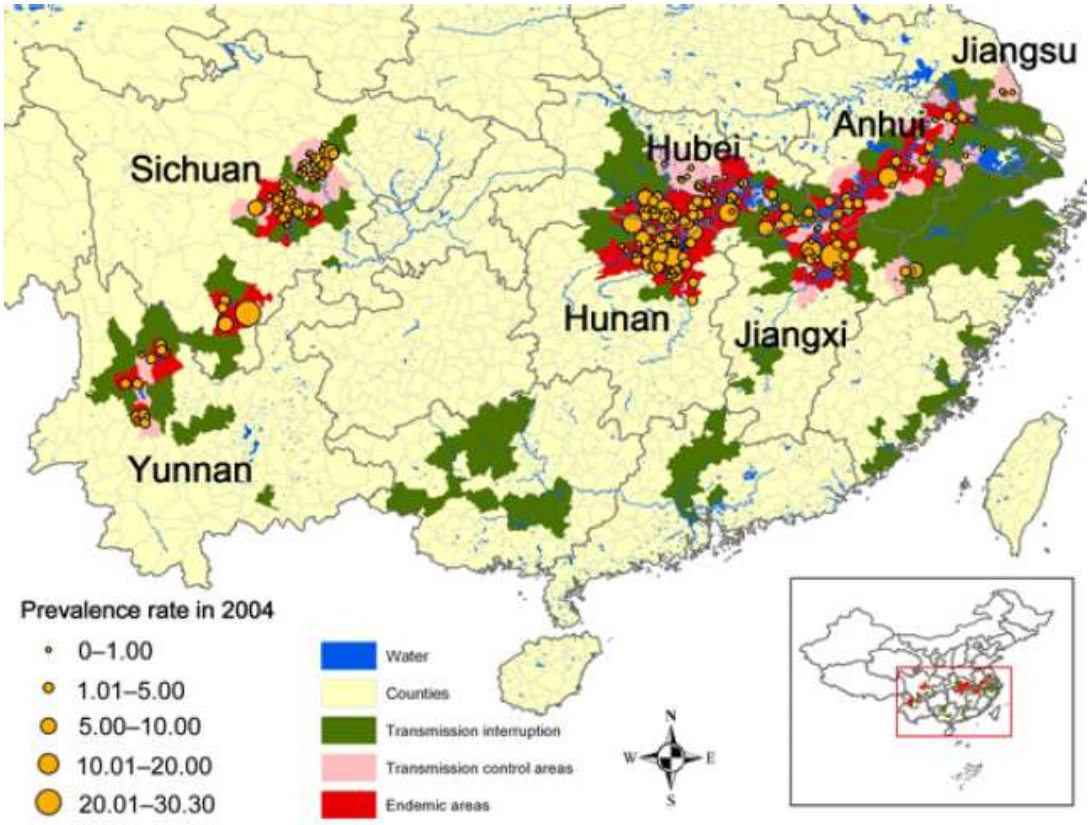
them more productive. These activities are being piloted in Anhui, Hubei, Jiangxi, Sichuan, and Yunnan provinces. The government is currently considering a proposal to implement this strategy more broadly, but funds to do so are currently unavailable (MOH PDR China 2008).

Status of Schistosomes (Source: Published Data)

Epidemiology

The third national sampling survey for schistosomiasis was conducted in 2004, and studied the prevalence of *S. japonicum* in more than 290,000 people, ranging from 6-65 years, from 239 villages in 7 endemic provinces (Zhou X-N et al. 2007; see Figure 1). Prevalence rates ranged from 0.3% in Jiangsu province to 4.2% in Hunan province, with a total estimated number of over 726,000 infected individuals throughout the country (Qin Liu et al. Draft 2007). In more than 50% of the villages, infection was less than 1%, and infection exceeded 10% in 7.6 percent of the villages. The study found that infection was more common in men than women (2.6% to 2.2% of participants), and significantly higher in fisherman (3.3% - Zhou X-N et al. 2007). It is estimated that nearly 10 million people live in at-risk areas for infection, with the majority of infected persons living in lake and marshland regions (Qin Liu et al. draft 2007, Zhou X-N et al. 2007).

Figure 1. Epidemiology of Schistosomiasis in PDR China, 2004



Source: Zhou et al. 2007

It has been noted that drawing direct comparisons between the 1995 schistosomiasis survey and the 2004 survey is difficult, as the 2004 survey covered a wider geographic area that included all schistosome-endemic areas in place of smaller regions that had not reached

transmission control status (Zhou X-N et al. 2007). However, several conclusions can still be made from the two surveys. There was an estimated decrease from 865,084 to 726,112 total cases (16.1% reduction) from the previous survey in 1995, as well as a 41.3% reduction prevalence in villages where schistosomiasis was transmitted during the same period (Zhou X-N et al. 2007). The number of people at risk in disease-endemic villages decreased from 22,209,662 to 13,937,325 as well (a 37.3% decrease). Though these findings indicate progress in schistosomiasis control, the authors found that prevalence rates in areas where transmission control was not achieved increased from 4.9% to 5.1% (also reported by the MOH; see "Source: Official" data - Zhou X-N et al. 2007).

Status of Food-Borne Trematodes (Source: Official)

Clonorchiasis

Epidemiology

The standardized rate of *C. sinensis* was 0.58% in 2003, or an estimated 12.49 million people infected. This is an increase of 75% from the 0.33% reported in the first national survey in 1990. The infection rate in Guangdong, Guangxi, and Jilin provinces all significantly increased by 182%, 164%, and 630% respectively. These provinces and the province of Anhui all had prevalence rates higher than the national average. Both the first and second national surveys indicated that infection was higher among males than females, and higher among businessmen, semi-farmers, semi-businessmen, fishermen, teachers, and more highly educated individuals (MOH PDR China 2008).

No data on fascioliasis or paragonimiasis were available from official sources in China.

Control Strategy

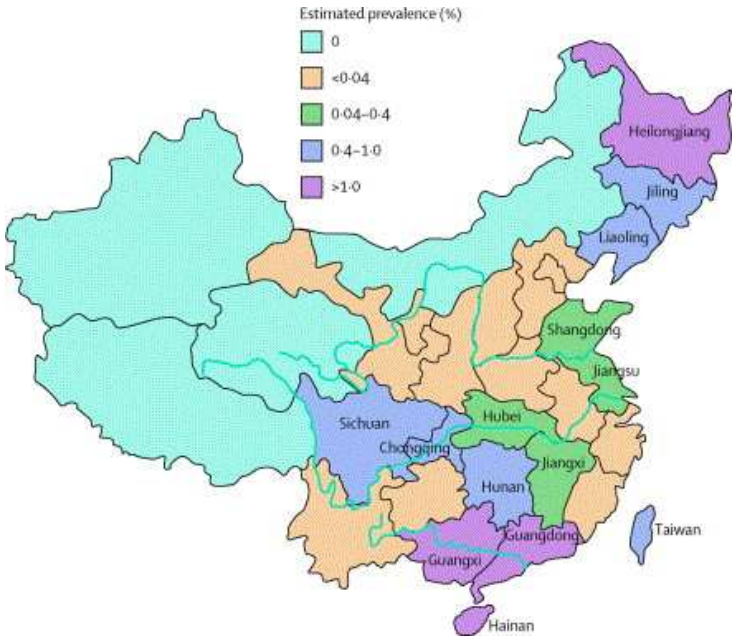
The control strategy for food-borne trematodes is addressed through the integrated control programme for parasitic diseases (see Control Strategy under Source: Official for STH).

Status of Food-Borne Trematodes (Source: Published Data)

Clonorchiasis

Clonorchiasis in China is endemic in several regions, with the highest prevalence in Heilongjiang, Guangdong, and Guangxi provinces (Lun et al. 2005; see Figure 1 and Table 2). In total, it is estimated that 15 million people are infected with *C. sinensis*, and approximately 570 million live in endemic areas (Lun et al. 2005). Chlonorchiasis is more common in some endemic areas in men than in women, attributed to a higher average consumption of raw freshwater fish by men (Lun et al. 2005). Individuals can also become infected through water contaminated with infected feces, as is common in Guangong and Guangxi provinces where lavatories are built adjacent to fish ponds (Lun et al. 2005). Infection also occurs when metacercariae are ingested after handling freshwater fish and not washing (Lun et al. 2005).

Figure 1: Estimated Prevalence of Clonorchiasis In China



Source: Lun et al. 2005

Table 2: Prevalence of Clonorchiasis by Province

Province	*Number of Men Examined*	*Number of Infected Men*	*Prevalence (%)*	*Number of Women Examined*	*Number of Infected Women*	*Prevalence (%)*
Guangdong	7,533	2,693	35.75	8,339	2,459	29.49
Guangxi	19,117	4,246	22.21	13,931	1,160	8.33
Heilongjiang	6,006	2,224	37.06	3,947	929	23.54
Hubei	207	8	3.86	261	3	1.15
Sichuan	27,588	2,433	8.82	25,474	1,869	7.34
Total	**60,451**	**11,604**	**19.20**	**51,952**	**6,420**	**12.36**

Source: Lun et al. 2005

Prevalence rates vary greatly between the provinces, with development playing a multifaceted role in transmission. According to a study conducted by Guoqing et al. in 2001, the prevalence was estimated at 0.24% and declining. This decline was linked to the improvement of living standards, which allowed people to eat more raw large culture fish (which do not harbor metacercaria) as well as a disinclination to eat fish from rivers polluted with industrial waste (Guoqing et al. 2001). Conversely, the infection rate in Guangdong Province was still high at 17.4% (Guoqing et al. 2001), with a transition to urban centers where eating raw fish was becoming more fashionable (it is noted that these findings differ from those included in Lun et al. 2005 and the associated Table 2). Intervening to stop the spread of clonorchiasis must involve area-specific epidemiological surveillance to target modes of transmission and prevalence, as well as tailored educational programmes and chemotherapy.

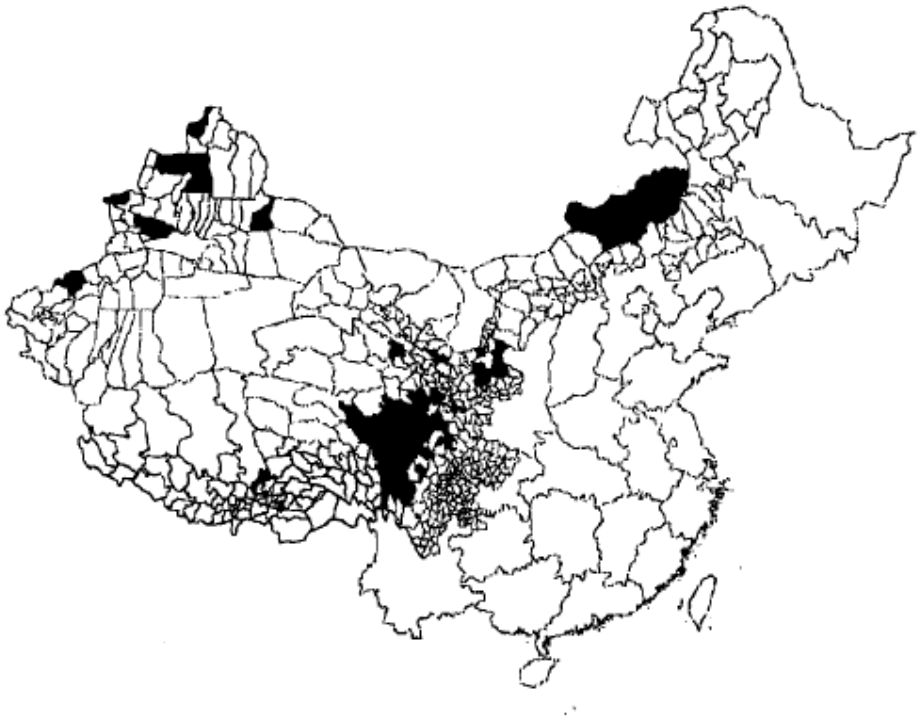
Status of Cestodes (Source: Official)

Echinococcosis

Epidemiology

Echinococcosis is endemic in Tibet, Sichuan, Qinghai, Ningxia, Gansu, Xinjiang, Inner Mongolia, Yunnan, Shanxi, Shaanxi and Heilongjiang provinces/autonomous regions in China. The Qinghai-Tibet region in particular has one of the most highly endemic areas in the world. The highest prevalence rate recorded from surveys in these areas was 14.99% (MOH PDR China 2008).

Figure 2: Counties Covered in the Echinococcosis Control Programme, 2007



Source: China PDR MOH

Control Strategy

A national control programme that covers 51 endemic counties has been ongoing since 2005, and echinococcosis control was brought into the national free treatment programme established by the Chinese central government in 2006 (MOH PDR China 2008).

Status of Cestodes (Source: Published Data)

Echinococcosis

Epidemiology

Echinococcosis is known to be endemic in eight provinces and autonomous regions in China: Gansu province, Heilongjian Province, Qinghai Province, Sichuan Province, Inner Mongolia

Autonomous Region, Ningxia Hui Autonomous region, Tibet Autonomous region, and Xinjiang Uigur Autonomous Region (Vuitton et al. 2003). High-risk areas are typically temperate regions covered with grassland or steppe, and their populations share the common characteristics of isolation, poverty, minority ethnic status, and animal herding with little agricultural development (Vuitton et al. 2003). The population at-risk is estimated to be more than 60 million, with an estimated 1.3 million existing cases needing treatment (Ito et al. 2003).

The highest prevalence of alveolar echinococcusis in the world has been recorded in Gansu province, up to 15% in some villages and averaging 5% in the region (Ito et al. 2003). Most symptomatic cases require surgery (typically estimated at US$ 600 - US$ 700), and the recurrence rate of hydatid cysts is high even after surgical intervention (Ito et al. 2003).

Cysticercosis

Epidemiology

Cysticercosis due to *T. solium* is highly endemic in five zones in China: 1) the north, including Hebei, Neimonggol, and Shanxi provinces; 2) the northeast, including Helongjiang, Jilin, and Liaoning; 3) the northwest, including Gansu, Ningxia, and Qinghai; 4) Shandong, Henan, Anhui, Tubei, and Shaanxi; and 5) Guandong, Guangzi, Hainan, Yunnan, and Sichuan (Ito et al. 2003). Many of the cases in these provinces are associated with the preference of minorities to eat raw pork. With an increase in tourism and the promotion of “ethnic” dishes to attract customers, infection with cysticercosis and trichinosis has increased. The total number of infected individuals with *T. solium* and cysticercosis is estimated to be more than 1 million (Ito et al. 2003).

Control Strategy

The Chinese population is increasingly moving from rural to peri-urban and urban areas. As a result, increased health hazards, including living in close proximity to livestock, stray dogs, and unregulated slaughtering facilities, are complicating disease control. This is especially concerning as control of cestodes is already hindered by a lack of education and surveillance. Several Chinese and international researchers have collaborated in recent years to investigate the epidemiology of the disease further, and the Chinese Ministry of Health has chosen echinococcosis and cysticercosis as principle targets for research (Ito et al. 2003).

Taeniasis

As pork is a staple food in China, *T. solium* cysticercosis is a nationwide public health issue, excepting minorities in Muslim societies (Myadagsuren et al. 2007). More specific data on the epidemiology of taeniasis were unavailable from other published data.

Hong Kong

Country Situation

In Hong Kong, a clean water supply and effective sewage management system has been maintained by the government to safeguard public health. The Department of Health also educates members of the general public to take good personal and food hygiene through various health education materials to prevent infections (Department of Health 2008).

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
7,132,00	292	352	409	424	997	1,164	1,390	982	262	38.9

Source: World Population Prospects: The 2006 Revision Population Database

Nota bene: An example of a fact sheet about intestinal parasitic infection published by the DOH can be found in the following link: http://www.chp.gov.hk/content.asp?lang=en&info_id=17&id=24&pid=9 (Department of Health 2006).

Status of Soil-Transmitted Helminths (Source: Official)

Helminths are not statutory notifiable diseases in Hong Kong. However, the Department of Health does have data on cases admitted to public hospitals. According to patient records, the annual number of cases diagnosed to have helminth infections ranged from 13 to 19 from 2005-2007. Strongyloidiasis accounted for most of the cases (see Table 1).

Table 1: Helminth Cases Reported to Hospital Authority of Hong Kong

Year	Strongyloidiasis	Enterobiasis	Ascariasis	Gnathostomiasis	Not Specified	Total
2005	10	0	0	0	3	13
2006	17	0	0	0	2	19
2007	9	2	1	1	1	14

Data from Hospital Authority, Hong Kon, SAR. Clinical Data Analysis and Reporting System. It should be noted that one person may have more than one type of helminth.

Status of Soil-Transmitted Helminths (Source: Published Data)

No data on soil-transmitted helminths were available from independent research from 1997-2008.

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from health authorities from 1997-2008.

Status of Food-Borne Trematodes (Source: Published Data)

One case of cholecystitis due to *Clonorchis sinensis* has been reported in Hong Kong (Rohela et al. 2006); however, other studies on the epidemiology of food-borne trematodes throughout the country were not available from 1997-2008.

Status of Cestodes

No data on cestodes in Hong Kong were available from health authorities or independent research from 1997-2008.

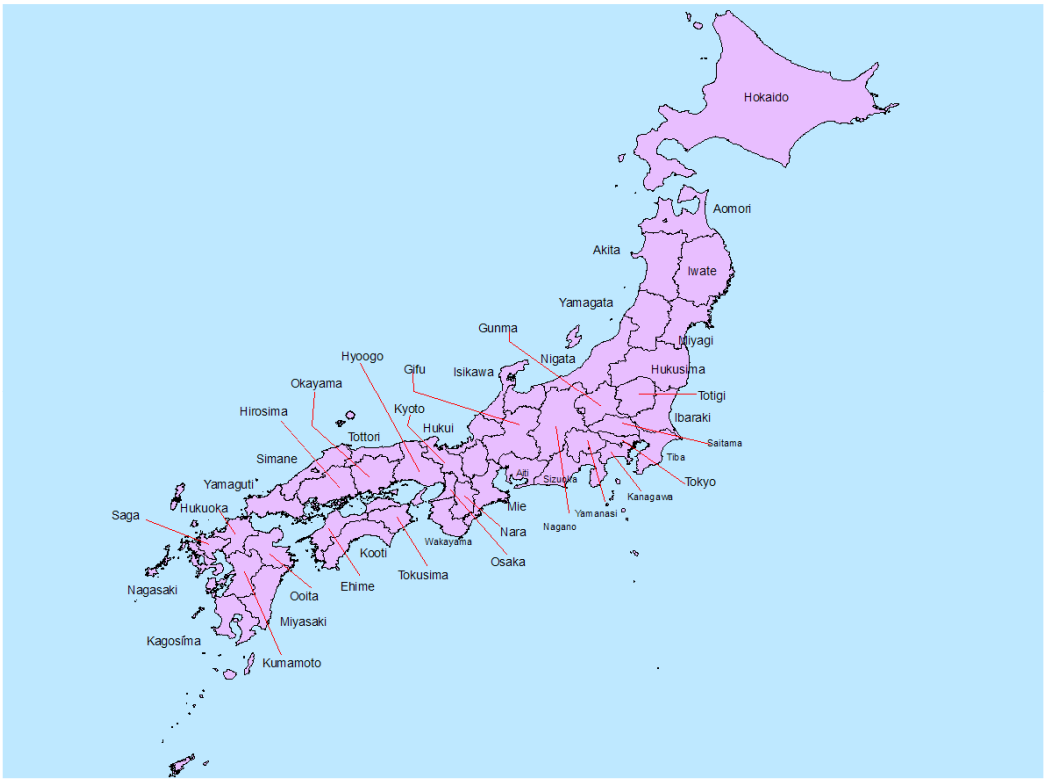
Status of Schistosomes

Schistosomiasis is not endemic to Hong Kong.

Japan

Country Situation

Soil-transmitted helminthiases do not impose a significant health burden in Japan, following years of control efforts. Food-borne trematode infections, especially paragonimiasis, still persist throughout the country. FBT infection is prevalent primarily in rural areas.



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
127,953,000	5,622	6,022	5,986	6,418	15,712	18,903	15,909	18,656	8,808	42.9

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data on soil-transmitted helminths were available from health officials between 1997-2008.

Status of Soil-Transmitted Helminths (Published Data)

Soil-transmitted helminths have been nearly eliminated within the last 50 years in Japan through extensive mass screening and treatment, carried out by the Japan Association of Parasite Control in cooperation with legislated school health activities (Nawa et al. 2001).

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from health officials between 1997-2008

Status of Food-Borne Trematodes (Source: Published Data)

Paragonimiasis is endemic in western Japan, especially in southern Kyushu (Nawa et al. 2001); approximately 50-100 *Paragonimus spp*. infections are reported annually (WHO 2004), though the actual number of cases (especially in rural areas) is likely higher. Metagonimiasis is also common, with 10-15% prevalence in populations that border major rivers (Nawa et al. 2001) and 150,000 estimated infections (WHO 2004).
One study of paragonimiasis patients in 1999 found that infection primarily occurred among middle-aged males who ingested raw wild boar meat. A smaller fraction of reported cases have also involved immigrants who had a history of eating freshwater crabs (Nakumura-Uchiyama et al. 2004). Japanese paragonimiasis patients tended to be older than immigrant patients (a mean age of 48 for Japanese patients as compared to a mean age of 36 among immigrants). Japanese males were twice as likely as Japanese women to develop paragonimiasis, while immigrant females were twice as likely as males to develop the condition (Nakumura-Uchiyama et al. 2004). Group infection is also more common among immigrants, and their infections were typically more severe than in Japanese patients (Nakumura-Uchiyama et al. 2004).

FBTs are most common in rural areas, where traditional food habits are more preserved and raw freshwater fishes and game meat are also incorporated into the diet (Nawa et. al. 2001). Due to general unawareness of food-borne parasitic zoonoses, the cysts caused by many cestode infections (such as paragonimiasis and fascioliasis) are often mistaken for cancers, and examination for these false carcinomas results in large economic losses (Nawa et. al. 2001). There is currently no legislative system applied to FBTs, and both increased surveillance for and awareness of FBTs is needed.

Status of Cestodes

No data were available on cestodes from health authorities or independent research from 1997-2008.

Status of Schistosomes

Schistosomiasis has been eliminated in Japan (Nawa et al. 2001).

Korea

Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
48,050,000	2,369	2,942	3,395	3,216	7,388	8,282	8,161	5,487	2,082	35.0

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data on soil-transmitted helminths were available from health officials between 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

In 1966, the Republic of Korea enacted the Law for the Prevention of Parasitic Diseases, which stipulated that schoolteachers or principals were responsible for finding cases through stool examination, as well as treating them twice a year (Rim 2003). Treating night soil, or the use of human feces as fertilizer, before use was also advocated. Experts from many fields were appointed to an Expert Committee for Parasite Control, and the Korean Society for Parasitology (KAPE) continues to employ technicians and facilities for examining faecal samples (Rim 2003). KAPE has conducted randomized national prevalence surveys every five years to continue monitoring soil-transmitted helminth infection (Rim 2003). Prevalence rates of geohelminths have substantially declined since the national control program began, and STH currently do not pose a significant health burden in Korea.

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from health officials between 1997-2008.

Status of Food-Borne Trematodes (Source: Published Data)

Between 1984-1990, faecal samples from 3,009,166 people living in endemic areas that tested positive for clonorchiasis were treated with Praziquantel. This program, coupled with environmental changes (mechanization of agriculture, urbanization, industrialization, and water pollution) has largely blocked the clonorchiasis reinfection cycle (Rim 2003).

Despite these factors, *Clonorchis sinensis* infection prevalence was 1.4% in 1997, a figure that has remained almost stagnant for 20 years (Rim 2003). This indicates that more focused clonorchiasis prevention, perhaps through targeted education campaigns, will be necessary to decrease prevalence figures. As eating raw vegetables and aquatic species are a valued part of many culinary traditions, however, further behavior change will be difficult and other alternatives will need to be explored.

Paragonimus westermani infections are present in Korea, but diagnosis of infection is difficult. As a result, few data are available on the nationwide prevalence of paragonimiasis, but prevalence is believed to have been high in the past and decreased significantly in recent years (Rim 2003).

Status of Cestodes (Source: Official)

No data on food-borne trematodes were available from health officials between 1997-2008.

Status of Cestodes (Source: Published Data)

The nationwide egg-positive rate for *Taenia spp.* was 0.02% in 1997 (Rim 2003). More recent information regarding the prevalence of *Taenia* infection was not available between 1997-2007.

Though cysticercosis cases have been documented in Korea (Rajshekhar 2003), no new information regarding the epidemiology of the disease was available between 1997-2007.

Status of Schistosomes

Schistosomiasis is not transmitted in Korea.

Lao People's Democratic Republic

Country Situation

Recent investigations in the Lao People's Democratic Republic (Lao PDR) have found that helminth infections, particularly soil-transmitted helminthiases and opisthorchiasis, are widespread throughout the country. Limited access to health services, poor hygiene and sanitation, and certain eating behaviours contribute to high infection levels in the country (Lao MOH 2008).

Map courtesy of the United Nations. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
5,759,000	715	747	780	706	1,016	706	496	297	94	19.2

Source: World Population Prospects: The 2006 Revision Population Database

Official Strategy for Helminth Control in Lao PDR

The Ministry of Health of Lao PDR has established a goal to reduce the intensity of all helminth infections to a low level or eliminate the disease within a risk group (preschool, school-age children, and/or women of childbearing age). Specific objectives outlined to achieve this goal include: 1) providing a unified approach for implementation of control strategies for the reduction and eradication of helminth infections; 2) helping to successfully manage and implement control activities; 3) promoting and motivating each agency to participate in the implementation of control measures; and 4) ensuring that vulnerable groups receive appropriate information for behavioural change (MOH Lao PDR 2008). Different parties at varying organizational levels have been assigned responsibility for implementing aspects of these objectives (see Table 6).

Table 2: Organization of Helminth Control Responsibilities

Organization	Responsibilities	Level
Department of Hygiene and Prevention (MoH)	• Focal point for coordination • Planning and strategy development • Monitoring, evaluation, data management, and analysis • Responsible for advocacy and orientation meetings • Responsible for mobilization of resources from international organizations, NGOs, and the private sector	Ministerial
Center for Malaria, Parasites and Entomology, Center for Laboratory and Epidemiology	Co-implementers of • Periodical and special surveys • Training activities • Mass drug administration	Ministerial
Center of Health Information and Education	• Developing IEC (information, education, and communication) materials • Organizing IEC events • Coordinating with media to ensure information delivery	Ministerial
University of Health Sciences, Institute for Tropical Medicine, National Institute for Public Health	Coordinating efforts for • Implementing research activities • Training students in medical sciences and health professional staff • Disseminating of scientific results in scientific and general literature	Ministerial
Provincial Malariology, Parasitology, and Entomology Station, Provinicial Epidemiology Unit Health Education Unit	• Planning of training, surveillance and control (MDA) activities at the provincial level • Coordinating activities with other development partners within the province • Disseminating information on prevention and control of helminth infections • Advocating meetings with the political leaders in the province • Conducting quality control for the district laboratory	Provincial
Provincial Hospitals	• Providing curative services (stools examination, treatment of positive cases)	Provincial
District Health Promotion Units	• Developing action plans for helminth control at the district level • Implementing control activities • Coordinating with non-health and private sectors within the district • Disseminating information on prevention and control of helminth infections • Facilitating advocacy meetings with the political leaders in the district • Supervising helminth control activities at the Health Center level	District
District Hospitals	• Providing curative services (stools examination, treatment of positive cases)	District
Local Health Centers	• Implementing control activities (MDA and EIC activities) • Coordinating with local schools, local mass organizations, and the community • Disseminating information on prevention and control of helminth infections • Facilitating advocacy meetings with the political leaders in the commune	Local

Source: Lao PDR Ministry of Health, 2008

The Ministry of Health has recognized that human helminthiasis are causing severe morbidity in Lao PDR, and that control of morbidity through mass drug administration (MDA) is simple and cost-effective. The MOH has stated that it is a right of every at-risk individual to receive regular preventive chemotherapy through MDA and health education. It has also pledged to improve water and sanitation, as well as promote behavioural change whenever possible (MOH Lao PDR 2008).

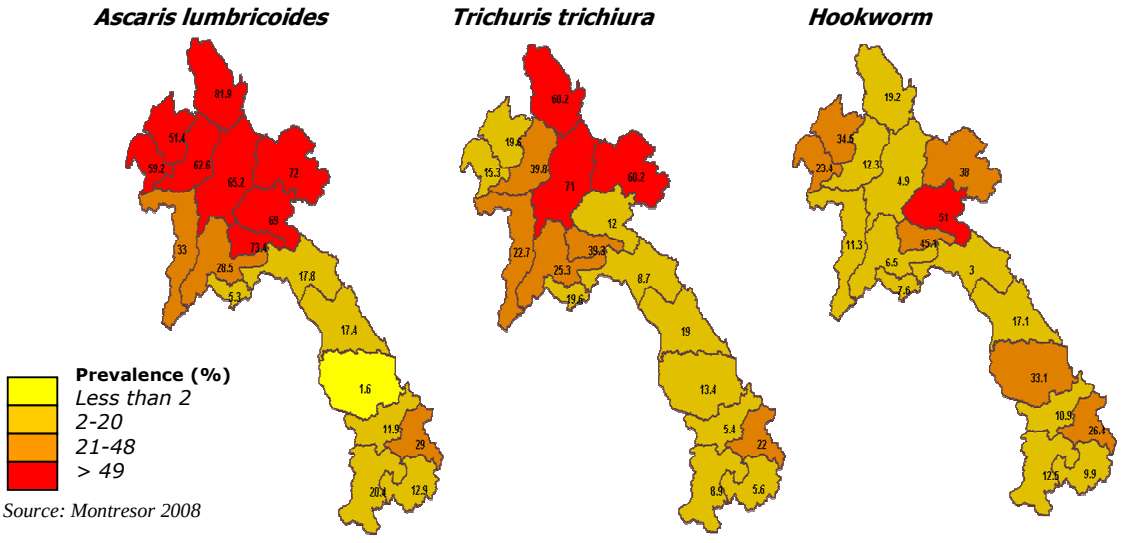
The three components of the control strategy emphasized by the MOH include health education, MDA and improvement in water and sanitation. Culturally appropriate information, education and communication (IEC) materials are intended to accompany all helminth control interventions. Health education topics related to helminth control will be incorporated into national primary school curricula. Health staff and technical staff will also be trained to enable proper case management in coordination with patient information and prevention activities. MDAs will be offered free to endemic communities, incorporating many private and public sectors using evidence-based interventions. MDAs will be integrated with ongoing public health interventions (such as school health programmes or LF control). Both coverage monitoring (after each MDA) and regular parsitological monitoring have been identified as integral parts of parasitology control. When financial resources permit, the MOH has also planned to increase water and sanitation facilities at least in schools, in order to sustain the benefits of the MDAs and provide a positive example for household facilities (MOH Lao PDR 2008).

Status of Soil-Transmitted Helminths (Source: Official)

Epidemiology

In 2006, the nationwide prevalence of STH infection was estimated to be 41.6% among surveyed pre-school children (Montresor 2008). A nationwide survey conducted in 2000-2002 also found that Ascaris infection was most prevalent among school-age children (34.9%), followed by Trichuris (25.8%) and hookworm (19.1%); mixed infection was also very common (Montresor 2008). All provinces in Lao PDR are endemic to STH and eligible for STH treatment (Montresor 2008; see Figure 1).

Figure 1: Prevalence of Soil-Transmitted Helminth Infections in Laos, 2000-2002



Source: Montresor 2008

Control Strategy

The MOH stated that regular treatment with albendazole or mebendazole and health education will be provided to three at-risk groups: 1) children between 2 and 5 years of age; 2) school-age children; and 3) woman of reproductive age. Children from 2 to 5 years will be targeted by at least once a year treatment, and special effort will be made to integrate interventions in this age group with existing health activities (such as Vitamin A distribution and vaccination campaigns). School-age children will be targeted by a single dose of albendazole or mebendazole either once or twice a year, based on the epidemiology of STH in the area. Schools will be the entry point for this group, with a global target of at least 75% coverage of school-age children and special efforts made to cover non-enrolled school-age children. Women of reproductive age will be targeted by at least once a year treatment, with special efforts made to integrate the intervention in this age group with existing public health activities (such as iron supplementation campaigns). Periodical surveys will be conducted to indicate changes in prevalence and identify any needs to modify the existing control strategy (MOH Lao PDR 2008).

The cost of an annual deworming program is estimated at US $250,200 (Montresor 2008; see Table 3). There is no estimated additional cost for drug distribution, as 1) preschool children are currently targeted through routine EPI activities, which is estimated to cost US $22,000 per year; 2) schoolteachers are not remunerated for distributing tablets to primary school age children; and 3) women of childbearing age should be reached through EPI routine activities or decentralized health centres (Montresor 2008). As these distribution channels are already operational, the only capital cost of an STH campaign would be an estimated US$ 25,000 to develop health education materials for women of childbearing age (Montresor 2008).

Table 3: Estimated Annual Cost for STH Control in Lao PDR

Mebendazole (500 mg)	5,340,000 tablets x US$ 0.03 per tablet	1,200,000 pre-school age children x 1 tablet/person	160,200
		1,840,000 school-age children x 1 tablet/person	
		2,300,000 women of childbearing age x 1 tablet/person	
Operational Costs	Drug Distribution	Pre-school age children	0
		Primary school age children	0
		Women of childbearing age	0
	Refresher training, supervision, monitoring, evaluation, logistics, IEC/social mobilization, etc.	Pre-school age children	30,000
		Primary school age children	30,000
		Women of childbearing age	30,000
Total			US $250,200

Source: Montresor 2008

Status of Implementation

For children aged 1 to 5 years, 500 mg mebendazole has been included in routine EPI activities since 2003 and the measles vaccination campaign in November 2007 (Montresor 2008). Data on the actual coverage of mebendazole distribution through EPI is unclear, though coverage of the measles campaign was estimated at 84.3% (492,485 children out of 584,137 targeted; Montresor 2008). The MOH is now planning to concentrate mebendazole, Vitamin A, and possibly other health product distribution in two yearly interventions (Montresor 2008).

For children aged 6 to 11 years, a National School Deworming Programme was initiated in September of 2005, and national coverage in all primary schools was achieved in April of 2007 (Montresor 2008). The target population in 2006 was estimated to be 1,015,374 children, with 891,881 (87.8%) enrolled in school and 123,493 (12.2%) not enrolled (Montresor 2008). The programme administers a single dose of mebendazole (500 mg) every year in all 17 provinces, with 8 provinces receiving two rounds of treatment per year (a targeted population of 363,662 children). The round administered in April 2007 reached 973,073 children, or 95.8% of the total target. Of these, it was estimated that 887,939 were enrolled (a coverage of 99.5% of the target), and 85,134 were not enrolled (a coverage of 68.9% of the target – Montresor 2008). Teachers were trained to provide health information in addition to distributing the drugs.

Though infection has not been eliminated through these control programmes (latrines and fresh water are only available in 40% of schools), over 90% of those infected in 2007 were considered "light" infections as defined by WHO standards (Phommsack et al. 2007; see Table 4). Though the MOH national policy on helminths recommends treatment of women of childbearing age, this intervention has not yet been implemented (Montresor 2008).

Table 4: Comparison between the prevalence and intensity of intestinal parasite infection in 4 schools at baseline (2004) and the 1st monitoring after the intervention (2006)

No. of children examined		Parasite Specie	Intensity of Infection							
			Negative (%)		Light		Moderate		Heavy	
2004	2006		2004	2006	2004	2006	2004	2006	2004	2006
2885	1000	*T. trichiura*	57.5	69.0	32.3	27.2	10.0	3.8	0.3	0.0
		A. lumbricoides	39.6	79.9	23.1	10.9	31.1	7.3	6.7	1.9
		Hookworm	80.3	77.7	17.6	20.1	0.8	1.5	0.3	0.7

Source: Phommsack et al. 2007

Status of Soil-Transmitted Helminths (Source: Published Data)

Epidemiology

A study conducted by Rim et al. (2003) found that 61.8% of 29,865 children examined were infected with helminths, especially with Ascaris (see Table 5). In another recent field survey, 4,105 individuals from nine districts of Champasack province in southern Lao PDR were evaluated for intestinal parasites (Sayasone 2007). Hookworm infections were prevalent in every district at a rate of 52%. Ascaris infection was also present throughout the province, though the prevalence ranged from as little as under one percent to 62 percent depending on the district.

Table 5: Prevalence of helminth infections among school age children in Lao PDR

Provinces (No of Districts)	No. of Children Examined (M/F)	No. of Total Positive (%)	Prevalence of Helminth infection (%)				
			Al	Tt	Hw	Ov	Others
Phongsaly (5)	1,288 (659/629)	1,236 (96.0)	1,055 (81.9)	775 (60.2)	248 (19.2)	237 (18.4)	0
Luang Namtha (5)	1,218 (678/540)	895 (73.4)	627 (51.4)	239 (19.6)	421 (34.5)	2 (0.2)	3 (0.2)
Oudomxay (5)	1,786 (895/873)	1,407 (79.6)	1,107 (62.6)	704 (39.8)	218 (12.3)	21 (1.2)	33 (1.9)
Bokeo (5)	1,340 (731/609)	1,003 (74.9)	793 (59.2)	205 (15.3)	313 (23.4)	8 (0.6)	0
Huaphan (5)	1,431 (782/649)	1,305 (91.2)	1,030 (72.0)	862 (60.2)	543 (38.0)	2 (0.1)	37 (2.6)
Luang Prabang (5)	2,224 (1,199/1,025)	1,963 (88.3)	1,450 (65.2)	1,580 (71.0)	109 (4.9)	52 (2.3)	18 (0.8)
Xayabury (4)	1,759 (873/886)	959 (54.5)	581 (33.0)	399 (22.7)	199 (11.3)	137 (7.8)	14 (0.8)
Xiengkhuang (5)	1,484 (760/724)	1,092 (74.0)	751 (69.0)	135 (12.0)	559 (51.0)	0	13 (0.9)
Xaysoumboun (3)	1,283 (663/620)	1,126 (87.8)	942 (73.4)	504 (39.3)	578 (45.1)	27 (2.1)	4 (0.3)
Vientiane (6)	1,419 (746/673)	690 (48.6)	405 (28.5)	359 (25.3)	92 (6.5)	41 (2.7)	7 (0.5)
Vientiane Municipality (3)	2,837 (1,425/142)	1,182 (41.5)	150 (5.3)	558 (19.6)	215 (7.6)	433 (15.2)	58 (2.0)
Bolikhamxay (1)	1,749 (913/836)	481 (27.5)	311 (17.8)	152 (8.7)	53 (3.0)	51 (2.9)	3 (0.2)
Khammuane (6)	1,359 (665/694)	843 (62.0)	236 (17.4)	258 (19.0)	233 (17.1)	437 (32.2)	17 (1.2)
Savannakhet (3)	3,596 (2,251/1,344)	1,915 (53.3)	58 (1.6)	482 (13.4)	1,190 (33.1)	932 (25.9)	54 (1.5)
Saravane (5)	1,559 (855/744)	669 (41.8)	190 (11.9)	87 (5.4)	174 (10.9)	344 (21.5)	15 (0.9)
Xekong (2)	951 (480/471)	535 (56.3)	276 (29.0)	209 (22.0)	251 (26.4)	70 (7.4)	21 (2.2)
Champasak (7)	1,723 (838/885)	821 (47.6)	353 (20.4)	153 (8.9)	215 (12.5)	324 (18.8)	40 (2.3)
Attepeu (4)	819 (387/432)	340 (41.5)	106 (12.9)	46 (5.6)	81 (9.9)	145 (17.7)	6 (0.7)
Total (79)	29,825	18,442 (61.8)	10,421 (34.9)	7,707 (25.8)	5,692 (19.1)	3,263 (10.9)	343 (1.2)

Al: *Ascaris lumbricoides*; Tt: *Trichuris trichiura*; Hw: *Hookworm*; O.v: *Opisthorchis viverrini*
Source: Rim et al. 2003

Status of Schistosomiasis (Source: Official)

Epidemiology

The only areas where the transmission of schistosomiasis has been documented in Lao PDR are the two districts of Khong and Mounlapamok in the province of Champasak. The estimated population at-risk in 2008 is estimated to be 73,000 individuals in Khong and 39,000 in Mounlapamok (Montresor 2008).

Control Strategy

Treatment with praziquantel that targeted the entire at-risk population was conducted in 1989 and yearly from 1991-1994. This resulted in a significant decrease in mortality and control of morbidity. Prevalence of schistosomiasis in school-aged children was estimated to be 2.1% in Kohn and 0.4% in Mounlapamok in 1999. Though another round of MDA targeting school-aged children was administered in 2001, routine MDAs were not continued. A survey in 2006-2007 in 18 randomly selected villages found that schistosomiasis was still transmitted in 13 of them, with prevalence of infection among those surveyed ranging between 1.6% to 68.8% (Montresor 2008).

As a result of this rise in cases, universal treatment with praziquantel was reinstated in 2007. Distribution of praziquantel was integrated with school-based distribution of mebendazole for STH infection (Montresor 2008). In total, 40,616 people were treated in Khong, which accounted for 92.2% of the targeted population. In Mounlapamok, 17,796 individuals were treated, which amounted to 63.2% of the targeted population (Montresor 2008). It has been recommended that the entire population of the two districts should be targeted for yearly treatment, as the country might significantly reduce or interrupt transmission if treatment is regular and the percentage of the population covered is high (Montressor 2008).

The estimated yearly budget needed to control schistosomiasis in Laos is US$ 47,800 (see Table 6). No capital costs would be incurred, as schistosomiasis control is ongoing in the affected provinces (Montresor 2008).

Table 6: Estimated Annual Cost of Schistosomiasis Control in Lao PDR

Praziquantel (600 mg)	285,000 tablets x US $0.08 per tablet	22,800
Operational Costs	Drug distribution	5,000
	Refresher training, supervision, monitoring, evaluation, logisitics, IEC/social mobilization, management of side-effects, etc.	20,000
Total		US $47,800

Source: Montressor 2008

Control Strategy

In the two districts where schistosomiasis is still transmitted (Khong and Mounlapamok, in Champasak Province), MDA with single dose praziquantel and health education will be made available to the entire population once a year (Lao MOH 2008). This MDA campaign will be continued for ten years. Health personnel will be periodically trained to recognize schistosomiasis and treat its effects, and periodic survey will monitor changes in prevalence and the need to modify control strategies (MOH Lao PDR 2008).

Status of Schistosomiasis (Source: Published Data)

Epidemiology

Laos began treatment in 1989 for whole populations in endemic areas with over 50% prevalence; if the prevalence was lower, only children between 2 and 14 years old were treated (Urbani et al. 2002). These campaigns were largely successful, decreasing schistosomiasis prevalence to an average of 2.1% in Khong and 0.4% in Mounlapamok by 1999 (Urbani et al. 2002; see also Source: Official).

Status of Food-Borne Trematodes (Source: Official)

Epidemiology

It is estimated that 1,744,000 individuals are infected with opisthorchiasis, with a population at-risk of approximately 4,262,000 (98% of the resident population of 4,360,000 – Montresor 2008). A nationwide survey of 29,846 children, mostly from 6 to 11 years old, found that opisthorchiasis is transmitted throughout the country with the exception of the province of Xiengkhuang (Montresor 2008).

Control Strategy

In areas where the prevalence of opistorchiasis exceeds 20%, anthelminthic chemotherapy with praziquantel and health education will be provided free of charge once a year to the entire population of the affected district. When prevalence is between 5% and 20%, health education will be offered and MDAs organized once every 2 years for that area. In regions where prevalence is less than 5%, positive cases will be treated on an individual basis, with praziquantel made available at all levels of health services. Access to adequate case management will also be established (MOH Lao PDR 2008).

Health personnel will be periodically trained to recognize FBT infections. IEC campaigns will also be conducted and combined with MDA campaigns to increase food safety and modify risky behaviours. Collaboration will be established between the fishing and aquaculture, food safety, and agriculture sectors, in order to decrease the risk of infections. Periodical surveys will be conducted to monitor changes in prevalence and any need to modify control strategies (MOH Lao PDR 2008).
In early 2008, praziquantel will be distributed universally in 6 districts of Champasack province, targeting 325,000 children and adults. In Khong and Mounlapamok districts, where schistosomiasis is also endemic, praziquantel is intended to control both opisthorchiasis and schistosomiasis (Montresor 2008). It has been suggested that, as the exact prevalence for each district is not well documented, all provinces should be considered eligible for either low-priority (once every two years) or high priority (once yearly) large-scale distribution of praziquantel (Montresor 2008). Praziquantel MDAs would also have the added benefit of helping to control taeniasis and paragonomiasis, as it is the drug used to control these diseases. Both diseases are known to be transmitted and widespread in Laos, but more detailed research on the epidemiology of both diseases is not currently available (Montresor 2008).

If a priority-based MDA was administered, it is estimated that it would cost US$ 541,464 every two years to administer an MDA to both high and low priority provinces (Montresor 2008; see Table 7). On years when MDAs are administered to only high priority provinces, the estimated total cost would be US$ 348,180. As such an intervention is not currently being carried out, it is also estimated that US$ 175,000 will be needed for training in primary and

secondary schools, involvement and training of community stakeholders, and development of health education material (Montresor 2008).

Table 7: Estimated Annual Cost of FBT Control in Lao PDR

Praziquantel (600 mg)	Year 1 and following even years	5,812,062 tablets x US$ 0.08 per tablet	464,964
	Year 2 and following odd years	3,496,004 tablets x US$ 0.08 per tablet	279,680
Operational Costs	Every year	Drug distribution in primary schools	0
		Drug distribution in secondary schools	0
		Drug distribution in communities at US $1,000 per province	17,000*
		Social mobilization/IEC activities at US$ 2,000 per province	34,000
		Other activities (refresher training, supervision, monitoring, evaluation, logistics, management of side effects, etc.)	25,500
Total	Year 1 and following even years		US $541,464
	Year 2 and following odd years		US $348,180

** Reduced to 9,000 in odd years when fewer provinces are targeted; Montresor 2008*

Status of Food-Borne Trematodes (Source: Published Data)

Epidemiology

The WHO estimated in 2004 that *O. viverrini* infected 2 million people nationwide, with 24% prevalence in southern provinces and 48% prevalence in school children (WHO 2004). In Sayasone's survey (2007) of 4,105 individuals from southern Champasack province, it was found that *O. viverrini* was present in an average of 70 percent of the population (not including the Paksong district, which was notably lower at only 9 percent). The southern provinces appear to have the highest helminth burden.

Status of Cestodes (Source: Official)

No data on cestodes were available from the country's health authorities from 1997-2008.

Status of Cestodes (Source: Published Data)

No data on cestodes were available from independent research from 1997-2008.

Macao

Country Situation

Helminths are not considered a public health priority in Macao, and there are no existing or planned interventions for helminth control (Macao CDC, personal communication). No surveys or surveillance data on STH, FBTs, and cestodes were available from 1997-2008 from health authorities or independent research. Schistosomiasis is not endemic to Macao.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
478,000	17	23	33	42	71	79	95	67	15	36.5

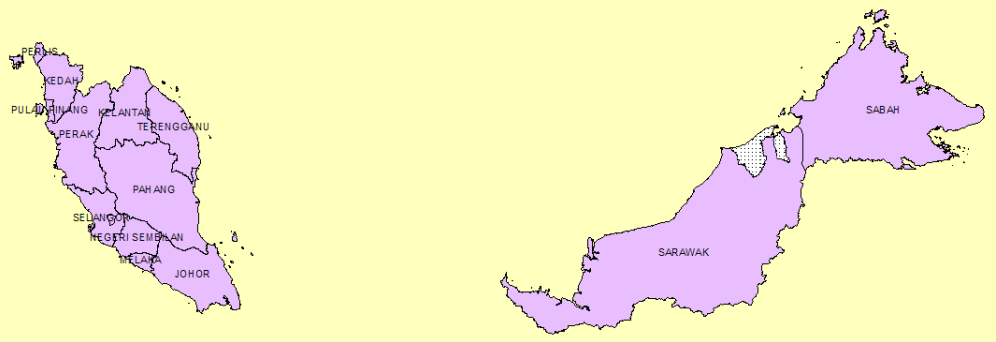
Source: World Population Prospects: The 2006 Revision Population Database

Malaysia

Country Situation

Intestinal parasitic infections are still a public health concern in Malaysia. However, the problem is well controlled and localized in specific areas and within certain population groups, such as the aboriginal population and those living in remote areas (MOH Malaysia 2008). Helminth infection control programmes have been well established for several decades in Malaysia. Anti-helminthic drugs have been provided free in government health facilities, as well as in outpatient clinics during health campaigns (MOH Malaysia 2008). An ongoing deworming programme has also been carried out in maternal and child clinics, mobile clinics provided in rural areas and aboriginal settlements, and school health programmes. Laboratories in government health facilities have also provided tests for helminth infection (MOH Malaysia 2008).

Since the problem is well controlled, helminth infection is not a primary public health priority in the country. No formal monitoring system is being carried out at the national level (MOH Malaysia 2008).



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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26,114,000	2,758	2,669	2,656	2,549	4,583	3,753	3,229	2,130	628	24.7

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from the country's health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

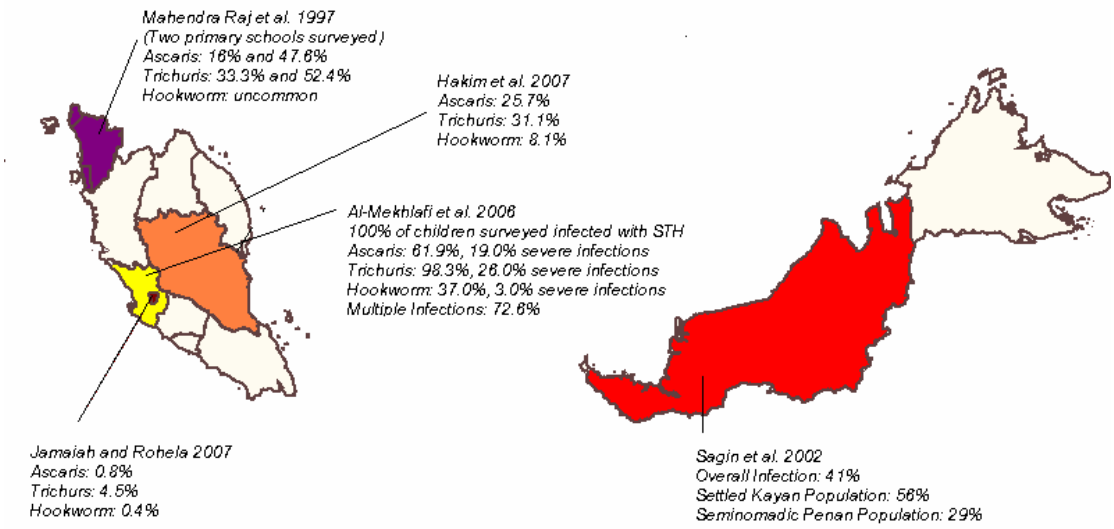
Epidemiology

Several small-scale studies on the epidemiology of STH have been conducted in Malaysia in recent years. The results of several publications are summarized as follows, with aid provided by the Ministry of Health (see Table 2).

Table 2: Summary of Selected Recent Studies on STH in Malaysia

Authors and Publication Date	Methodology	Summary of Results
S Mahendra Raj et al. (1997)	Stool survey of 249 students in 2 primary schools in northeastern peninsular Malaysia	• Prevalence of Ascariasis: 16% and 47.6% • Prevalence of Trichuris: 33.3% and 52.4% • Prevalence of hookworm: uncommon • No significant influence on height and weight between moderately infected and uninfected; children with heavy Ascaris infection consistently lighter and shorter
DD Sagin et al. (2002)	Bakum Dam Health Impact Assessment Survey among 255 people at 7 interior villages, Sarawak	• Overall infection rate: 41% • Higher infection rate among the settled Kayans (56%) than the seminomadic Penans (29%) • Infection rate high among children less than 14 years old (68%) • Higher infection rate among women (57%) compared to men (33%) • Polyparsitism in 8% of infections, with Trichuris/Ascaris more common
I Jamaiah and M Rohela (2005)	Stool survey among 240 attendees to a medical fair at UM Medical Center	• Overall infection rate: 6.9% • Prevalence of Trichuris: 4.5% • Prevalence of Ascaris: 0.8% • Prevalence of Hookworm: 0.4%
Al-Mekhlafi MS et al. (2006)	Cross-sectional study of 281 aborigine children aged 2-15 years	• 100% of children infected with STH • 26.3% infected with only Ascaris, Trichuris, or hookworm • 72.6% infected with multiple types of STH • Overall prevalence of Ascaris: 61.9%, 19.0% with heavy intensity ascariasis • Overall prevalence of Trichuris: 98.2%, 26.0% with heavy intensity trichuriasis • Overall prevalence of hookworm: 37.0%, 3.0% with heavy intensity infection
S Lokman Hakim et al. (2007)	Analysis of 74 stool samples taken from aborigine settlement during rotavirus outbreak	• Prevalence of Ascaris: 25.7% • Prevalence of Trichuris: 31.1% • Prevalence of hookworm: 8.1%

Figure 1: Location of Selected Studies and Prevalence of STH



All of these studies show that STH are still prevalent in rural communities where sanitation is poor. Groups affected by high rates of STH include aboriginal groups, as well as inhabitants of islands and forest fringe areas (Singh and Cox-Singh 2001; see Table 3). The authors also cited studies of high incidence rates in fishing villages and plantations, but these studies were not current enough to include in this review. Despite the prevalence of STH in rural and aboriginal communities, it has been recognized that the general population of Malaysia does not require an MDA for helminthiases (Jamaiah et al. 2005).

Table 3: Prevalence of STH recorded in small-scale studies of selected communities

	Ascaris (%)	*Trichuris (%)*	*Hookworm (%)*	*Total Prevalence of STH*
Peninsular Malaysia				
Dengkil *(aboriginal)*	62.9	91.7	28.8	NR
Penang *(island)*	40.3	33.3	34.1	NR
Post Brooke *(aboriginal)*	59.5	41.7	6.0	79.8
Sarawak				
Serian (*forest*)	18.0	34.3	11.0	47.5

Adapted from: Singh and Cox-Singh 2001

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from the country's health authorities from 1997-2008.

Status of Food-Borne Trematodes (Source: Published Data)

Two cases of clonorchiasis were reported from 246 stool samples collected at the University Malaya Medical Center (Jamaiah and Rohela 2005). Both cases were in Chinese women who were born in Malaysia and frequently ate raw fresh water fish with porridge. Though food-borne trematodiasis do not seem to pose a significant health burden among the general population, these cases highlight a need to continue surveillance for FBTs among ethnic minorities and immigrant populations.

Status of Cestodes (Source: Official)

No data on cestodes were available from the country's health authorities between 1997-2008; however, the Ministry of Health did recognize an independent study on cysticercosis (see Noor Azian et al. in “Published Data”).

Status of Cestodes (Source: Published Data)

Cysticercosis has typically been a rare disease in Malaysia (Chew et al. 2001). One study (Noor Azian et al. 2006) analysed serum samples of 135 people in a rural village in Sabah, Malaysian Borneo. The study found that the seroprevalence of cysticercosis antibodies was 2.2%, indicating exposure to cysticercosis in the population. One case of neurocysticercosis was recently diagnosed in an Indian immigrant (Chew et al. 2001), and 3 cases of neurocysticercosis in immigrants were reported to the University Malaya Medical Centre from 2000-2005 (Arasu et al. 2005). These imported cases highlight the need to continue surveillance for cestodes among the Malaysia's large population of immigrants (Chew et al. 2001).

Status of Schistosomes

Schistosomiasis is not endemic to Malaysia.

Mongolia

Country Situation

Mongolia has a vast territory divided into many climatic regions. In recent years, global warming and economic changes have influenced the pattern of diseases caused by parasites. The current challenge for the country are: 1) to identify the infection rate of parasitic diseases; 2) to study the ecology and epidemiology of infectious agents, reservoirs and transmitters; and 3) to develop prevention methods based on the scientific evidence (MOH Mongolia 2008).

Currently, Mongolia is importing vegetables and fruits from abroad. In the past, most of the meat sold at meat markets was produced by the state meat factory, which employed quality control mechanisms to stop the sale of infected or poor quality meats. Increased privatization of livestock and meat factories has negatively influenced the slaughtering practice in terms of quality assurance, and the state no longer has strong control over the slaughtering practice or mass campaigns to treat diseased livestock. Consumption of uncooked meat products (for example barbeque) has also increased. All of these set the conditions for increase of parasitic diseases (MOH Mongolia 2008).

The National Centre for Communicable Diseases (NCCD) in Mongolia has established several goals to address helminth control. It plans to improve human and equipment capacity of the parasitology laboratory at the NCCD. It also intends to make a collection of the parasites that exist in Mongolia for training and research purposes. (MOH Mongolia 2008).

Map courtesy of the United Nations. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
2,511,000	233	226	269	12	21	16	12	5	5	24.6

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

In recent years, ascariasis and trichuriasis cases have significantly increased (MOH Mongolia 2008). These cases have been associated with consuming contaminated vegetables and fruits. In a study of 20,077 stool samples analysed by the Parasitology Laboratory of the National Center for Communicable Diseases, 11 cases of Ascaris were found (MOH Mongolia 2008).

Soil-Transmitted Helminths (Source: Published Data)

In one study evaluating stool and serum samples of 165 and 683 residents from two northern Mongolian villages, the authors found no evidence of soil-transmitted helminth infections (Huh et al. 2006). The authors were surprised by these findings, as food and water were found to be contaminated with other parasites such as *C. parvum*, *E. coli* and *G. lamblia* (Huh et al. 2006). The authors supposed that the lack of helminths might be due to the small proportion of farmers in the semi-nomadic pastoralist communities that they studied. As general sanitation and access to treated water is limited in many Mongolian communities, more studies are needed to determine if these findings are indicative of the epidemiology of soil-transmitted helminths in Mongolia.

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from health authorities from 1997-2008.

Status of Food-Borne Trematodes (Source: Published Data)

No data on food-borne trematodes were available from independent research from 1997-2008.

Status of Cestodes (Source: Official)

Table 1: Cases of Cestode Infection Reported to the Parasitology Laboratory, National Center for Communicable Diseases

Year	Total Number of Samples	Ascariasis	Enterobiasis	Taeniasis
2006	14,259	7	206	24
2007 (first quarter)	5,818	4	108	27

Source: Records of the Parasitology Laboratory at the National Center for Communicable Diseases

Taeniasis

Taeniasis distribution is 10.2% in rural areas, and 5.3% in the capital city (Mongolia NCCD 2008). Infection with *T. saginata* occurs generally among the population, though the 20-49 age group exhibits higher morbidity. The prevalence rate shows little difference based on gender, estimated at 8.9% for males and 8.3% for females. Certain professions were linked to higher incidences of taeniasis, including 13.6% of restaurant workers, 17% of meat processing factory workers, and 6.5% of bakery workers (NCCD Mongolia 2008). The taeniasis morbidity rate was also found to be high among people who dealt with livestock, and people who have close contact with unprocessed meat were found to have a higher risk of contamination.

Cysticercosis

According to geographical zone, cysticercosis has occurred at a rate of 0.7-1% in forest-steppe and steppe zones, and 0.2% in the desert zone. Studies done at "Makh impex" Co. Ltd., a meat processing factory, between 1997-2001 and 2002 also found that 0.8% of the 111,870 cattle tested were infected with cysticerces (NCCD Mongolia 2008).

Status of Cestodes (Source: Published Data)

Taeniasis

A study was conducted on 118 taeniid proglottids brought by the carriers to the Mongolian National Center of Communicable Diseases or local health centers between 2002-2006. All samples confirmed to be *T. saginata*, distributed in at least 10 of Mongolia's 21 provinces (Myadagsuren et al. 2007). The report found that the prevalence of taeniasis was not significantly different in men and women (47.5% and 52.5% of cases, respectively). The *T. saginata* carriers in this study were predominantly in the 15- to 29-year age group (35.6%), followed by the 30- to 44-year group (33.0%), those 45 years or older (22.0%), the 5- to 14-year group (7.6%), and the 1- to 4-year group (1.7% - Myadagsuren et al. 2007). The taeniasis patients studied held varied occupations, with the highest prevalence noted among herdsmen (12.7%) and schoolchildren in junior high school (11.8%). The authors stated that the source of infection for *T. saginata* has not yet been specified in Mongolia, though it was likely attributable to beef and/or yak meat cooked using hot stones and roast beef commonly sold in small markets.

The authors stated that there was no evidence of *T. solium* cysticercosis in Mongolia, in contrast to neighboring Inner Mongolia (where *T. solium*, *asiactica*, and *saginata* have all been confirmed). *T. saginata* is much easier to detect, as single proglottids of the worm are actively and spontaneously voided from the anus daily, facilitating control (Myadagsuren et al. 2007). The authors stressed that further field surveys (especially comparing Mongolia and northern Inner Mongolia) should be conducted. Active case detection, establishment of an effective treatment of tapeworm carriers, and establishment of a system to evaluate beef quality were also identified as necessary priorities for taeniasis control in Mongolia (Myadagsuren et al. 2007).

Echinococcosis

In 1997, a study evaluating the seroprevalence of cystic echinococcosis in north-western Mongolia found that 5% of 334 semi-nomadic pastoralists tested positive for antibodies to *Echinococcus granulosus*. Out of all test subjects, only 10% had heard of the disease, and only 5% recognized hydatid cysts in their livestock. This was a significant contrast to the population of neighboring Xinjiang Uygur Autonomous Region in China, where 76% had seen and recognized cysts in slaughtered animals (Watson-Jones et al. 1997). Mongolian pastoralists are closely associated with their domestic animals, slaughtering their livestock at home and discarding offal for dogs and other scavengers. The authors concluded that this close relationship was likely to encourage transmission of echinococcosis (Watson-Jones et al. 1997).

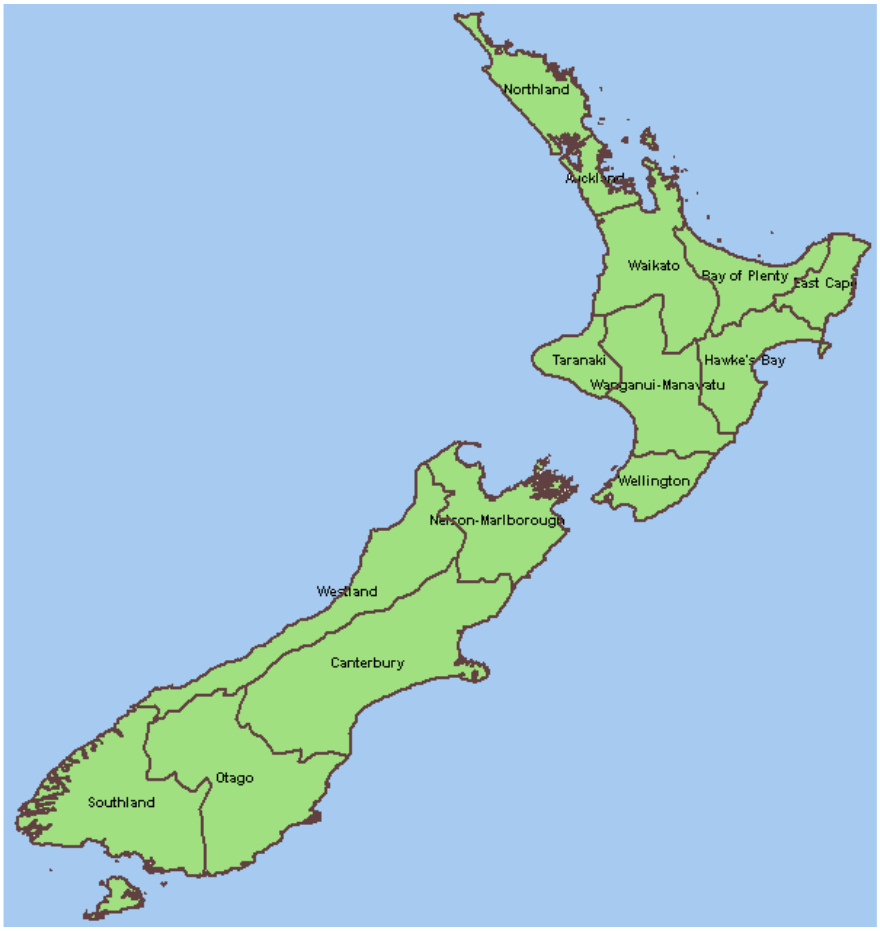
Status of Schistosomes

Schistosomiasis is not endemic in Mongolia.

New Zealand

Country Situation

Though data on helminths in New Zealand is scarce, the country's level of development and the lack of published data on helminth infections suggest that helminths do not constitute a significant health burden in New Zealand. Though echinococcosis was previously a public health issue, a nationwide control programme has virtually eliminated the disease within the country (see "Published Data" under "Status of Cestodes").



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4,140,000	284	285	308	311	552	581	621	500	190	35.5

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data on soil-transmitted helminths were available from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

No data on soil-transmitted helminths were available from independent research from 1997-2008.

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from the country's health authorities between 1997-2008.

Status of Food-Borne Trematodes (Source: Published Data)

No data on food-borne trematodes were available from independent research between 1997-2008.

Status of Cestodes (Source: Official)

No data on cestodes were available from health authorities from 1997-2008.

Status of Cestodes (Source: Published Data)

Echinococcosis

New Zealand undertook a national campaign to address echinococcosis in the late 1950s. The campaign, which included local voluntary committees, education, a levy on dog owners, and chemotherapy, virtually eliminated the presence of *E. granulosus* in the country by 1999 (Crump et al. 2001).

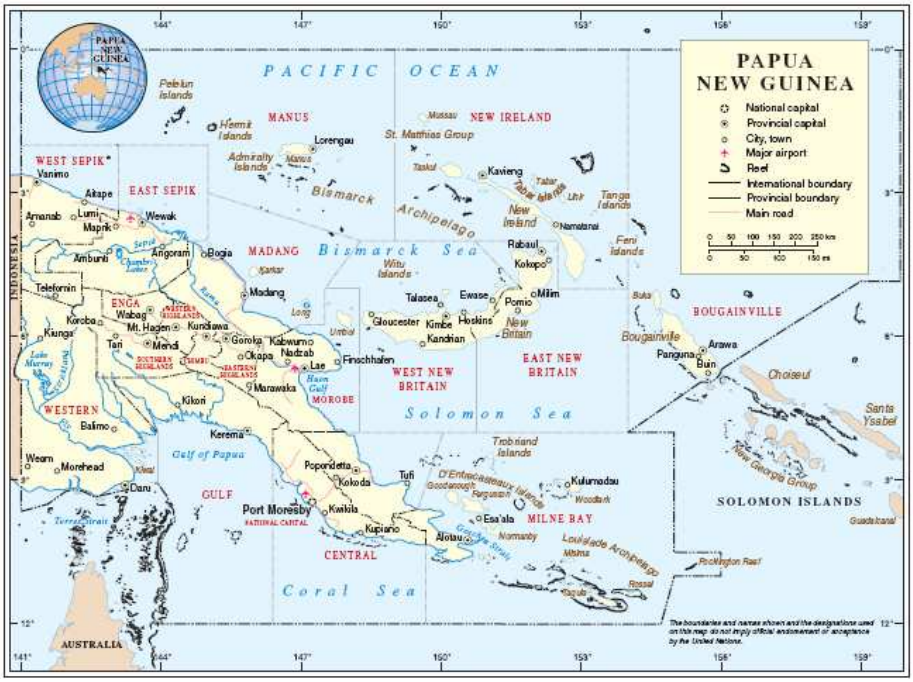
Status of Schistosomes

Schistosomiasis is not endemic to New Zealand.

Papua New Guinea

Country Situation

At the time of publication, few studies have been conducted to document the epidemiology of helminth infection in Papua New Guinea. However, given the low socioeconomic status of the general population of Papua New Guinea and the nation's tropical climate, it is likely that soil-transmitted helminths, and possibly other parasites, pose a significant health burden.



Map courtesy of the United Nations. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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6,202,000	898	856	747	644	1,048	842	587	337	96	19.5

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data on soil-transmitted helminths were available from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

One study examining the prevalence and intensity of *Strongyloides fuelleborni* infection in 179 children under five years old found that 68% of the children had one or more infections with Ascaris, hookworm, and/or Strongyloides (King et al. 2004). Children living in houses with tin roofs were less likely to have Ascaris than children living in traditional houses, and mean Ascaris intensity was higher in children of uneducated mothers (King et al. 2004).

Several studies on hookworm have been carried out in PNG (Barnish and Ashford. 1989; Pritchard, 1990, 1995; Allemann et al. 1994); however, none were conducted recently enough to be included in this review. It has been estimated from older data that intestinal parasites, especially hookworm, affect 75% of the population (Sawen 2005). As all of these studies indicated a high prevalence of helminth infection, there is a need to conduct epidemiological studies on the current status of hookworm and other STH in the country.

Control Strategy

The first MDA targeting lymphatic filariasis elimination was initiated in 2005 in Milne Bay province. A second round in this province, as well as five other provinces, was conducted in 2006, and the country is planning to incrementally include all of Papua New Guinea's 20 provinces in the upcoming years (WHO 2007). The impact of the lymphatic filariasis MDAs on STH remains to be assessed.

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from health authorities from 1997-2008.

Status of Food-Borne Trematodes (Source: Official)

No data on food-borne trematodes were available from independent research from 1997-2008.

Status of Cestodes (Source: Official)

No data on cestodes were available from health authorities from 1997-2008.

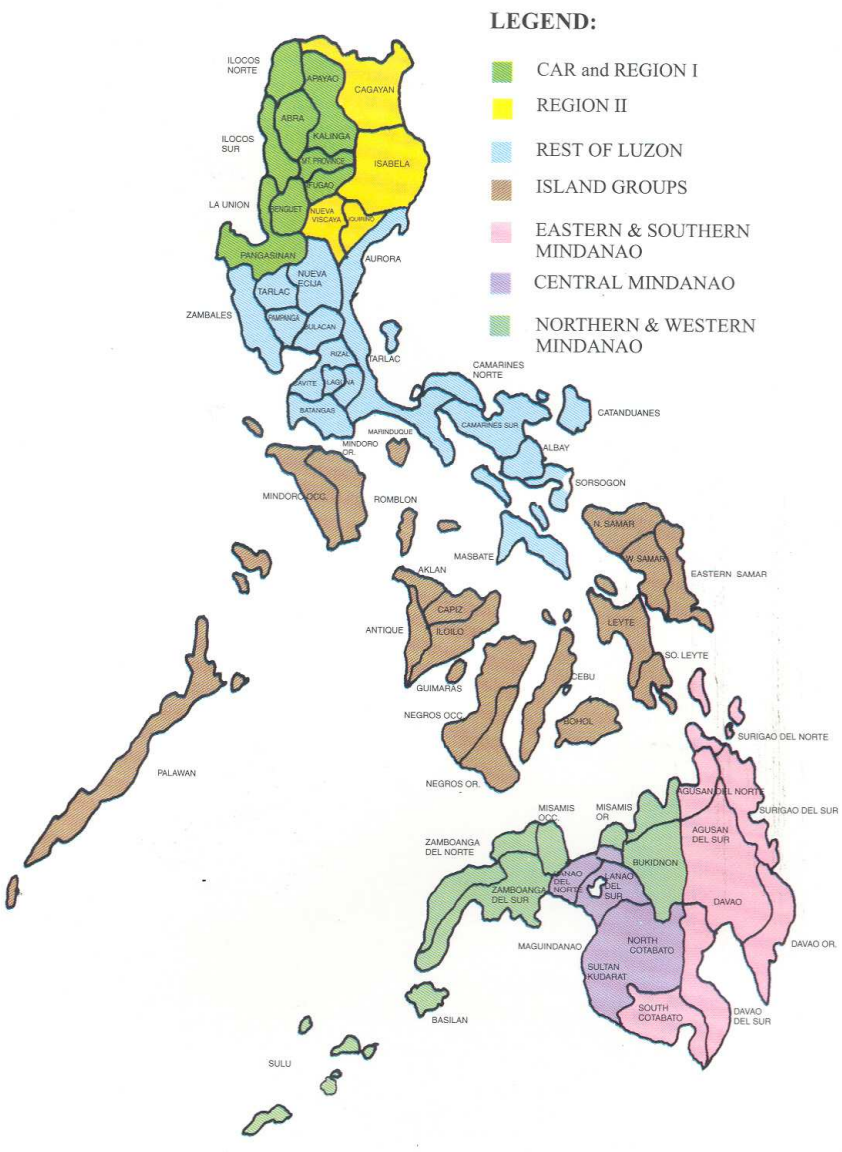
Status of Cestodes (Source: Published Data)

There is no evidence that taeniasis is present in Papua New Guinea, and a survey conducted at the southern end of the border with West Papua found no positive cysticercosis cases (Owen 2006). No information on echinococcosis was available between 1997-2008.

Status of Schistosomes

Schistosomiasis is not endemic to Papua New Guinea (WHO 2006).

Philippines



Map courtesy of the National Commission on Indigenous Peoples (NCIP). The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
86,264,000	11,027	10,154	9,714	9,055	15,332	11,596	8,481	5,668	1,876	21.8

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

Epidemiology

Soil transmitted helminthiasis (STH) persist in the Philippines where poverty, inadequate sanitary facilities, indiscriminate defecation, poor eating habits, and ignorance of unhealthy behaviours predominate. It is also observed that the prevalence of STH is related with areas that are basically agricultural and low on the economic and human development scale. Three major causes of intestinal parasitism in the country are *Ascaris lumbricoides*, *Trichuris trichiura* and Hookworm (*Ancylostoma duodenale* and *Necator americanus*. As their major developments occur in the soil, geofactors like temperature and humidity primarily determine its distribution (DOH Philippines 2008).

STH is perceived to be one of the most important disease burdens affecting children under 15 years of age, and are typically most intense among children age 5-14 years old. A baseline parasitologic survey of kindergarten and Grade 1 pupils showed a cumulative prevalence of 66.9 percent. The 6-14 years age group harbors the greatest load of worms and the highest prevalence rate, and therefore serves as the most significant source of transmission. Based on past surveys done in the Philippines on STH, the national prevalence persisted at high levels exceeding 50% (DOH Philippines 2008).

The most recent national survey on STH in 2004 examined 6,358 children aged 12-71 months from target locations throughout the country. The study revealed a mean prevalence rate of 66% in the communities that were studied. The prevalence rate among the children studied ranged from 48% to 93%, with Bicol having the highest prevalence rate and Central Visayas having the lowest. Out of the 17 regions in the country, 16 have a prevalence rate more 50% (DOH Philippines 2008). More detailed results from the report are summarized in Tables 2, 3, 4, and 5.

In addition, the 2004 STH survey showed that only less than a third (30%) of households in the study areas have piped-in water, while the other 69.7% depend on deep wells, open-dug wells, springs, and a few on rainwater. The same study also showed that nearly three fourths (72%) of households have sanitary toilets, though a significant percentage (28%) still use unsanitary toilets (open spaces or pits exposed to insects – DOH Philippines 2008).

Figure 1: Test sites of 2004 national prevalence survey

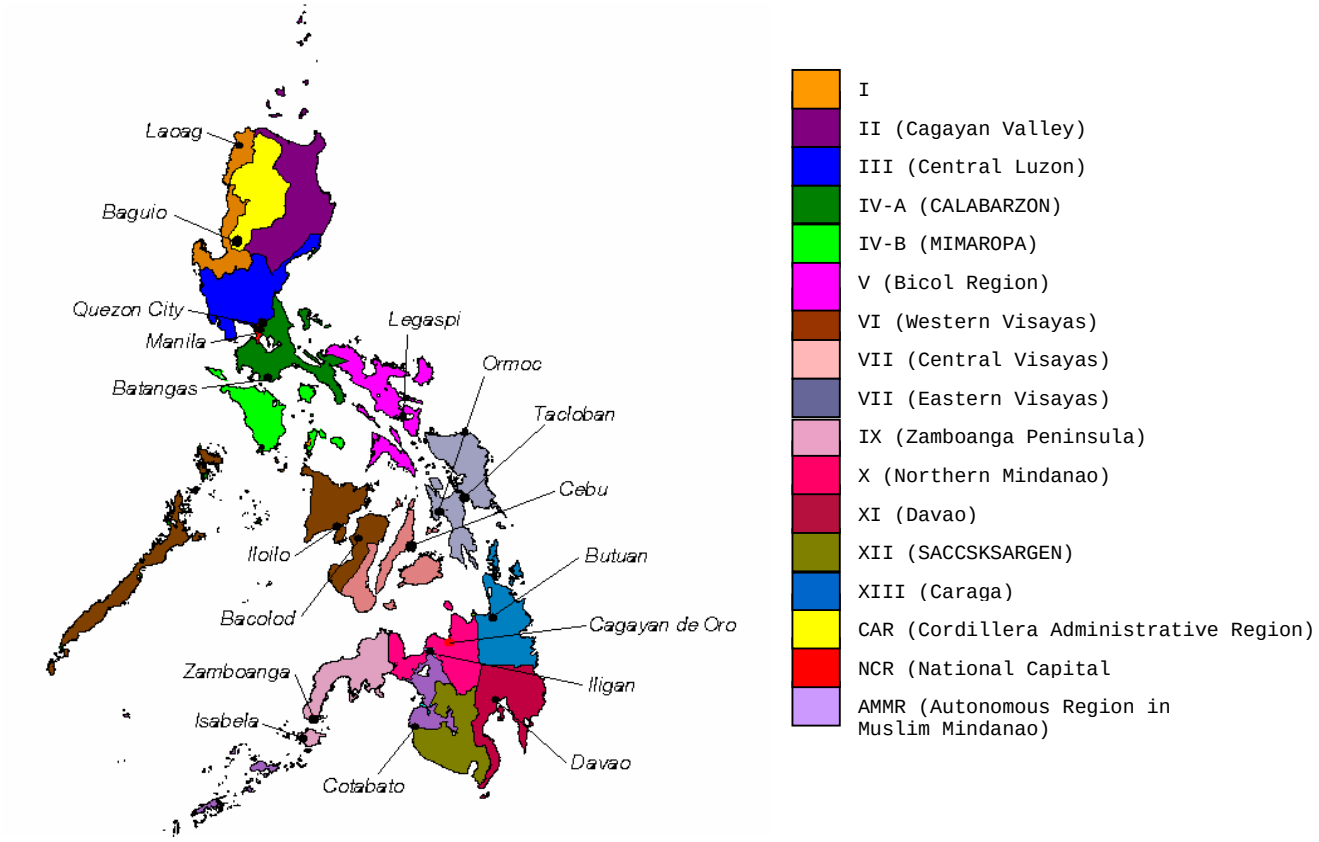


Table 2: Prevalence of STH Across Regions, 2004

Region	No. of stools examined	No. of positives	% positive	Region	No. of stools examined	No. of positives	% positive
1	399	309	77.4	9	388	228	58.8
2	400	199	49.8	10	400	244	86.0
3	264	182	68.9	11	301	191	63.5
4A	400	216	54.0	12	400	306	76.5
4B	401	311	77.6	CARAGA	397	206	51.9
5	200	185	92.5	CAR	400	198	49.5
6	400	291	72.8	NCR	400	299	74.8
7	398	189	47.5	ARMM	408	214	52.5
8	402	331	82.3	TOTAL	6358	4199	66.4

Source: DOH Philippines

Table 3: Distribution of Infected Children by Age Group and Specific Parasite, 2004

Age group (months)	Any Parasite		Ascaris		Trichuris		Hookworm	
	No.	%	No.	%	No.	%	No.	%
12-23	445	9.9	339	11.0	197	11.2	5	4.7
24-35	740	17.8	602	19.5	421	15.8	12	11.3
36-47	924	22.1	691	22.4	582	21.9	25	23.6
48-59	1074	25.8	733	23.8	742	27.9	25	23.6
60-71	1006	24.2	716	23.2	716	26.9	39	36.8
Total	4199	100	3081	100	2658	100	106	100

Source: DOH Philippines

Table 4: Distribution of Infected Children According to Specific Parasite, 2004

Observation	**Total**	**%**
Without parasite	2159	34.0
With parasite	4199	66.0
• Ascaris only	1475	23.2
• Trichuris only	1067	16.8
• Hookworm only	7	0.1
• Enterobius only	11	0.2
• Ascaris and Trichuris	1526	24.0
• Ascaris and hookworm	18	0.3
• Ascaris and Enterobius	2	0.0
• Hookworm and trichuris	14	0.2
• Enterobius and Trichuris	2	0.0
• Ascaris, Trichuris and hookworm	66	1.0
• Ascaris, Enterobius and Trichuris	5	0.1
• Ascaris, Enterobius and hookworm	1	0.0
• Ascaris, Enterobius, hookworm and Trichuris	2	0.0
Total	6358	100

Table 5: Overall Arithmetic and Geometric Mean Egg Counts of Ascaris, Trichuris, and Hookworm, 2004

Parasite	***Arithmetic mean***	***Geometric mean***
Ascaris	25.940.8	3,654.3
Trichuris	1,655.8	293.0
Hookworm	208.4	95.1

Control Strategy

Reducing helminth infection is regarded as the number one health intervention priority for school-age children due to the high disease burden and the high cost-efficacy of conducting mass deworming campaigns. In response to this major health problem, the DOH developed a national programme to control STH, which was piloted in five provinces and continued to expand until it reached all provinces in the country in 2006 (DOH Philippines 2008).

The Philippine Department of Health began MDAs twice a year for all children between 1 and 12 years of age in 2006. For preschoolers, the nationwide “Garantisadong Pambata” (or "Healthy Children) program schedules two rounds of deworming annually, and is primarily administered through local *barangay* health units and staff, trained *barangay* health workers, and day care workers. Deworming schoolchildren from 6-12 years old also occurs twice a year, and is overseen by the Department of Education. In filariasis-endemic areas, the annual MDA with be provided by the Philippine DOH. Mass chemotherapy is expected to continue for 3 years, as eggs can remain infective in soil for up to 2 years. After 3 years of MDA, the DOH expects worm prevalence to decline below 50 percent and mass deworming may be reduced to once per year. The DOH has also prioritized selective deworming of at-risk groups, including adolescent girls, pregnant women, and special groups such as indigenous peoples; these groups are intended to receive deworming drugs once they consult a health center (DOH Philippines 2008).

In consideration of the prohibitive cost of interventions for local governments, as well as the number of different control programs in place throughout the country, the DOH National Center for Disease Prevention and Control found it necessary to integrate the STH Control Program (STHCP) with other the Garantisadong Pambata (GP), Filariasis and Schistosomiasis Control Programs. The STHCP was also linked with other initiatives from other Government agencies, such as the Department of Education and the Department of Social Welfare & Development. NGOs such as Council for the Welfare of Children, Feed the Children, Helen Keller International, Plan International, Save the Children, World Vision, WHO and UNICEF were also included. The Integrated Helminth Control Program Framework (ICHP) was created to oversee all of these actors, and coordinates the overall policy direction and major strategies that need to be accomplished to reduce the STH burden to at least 30% among the 1-12 year-old children by 2010 (DOH Philippines 2008).

The ICHP has outlined the following three priorities for all control programmes:

1. Chemotherapy: Mass deworming applied to pre-school children and school children, while selective deworming is recommended for adolescent females, pregnant women and the special population groups of food handlers, soldiers, farmers and indigenous populations. Mass deworming is done twice a year or every 6 months. Selective deworming must be done once a year anytime an individual from a target group consults a health facility.
2. Water, Sanitation and Hygiene (WASH): Cornerstone in the reduction of diseases, especially those related to intestinal parasitism.
3. Behavioural Change: Promoting behavioural change through identification of behaviours that promote health or ill health, development and implementation of advocacy and communication plans, and involvement of families and communities in behavioural change, advocacy, and social mobilization.

Impact of Control Programmes

Measuring the effectiveness of the existing strategies in the STHCP is scheduled in 2009 through a National Prevalence Survey. The accomplishment of each region is compiled quarterly, and shows that the percent of the population treated varies significantly throughout the country (see Table 6).

Table 6: Results of annual deworming campaigns for pre-school and school-aged children in 2007 (cumulative data from all partners)

Region	Jan '07			Region	April '07		
	NSO Estimates, 6-12y/o	# dewormed	Accomp		NSO Estimates, 1-5y/o	# dewormed	Accomp
CAR	286,632	117,436	41%	CAR	238,860	185,328	78%
NCR	1,983,817	923,391	47%	NCR	1,653,181	727,181	44%
CHD 1	822,557	629,000	76%	CHD 1	685,464	533,944	78%
CHD 2	555,241	366,192	66%	CHD 2	462,701	367,687	79%
CHD 3	1,690,046	670,890	40%	CHD 3	1,408,372	915,480	65%
CHD 4A	2,094,427	627,456	30%	CHD 4A	1,745,356	1,106,572	63%
CHD 4B	365,741	16,188	4%	CHD 4B	304,784	173,620	57%
CHD 5	920,782	630,453	68%	CHD 5	767,319	264,283	34%
CHD 6	1,228,471	340,208	28%	CHD 6	1,023,726	394,291	39%
CHD 7	1,231,031	615,640	50%	CHD 7	1,025,859	728,177	71%
CHD 8	704,837	25,419	4%	CHD 8	587,364	335,434	57%
CHD 9	569,633	50,591	9%	CHD 9	474,695	398,415	84%
CHD 10	782,772	356,100	45%	CHD 10	652,310	412,343	63%
CHD 11	749,867	762,042	102%	CHD 11	624,889	497,669	80%
CHD 12	699,651	25,592	4%	CHD 12	583,042	436,079	75%
CARAGA	426,624	339,779	80%	CARAGA	355,520	236,376	66%
ARRMM	597,012	254,291	43%	ARRMM	497,510	377,700	76%
TOTAL	**15, 709,141**	**6,750,678**	**43%**	**TOTAL**	**13,090,951**	**8,090,579**	**73%**

Region	July '07			Region	October '07		
	NSO Estimates, 6-12y/o	# dewormed	Accomp		NSO Estimates, 1-5y/o	# dewormed	Accomp
CAR	286,632	117,436	41%	CAR	238,860	189,243	79%
NCR	1,983,817	1,078,759	47%	NCR	1,653,181	1,299,991	79%
CHD 1	822,557	153,233	76%	CHD 1	685,464	599,654	86%
CHD 2	555,241	274,583	66%	CHD 2	462,701	399,959	86%
CHD 3	1,690,046	246,963	40%	CHD 3	1,408,372	0	0%
CHD 4A	2,094,427	627,466	30%	CHD 4A	1,745,356	1,161,340	67%
CHD 4B	365,741	121,131	4%	CHD 4B	304,784	171,047	42%
CHD 5	920,782	340,245	68%	CHD 5	767,319	0	0%
CHD 6	1,228,471	53,694	28%	CHD 6	1,023,726	822,608	80%
CHD 7	1,231,031	503,700	50%	CHD 7	1,025,859	839,698	82%
CHD 8	704,837	233,284	4%	CHD 8	587,364	0	0%
CHD 9	569,633	534,000	9%	CHD 9	474,695	0	0%
CHD 10	782,772	481,994	45%	CHD 10	652,310	498,781	76%
CHD 11	749,867	384,541	102%	CHD 11	624,889	500,389	80%
CHD 12	699,651	322,414	4%	CHD 12	583,042	181,896	31%
CARAGA	426,624	295,805	80%	CARAGA	355,520	188,432	53%
ARRMM	597,012	252,291	43%	ARRMM	497,510	0	0%
TOTAL	**15, 709,141**	**6,021,539**	**38%**	**TOTAL**	**13,090,951**	**6,853,038**	**52%**

Source: Soil Transmitted Helminthiasis Control Program, National Center for Disease Prevention and Control, Department of Health

The Department of Health currently recommends the following actions to ensure the success of deworming campaigns in the Philippines:

1. The ICHP, as a public health program, must be mainstreamed into the ongoing health sector reforms initiated by DOH in partnership with the local governmental units (LGUs). The management and implementation of ICHP must take into account reforms in governance, service delivery, financing and regulations and the installations of support systems. It is believed that mainstreaming the ICHP initiatives into the overall health sector reform agenda, particularly through the Fourmula One Strategy, will most likely succeed and result to better health outcomes in the long term.
2. Activities will have to achieve a higher coverage rate, since adequate resources have been made available by the DOH. Greater advocacy and integration of activities with local health initiatives are recommended.
3. Synchronization of activities and sharing of resources (drugs, IEC etc) has to be coordinated with the Department of Education to ensure greater coverage and facilitate equitable distribution of drugs in all age groups (DOH Philippines 2008).
4. The program should expand deworming campaigns to cover adolescent girls and pregnant women as adequate resources are made available.

Status of Soil-Transmitted Helminths (Source: Published Data)

Epidemiology

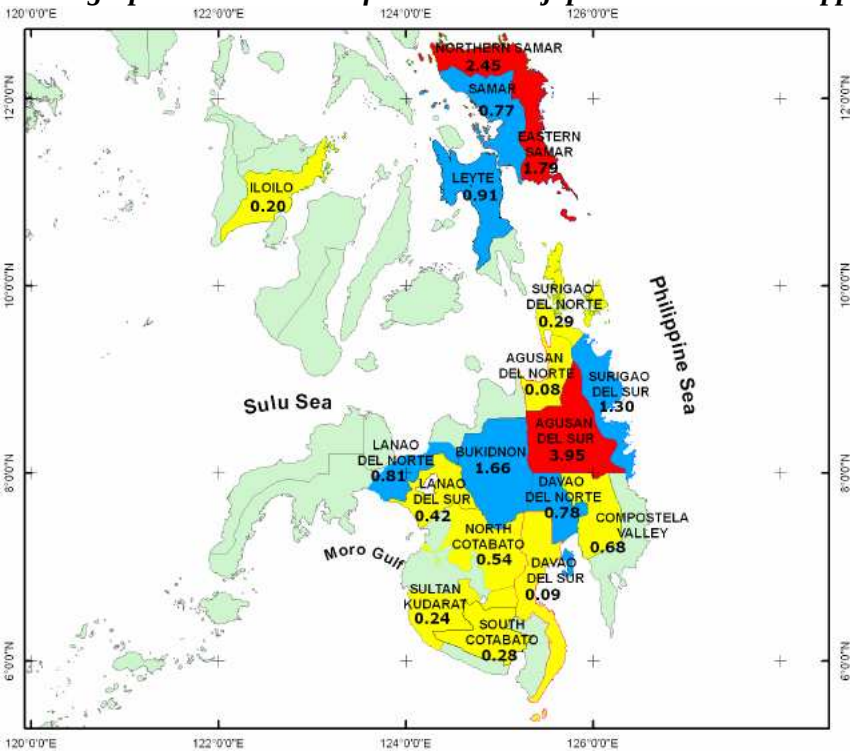
Several small-scale surveys of helminth distribution have been carried out in the Philippines in recent years. A survey of 301 inhabitants of Roxas City, Mindoro, yielded a 65% positive infection rate with STH. Ascaris infections were highest (52%), followed by Trichuris (28%) and hookworm (8% - Kim et. al 2003). A survey of 284 children in 11 institutions and 3 street communities in Manila yielded a 62% infection rate with STH; Trichuris infections were 45%, Ascaris 36%, and hookworm 7% (Baldo et al. 2004). In Legaspi City, 78% of 64 children and adolescents were positive for STH, with Trichuris the most common, followed by Ascaris and hookworm. The infection rate was 95.5% positive among the primary school children tested (Lee et al. 2000).

Status of Schistosomes (Source: Official)

Epidemiology

Schistosomiasis caused by *Schistosoma japonicum* has been controlled in some parts of the Philippines, including Bohol, Zamboanga del Norte, Davao del Sur, Sultan Kudarat and Surigao del Sur. The disease is still endemic in 12 regions (previously 10 regions as of 2003, affecting 28 provinces, 190 municipalities, 15 cities and 2,230 villages as of 2007. The number of endemic areas has increased in recent years due to active surveillance of human cases and snail vectors through environmental mapping (DOH Philippines 2008).

Figure 3: ***Geographic Distribution of Schistosoma japonicum in the Philippines***



Source: DOH Philippines

The total population affected is approximately 12 million, and about 2.5 million are directly exposed to the parasite. Children from 5-15 years of age have the highest intensity of infection, and the national mean prevalence for the general population was 4.5 in 1997. The morbidity rate for schistosomiasis has declined from 17.5 cases per 100,000 population in 1997 to 5.6 per 100,000 population in 2000. The case-fatality ratio has also continued to decline, from 0.9 deaths per 100,000 cases in 1980 to a the current plateau of 0.3 per 100,000 in 1997. As of 2006, the national average prevalence was 2.5 based on active surveillance by field health schistosomiasis teams (DOH Philippines 2008).

A WHO-supported national prevalence survey in Mindanao, the Visayas, and Luzon was initiated in 2005 and completed in 2007. In Mindinao, a total of 22 provinces in 6 regions were covered, with a response rate of 70% (with the exception of Maguindanao Province). In the Visayas, 10 out of 11 provinces in 3 regions participated, with a response rate of 32.2%. In Luzon, eight regions were covered with a response rate of 73%. The results gathered from the endemic provinces are summarized in Table 7.

Table 7: Prevalence of Schistosomiasis as Stratified by Province 2005-2007

Provinces	Prevalence %
Agusan del Sur	3.95
Northern Samar	2.45
Eastern Samar	1.79
Bukidnon	1.66
Surigao del Sur	1.3
Leyte	0.91
Lanao del Norte	0.81
Davao del Norte	0.78
Western Samar	0.77
Compostela Valley	0.68
Mindoro Oriental	0.63
Cotabato - Kidapawan	0.54
Marawi City	0.12
Sorsogon	0.36
Surigao del Norte	0.29
South Cotabato	0.28
Sultan Kudarat	0.24
Iloilo City	0.2
Davao del Sur - Digos	0.09
Agusan del Norte	0.08
Cagayan	0.04

Source: DOH Philippines

In all of the endemic provinces, the prevalence rate of the disease is was higher among males than females, suggesting that occupational hazards of farming and fishing are key risk factors for infection. Infection prevalence is also high in adults compared with younger age groups, also supporting that occupational exposure is a significant predictor of infection (DOH Philippines 2008).

Control Strategy

The overall goal of the schistosomiasis control programme is to reduce the prevalence rate of the disease to less than 1% by 2010. In order to meet this goal, the intervention aims to achieve the following:

1. Morbidity control through mass treatment of the exposed population aged 5 -65
2. Infection control through active case finding and treatment of all confirmed cases (performed in areas with low to moderate prevalence)
3. Transmission control through environmental sanitation, environmental modification, and snail control in low prevalence areas
4. Support of interventions through health promotion and advocacy and health education
5. Surveillance through health promotion, advocacy, and health education

There are several challenges to meeting these achievements. One difficulty results from the poor operational performance of the reporting system. To date, there is no web-based schistosomiasis surveillance and information system through GIS for use of local governmental unit (LGU) stakeholders or regions. Irrigation and agriculture projects, which have an impact on schistosomiasis transmission, rely on the DOH for schistosomicide drugs. Environmental health risk and health impact assessment must be pursued before any water

resource development projects are undertaken. There is a need for national governmental organizations (such as the Department of Natural Resources) and local governments to work on schistosomiasis elimination as a public health problem using international, national, and local resources (DOH Philippines 2008).

In order to address these challenges, the DOH highlighted the following as recommendations for improvement:

1. Development of the capacity of the Local Chief Executives in the management of the schistosomiasis programme in their areas
2. Building the institutional and technical capacity of local governmental units in endemic areas
3. Controlling transmission through sanitation and hygiene
4. Intensifying surveillance of human cases and snail vectors
5. Conducting rapid epidemiological surveys in response to suspected cases in suspected areas

Status of Schistosomiasis (Source: Published Data)

The published literature seems to reinforce the epidemiological findings of the MOH (Leonardo et. al 2002, Carabin et al. 2005). One study of 1,425 households in 50 villages of Western Samar province found an average prevalence rate of nearly 18%, 3.2% of whom were at least moderately infected (McGarvey et al. 2006). Intensity of infection, however, varies widely between villages as a function of geography, age, sex, and ecology (Carabin et al. 2005); a similar study in the same region found that the prevalence of light to moderate infection ranged from 0% to 45% between villages (Tarafder et al. 2006).

Schistosoma japonicum is endemic in Mindoro Oriental, Sorsogon, Bohol, Northern Leyte, Samar, and almost all provinces in Mindinao (Belizario et al. 2005). Prevalences range from 0.05% in Bohol and 17% in Samar (Belizario et al. 2005). However, the low sensitivity of schistosomiasis screening, particularly with low-intensity infections, means that the prevalence is likely much higher (Carabin et al. 2005). In contrast with *S. mansoni* infection, where intensity of infection is linked to increased morbidity, morbidity from *S. japonicum* in the Philippines has been linked more to chronic untreated infections (Carabin et al. 2005). As a result, it is critical to understand the prevalence of even low-intensity infections to effectively combat schistosomiasis morbidity.

One study conducted among 477 youth aged 7 to 20 years on the island of Leyte evaluated the relationship between chronic *Schistosoma* infection and nutritional status (Coutinho et al. 2006). The subjects were evaluated at the beginning of the study, 4 weeks post-treatment, and every 3 months for 18 months thereafter. The study found that height-for-age and body-mass index (BMI) Z-scores improved modestly but significantly over time, and those who suffered from high-intensity re-infection at 18 months had significantly less absolute growth than children with lower-intensity and/or no reinfection (Coutinho et al. 2006). The authors concluded that annual treatment intervals for schistosomiasis are very important to reduce nutritional morbidity.

Control Strategy

Control of schistosomiasis is currently focused on reducing morbidity through praziquantel chemotherapy, supplemented with sanitation, health education, and molluscicide (Leonardo et al. 2005). As foreign aid for these programs has ended, many are concerned that low disease awareness among risk groups, security issues, poverty, and a devolved health system

will make it difficult to maintain and improve upon recent reductions in prevalence (Leonardo et al. 2005).

Status of Food-Borne Trematodes (Source: Official)

Epidemiology

Health authorities in the Philippines have not conducted nationwide surveys to assess the epidemiology of food-borne trematodes in the country. However, the Philippine DOH did recognize the results of several studies carried out by independent researchers. Studies by Belizario et al. have reported high rates of capillaria and heterphyid infections in Southern Mindanao, and paragonimus in Western Mindano (Belizario et al. 2000, 2004, 2007). A recent review of food and water-borne parasitoses in the Philippines highlighted the need for up-to-date epidemiologic data to ensure more realistic planning, appropriate programme implementation, efficient resource management, and reliable disease monitoring (Belizario and Anastacio, 2007). The details of these and other independent surveys are further discussed in the "Published Data" section.

Control Strategy

Although there are a few local government units in the Philippines that address FBT infections, there are currently no national control programmes, nor guidelines for their control and prevention. Health facilities typically treat FBT infection on a case-by-case basis. Recent outbreaks of capillariasis have resulted in MDAs in selected communities with active involvement of the local governments (MOH Philippines 2008).

Status of Food-Borne Trematodes (Source: Published Data)

Paragonimiasis, heterophyidiasis, echinostomiasis, taeniasis, and intestinal capillariasis are all present in the Philippines (Belizario et al. 2007). Pollution, poverty, and population growth are the three major determinants of the epidemiology and disease burden of food- and water-borne parasitoses (Belizario et al. 2007). Disease recognition is often poor for these diseases due to ignorance or poor local diagnostic capabilities, which increasingly complicates and delays treatment. Public health facilities and services indicate only sporadic occurrences of cases, which is also the likely result of misdiagnosis (Belizario et al. 2007). Better case recognition, health education, and food safety are needed in order to attempt to control and prevent these infections.

Fascioliasis

Though it has been confirmed that *F. gigantica* is present in the Philippines, there has been some uncertainty as to whether *F. hepatica* is present in the Philippines. Many scientists have discounted the presence of *F. hepatica* in the Philippines, but reports of cases have still been made (Fernandez et al. 2006). This distinction is important, as the snail intermediate host of *F. gigantica* is aquatic, while the host for *F. hepatica* is terrestrial and semi-aquatic. Strategies for controlling the intermediate host would have to be adapted to reflect which species was prevalent in an area (Fernandez et al. 2006). No specific epidemiological data on the prevalence, type, or distribution of fascioliasis were current enough to include in this publication.

Paragonimiasis

Few epidemiological studies have been conducted to document paragonimiasis, though cases have been documented throughout the country. Leyte, Sorsogon, and Basilan provinces are considered endemic (Belizario, 1999). Country prevalence surveys were not conducted recently enough to include in this publication; however, two studies do offer a glimpse of the situation. One study found that 16.3% of pulmonary tuberculosis patients in Sorsogon were infected with paragonimus (Belizario, 1999). Another study in the municipality of Casiguran found that 25% of diagnosed tuberculosis patients exhibited paragonimiasis, and that two of these suspected tuberculosis patients were actually only positive for paragonimiasis (Belizario, 1999). Though small in scale, both studies highlight the importance of raising awareness of paragonimiasis and other FBTs for proper diagnosis and treatment.

Capillariasis and Others

In addition to the food-borne trematodes common throughout Southeast Asia, cases of more rare and localized parasitic infections have also been documented in the Philippines. Following twelve deaths due to an indefinite diagnosis of "gastroenteritis," a survey of 72 patients in Davao, Mindinao who presented similar symptoms found that 16 individuals (22.2%) were positive for *Capillaria philippinensis* infection, which is transmitted through ingesting raw fish and other freshwater animals (Belizario et al. 2000). The increase in cases was attributed to poor harvests, which likely forced the population to rely more on food sources from rivers. These surveys also indicated that *Haplorchis taichui*, a freshwater fluke also transmitted through raw fish, was present among 17% and 16% of the population of two villages (Belizario et al. 2004). It was acknowledged that this high prevalence would likely have gone unnoticed were it not for the ongoing investigations on intestinal capillariasis (Belizario et al. 2004).

Status of Cestodes (Source: Official)

Though infections with *Taenia spp*. has been documented in the Philippines (RITM 2006), no studies had been conducted to detail the prevalence and intensity of these infections at the time of publication.

Status of Cestodes (Source: Published Data)

No data were available on cestodes in the Philippines from data published between 1997-2008.

Singapore

Country Situation

Singapore does not survey the prevalence of helminth infections, as it is not considered a cause for public health concern (MOH Singapore 2008). Due to Singapore's high level of urbanization, very few parasitic diseases are encountered. Sporadic cases of infection with clonorchis/opisthorchis, taeniasis, and hydatid disease have been documented (Singh et al. 1991), but such infections are uncommon.

Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

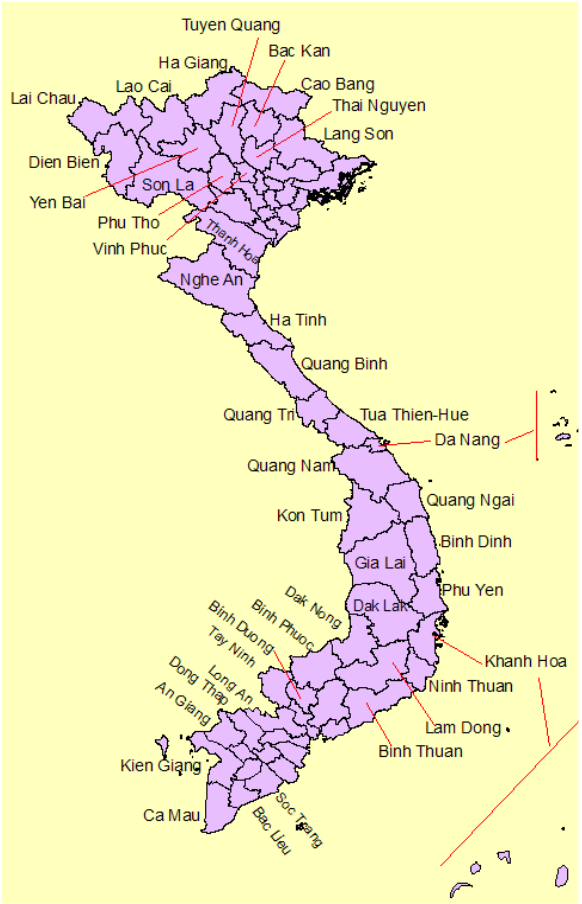
Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
4,382,000	207	275	342	301	529	677	844	644	179	37.5

Source: World Population Prospects: The 2006 Revision Population Database

Viet Nam

Country Situation

The prevalence of helminth infections in Viet Nam is one of the highest in the Western Pacific. There is an urgent need to administer at least regular distribution of deworming to pre-school children, primary schoolchildren, and women of child bearing age (WHO 2007). In contrast to the other Mekong countries, schistosomiasis is not transmitted in Viet Nam (WHO 2006a).



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
86,206,000	8,101	7,755	9,036	9,366	16,084	13,172	10,235	5,913	1,744	24.9

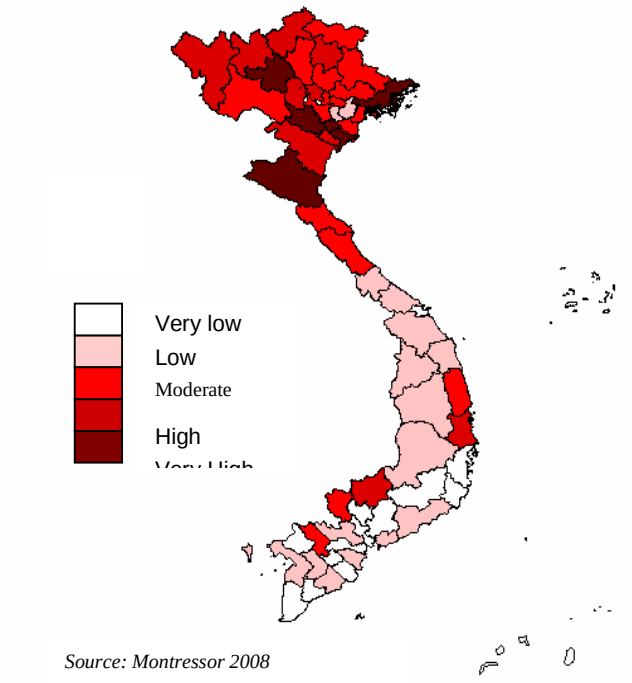
Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

Epidemiology

Soil-transmitted helminths are endemic in 54 out of 64 total provinces in Viet Nam (see Figure 1). The population of preschool, schoolchildren (ages 6-14), and women of childbearing age at-risk are estimated to be 5, 6, and 14.75 million respectively (Montresor 2008).

Figure 1: ***Prevalence of STH Infection in Viet Nam***



Source: Montressor 2008

Control Strategy

The control strategy currently in place focuses on treatment of all individuals at risk in the endemic provinces. Preschool children are targeted through a Vitamin A distribution campaign, schoolchildren through school deworming programmes, and women of childbearing age through village health workers (Montresor 2008). As of 2008, 1,000,000 preschool children have been targeted through a campaign that began its first MDA in December of 2007. Since 2002, the programme targeting school children has been in place and expanding to the 5,860,000 school children now treated every year. A pilot programme targeting 50,000 WCBA has also been initiated (Montresor 2008).

It is estimated that a total of 22 million tablets are needed to cover all targeted population. Currently, a total of 8 million tablets will be available to preschool and schoolchildren (2 million and 6 million, respectively). It is estimated that the total cost of distribution to preschoolers and schoolchildren will total US$ 90,000. Distributing tablets to WCBA would total an estimated US$ 60,000 (Montresor 2008).

Status of Soil-Transmitted Helminths (Source: Published Data)

Epidemiology

Prevalence figures of geohelminths in Viet Nam exceed most other developing nations (Chan 1997). A recent review of prevalence surveys conducted by van der Hock et al. (2003) estimates that, out of a total population of 80 million, there are 33.9 million people (44.4% of the population) infected with *Ascaris*, 17.6 million (23.1%) with *Trichuris*, and 21.8 million (28.6 %) with hookworm. An updated estimation of prevalence from the WHO in 2007 found similar totals for Ascaris and Trichuris, though the number of hookworm cases was a significantly lower 19.07 million (see Table 2).

The number of *Ascaris* and *Trichuris* infections was higher in the plain and coastal areas, and showed a dramatic increase in prevalence in northern provinces. Hookworm infections were more prevalent in mountainous regions, but their distribution was uniformly high throughout the country. The lower prevalence of *Ascaris* and *Trichuris* infections in the south is likely

attributable to the dry season, which reduces the ability of *Ascaris* and *Trichuris* eggs to incubate for two to three weeks in moist soil (necessary for the eggs to become infective). Overall, the prevalence of soil-transmitted helminths was highest in peri-urban areas and among children from five to fifteen years of age. Low educational level, daily contact with agricultural soils (especially nightsoils, or soils fertilized with human feces), low socio-economic status, and poor sanitation were all found to be significant risk factors for infection (van der Hock et al. 2003).

Table 2. Estimated National Prevalence of STH

	Ascaris		**Trichuris**		**Hookworm**	
Region	*% Prevalence*	*No. Infected*	*% Prevalence*	*No. Infected*	*% Prevalence*	*No. Infected*
North (Red River Delta, Northern Uplands)	68.8%	24,768,000	36.7%	13,212,000	22.9%	8,244,000
Centre (North Central Coast, Central Highlands, South Central Coast	37.4%	5,610,000	9.1%	1,365,000	34.3%	5,145,000
South (South East, Mekong River Delta)	14.6%	1,234,000	1.7%	493,000	19.6%	5,684,000
Total		34,612,000		15,070,000		19,073,000

Source: WHO 2007

Intervention Status

An intervention in 2005 specifically focused on cost containment targeted 2.7 million schoolchildren for one month, with 96.1% of the parents reporting an improvement in their child's health post-intervention (Montresor et al. 2006).

Status of Food-Borne Trematodes

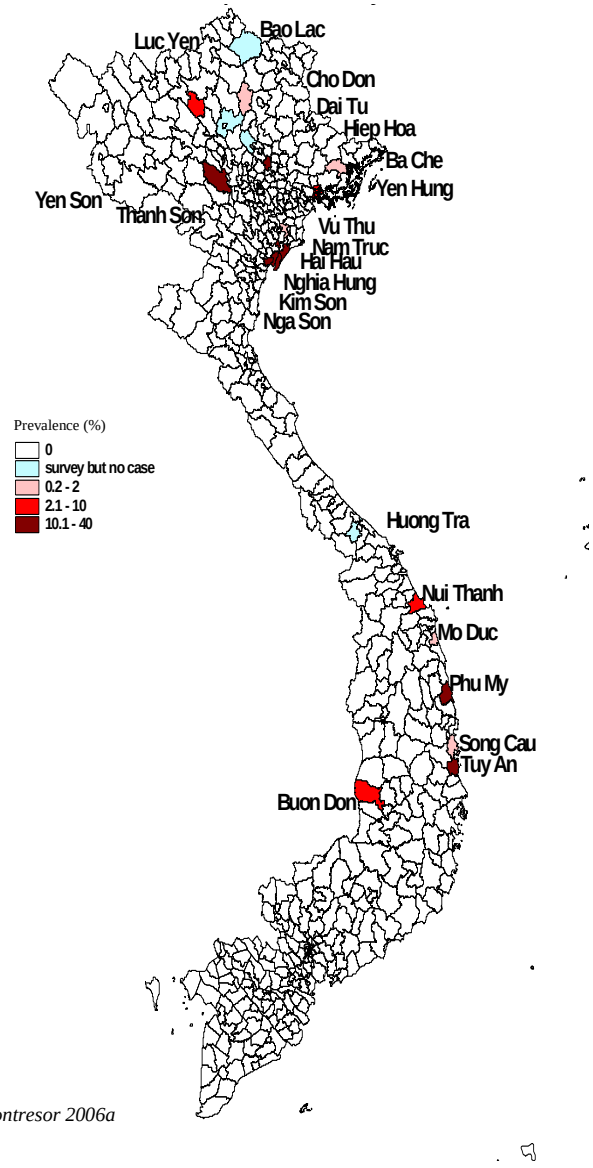
Clonorchiasis/Opisthorchiasis (Source: Official)

Epidemiology

Clonorchiasis is transmitted in 12 districts in northern Viet Nam, especially in the Red River delta area. Opisthorchiasis is endemic in 6 districts, most of which are in central Viet Nam (Montresor 2006a; see Figure 2). The population at-risk was estimated to total 585,000 individuals in priority districts (areas with a prevalence greater than or equal to 10%), and 58,000 individuals in non-priority districts (Montresor 2008). Adult males aged 20-49 years

are most frequently infected with clonorchiasis or opisthorchiasis, and infection is strongly linked to the tradition of eating raw fish with alcohol. Women and children rarely drink alcohol and are less at risk than men, though some women and children do still consume raw fish. Raw fish consumption is more frequent during the hot season, as it is considered a "cooling dish" (Montresor 2006a).

Figure 2: ***Prevalence of Clonorchiasis and Opisthorchiasis by District***



Source: Montresor 2006a

As many infections are asymptomatic, the number of cases reported by hospitals in Viet Nam is low and few clinical diagnoses are made, even in highly endemic areas (Montresor 2006a).

Clonorchiasis/Opisthorchiasis (Source: Published Data)

Epidemiology

In a review of epidemiological studies carried out in 12 out of Viet Nam's 61 provinces, *Clonorchis sinesis* was found in nine northern provinces, while *O. viverrini* was detected in three southern provinces (De et al. 2003). The prevalences of *C. sinensis* varied from 0.2% to 26.0%, with the highest infection rate in the Red River Delta region. The highest rates of infection were logically associated with communities that consumed higher amounts of raw fish. Males and those of middle age were found to be at increased risk of infection, which were attributed to frequent male-dominant gatherings where both raw fish and alcohol are consumed. *O. viverrini* infection rates ranged from 15.2% to 36.9% (De et al. 2003).

Control Strategy

It has been recommended that all districts where the prevalence of Clonorchis/Opisthorchis is estimated to be equal or greater than 10% should be prioritized for control measures, including treating all people with a history of consuming raw fish once a year (Montresor 2006a). Since drinking parties and the consumption of raw fish are most frequent in summer, it was suggested that any intervention should take place at least 4 weeks after the end of

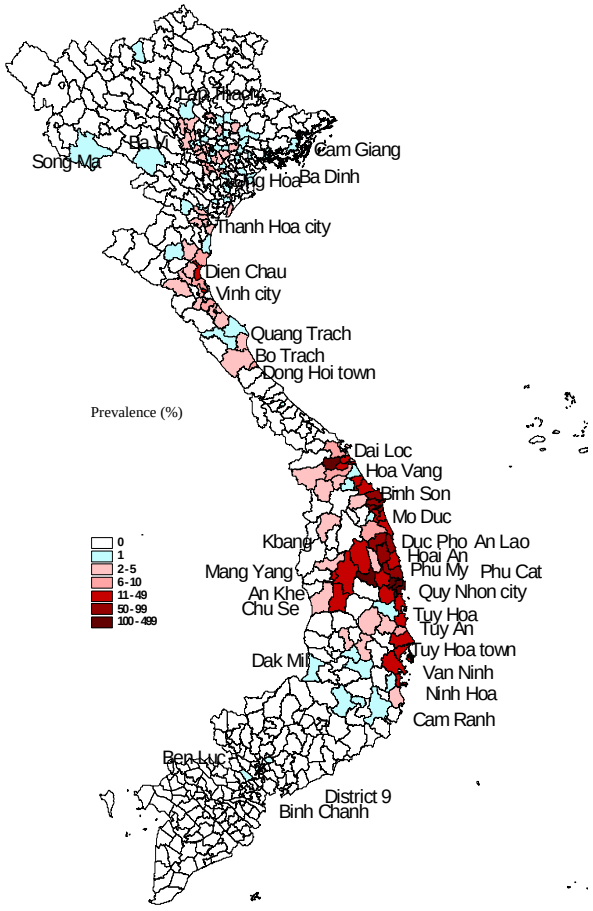
summer to allow the praziquantel to have the maximum effect. It was estimated that 230,000 USD would be necessary to cover the necessary praziquantel, distribution costs, and monitoring and evaluation costs of an annual control campaign (Montresor 2008).

Fascioliasis (Source: Official)

Epidemiology

Fascioliasis due to *Fasciola gigantica* is typical of rural areas of Viet Nam, but is not infrequent in peri-urban areas as well (Montresor 2006b). 172 districts in 36 provinces are endemic, with 5,000 patients estimated to be in need of treatment every year (Montresor 2006b; see Figure). Since the start of tablet donations in 2004, there has been an increase in the number of cases reported in response to available treatment (2000 in the first 8 months of 2006 alone). Cases are widespread throughout the country, making identification of high-transmission areas difficult (Montresor 2006b). Transmission to humans is strictly linked to eating raw water-grown vegetables that harbor *F. gigantica* metacercariae. Washing the vegetables with water, vinegar, or lemon juice is not sufficient to remove the encysted metacercariae (Montresor 2006b). Use of contaminated kitchen tools in preparing other foods can also cause the metacercariae to be transmitted.

Figure 3: ***Prevalence of Fascioliasis by District in Viet Nam***



Source: Montresor 2006b

Women aged 17 to 45 are most frequently diagnosed, and reportedly consume raw vegetables more frequently than men. Clustering of cases within families has been observed, as well as a peak seasonality in infections from April to September in some hospitals (Montresor 2006b).

Control Strategy

The Ministry of Health developed case management guidelines for human fascioliasis in August 2006, recommending diagnosis based on several tests (Montresor 2006b). Since many of the tests are not widely available, these guidelines were only applicable in hospitals at the provincial and national level after patients have been referred from local health facilities (Montresor 2006b). As of 2008, 3,000 patients had been treated with donated tablets of triclabendazole, and health personnel in endemic districts were trained to recognize suspect cases and provide treatment. (Montresor 2008b).

As artesunate, albendazole, and praziquantel were demonstrated to have low cure rates for fascioliasis, triclabendazole is recommended by the current MOH guidelines as the only treatment for fascioliasis control (Montresor 2006b). However, the drug is not registered for human use nor included on the national list of essential medicines in Viet Nam, and it has

been recommended that registering and including this drug in the list of essential medicines is essential to facilitate control efforts (Montresor 2006b). Shortages of the drug is currently the largest impediment to localizing and expanding treatment. The WHO has donated 10,000 tablets, but it is estimated that 30,000 tablets and 14,000 USD for health education are needed annually for treatment (Montresor 2006b).

Fascioliasis (Source: Published Data)

Epidemiology

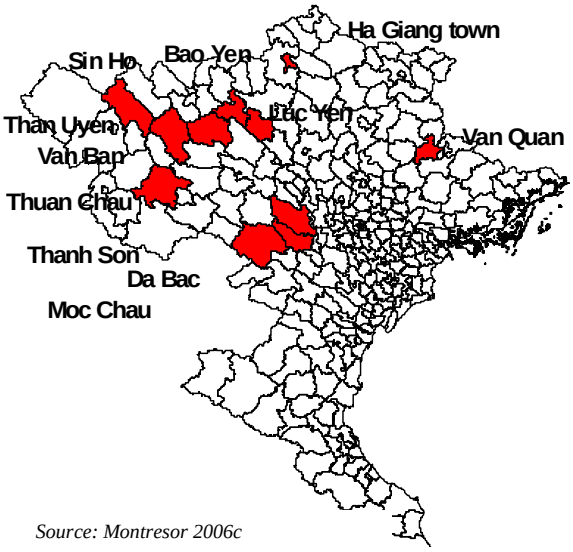
Fasciolopsis buski is prevalent throughout Viet Nam, though the point prevalence of infected persons is low (De et al. 2003). Study results from three provinces list infection rates from 1.2% to 3.8%. *Fasciola gigantica* has been recognized in Viet Nam only in the 1990s, and the reasons for its emergence are not fully understood. Between 1997 and 2000, over 500 cases were documented (Hein et al, 2001), and 2,191 cases were documented in hospitals between November 2004 and August 2006. Since only 10 hospitals currently stock the treatment, there is a great likelihood that infections in many isolated and poor populations are underreported and under-treated (WHO 2006).

Paragonimiasis (Source: Official)

Epidemiology

According to data from 2006, paragonimiasis (primarily *P. heterotremus* and some *P. westermani*) is transmitted in 11 districts in 8 provinces of northern Viet Nam (Montresor 2006c). Cases are often confined to certain communes, and typically do not affect the entire district; this may be due to the fact that paragonimiasis is endemic in mountainous areas with separated watersheds, creating closed ecological niches (Montresor 2006c). Children aged 6 to 10 years are most affected, as they frequently consume crabs that are not adequately cooked enough to kill the encysted metacercariae (Montresor 2006c). Crab-eating may decrease with age, but adult eating habits in affected communities are less understood. However, it is acknowledged that crabs provide an important source of protein in poor, rural communities, creating significant risk for paragonimiasis in endemic areas.

Figure 4: ***Districts Infected with Paragonimiaisis***



Source: Montresor 2006c

It is estimated that 20,000 individuals are at risk of paragonimiais. As of 2008, 6 districts in 2 provinces received preventive chemotherapy with praziquantel (Montresor 2006c).

Control Strategy

A higher dosage of 40 mg/kg of praziquantel given over two days has been recommended as standard chemotherapy to treat paragonimiasis, as a single dose has been reported to achieve low cure rates (Montresor 2008). It is estimated that approximately 25,000 USD per year would be adequate to provide praziquantel tablets, distribution, and monitoring and evaluation in all affected areas (Montresor 2008). It has been recommended that a control plan should include targeted treatment to treat all early infections, as well as individual treatment of suspected cases (Montresor 2008).

Paragonimiasis (Source: Published Data)

Epidemiology

Paragonimus heterotremus has been recorded in 6 northern provinces, at infection rates of 0.2% to 11.3% (De et al. 2003). Infection was more common in provinces where mountainous streams provide good habitats for stone crabs. In contrast to trends in other Asian countries and other surveys in Viet Nam, the authors found that the highest prevalence rates occurred between 30 and 50 years of age, with no significant difference between male and female infection rates (De et al. 2003). The authors stressed that more research was needed to validate this age and sex profile for the disease in Viet Nam.

Note Bene:

As *C. sinensis*, *O. viverrini*, and *F. buski* all are associated with aquaculture, a comprehensive program to contol water contamination and snail vectors might reduce all three disease burdens (De et al. 2003).

Status of Cestodes (Source: Official)

No data on cestodes were available from the health authorities in Viet Nam from 1997-2008.

Status of Cestodes (Source: Published Data)

Epidemiology

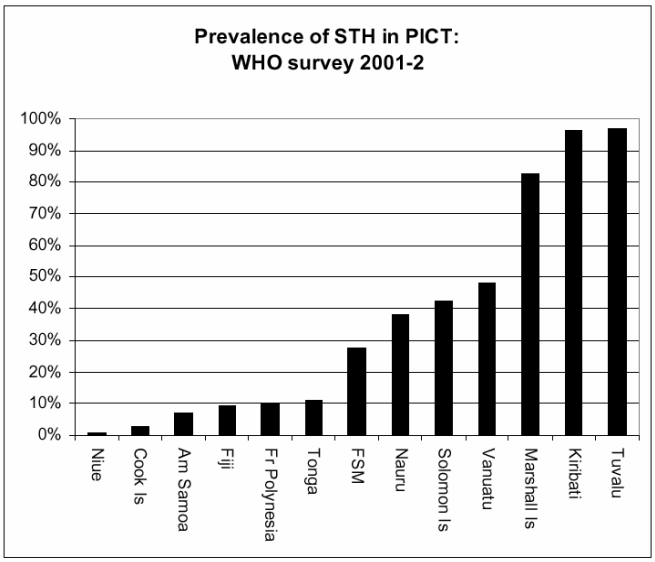
The majority of the information regarding cysticercosis in Viet Nam comes from hospital records, most of which were considered too outdated to be included in this review. One study in the northern Bac Ninh province in 2000 found 5% of 597 subjects had cysticerosis infection (Doanh et al. 2002). In one village, 18 males (69.2%) and 8 females (30.8%) were serologically positive and exhibited subcutaneous nodules (De et al. 2001). Consuming raw pork and unwashed vegetables, poor sanitation, frequent contact with pigs, and use of nightsoil were all found to be risk factors for cysticercosis (Willingham et al. 2003). Raw meat consumption and lack of sanitation were most associated with infection in the north, while consumption of raw vegetables was more strongly associated with infection in the south (Willingham et al. 2003). A study found that treatment with 2-3 courses of praziquantel at 30 mg/kg/day cured 95.7% of subcutaneous nodules, but only 18.8% of cerebral cysts; albendazole at 15 mg/kg/day for 2-3 courses of 20 days cleared 83.3% of subcutaneous nodules and 43.8% of cerebral cysts after six months of treatment (De et al. 1998). The strong efficacy of these drugs is promising for future interventions, but much more data on the prevalence of cysticercosis will be needed to target the interventions appropriately.

Forward for the Pacific Island Countries

Though data on helminth infections is scarce throughout many areas in the WPR, the epidemiology of helminth infections in the Pacific is particularly understudied. Unless otherwise noted, data on food-borne trematodes or cestodes in the Pacific Island nations were unavailable between 1997-2007. Schistosomiasis is not endemic to the Pacific island countries and areas (Biregional Report: Health in Asia and the Pacific), and thus is not addressed.

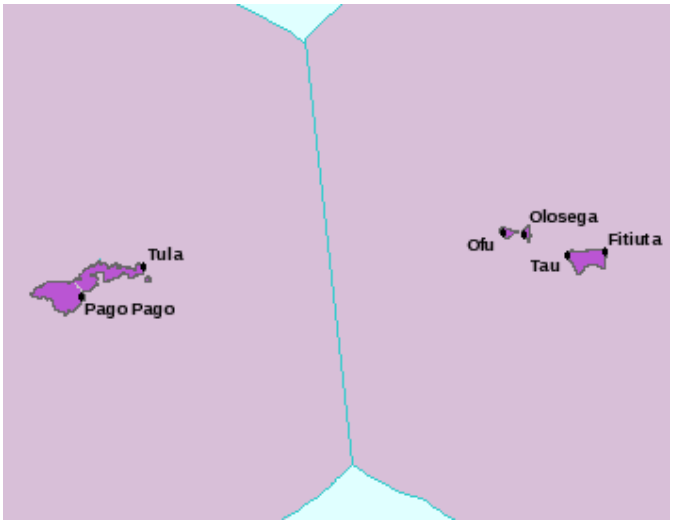
The only recent study on soil-transmitted helminth infection on many of these islands was a multi-country survey conducted from 2001-2002, the results of which were detailed in Hughes et al. 2004. In this study, two WHO survey teams, each consisting of an environmental health specialist, a nutritionist, and a parasitologist, visited 14 different Pacific Island countries. The governments of these countries selected two schools to be surveyed in advance, one from the capital or commercial center (school 1, also referred to as the "urban school" in this review) and one from a less accessible area (school 2, also referred to as the "rural school" in this review). Only one school in Niue was surveyed, as it was the only primary school on the island (Hughes et al. 2004). Stool samples from a total of 1,996 students were analysed, the results of which are discussed the profile for each country as well as an accompanying chart (see Figure 1). The survey is referred to as the PIS (Pacific Island Survey) in this report.

Figure 1: Summary of Findings from Hughes et al. 2004



Source: Speare et al. 2006

American Samoa



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
68,000	37	6

Source: United Nations Economic and Social Commission for Asia and the Pacific

Status of Soil-Transmitted Helminths (Source: Official)

No data on soil-transmitted helminths were available from health officials from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

As part of the 2001-2002 Pacific Island helminth survey, one commercial/urban school and one rural school in American Samoa were examined by a WHO survey team (Hughes et al. 2004). In the commercial Matafau school, 6.9% of 29 students were infected by helminths, all of whom were boys (Hughes et al. 2004). No Ascaris cases were reported, and the infections noted were light infections with Trichuris and hookworm. In the more rural Taputapu school, no infections with STH were found. Another review of 240 stool samples from January 1999 to June 2001 also showed that 35 (14%) were positive for helminths; of these, 68% were positive for Ascaris, 25% for hookworm, and 5% for Trichuris (Pacific Helminth Initiative: American Samoa, personal communication, 2008).

MDAs with DEC and albendazole were carried out from 2000-2004 as part of the Pacific Eliminate Lymphatic Filariasis (PacELF) program, and another campaign was planned for 2005. The highest percentage treated was estimated at 66% of the population in the 2003 campaign (WHO 2006). The impact of the MDAs distributed through the PacELF program on STH remains to be assessed.

Federated States of Micronesia

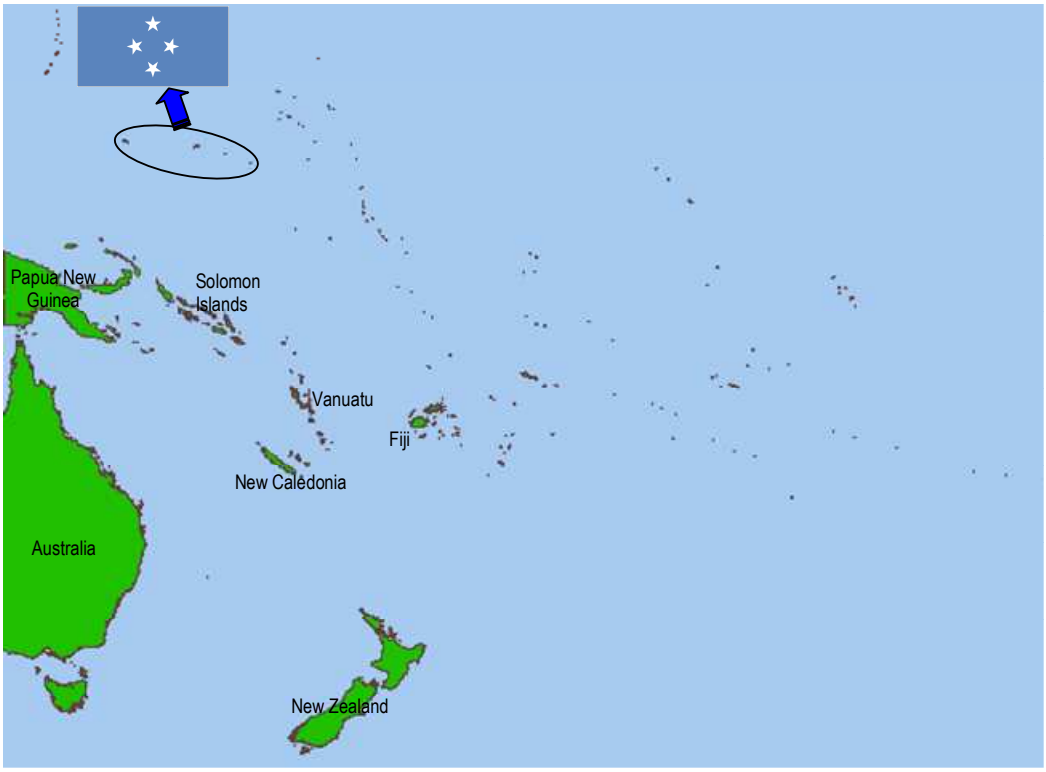


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Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
111,000	14	14	14	13	20	11	10	7	2	19.7

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

In one study conducted by the Federated States of Micronesia Health Department, WHO Collaborating Center for Control of Lymphatic Filariasis, and James Cook University, 151 school children on Satawal Island from grades 1 to 8 were analysed for parasites. The study found that infection prevalence of Ascaris reached 100% for students in grades 1-4, 79% for grades 5 and 6, and 69% for grades 7 and 8 (Melrose et al. 2003). Infection with Trichuris was highest among children in grades 1-4 as well, with an average prevalence of nearly 25% in these grades and 12% in grades 5-8. By contrast, hookworm infections increased in prevalence as the children aged, with less than 2% prevalence in grades 1 and 2 and nearly 8% prevalence in grades 7 and 8 (Melrose et al. 2003; see Table 1). The authors concluded that, given the high level of transmission, a single dose of albendazole administered by the PacELF program would likely not have much effect in reducing helminth infection (Melrose et al. 2003). The authors concluded that intensive improvement of sanitation and hygiene are needed, possibly in addition to MDAs for schoolchildren every six months (Melrose et al. 2003).

Table 1: Parasite Type and Prevalence on Satawal Island, 2003

Parasite	Grades 1 & 2 Prevalence %	Grades 3 & 4 Prevalence %	Grades 5 & 6 Prevalence %	Grades 7 & 8 Prevalence %
Ascaris lumbricoides	100	100	79.3	69.2
Trichuris trichiura	21.3	28.6	17.2	7.7
Hookworm	1.6	2.8	6.9	7.7
Entamoeba histolytica/dispar	16.3	8.6	10.3	0
*Entamoeba coli**	55.0	57.0	38.0	27.0
Giardia Lamblia	3.3	0	0	0
*Endolimax nana**	9.8	5.7	0	0
Blastocystis hominis	1.6	0	0	0
*Chilomastix Mesnili**	3.3	5.1	0	0
No parasites detected	0	0	13.7	26.9

Source Melrose et al. 2003

Status of Soil-Transmitted Helminths (Source: Published Data)

The 2001-2002 PIS conducted helminth studies on the islands of Pohnpei and Yap in Micronesia. On Pohnpei, 11.5% of the 61 students tested were infected with STH, the majority of which were Ascaris infections. In the rural test site, 38% of the 97 students tested were positive for helminth infection, with Ascaris again predominating. On Yap, 33% of the 108 urban students surveyed were positive for helminth infection, with hookworm predominating; of the 59 rural students tested, 32% were positive for helminths, the majority of which were hookworm infections (Hughes et al. 2004).

The difference in type, intensity, and age disparity of helminth infection between these three islands warrant further study of the helminth burden in Micronesia.

Fiji

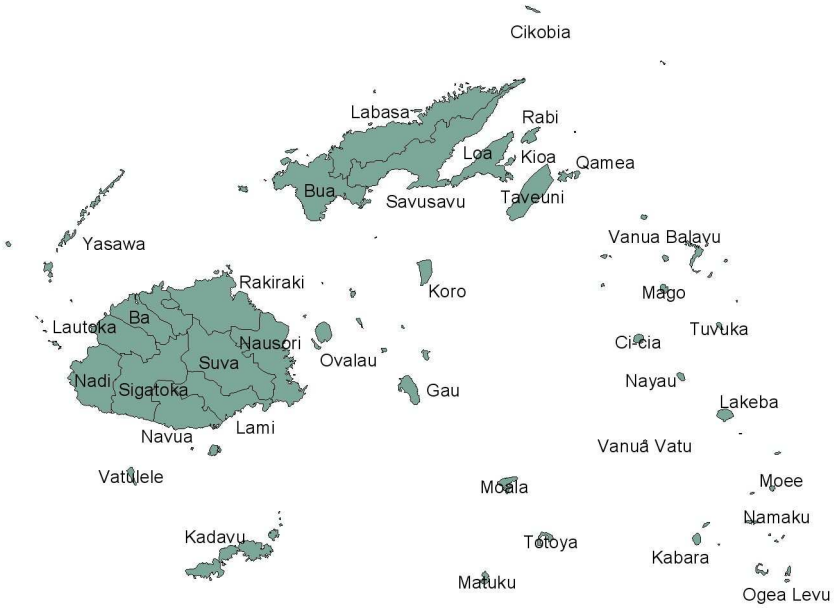

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Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
833,000	90	92	90	82	151	102	98	69	23	23.7

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data on soil-transmitted helminths were available from health officials between 1997-2008.

Status of Soil-Transmitted Helminths (Published Data)

A study carried out in 1998 tested 123 villagers in the coastal area of Viti Levi island, as well as 130 primary school children in an interior mountain region on the same island. Among the 123 coastal villagers, 13 (11%) were positive for Ascaris, 2 (2%) were positive for Trichuris, and 62 (50%) for hookworm (see Table 1). Males were more affected than females (Mathai et al. 1998). Of the 130 primary school children tested, 6(5%) were infected with Ascaris, and 25 (19%) with hookworm (Mathai et al. 1998; see Table 2). In the 2001-2002 PIS, 10.3% of 58 children at the urban test site were infected with helminths, compared to 9.1% of the 176 children at the rural test site; both Ascaris and hookworm were recorded (Hughes et al. 2004).

Table 1: ***Prevalence of intestinal helminth infection in 123 villagers***

	Female	Male	Total
Number tested	61	62	123
Ascaris	*8	5	13
Hook worms	24	38	62
Strongyloides	5	7	12
Trichuris trichiura	0	2	2
Mixed infection*	5	3	8
Total positive	**42**	**55**	**97**

** Mixed infections were present in 5 females and 3 males i.e. Ascaris and hook worms in 3, hook worms and strongyloides in 3, ascaris and strongyloides in land hook worm and trichuris in 1.*

Source: Mathai et al. 1998

Table 2*: Prevalence of intestinal helminth infection in primary school children*

	Girls	Boys	Total
Number tested	57	73	130
Hook worms	10	15	25
Ascaris lumbricoides	3	3	6
Strongyloides sp	0	4	4
Mixed infection*	2	4	6
Total positive	**15**	**26**	**41**

** 2 girls and 4 boys had mixed infections i.e., hood worm and Ascaris in 1 girl and 2 boys, hook worm and strongyloides in 1 girl and 2 boys.*

Source: Mathai et al. 1998

The authors of the study concluded that intestinal helminth infections were high in Fiji, particularly in the coastal areas. Though most homes have latrines, there is still significant fecal contamination of open land, resulting in a higher prevalence of hookworm among farmers and those in regular contact with the soil (Mathai et al. 1998). It was suggested that increased public awareness and public health measures were necessary to reduce the prevalence of STH infection in Fiji (Mathai et al. 1998).

MDAs with DEC and albendazole were carried out from 2002-2004 as part of the PacELF program, and additional campaigns were planned for 2005 and 2006 (WHO 2006). The highest percentage treated was estimated at 67% of the population in the 2002 campaign (WHO 2006). The effect of this programme on helminth prevalence has yet to be evaluated.

French Polynesia

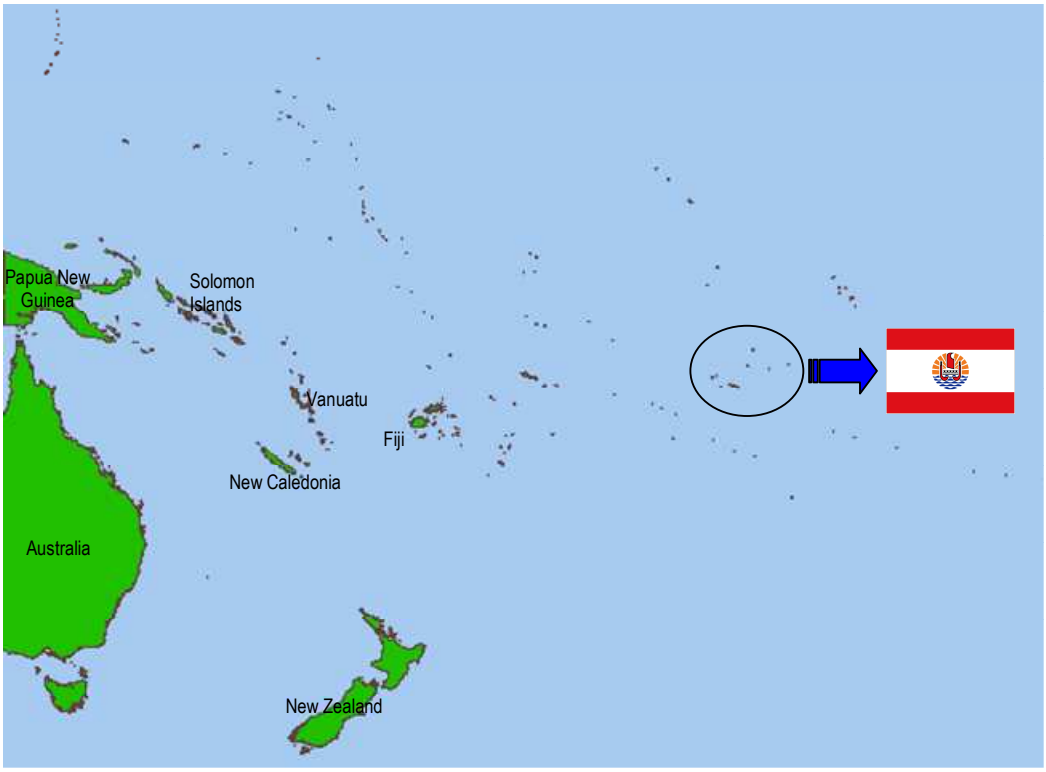

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Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
259,000	23	24	23	27	43	40	34	22	8	27.1

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Official)

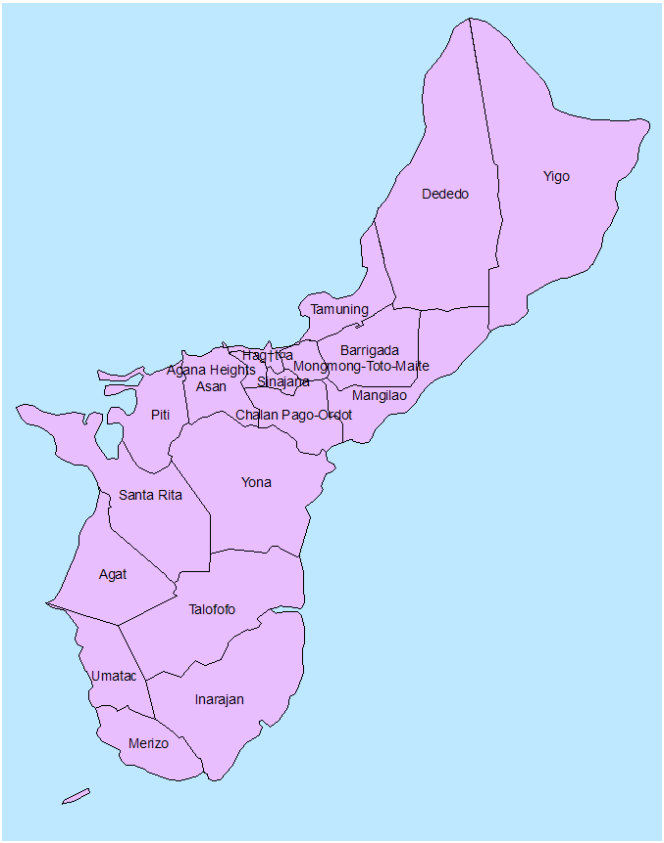
No data on soil-transmitted helminths were available from health officials from 1997-2008.

Status of Soil-Transmitted Helminths (Published Data)

The 2001-2002 PIS found that 5.9% of 68 students in the urban test site were infected with helminths. In the rural test site, 12.9% of the 93 students tested positive. All of the infections at both locations were light or moderate Trichuris infections (Hughes et al. 2004).

MDAs with DEC and albendazole were carried out from 2000-2004 as part of the PacELF program, and another campaign was planned for 2005. The highest percentage treated was estimated at 92% of the population in the 2004 campaign (WHO 2006). Whether this programme has also contributed to a reduction in helminth prevalence has yet to be evaluated.

Guam



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
171,000	23	17	16	15	25	25	24	17	5	28.4

Source: World Population Prospects: The 2006 Revision Population Database

Country Situation

Helminthiases are not reportable diseases in Guam, though the Department of Public Health and Social Services does occasionally receive reports of infestations. In 2007, 1 case of ascariasis, 1 case of hookworm, and 2 cases of schistosomiasis were reported in the country; all were adults who were believed to have contracted their infections in other countries (R. Haddock, personal communication, 2008). As most homes are connected to sanitary sewers or septic tanks, it was not anticipated that soil-transmitted helminths would become a serious problem in Guam in the foreseeable future. Schistosomiasis is not endemic to Guam, and it is also unlikely that cases would increase without being imported from other countries.

No data on prevalence surveys were available from the health authorities in Guam or independent research. No formal interventions had been carried out in the country, and there were no formal programmatic control interventions planned for 2008 (R. Haddock, personal communication, 2008).

Kiribati

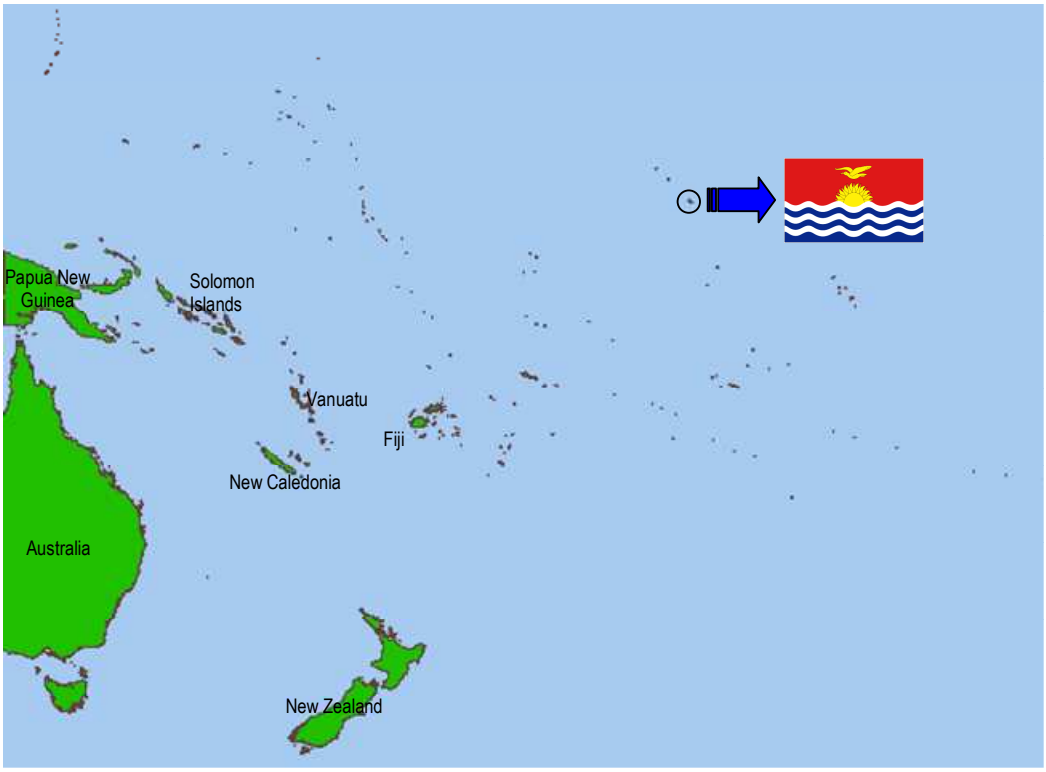


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Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
96,000	36	5

Source: United Nations Economic and Social Commission for Asia and the Pacific

Status of Soil-Transmitted Helminths (Source: Official)

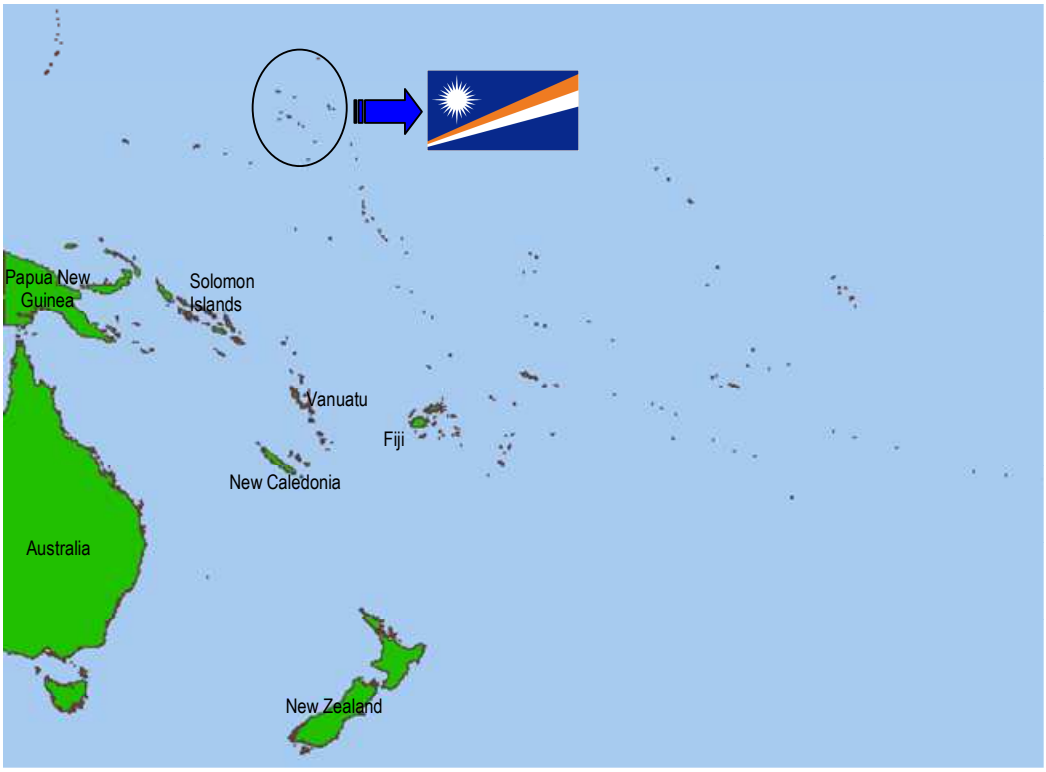
No data on soil-transmitted helminths were available from health officials from 1997-2008.

Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, 94.9% of the 39 students (and 100% of girls) in the urban test site were positive for helminth infection. In the rural test site, 96.7 of the 90 students surveyed were positive for helminth infection. The majority of these cases were Trichuris infection, though hookworm was documented as well (Hughes et al. 2004).

MDAs with DEC and albendazole were carried out from 2001-2005 as part of the PacELF program (WHO 2006, Palmer 2006). The highest percentage treated was estimated at 61% of the population in the 2004 campaign (WHO 2006). The WHO and UNICEF have both supported twice yearly de-worming (Pamela Messervy, personal communication, 2008).

Marshall Islands



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
62,000	38	4

Source: United Nations Economic and Social Commission for Asia and the Pacific

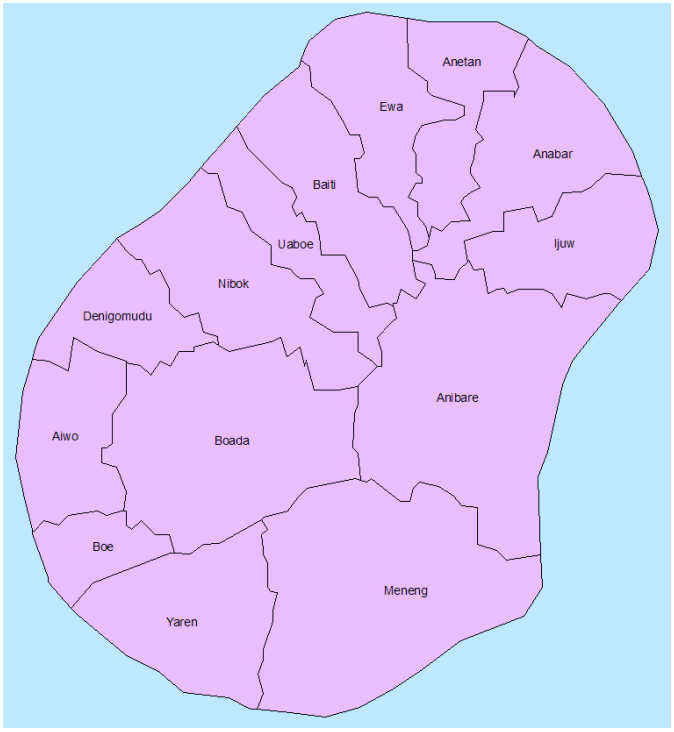
Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, 79% of the 28 students tested were positive for helminths at the urban testing site; most of these infections were with Trichuris. At the rural test site, 84% of the 92 students surveyed were positive for helminth infection. Infection at the rural site was primarily with Trichuris, but high rates of hookworm infection and some cases of Ascaris were also documented. Boys were more affected than girls at both schools (Hughes et al. 2004).

Nauru



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
10,000	39	3

Source: United Nations Economic and Social Commission for Asia and the Pacific

Status of Soil-Transmitted Helminths (Source: Official)

Surveys on the prevalence of helminths have not been conducted in Nauru as of 2008. Programmatic activities for helminth control will be planned for 2009 (MOH Nauru, personal communication).

Status of Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, 25% of the 36 students surveyed at the urban test site tested positive for helminth infection. All of these were Trichuris infections, and boys were nearly four times more likely to be infected than girls. In the rural test site, 47% of the 53 students surveyed were positive for helminth infection. Infection was nearly equal among boys and girls, and the majority of infections were with Trichuris, though a few cases of hookworm were also documented (Hughes et al. 2004).

Nauru is not endemic to lymphatic filariasis, and no MDAs have been carried out on the island in conjunction with PacELF activities (WHO 2006). More research needs to be conducted to determine the extent of helminth infection and its affect on health.

New Caledonia

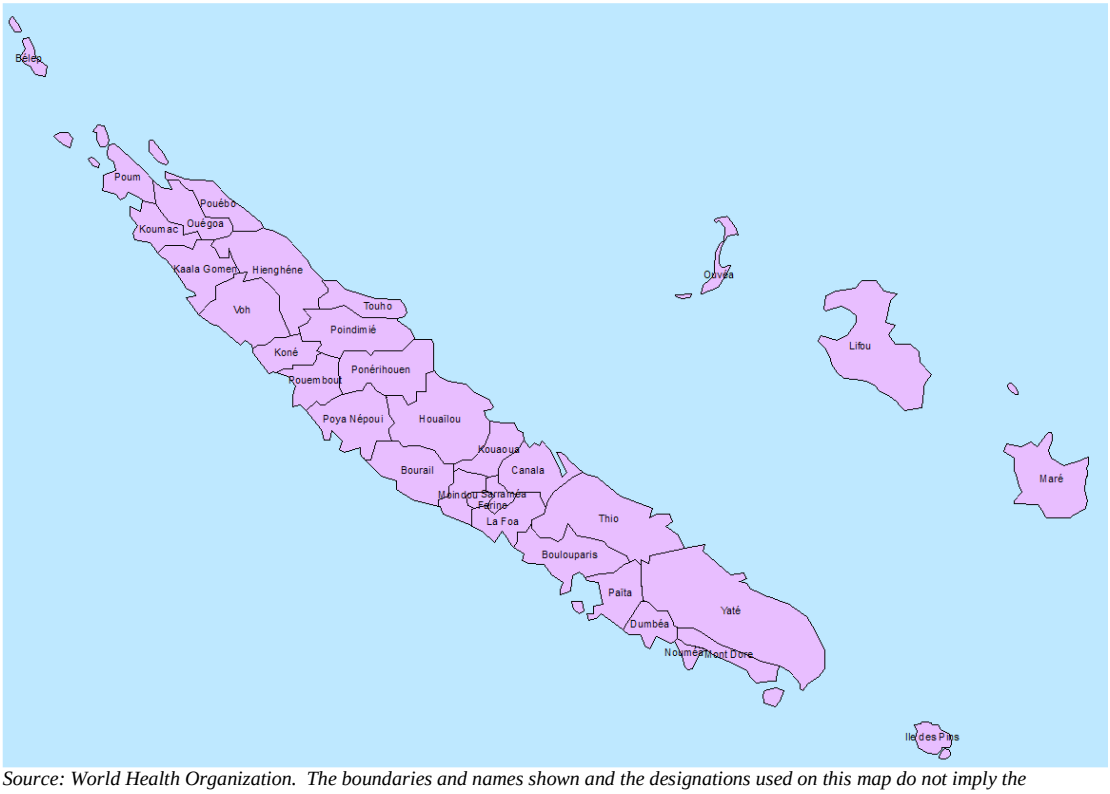


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Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
238,000	20	22	22	21	37	38	31	22	8	28.8

Source: World Population Prospects: The 2006 Revision Population Database

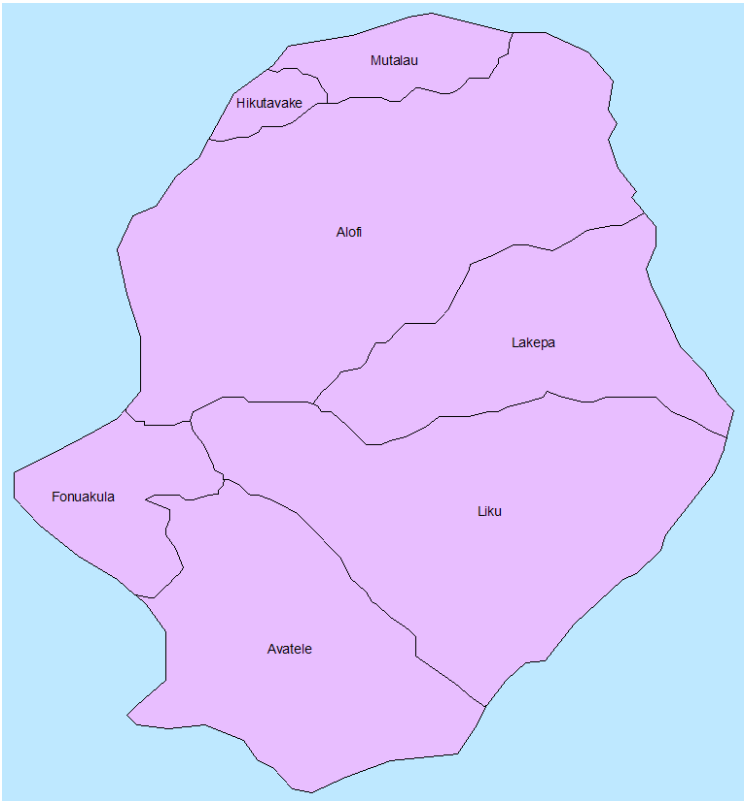
Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Soil-Transmitted Helminths (Source: Published Data)

Recent studies on the epidemiology of STH in New Caledonia were not available at the time of publication. Though lymphatic filariasis is partially endemic in New Caledonia, no MDAs have been administered (WHO 2006). There is a need for more studies to assess the prevalence of STH throughout the country.

Niue



Source: World health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
2,000	26	16

Source: United Nations Economic and Social Commission for Asia and the Pacific

Status of Soil-Transmitted Helminths (Source: Official)

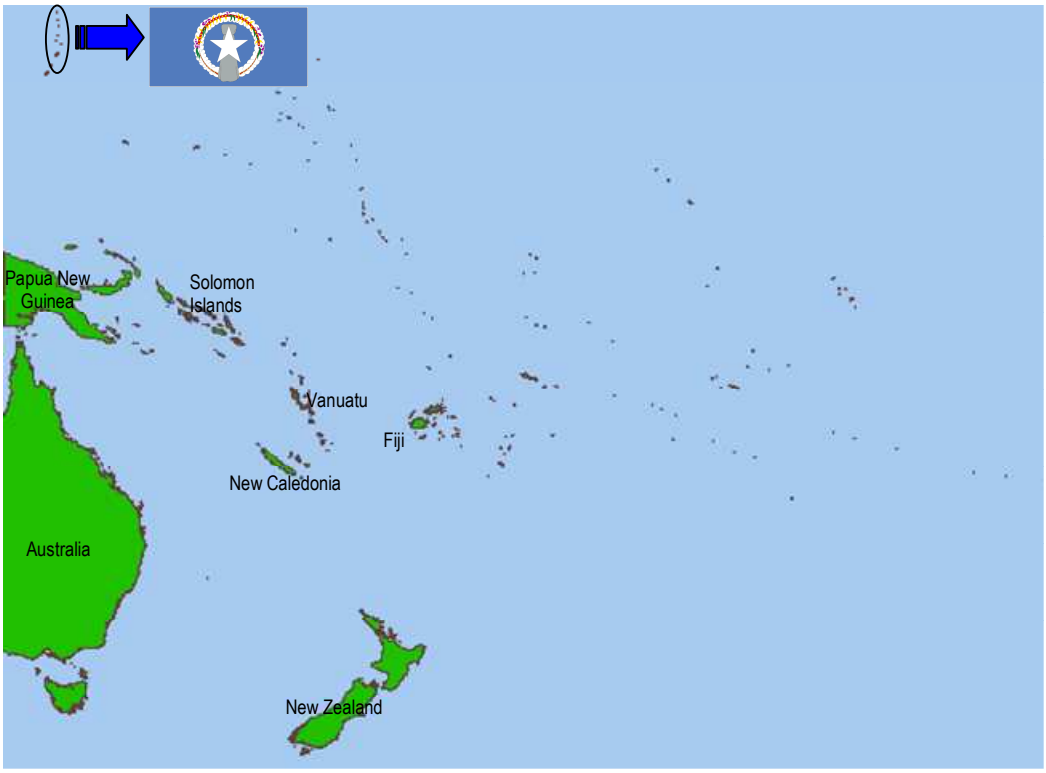
No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, one boy out of the 139 students surveyed exhibited a light Trichuris infection. Only one school survey was conducted, as there is only one primary school on the island (Hughes et al. 2004). Given the small size of Niue's population, soil-transmitted helminths do not seem to constitute a significant public health problem in Niue.

MDAs with DEC and albendazole were carried out from 2000-2004 as part of the PacELF program. The highest percentage treated was estimated at 97% of the population in the 2000 campaign (WHO 2006). Given the low prevalence of STH, this campaign may be sufficient enough to function as a method for STH control as well.

Northern Mariana Islands



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
85,000	19	3

Source: United Nations Economic and Social Commission for Asia and the Pacific

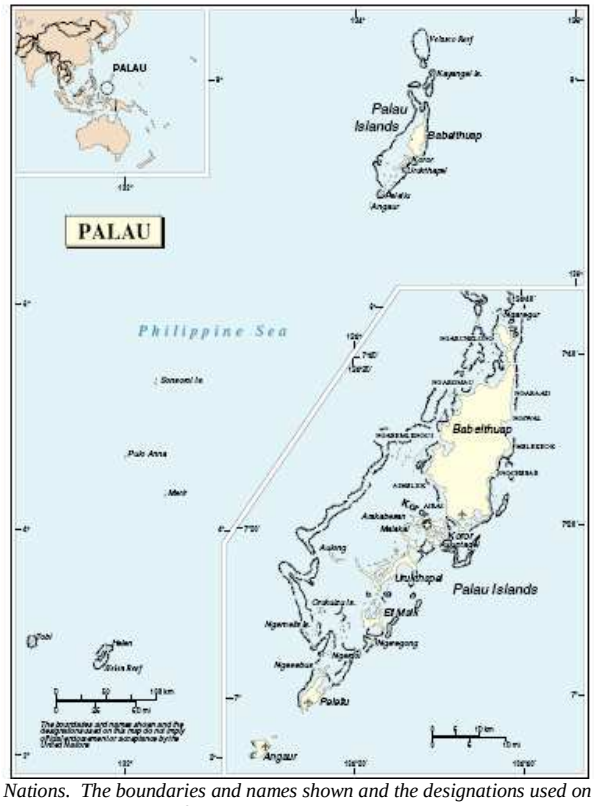
Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

Recent studies on the epidemiology of STH in the Northern Mariana Islands were not available at the time of publication. The Northern Mariana Islands are not endemic for lymphatic filariasis, and no MDAs have been carried out on the island in conjunction with PacELF activities (WHO 2006).

Palau



Map courtesy of the United Nations. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
21,000	26	8

Source: United Nations Economic and Social Commission for Asia and the Pacific

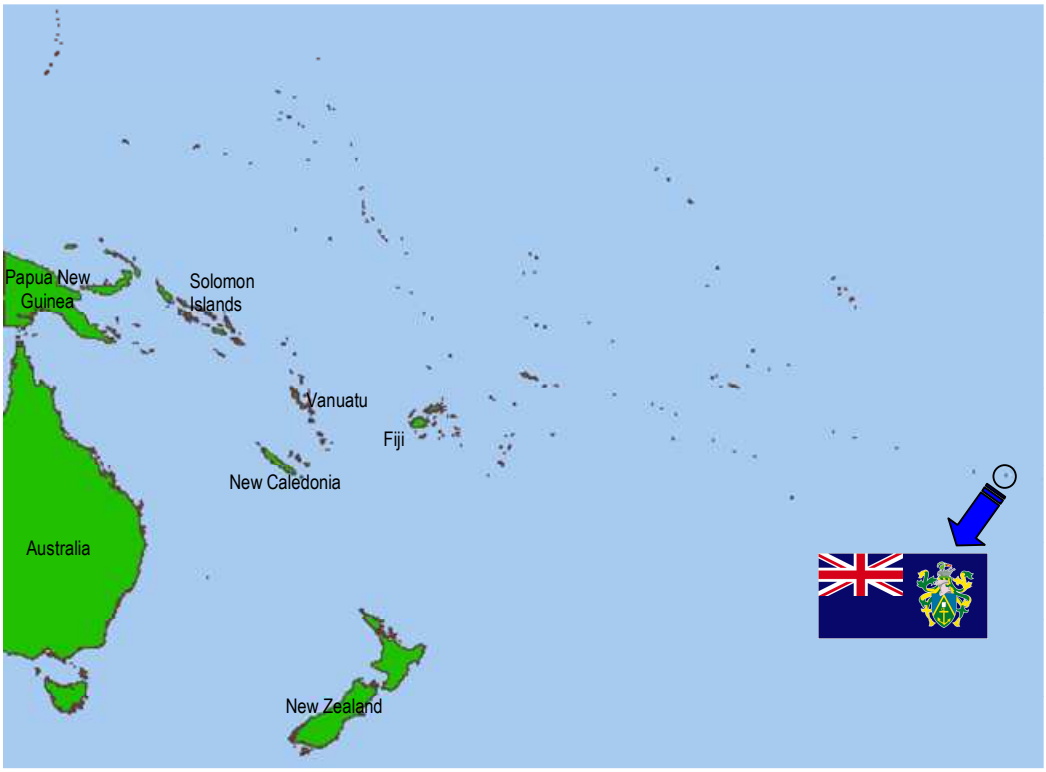
Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

Recent studies on the epidemiology of STH in Palau were not available at the time of publication. Though lymphatic filariasis is partially endemic in Palau, no MDAs have been carried out on the island in conjunction with PacELF activities (WHO 2006).

Pitcairn Islands



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population
48 (age groups not available)

Source: CIA World Factbook

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

Recent studies on the epidemiology of STH in the Pitcairn Islands were not available at the time of publication. The Pitcairn Islands are not endemic to lymphatic filariasis, and no MDAs have been carried out on the island in conjunction with PacELF activities (WHO 2006). More research needs to be conducted to determine the extent of helminth infection and its affect on health.

Samoa

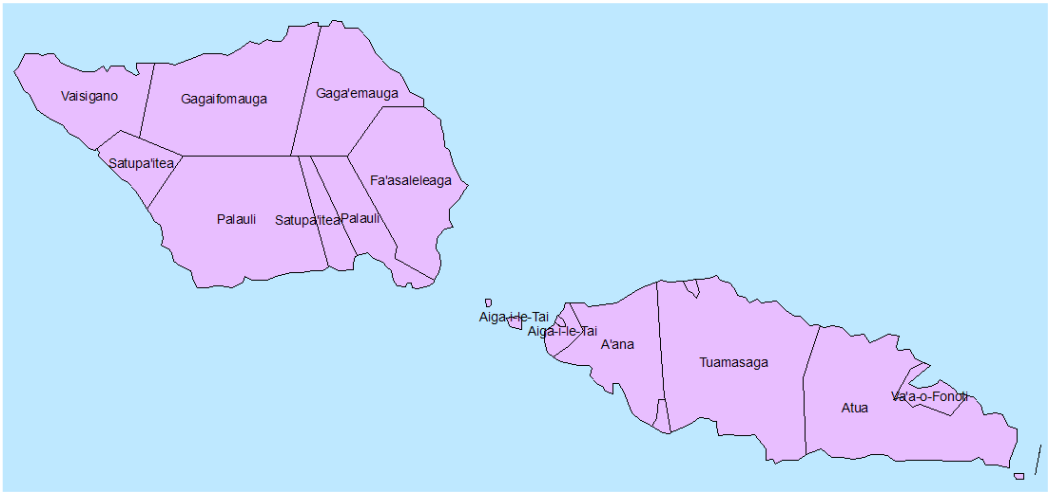


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Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
185,000	25	27	23	20	25	24	19	10	4	19.3

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

Recent studies on the epidemiology of STH in Samoa were not available at the time of publication. MDAs with DEC and albendazole were carried out from 1999-2003 (WHO 2006) and again in 2006 (Palmer 2006) as part of the PacELF programme. The highest percentage of the population treated between 1999-2003 was estimated to be 84.5% in 1999. Epidemiological surveys are needed to understand the prevalence of STH on these islands, and whether the PacELF MDAs are a sufficient means for STH control.

Solomon Islands

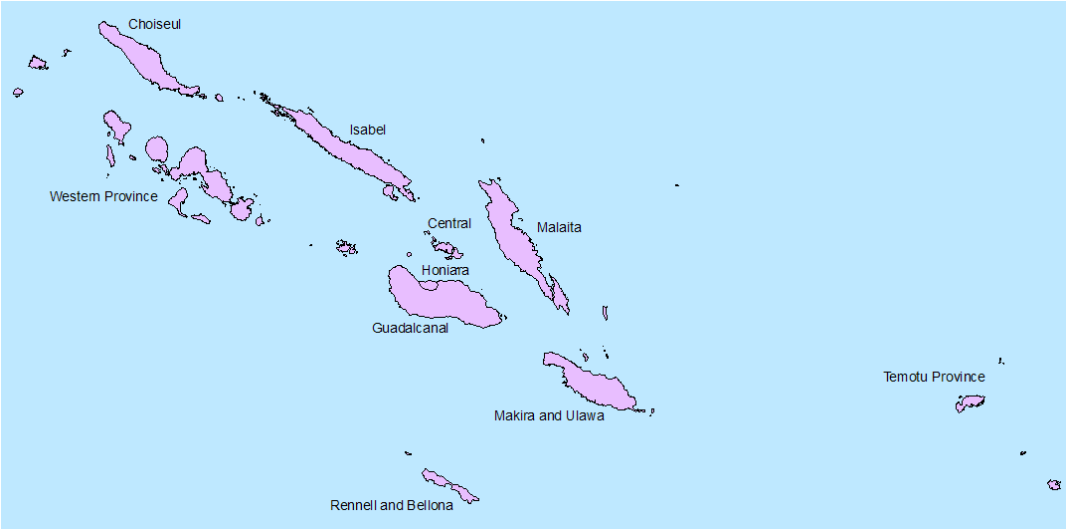

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Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
484,000	70	65	59	52	88	65	39	25	9	19.4

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, 41% of 59 students surveyed in the urban test site were positive for helminth infection. All three species of STH were recorded, though hookworms were the most prevalent. All infections were of light intensity. In the rural test site, 45% of the 40 students tested were positive for helminth infection. Again, all three STH species were recorded, with Trichuris and hookworm nearly equal in prevalence. Most infections were light, though a few moderate infections with Trichuris were noted (Hughes et al. 2004).

Tokelau

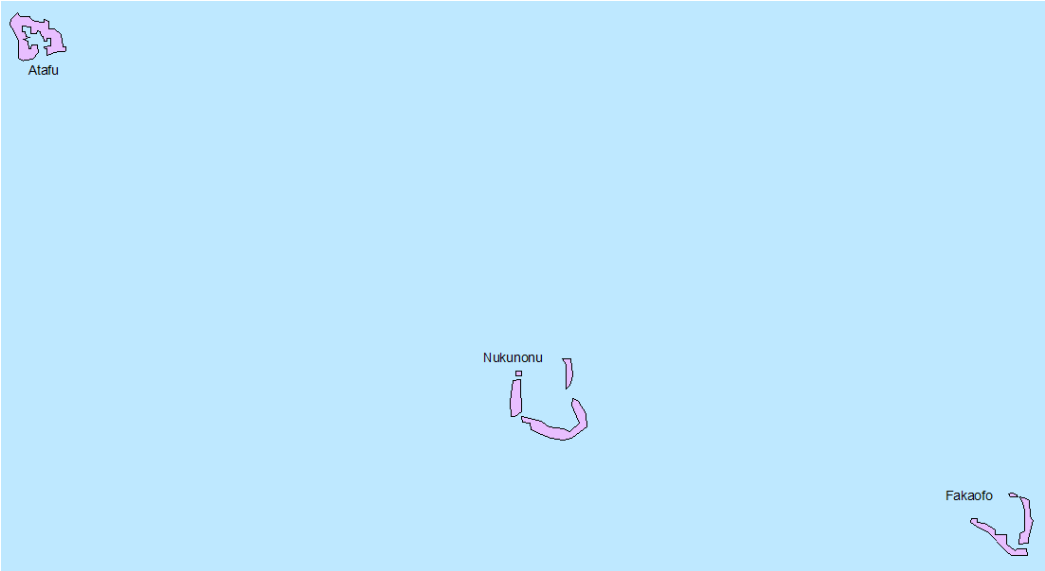

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Table 1: Population by Age Group

Total Population
1,449 (age groups not available)

Source: United Nations Economic and Social Commission for Asia and the Pacific

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

Recent studies on the epidemiology of STH in Tokelau were not available between 1997-2008. Lymphatic filariasis is not endemic to Tokelau, and no MDAs have been carried out on the island in conjunction with PacELF activities (WHO 2006). More research needs to be conducted to determine the extent of helminth infection and its affect on health.

Tonga

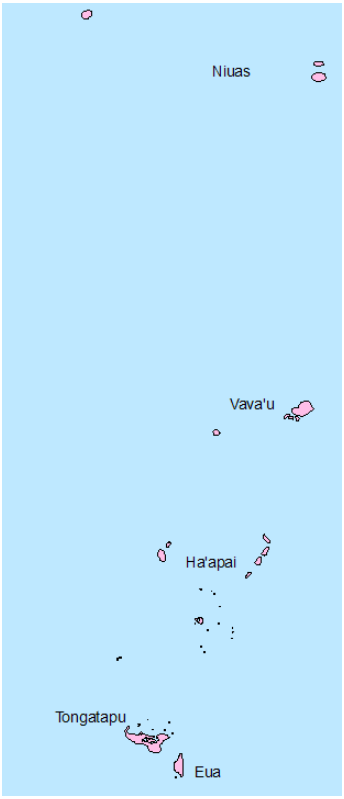

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Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
100,000	12	12	13	11	19	10	7	6	3	20.6

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, 8% of the 96 students from the urban test site were positive for helminth infection; all of cases were light infection with Trichuris. At the rural test site, 13% of the 120 students tested were positive for helminth infection. Light infections with all three species of STH were documented, with hookworm being the most prevalent.

MDAs with DEC and albendazole were carried out from 1999-2003 as part of the PacELF program. The highest percentage treated was estimated at 91% of the population in the 2003 campaign (WHO 2006). Whether this programme has also contributed to the low helminth prevalence has yet to be evaluated.

Tuvalu

Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-14 (000)	60 + (000)
10,000	34	8

Source: United Nations Economic and Social Commission for Asia and the Pacific

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, 88% of the 32 students surveyed in the urban site were positive for infection with either Trichuris or hookworm. Infection with Trichuris was more common, and both light- and medium-intensity infections were recorded. In the rural test site, 100% of all 86 students surveyed were positive for Trichuris. The majority of these cases (44%) were heavy infections (Hughes et al. 2004). Tuvalu had the highest prevalence of soil-transmitted helminth infection recorded in any country during the PIS survey.

Following this survey, MDAs of diethylcarbamazine (DEC) and albendazole were administered to all residents two years or older as part of the Pacific Eliminate Lymphatic Filariasis (PacELF) effort (Speare et al. 2006). The coverage was estimated at 81% of the population in 2001, 47% in 2002, and 83% in 2003 (Speare et al. 2006); additional campaigns have since been carried out in 2004 and planned for 2005 (WHO 2006).

Following these MDAs, another study was conducted in 2004 to examine the effects of the campaign. The study surveyed the residents of the island of Nukufetau, where the survey of the urban test site for the 2001-2002 PIS was also conducted. Out of the 206 specimens that were collected (35% of the population on the island), 70% of the islanders were infected with STH (Speare et al. 2006; see Figure 1). Most of these were Trichura infections, though some infection with hookworm was also recorded. When comparing the 2001 data for children from 5-12 years with the 2004 survey results, the prevalence of Trichuris had declined slightly from 84% to 75%; light (57%), medium (16%) and heavy (2%) infections were still observed in the 2004 study (Speare et al. 2006). A significant 95% reduction in hookworm infection among this age group was noted, though infection was still high among adults (Speare et al. 2006).

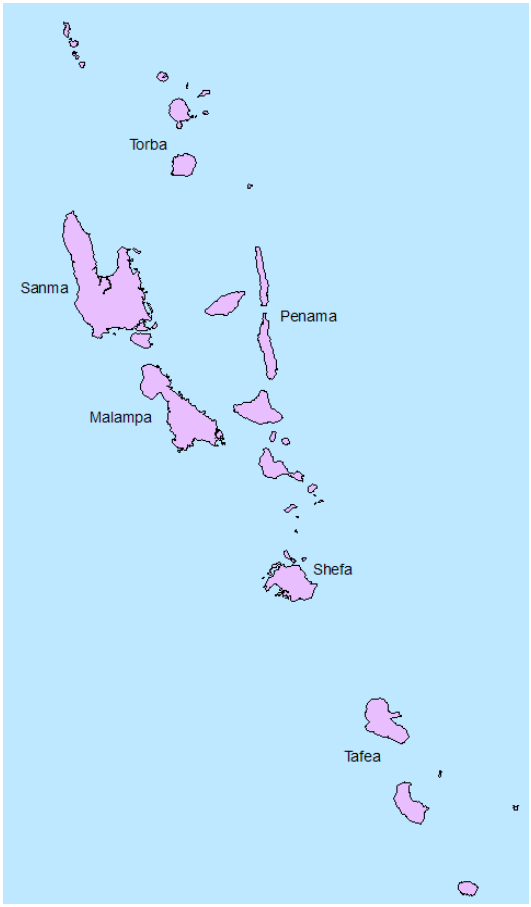
Table 2: Results from the 2004 STH Prevalence Survey by Speare et al.

Age group (years)	Total population	Number examined (% pop of age group)	Hookworm positive (%)	*Trichuris* positive (%)	STH positive (%)	*Trichuris* Geometric Mean Intensity EPG*
0–9	171	62 (36.3)	1 (1.6)	43 (69.4)	43 (69.4)	54.2
10–19	95	26 (27.4)	1 (3.8)	19 (73.1)	19 (73.1)	67.6
20–29	51	6 (11.8)	0 (0.0)	5 (83.3)	5 (83.3)	40.9
30–39	70	15 (21.4)	3 (20.0)	10 (66.7)	10 (66.7)	35.3
40–49	79	25 (31.6)	5 (20.0)	16 (64.0)	17 (68.0)	17.6
50–59	52	37 (71.2)	9 (24.3)	27 (73.4)	27 (73.0)	56.0
60–69	47	23 (48.9)	3 (13.0)	13 (56.5)	14 (60.9)	20.3
≥70	20	12 (60.0)	2 (16.7)	8 (66.7)	9 (75.0)	35.5
Total	585	206 (35.2)	24 (11.7)	141 (68.4)	144 (69.9)	41.2
CI 0.95			9.5–13.9%	65.2–71.6%	66.7–73.1%	

Source: Speare et al. 2006

The authors of the 2004 study noted that, in comparison to a similar campaign in Indonesia, a lower prevalence of helminth infection would have been expected after 3 years of MDA (Speare et al. 2006). The authors suggested that another antihelminthic that has been proven to be more effective against Trichuris (such as mebendazole or ivermectin) should be used in place of albendazole for future campaigns (Speare et al. 2006). More tailored, STH-specific MDA and education campaigns separate from the PacELF program may be necessary to make a significant reduction in helminth prevalence in Tuvalu.

Vanuatu



Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population	0-4 Years (000)	5-9 Years (000)	10-14 Years (000)	15-19 Years (000)	20-29 Years (000)	30-39 Years (000)	40-49 Years (000)	50-59 Years (000)	60+ Years (000)	Median Age
221,000	31	29	27	25	37	28	20	13	4	19.6

Source: World Population Prospects: The 2006 Revision Population Database

Status of Soil-Transmitted Helminths (Source: Official)

Epidemiology

In 2002, a mid-term evaluation of the effects of a lymphatic filariasis MDA was conducted (see Table 2). At the rural Eratap school, the overall prevalence of helminth infection was 78.3% before the MDA, and 16.6% after the MDA; at the urban Freshwota school, the overall prevalence of infection was 54.3% before the MDA, and 13% after the MDA was administered. The results of the evaluation confirmed that, though helminth infection was greatly reduced after the MDA, the prevalence of infection was still high at these schools despite 2 years of treatment with albendazole and DEC. It was recognized that there was a need for further control measures beyond the LF MDA to reduce the infection rate (Vanuatu Ministry of Health 2008).

Table 2: Helminth Infection Before and After Lymphatic Filariasis MDA

			Ascaris		*Trichuris*		Hookworm		
School	No. Children (Male/female)	Mean Age (Years)	Prevalence (%)	GeoMean egg count per gram	Prevalence (%)	GeoMean egg count per gram	Prevalence (%)	GeoMean egg count per gram	% Mixed infections
Before MDA									
Eratap	60 (30/30)	10.3	58.3	49.1	28.3	4.0	53.3	24.1	50
Freshwota	46 (21/25)	11.5	32.6	6.8	19.6	1.3	41.3	6.8	30.4
After MDA									
Eratap	72 (38/33)	10	12.5	-	4.2	-	0	-	0
Freshwota	46 (23/23)	11.6	4.3	0.4	8.7	0.3	6.5	0.3	6.5
Pango	62 (30/32)	10.1	14.5	1.3	9.6	1.5	3.2	0.2	4.8
Vila Not	67 (37/30)	11	9	0.8	6	0.3	4.5	0.2	3
Manua	84 (47/37)	10.7	6	-	2.4	-	0	-	0

Source: Vanuatu Ministry of Health

Control Strategy

Vanuatu introduced a helminth control programme in 2005, targeting children aged 5-15 years old and placing emphasis on primary school children. The programme was introduced to primary schools throughout the country. IEC materials were also produced and distributed to schools and health facilities. The goal of the materials was to inform the community about the programme, highlight ways to prevent infection, and promote awareness among children and the entire community (MOH Vanuatu 2008).

In 2008, two rounds of deworming treatment are planned (February and July), with two rounds of spot-check monitoring conducted in both schools and health facilities. After 3 years of implementation, the programme is in need of overall evaluation and critiques on specific issues to help guide the programme in the future. The MOH requested technical assistance to develop a monitoring and evaluation framework for the programme (MOH Vanuatu 2008).

The MOH also distributed materials such as cement, mesh wire, and PVC pipe intended for construction of the base of ventilated improved pit toilets (VIPs). The programme experienced difficulties with completing projects at the school level, as materials to finish the toilets were supposed to be provided by the school committees and parent-teacher associations. Most schools could not meet the cost of building the toilets, and some schools that received the materials for the initial stages of the project could not complete the toilet for student use. Access to clean water at the primary school level was recognized as an additional necessary improvement to sanitation, but was not planned for 2008 due to insufficient funding (MOH Vanuatu 2008).

In 2007, a programme was initiated to include deworming tablets within the existing delivery of medical supplies to the provinces. However, it was acknowledged that it will take time for health workers to become familiar with this new information. More general awareness of helminth control is needed to ensure that health workers and school teachers are provided with updated information and reminders regarding the programme (MOH Vanuatu 2008).

Status of Soil-Transmitted Helminths (Source: Published Data)

In the 2001-2002 PIS, 31% of the 77 students at the urban test site were positive for helminth infection; primarily light infection with hookworm, Trichuris, and Ascaris were all documented. In the rural test site, 66% of the 73 students tested were positive for helminths. Infection at this site included light- and moderate-intensity infections for all three species, as well as a small percentage of heavy hookworm infections (Hughes et al. 2004). The presence of moderate- and high-intensity hookworm infection is concerning, given the high correlation between hookworm intensity and anaemia.

MDAs with DEC and albendazole were carried out from 2000-2004 as part of the PacELF program. The highest percentage treated was estimated at 80% of the population in the 2000 campaign (WHO 2006). These MDAs have helped to reduce the helminth burden, though additional interventions are necessary to prevent reinfection (see "Source: Official").

Wallis and Futuna

Source: World Health Organization. The boundaries and names shown and the designations used on this map do not imply the expression of an opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table 1: Population by Age Group

Total Population
16,309 (age groups not available)

Source: CIA World Factbook

Status of Soil-Transmitted Helminths (Source: Official)

No data were available on soil-transmitted helminths from health authorities from 1997-2008.

Status of Soil-Transmitted Helminths (Source: Published Data)

Recent studies on the epidemiology of STH in Wallis and Futuna were not available at the time of publication. Mass drug administration of DEC for lymphatic filariasis has been ongoing since 1978. Control of lymphatic filariasis MDAs was given to PacELF in 2002, and yearly MDAs were been planned until 2006 (WHO 2006). More studies need to be conducted to assess the prevalence of STH on the islands, as well as the possible effects of the MDAs on STH prevalence.

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