# Epidemiology of Parasitic Infections in the Philippines: Focus on Intestinal Parasitoses

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# Major Parasitic Infections in the Philippines

- **SOIL-TRANSMITTED HELMINTHIASIS**
- **FOOD AND WATER BORNE PARASITIC INFECTIONS**
- **VECTOR-BORNE PARASITIC INFECTIONS**
  - Malaria
  - **Schistosomiasis**
  - Lymphatic Filariasis

# Neglected Tropical Diseases (NTDs)

- Have burdened humanity since the beginning of recorded history
- Recently identified as **“targets of opportunity”** in the effort to improve global health
- **Targeted for control or elimination** due to remarkable scientific breakthroughs and unprecedented corporate philanthropy

*Elephantiasis as observed by a European traveler, 1614 A.D.*

*Schistosomiasis in a female corpse from Western Han Dynasty*

# “Targets of Opportunity”
(WHO, CDC)

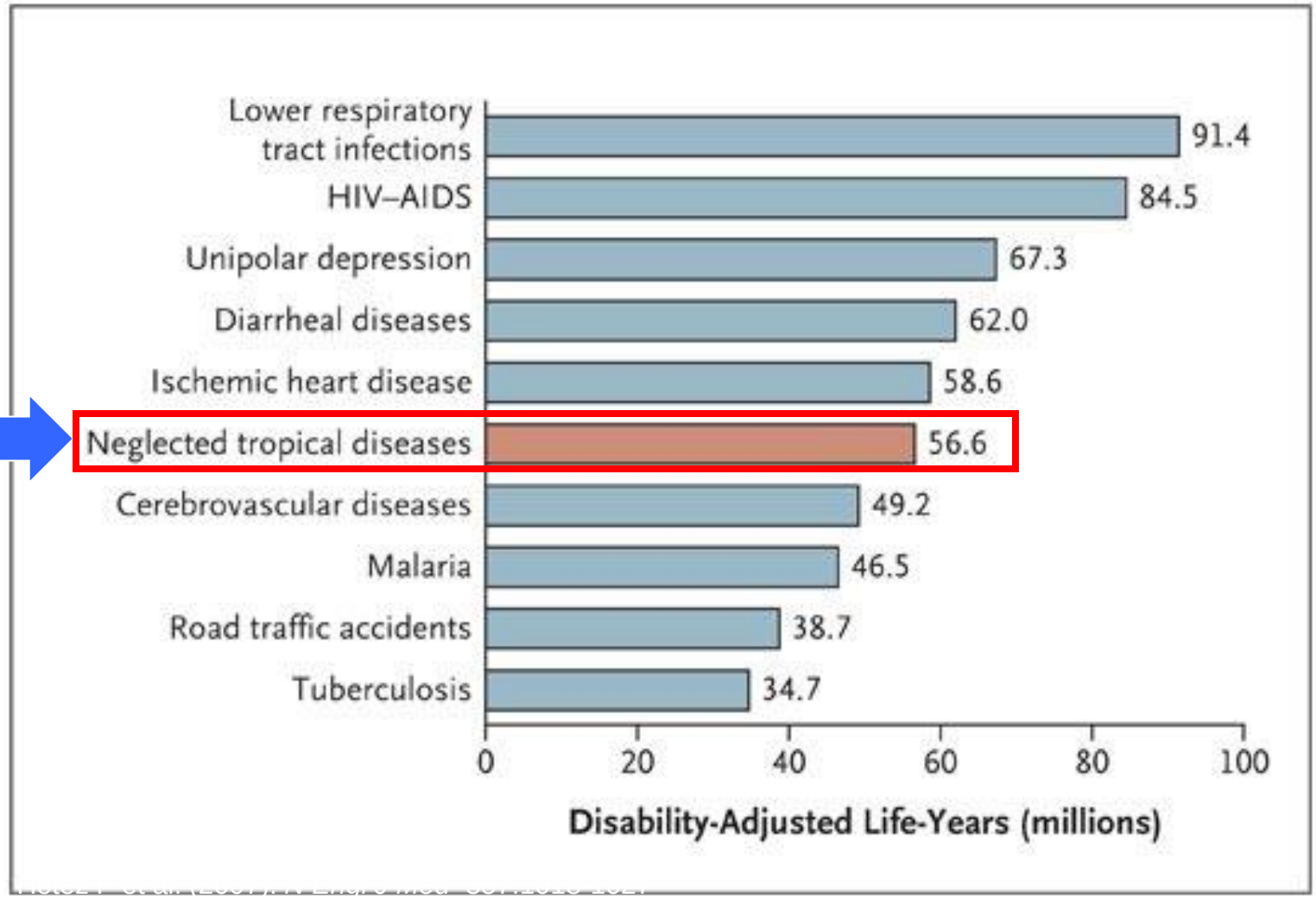
- **Soil-transmitted helminthiasis** (ascariasis, trichuriasis, hookworm infection)
- **Schistosomiasis**
- **Lymphatic filariasis** (elephantiasis)
- **Leprosy**
- **Foodborne trematodiases**
- **Strongyloidiasis**
- **Neurocysticercosis**
- **Dengue**
- **Scabies**
- Treponematoses
- Leptospiprosis
- Other tropical infections

# The Collective Impact of NTDs

- **Diseases of poverty**
  - Causing enormous disability and suffering
  - Greater susceptibility to often fatal diseases
- **Over 50 million future years of disability-free lost** (Hotez *et al*., 2007)

- **Endemic in over 100 of the poorest countries in Africa, Asia and Latin America** – most often with **multiple diseases** affecting any given community --- ***The Philippines is "in"*** ☹

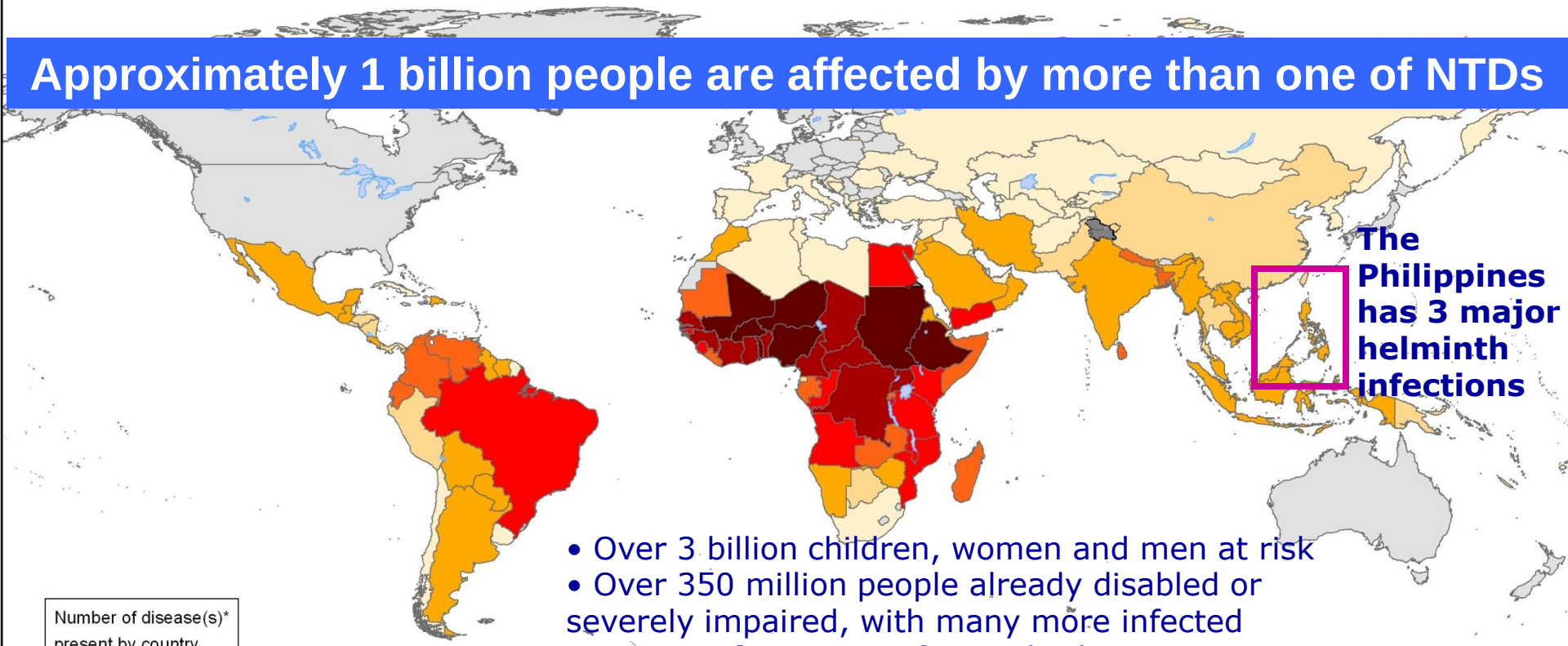
# The 10 Leading Causes of Life-Years Lost to Disability and Premature Death Globally




Hotez P et al. (2007). *N Engl J Med* 357:1018-1027

# Number of neglected diseases* present by country

## Approximately 1 billion people are affected by more than one of NTDs




- Over 3 billion children, women and men at risk
- Over 350 million people already disabled or severely impaired, with many more infected
- **Tremendous costs** for medical treatments that drain resource-scarce health systems
- Equally **high social and economic toll**, as physical incapacitation limits school attendance and impairs work productivity, at a cost of over $10 billion annually

Number of disease(s)* present by country
1
2
3
4
5
6
7

*Chagas
Dracunculiasis
Lymphatic filariasis
Leprosy
Leishmaniasis
Onchocerciasis
Schistosomiasis
Soil transmitted helminths

World Health Organization

The boundaries and names shown and the designations used on this map do not imply the expression of any 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. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: WHO
Map Production:
Public Health Mapping and GIS
Communicable Diseases (CDS)
World Health Organization

**Table 1.** The Major Neglected Tropical Diseases Ranked by Prevalence.*

| Disease | | Global Prevalence (millions) | Population at Risk | Regions of Highest Prevalence | Source |
|---|---|---|---|---|---|
| Ascariasis | * | 807 | 4.2 billion | East Asia and Pacific Islands, sub-Saharan Africa, India, South Asia, China, Latin America and Caribbean | Bethony et al.,[6] de Silva et al.[7] |
| Trichuriasis | * | 604 | 3.2 billion | Sub-Saharan Africa, East Asia and Pacific Islands, Latin America and Caribbean, India, South Asia | Bethony et al.,[6] de Silva et al.[7] |
| Hookworm infection | * | 576 | 3.2 billion | Sub-Saharan Africa, East Asia and Pacific Islands, India, South Asia, Latin America and Caribbean | Bethony et al.,[6] de Silva et al.[7] |
| Schistosomiasis | * | 207 | 779 million | Sub-Saharan Africa, Latin America and Caribbean | Steinmann et al.[8] |
| Lymphatic filariasis | * | 120 | 1.3 billion | India, South Asia, East Asia and Pacific Islands, sub-Saharan Africa | Ottesen,[9] WHO[10] |
| Trachoma | | 84 | 590 million | Sub-Saharan Africa, Middle East and North Africa | International Trachoma Initiative,[11] Médecins sans Frontières[12] |
| Onchocerciasis | | 37 | 90 million | Sub-Saharan Africa, Latin America and Caribbean | Basáñez et al.[13] |
| Leishmaniasis | | 12 | 350 million | India, South Asia, sub-Saharan Africa, Latin America and Caribbean | Desjeux[14] |
| Chagas' disease | | 8–9 | 25 million | Latin America and Caribbean | WHO[15] |
| Leprosy | | 0.4 | ND | India, sub-Saharan Africa, Latin America and Caribbean | International Federation of Anti-Leprosy Associations[16] |
| Human African trypanosomiasis | | 0.3 | 60 million | Sub-Saharan Africa | Févre et al.[17] |
| Dracunculiasis | | 0.01 | ND | Sub-Saharan Africa | Carter Center[18] |
| Buruli ulcer | | ND | ND | Sub-Saharan Africa | Global Buruli Ulcer Initiative[19] |

* ND denotes not determined.

# INTESTINAL HELMINTHIASIS: A MAJOR PUBLIC HEALTH PROBLEM OF THE DEVELOPING WORLD

**ABOUT TWO BILLION OF THE WORLD'S POPULATION ARE CHRONICALLY INFECTED WITH INTESTINAL HELMINTHS.** (WHO)

**AS A CONSERVATIVE ESTIMATE, AT LEAST 20 MILLION FILIPINOS MAY BE CHRONICALLY INFECTED WITH INTESTINAL HELMINTHS.**


***True or False?***

***THE PHILIPPINES IS WORMY.***

# NON-PATHOGENIC AMEBAE > PATHOGENIC AMEBAE

## Biomedical Surveys 1967-1984

**US Naval Medical Research Unit 2**
(Cross and Basaca-Sevilla, 1985)

| Parasite/Organism | Prevalence (n~30,000) % |
|---|---|
| ***Trichuris trichiura*** | 65 |
| ***Ascaris lumbricoides*** | 44 |
| **Hookworm** | 35 |
| *Entamoeba coli* | 21 |
| *Endolimax nana* | 9 |
| ***Giardia lamblia*** | 6 |
| ***Entamoeba histolytica*** | 5 |
| *Entamoeba hartmanni* | 3 |
| ***Echinostoma sp.*** | 3 |
| ***Schistosoma japonicum*** | 3 |
| *Iodamoeba butschlii* | 1 |
| *Chilomastix mesnili* | 1 |

**Others (< 1%):** *E.vermicularis, Taenia sp., Paragonimus sp., C.philippinensis, Heterophyid, Diphyllobothrid, Opistorchid, B. coli, H.nana, H.diminuta,* ***Physaloptera sp., D. fragilis***

***THE PHILIPPINES: A HAVEN FOR PARASITES***

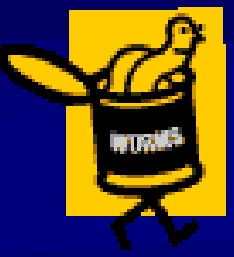
***But how much of these are you reporting?***

# INTESTINAL PARASITOSES IN THE PHILIPPINES

**Intestinal parasitism described as one of the most commonly occurring diseases in the country**

- **important cause of morbidity including diarrhea, malnutrition, and diminished productivity**
- **often times, affecting the poor and impoverished**

(DOH, National Objectives for Health 1999-2004)

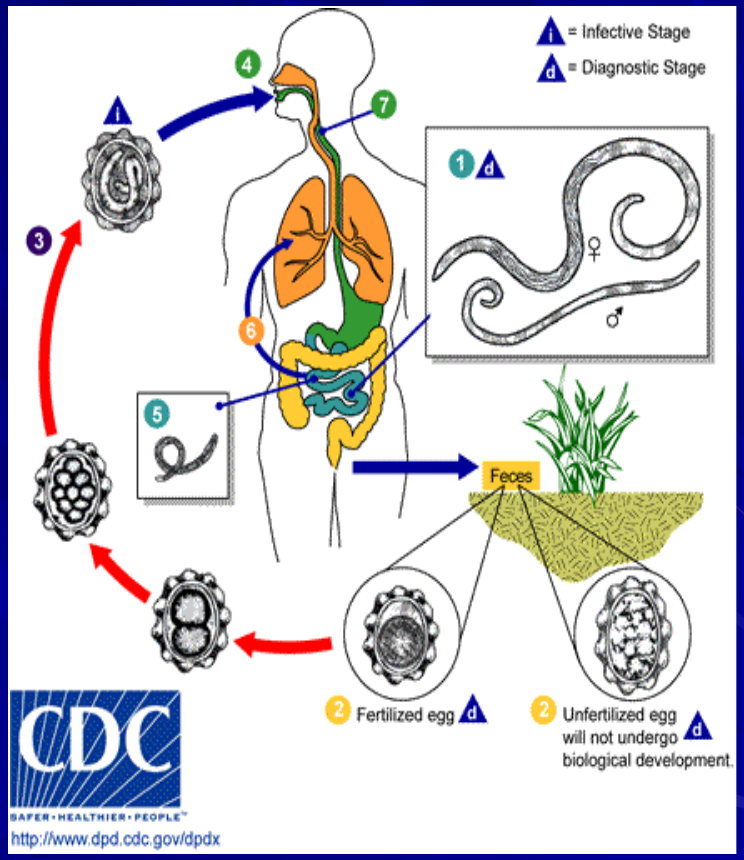


***3P's: People, Parasites, Poverty***

# Soil-Transmitted Helminthiasis (STH) (roundworm, whipworm, hookworm)

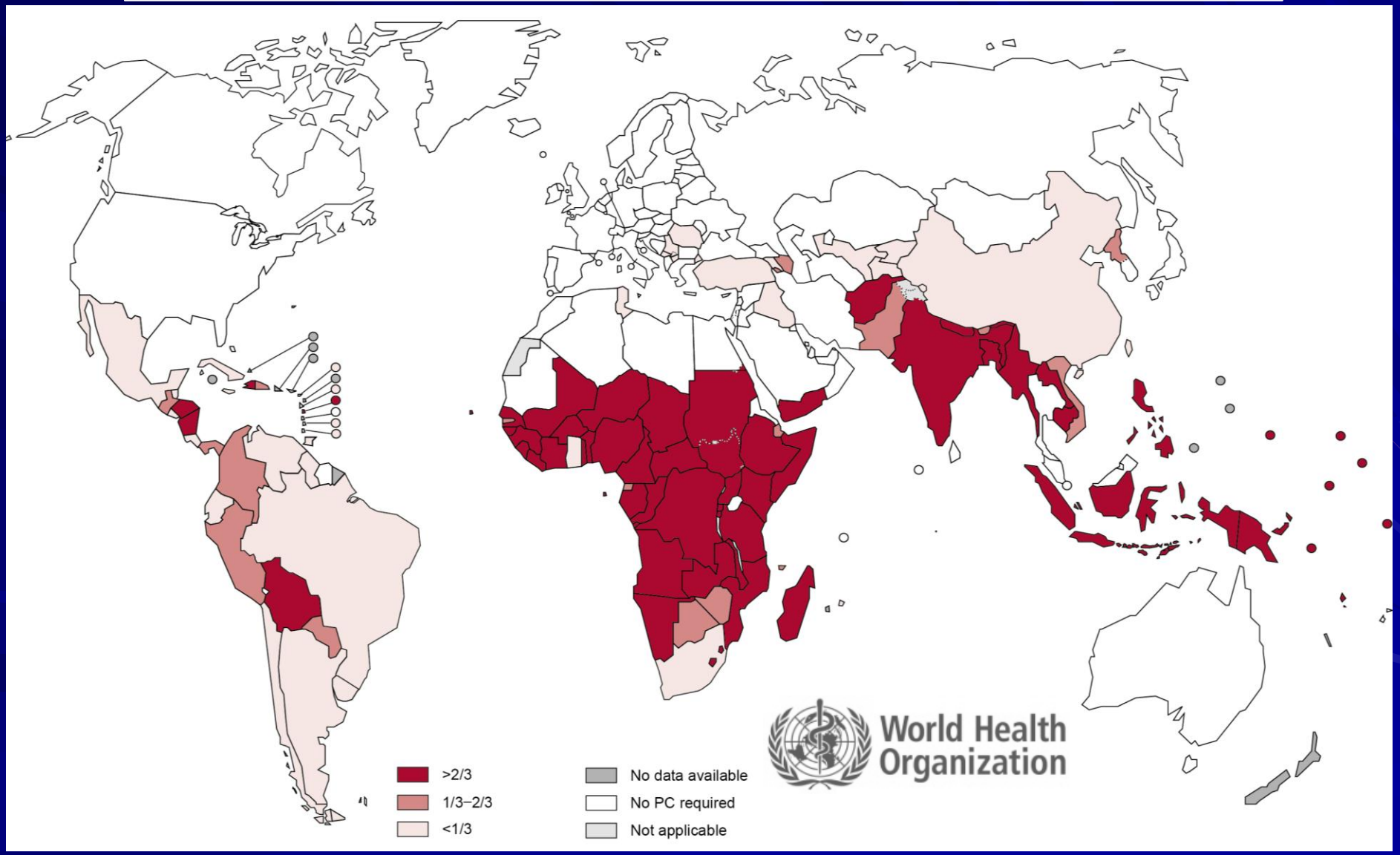
- Among the most common infections affecting the poorest and most deprived communities
- Caused by:
  - Ingestion of eggs from contaminated soil (*Ascaris* and *Trichuris*) or
  - Skin penetration by larvae from soil (hookworms)
- Poor environmental sanitation/ **open defecation** and poor hygiene among the major factors for exposure

***"People infecting people"***




Life cycle of *Ascaris*

# Proportion of children (1-14 years of age) in each country requiring preventive chemotherapy for STH
(WHO, 2011)



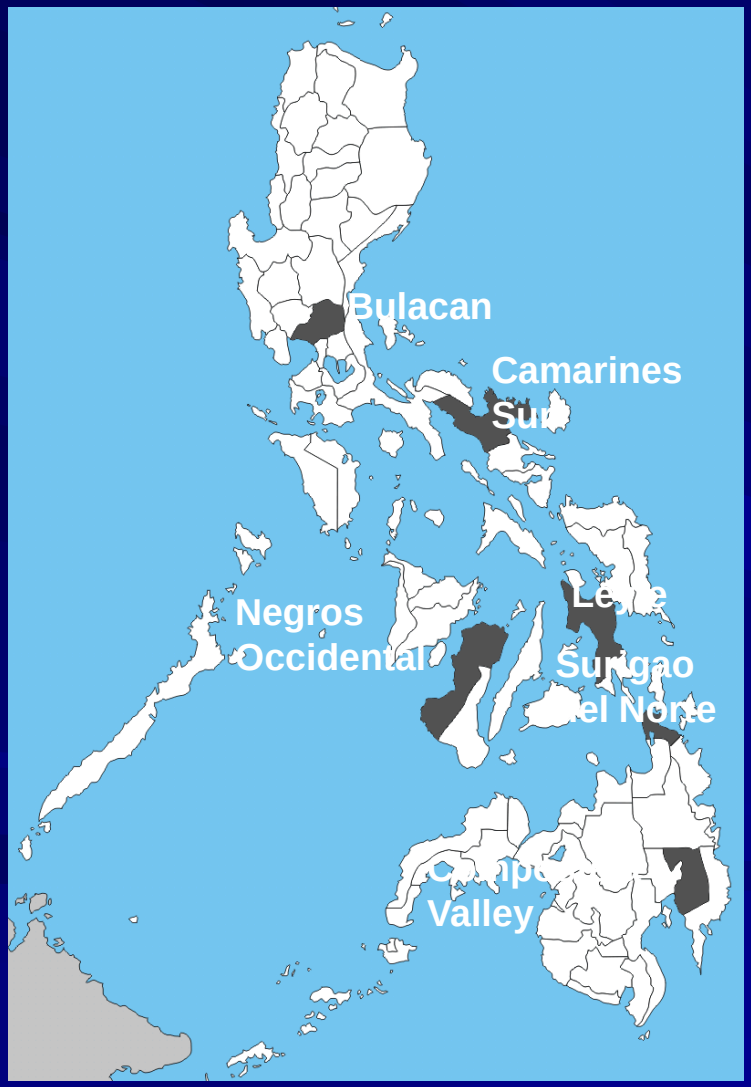
# Soil-transmitted Helminthiasis
## (ascariasis, trichuriasis, hookworm infection)

### Situationer

- **Affects more than 2 billion people worldwide**
  *Ascaris* infects 1.221 billion people, *Trichuris* 795 million, and hookworms 740 million (WHO)
- **In the Philippines, 66% of pre-school age children (PSAC) and 67% of school age children (SAC) infected with STH**
  (DOH/de Leon and Lumampao, 2004; Belizario *et al*., 2005)
- **54% of school age children (SAC) in sentinel sites prior to launch of DOH-IHCP (2006), 45% on ffup (2009)**
  (Belizario *et al*., 2009)

***The Philippines remains wormy*** ☹

# *How big a problem are worm infections?*
# Follow-up Sentinel Surveillance (2009)




**Cumulative prevalence of STH infections**

**Preschool-age children 43.7%** (16-67%)

*Ascaris* in 30.9%
*Trichuris* in 31.4%
Hookworm in 1.1%

**School-age children 44.7%** (15-61%)

*Ascaris* in 27.7%
*Trichuris* in 33.3%
Hookworm in 1.9%

***Baseline: PSAC=66%, SAC=67%***

(de Leon and Lumampao, 2004; Belizario *et al.*, 2013)

***WHO Target: <20%***

**Approximately <u>14 million children</u> are infected with intestinal worms**

# *How big a problem are worm infections?*
# Sentinel Surveillance (2011)


## Cumulative prevalence of STH infections

**Adolescent females 30.4%** (13-62%)

*Ascaris* in 16.3%

*Trichuris* in 20.4%

Hookworm in 2.8%

**Pregnant women 31.5%** (13-76%)

*Ascaris* in 18.8%

*Trichuris* in 20.4%

Hookworm in 5.5%

(Belizario *et al.*, 2012)

***WHO Target: <20%***

# What about STH Infections in Private Elementary School Children?

## Quezon City and Taguig City

**Cumulative prevalence = 14.4%**
**(4.4% - 32.0%)**

***None of the schools had zero prevalence***

***Up to 1 of 3 private school kids infected***

***Ascaris* = 8.3%**

***Trichuris* = 7.5%**

(Belizario *et al.*, 2005)

# STH impact on health and development, especially of children

## Morbidities

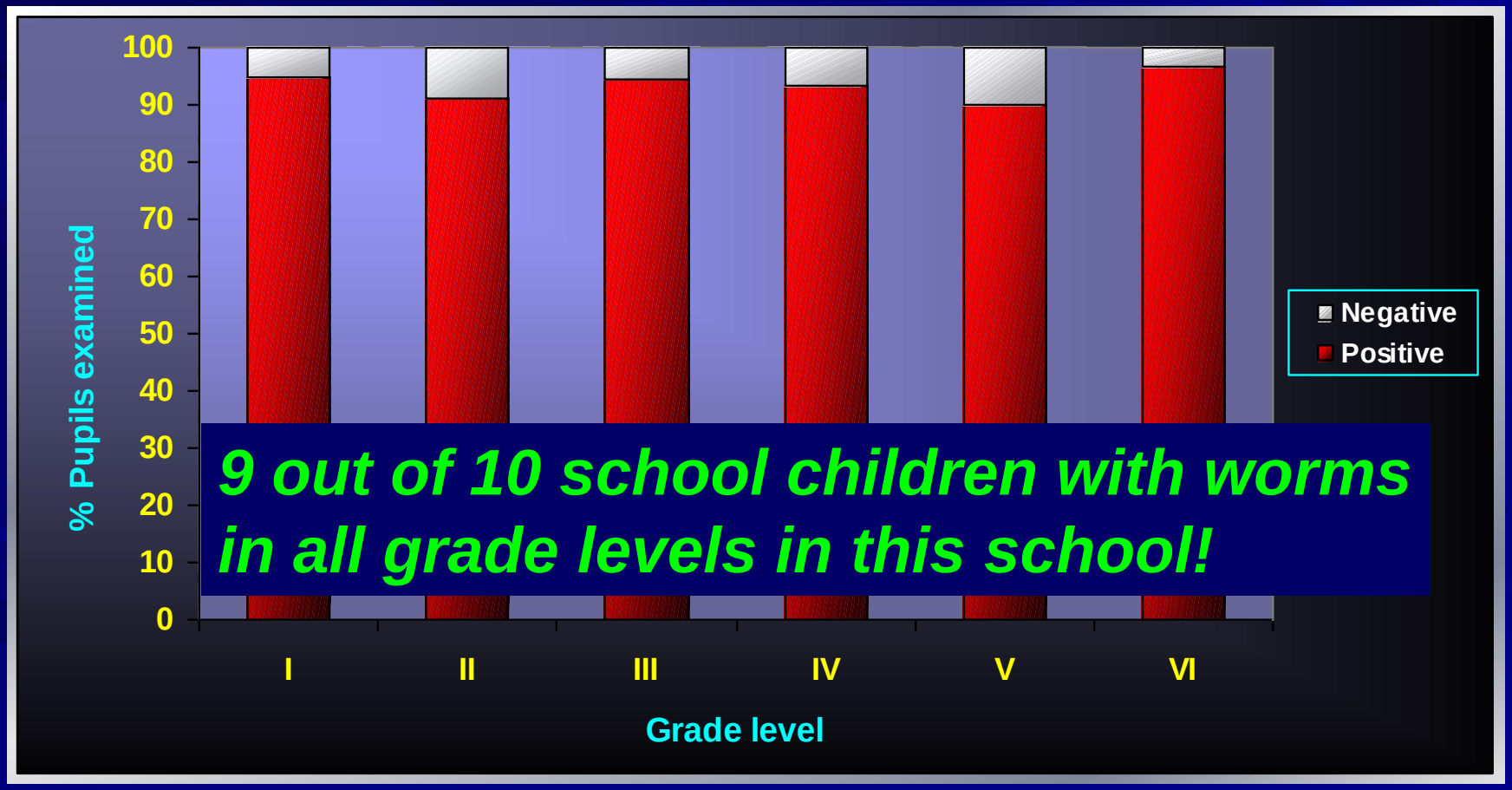
- Growth stunting (malnutrition)
- Decreased physical activity
- Poor mental and physical development that affect school performance (Easton, 1999)

Students from a school in Guimaras Island, Philippines (UP Manila, 2012)

**Heavy intensity STH** result in greater morbidity and complications, including intestinal obstruction, iron-deficiency anemia, and dysentery syndromes (Bethony, 2006)

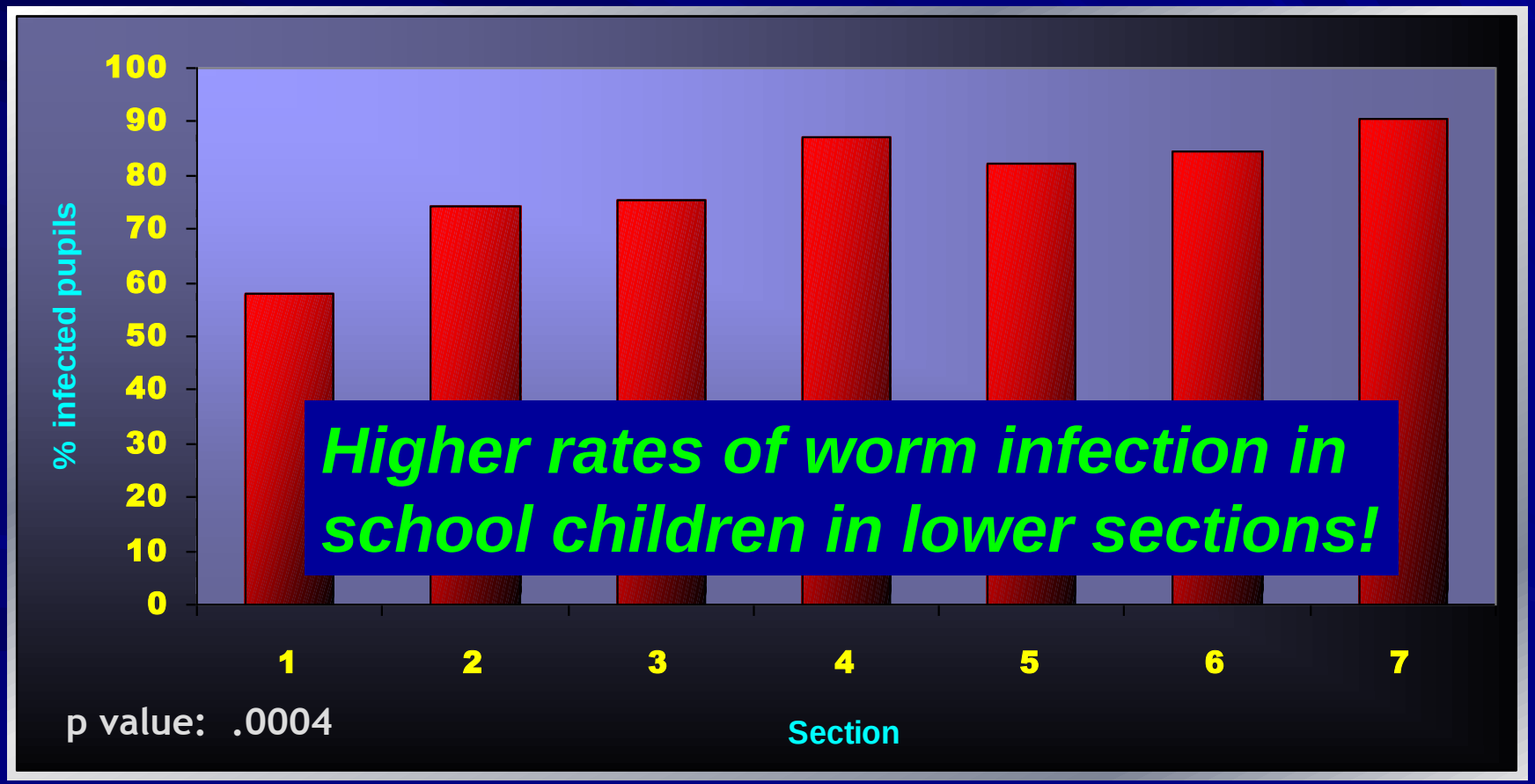
# Cumulative Prevalence of STH Infection According to Grade Level

**DESM, Biñan, Laguna, 1998**
(Belizario *et al.*, 2000)



# Cumulative Prevalence of STH Infection Among Grade III Pupils According to Section

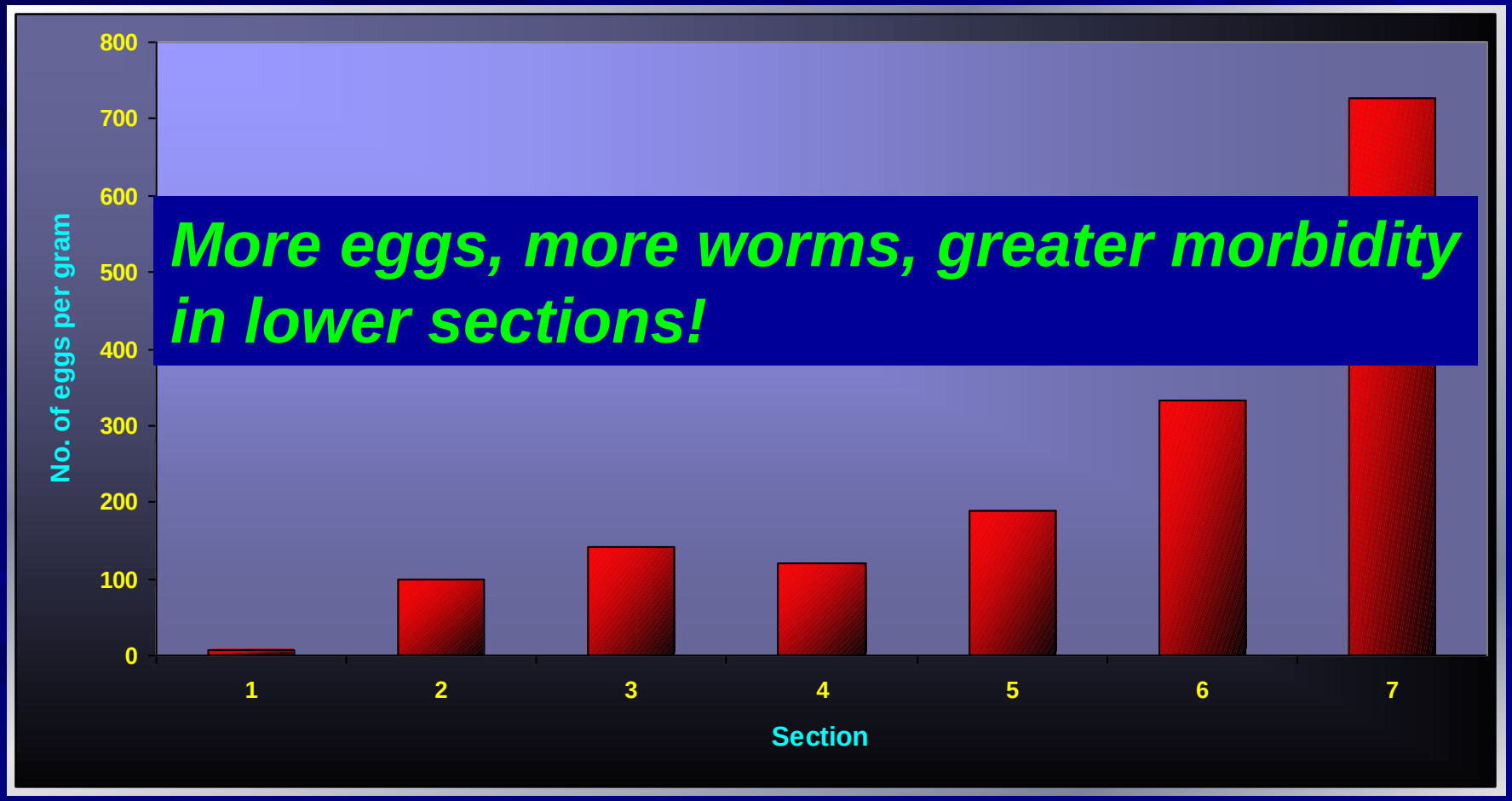
**SVES, Biñan, Laguna, 1999**
(Belizario *et al.*, 2000)



# Geometric Mean of *Trichuris* Eggs Among Grade III Pupils According to Section

**SVES, Biñan, Laguna, 1999**

(Belizario *et al.*, 2000)

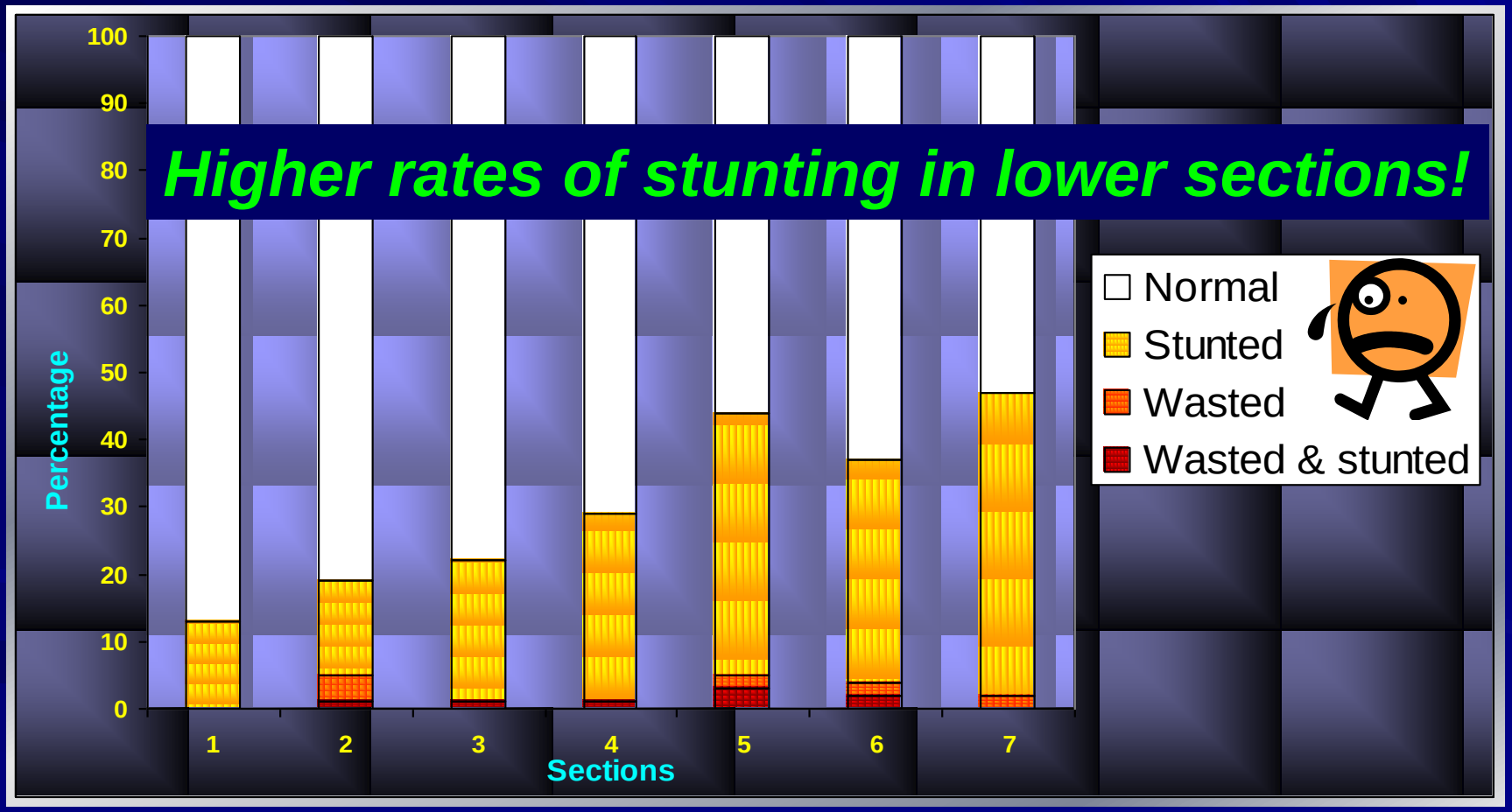


# Nutritional Status of Grade III Pupils

## (height for age & weight for height)

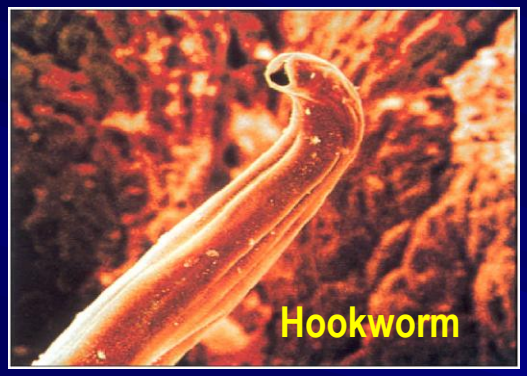
**SVES, Biñan, Laguna, 1999**

(Belizario *et al.*, 2000)



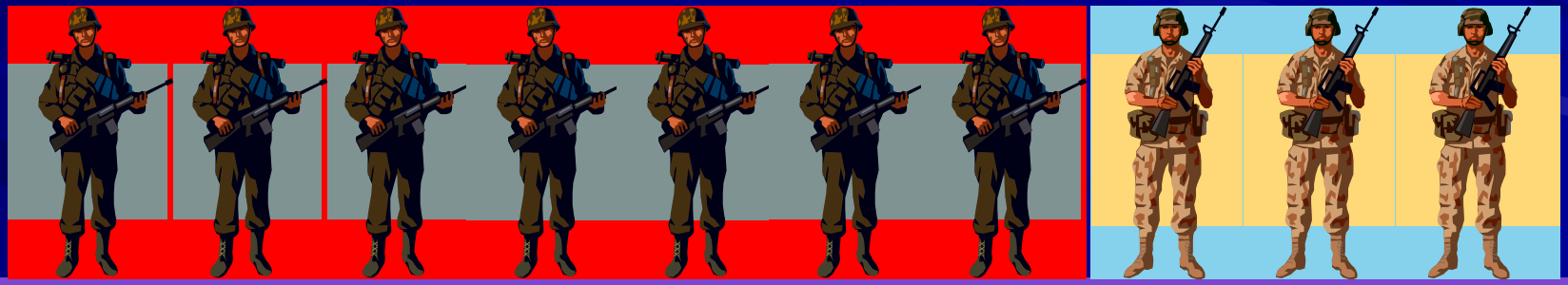
# STH Infections in the AFP Gamu, Isabela, 2005

(Belizario *et al*., 2005)




| | |
|---|---|
| **Cumulative Prevalence** | **74.4%** |
| **CAAC (CAFGU)** | **85.9%** |
| **Enlisted Personnel** | **44.8%** |
| **Hookworm Prevalence** | **46.9%** |

***Aren't they supposed to defend us?***



***7 out of 10 soldiers with STH, 1 of 2 with hookworm!***

# Basic Interventions for Reducing Helminth Infections *(WAR ON WORMS)*

Drug treatment - Morbidity control

Improvements in sanitation

Improvements in personal hygiene

Health education

# Soil-transmitted Helminthiasis

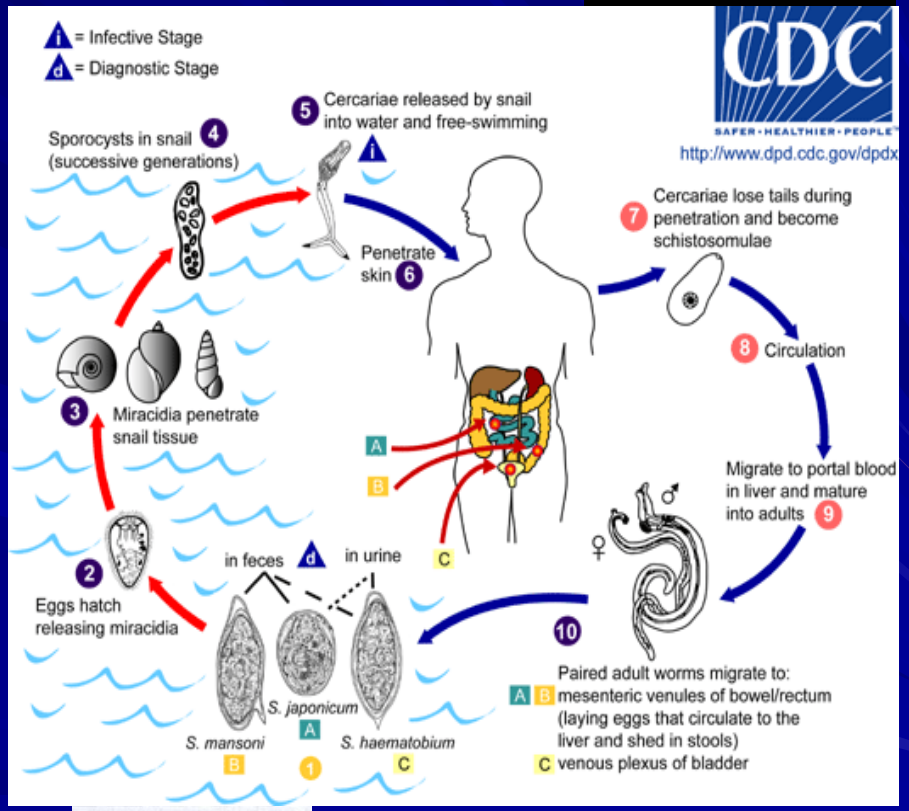
**World Health Assembly targets and deadlines**

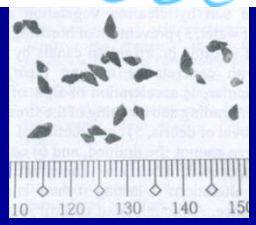
Member States "…to ensure access to essential drugs against…STH infections in all health services in endemic areas for the treatment of clinical cases and groups at high risk of morbidity such as women and children, with the goal of attaining a minimum target of regular administration of chemotherapy to at least 75% and up to 100% of all school-age children at risk of morbidity by 2010". (WHA54.19, 2001)

***WE ARE NOT APPROXIMATING OUR TARGETS***

# Schistosomiasis

- Caused by parasitic blood fluke that infect mammals, including humans
  - Skin penetration by infective cercariae after human contact with contaminated water
- Various animals, such as dogs, cats, rodents, pigs, horses, carabaos, cows, and goats serve as reservoir hosts
- Targeted for control/ elimination (?)
- Top 3: China, **Philippines** ☹, Indonesia



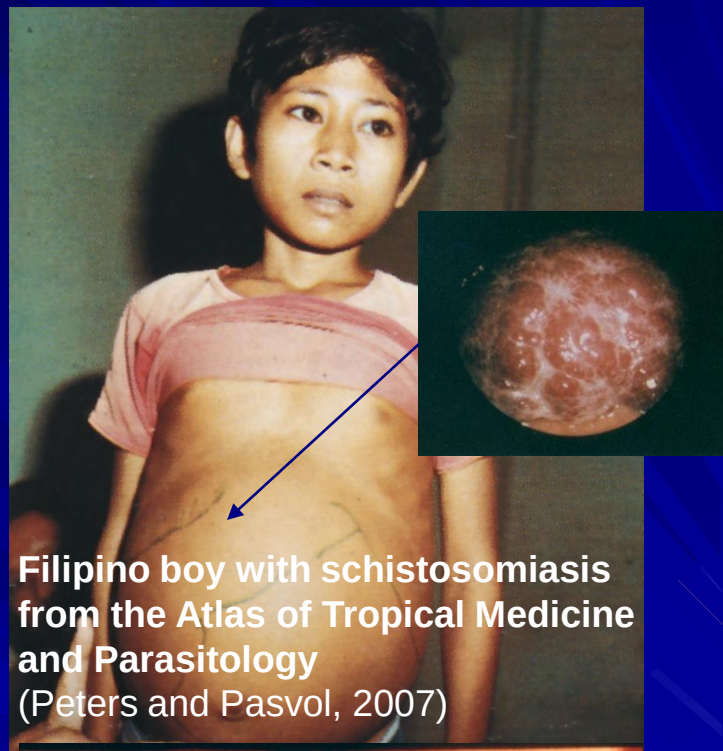
# Schistosomiasis

Situationer

- 207 million people living in 74 countries are infected
- 120 million are symptomatic
- 20 million with severe morbidity
- 280,000 deaths each year

(Chitsulo *et al.*, 2000; US Global Health Policy - Fact Sheet, 2009)

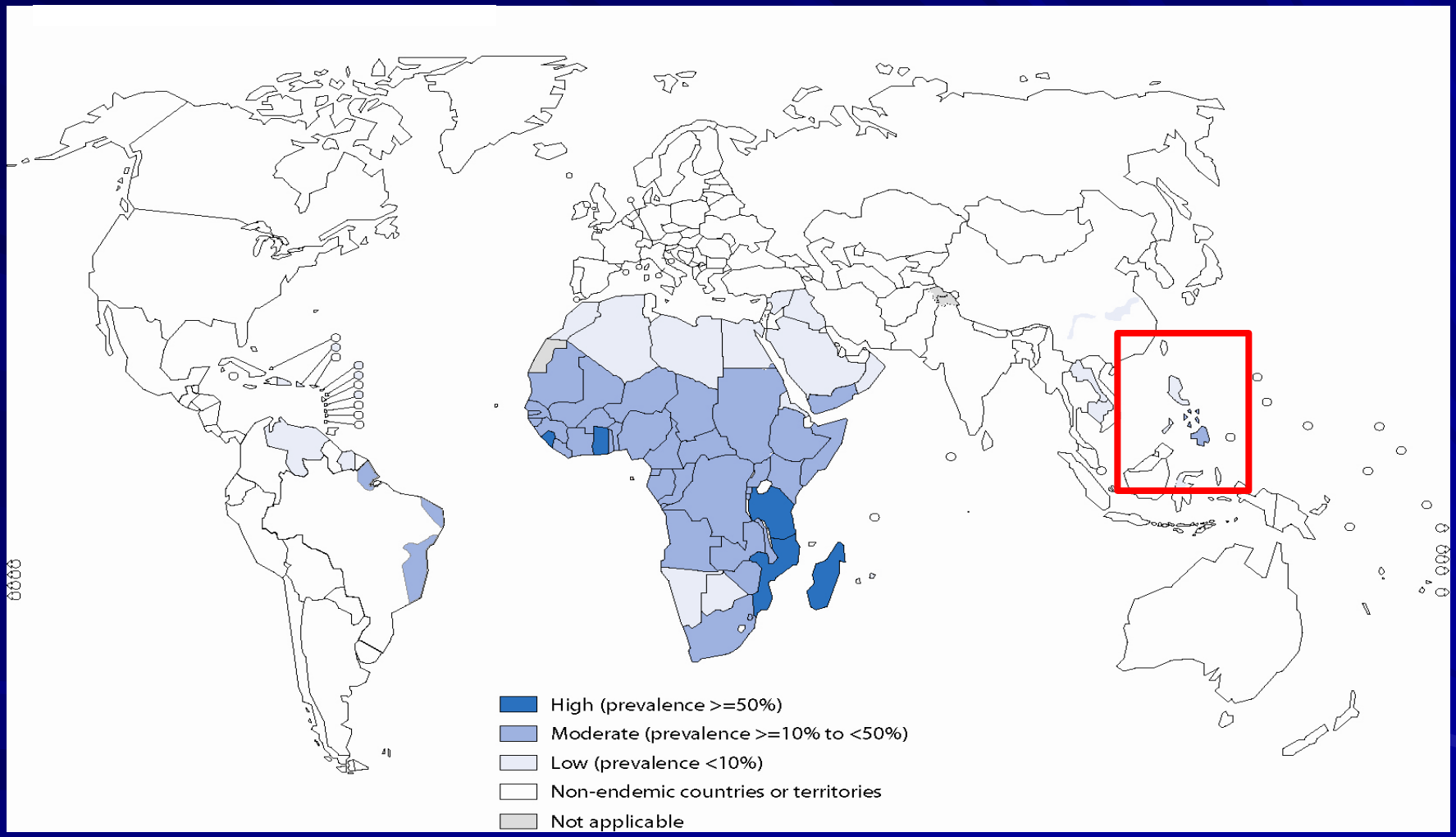
- Hepato-splenic schistosomiasis caused by *S. japonicum* (most deadly and difficult to control due to animal reservoir hosts)



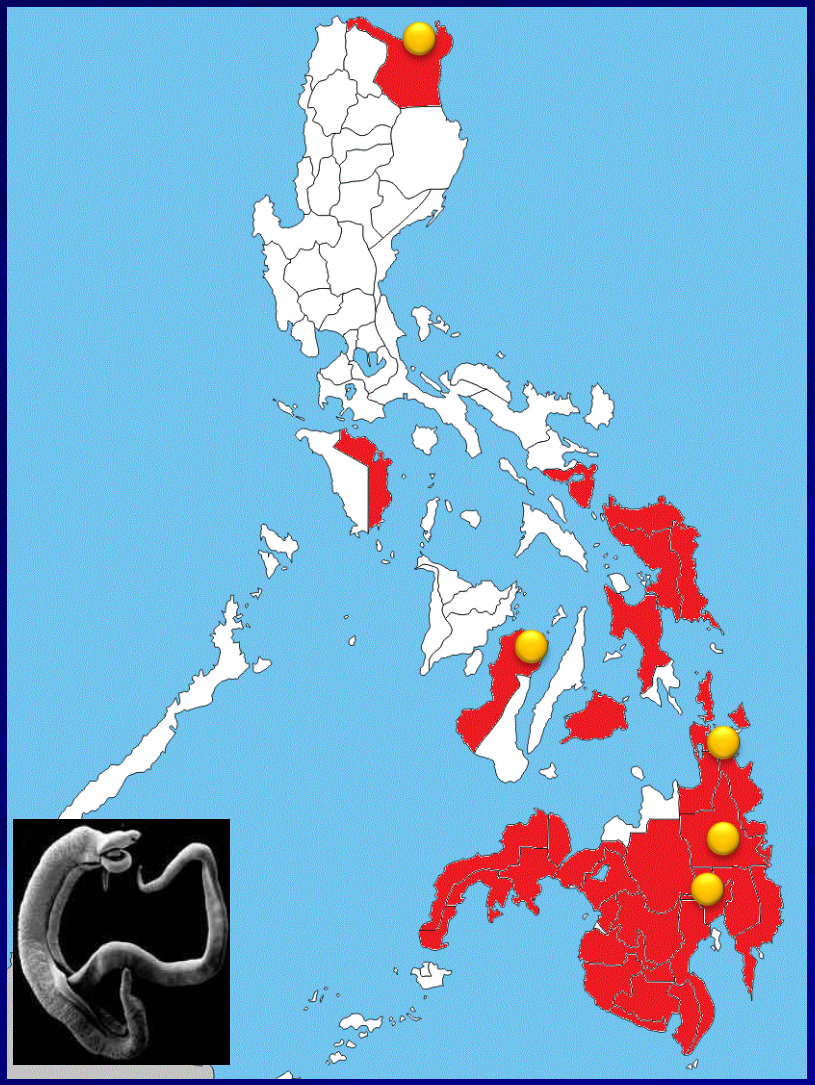
**Filipino boy with schistosomiasis from the Atlas of Tropical Medicine and Parasitology**
(Peters and Pasvol, 2007)


***S. japonicum* in the portal vein**

# Global Distribution of Schistosomiasis in 2010 (WHO)



# Schistosomiasis in the Philippines



- Endemic in 12 regions covering 28 provinces, focal distribution, emerging in more areas
- 6.8% in school-age children in Calatrava, **Negros Occidental**
- 3.1% in school-age children in Carmen and Sto. Tomas, Davao del Norte
- 4.8% in school-age children in Surigao del Norte
- 31.8% (5-70%) in school-age children in Bunawan and Trento, Agusan del Sur

(Belizario *et al.*, 2007, 2012, 2013)

***WHO/DOH Target: <1%***