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2008

SCI
Schistosomiasis Control Initiative

The underestimated burden of schistosomiasis and intestinal helminths

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The Neglected Tropical Diseases

Core Group of 13

- Protozoan Infections
  - **Human African Trypanosomiasis (HAT)**
  - **Chagas Disease**
  - **Leishmaniasis**
- Bacterial Infections
  - **Buruli Ulcer**
  - **Leprosy**
  - **Trachoma**
- Helminth Infections
  - **Ascariasis**
  - **Hookworm Infection**
  - **Trichuriasis**
  - **Schistosomiasis**
  - **Lymphatic Filariasis**
  - **Onchocerciasis**
  - **Dracunculiasis**

The United Nations Millennium Development Goals (MDGs) – we could speed progress towards most of the MDG's

1. Eradicate extreme poverty and hunger.
2. Achieve universal primary education.
3. Promote gender equality and empower women.
4. Reduce child mortality.
5. Improve maternal health.
6. Combat HIV/AIDS, malaria and other diseases.
7. Ensure environmental sustainability.
8. Develop a global partnership for development.

NTDs are included in "other diseases"

Why is it important to estimate burden of disease?

- Limited resources mean difficult choices

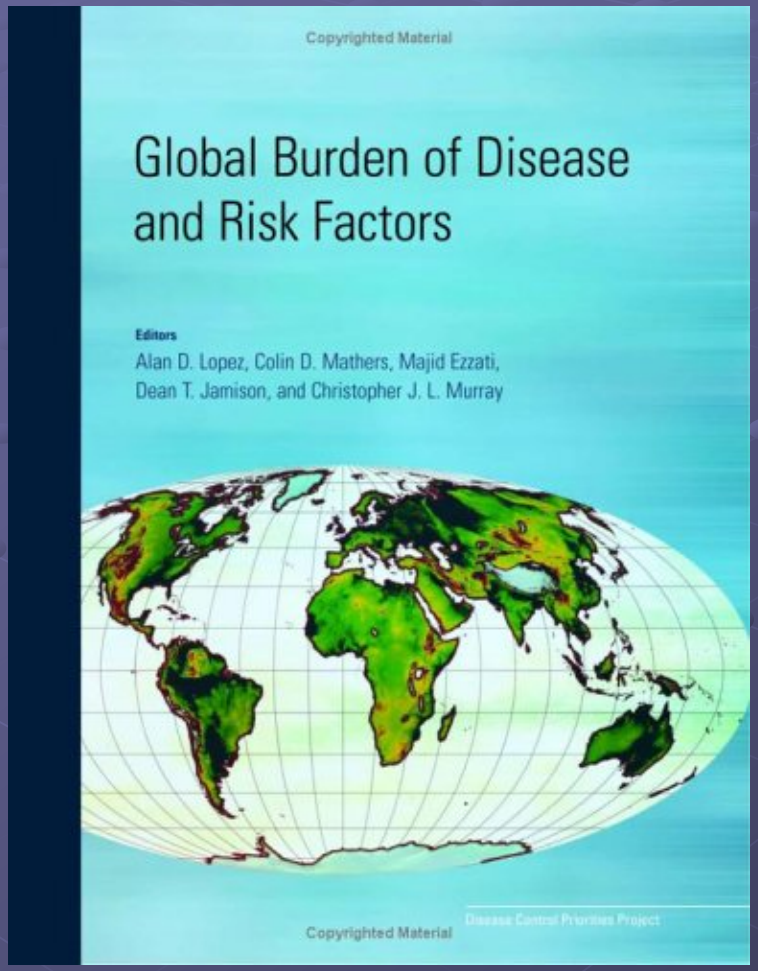
- Increasing pressure to justify choices in expenditure

  Decision-makers require scientific evidence to improve global public health

- Raising costs of health services as % GDP

Imperial College London

Global Burden of Disease



In 1992 the World Bank commissioned the initial GBD

Needed a single, holistic measure of overall population health

Harvard School of Public Health and World Health Organisation

Global Burden of Disease Study 2010

BILL & MELINDA GATES *foundation*

"The GBD 2010 study developed improved methods to make full use of the increasing amount of health data, particularly from developing countries, and included a comprehensive and consistent revision of disability weights.

Disability Adjusted Life Year (DALY)

- Takes into account mortality and morbidity
- Measurement of the gap between current health status & ideal situation of living into old age free of disease & disability
- 1 DALY is one lost year of 'healthy' life

Murray CJL, Lopez AD, eds: *The Global Burden of Disease: A comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Cambridge, MA: Harvard University Press on behalf of the World Health Organization and the World Bank; 1996

Information needed for DALYs

- Life expectancy
- Incidence of diseases by age category
- Sequelae of disease
- Duration of each sequelae
- Mortality rate by age category
- Disability weight

Disability Weighting

Disability Class	Severity Weight	Indicator condition
1	0.00 - 0.02	Vitiligo on face, **weight-for height less than 2 SDs**
2	0.02 - 0.12	**Watery diarrhoea**, severe sore throat, severe anaemia
3	0.12 - 0.24	**Radius fracture in a stiff cast**, infertility, erectile dysfunction, rheumatoid arthritis, angina
4	0.24 - 0.36	Below- the-knee amputation, **deafness**

Disability Weighting

Disability Class	Severity Weight	Indicator condition
5	0.36 - 0.50	Recto-vaginal fistula, mild mental retardation, Down-syndrome
6	0.50 - 0.70	**Unipolar major depression**, blindness, paraplegia
7	0.70 - 1.00	Active psychosis, dementia, **severe migraine**, quadriplegia

DALY Calculation

DALY = Years Life Lost + Years Lost to Disability

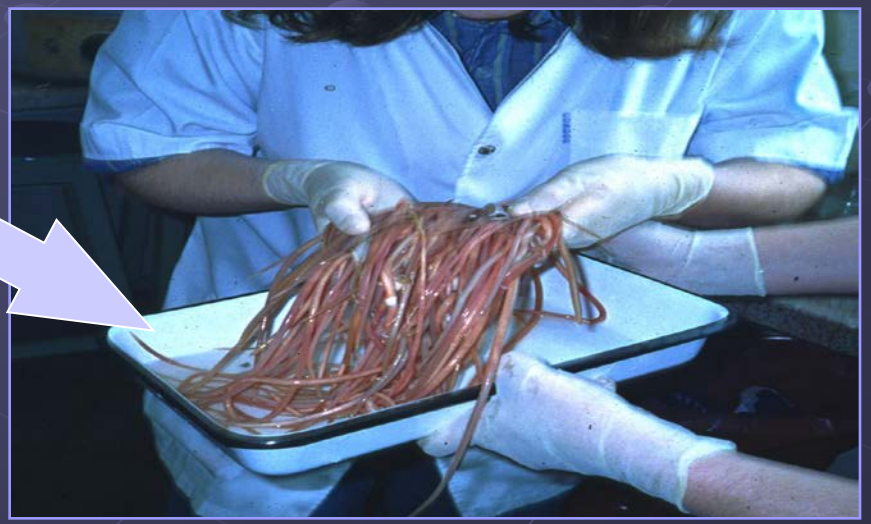
YLL YLD

Morbidity versus Mortality

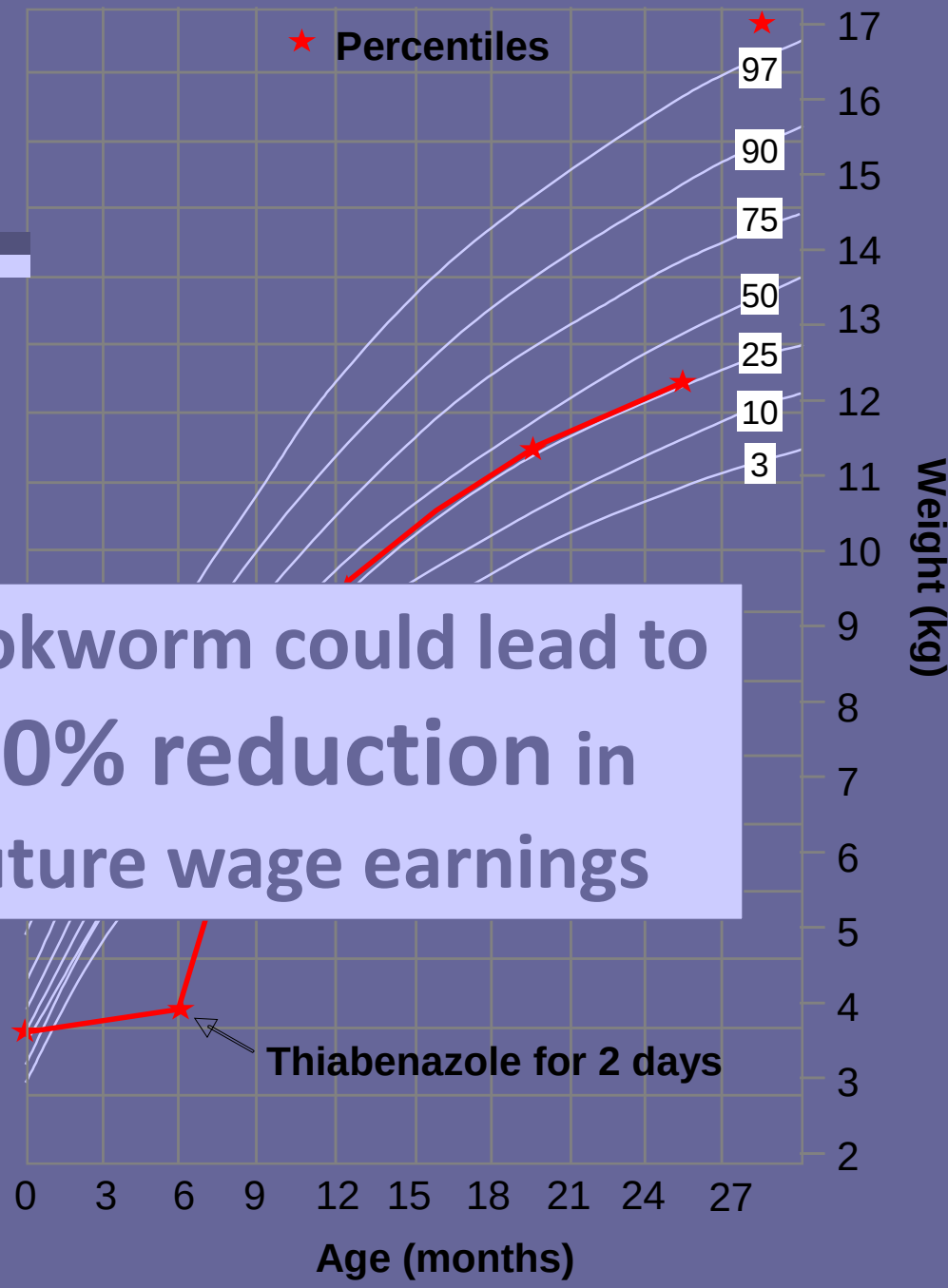
Soil Transmitted Helminth Infections
"Worms"

Ascariasis, Tri

Lets treat this girl with ONE TABLET of albendazole at a cost of just 2 US cents or 1penny



STHs Lead to Stunting and Decreased School Performance in Children

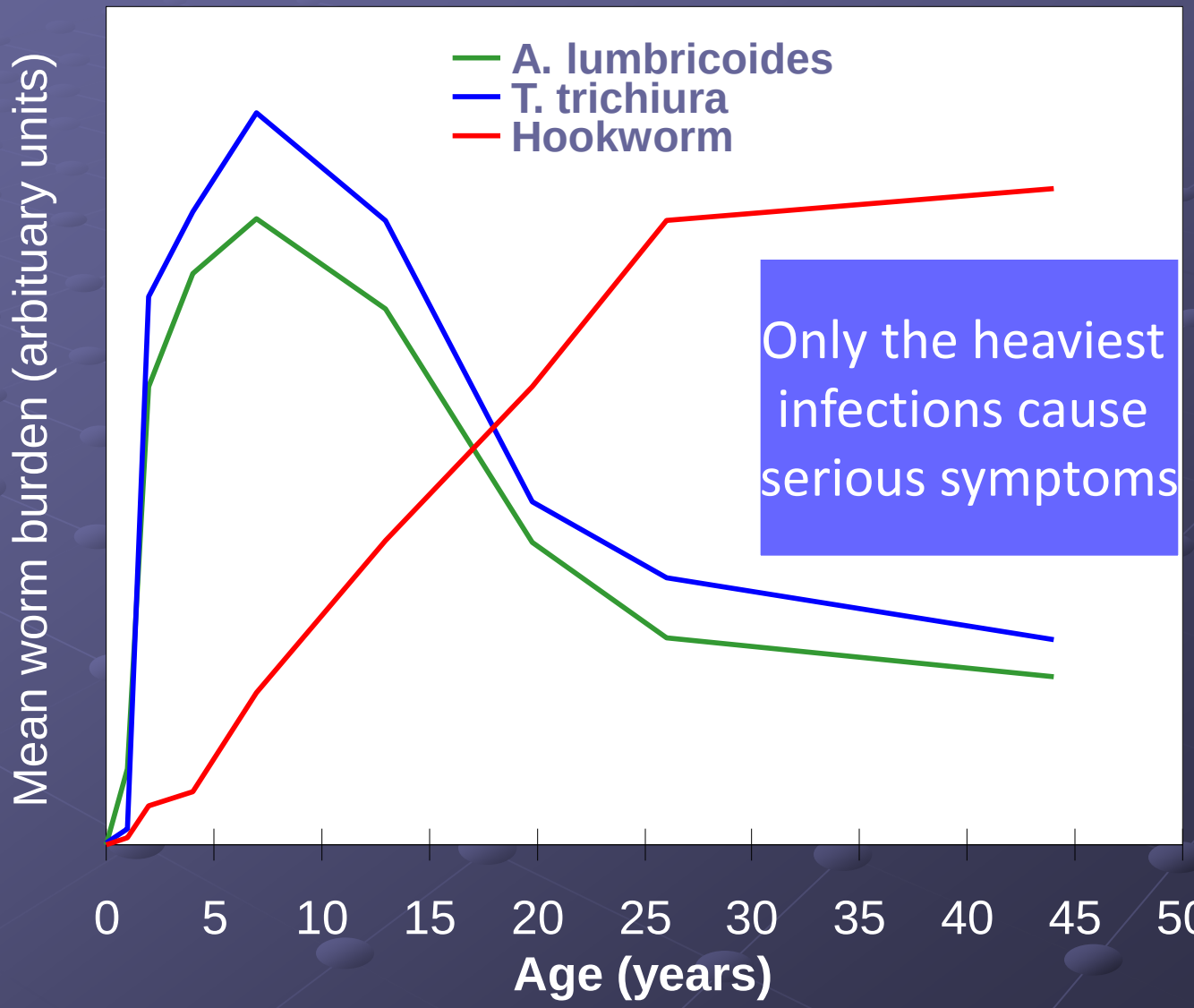


Hookworm could lead to 40% reduction in future wage earnings

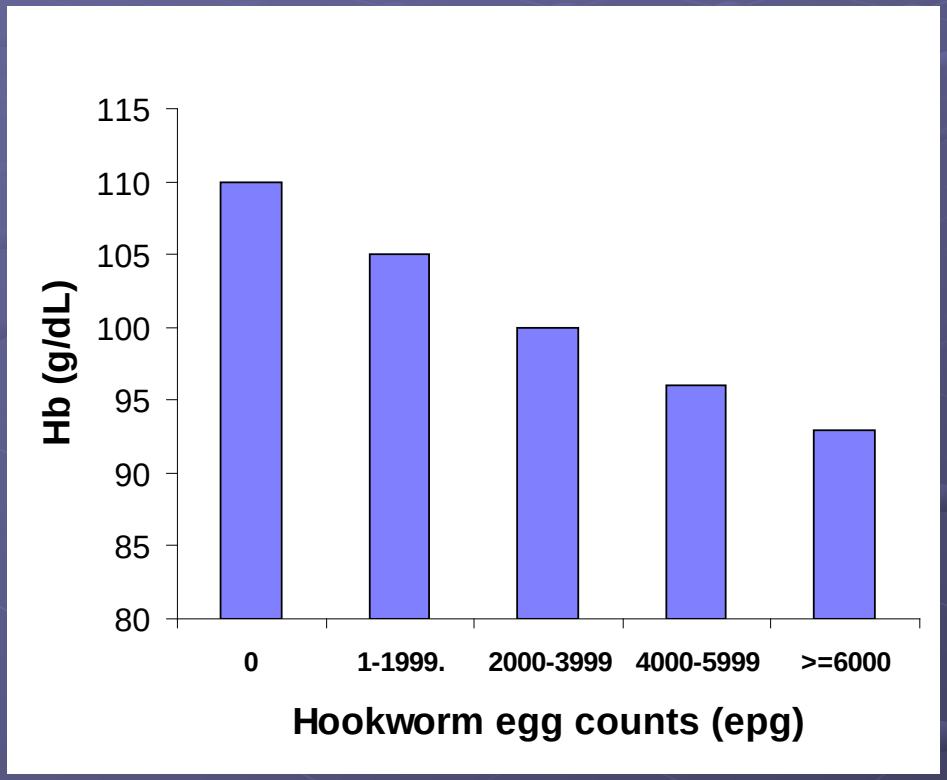
Impact of the STH and schistosomiasis on children after infection

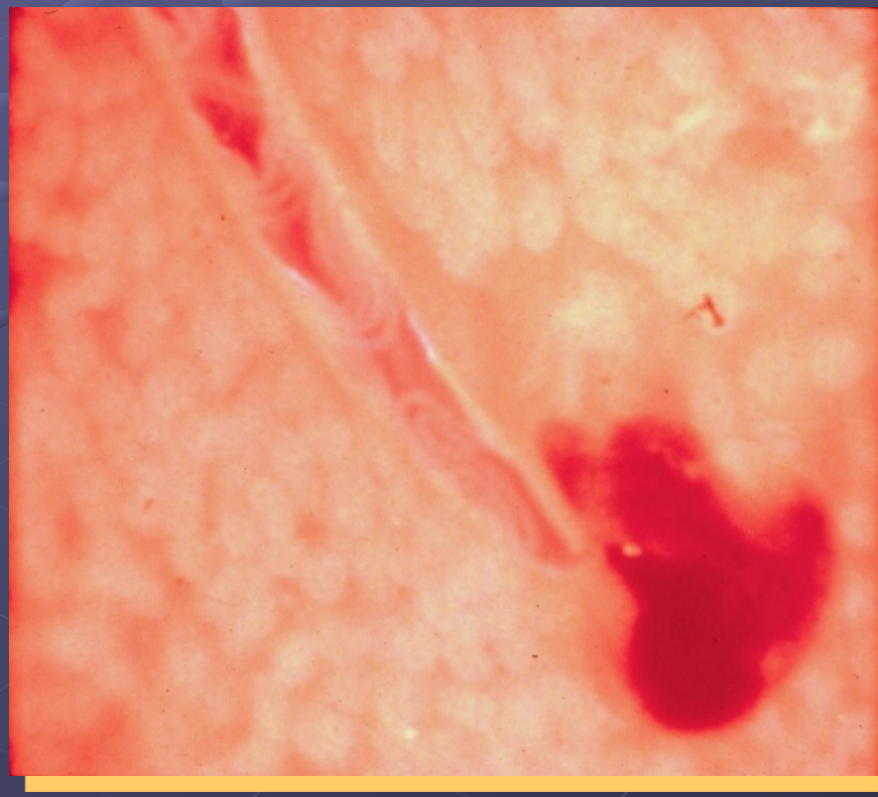
Species	Stunting	Intestinal disorder	Anaemia	Cognition	Long term Sequelae to organs
Ascariasis	Yes	Yes		Yes	
Trichuris	Yes	Yes		Yes	
Hookworm	Yes	Yes	Yes	Yes	
Schisto-somiasis	Yes	Yes	Yes	Yes	Yes

Age specificity of infection



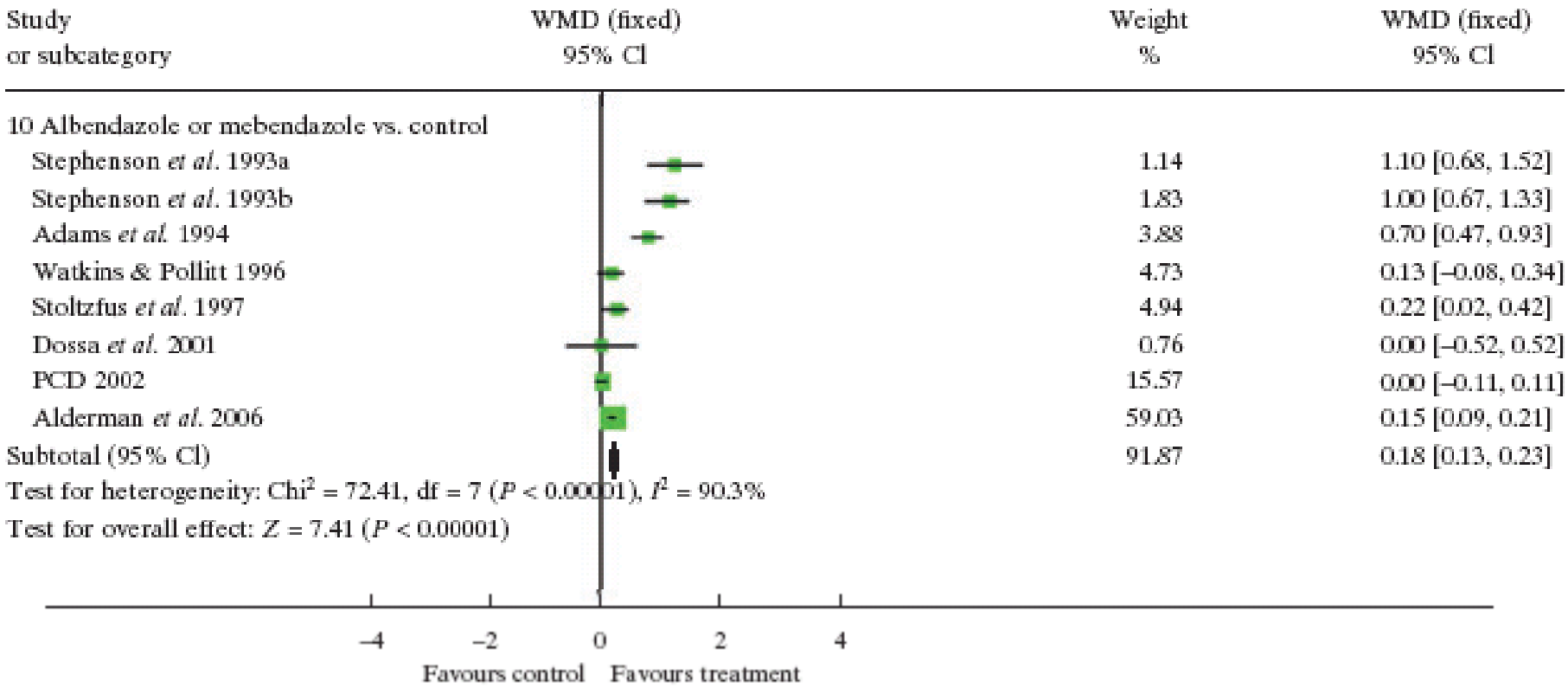
A major consequence of hookworm is blood loss and anaemia





Loss of 30 to 200 µL blood per day for each hookworm

Impact on weight



Hall et al. 2008. *Matern Child Nutr*. 4, 118-236

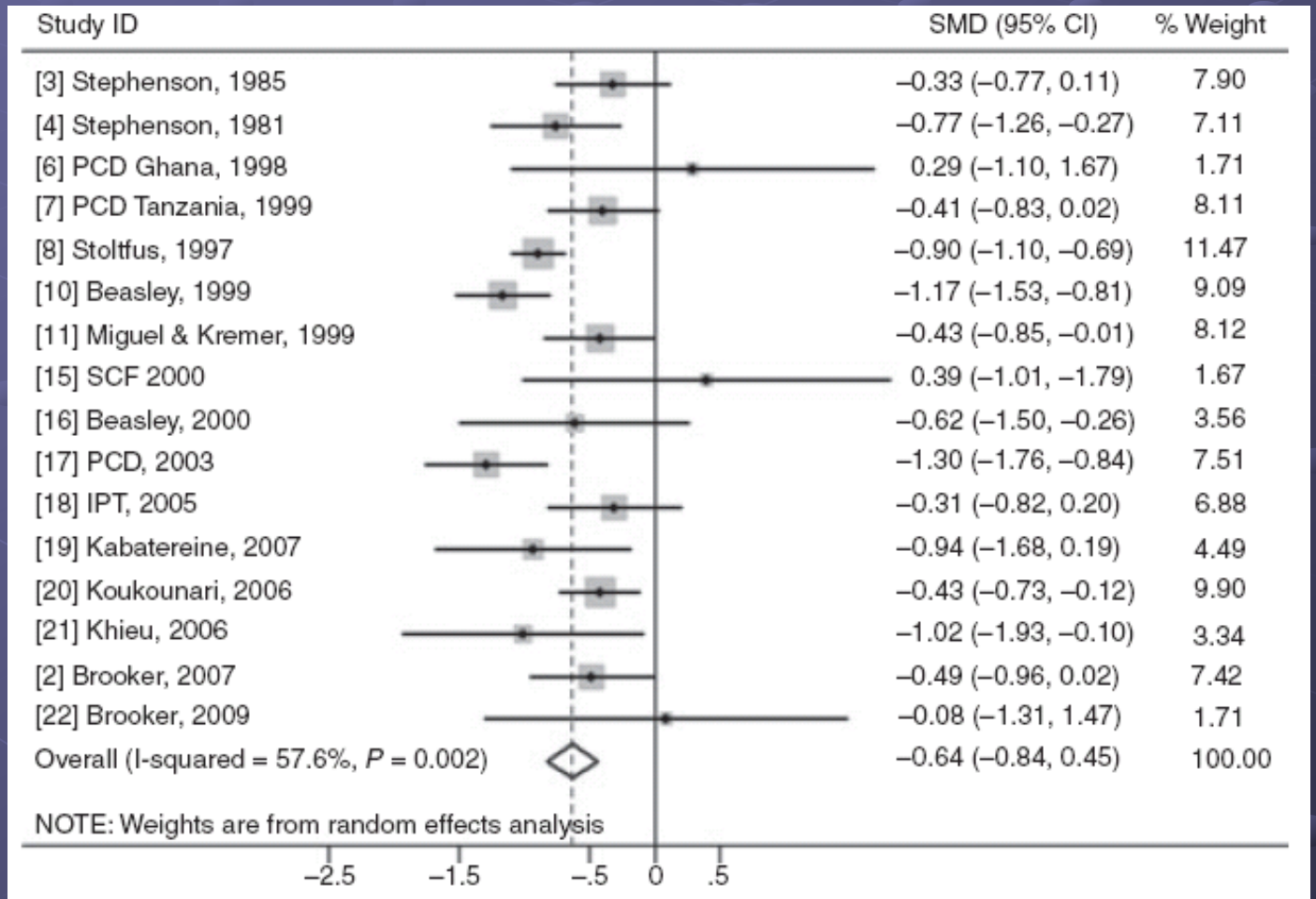
Single round of deworming lead to 0.34 kg weight increase

Taylor-Robinson et al. 2007. Cochrance Sys Review

Impact of hookworm on haemoglobin

Uninfected versus heavy infection – 4000+ eggs/gram

Forest plots of the impact of hookworm infection on Hb among school-aged children

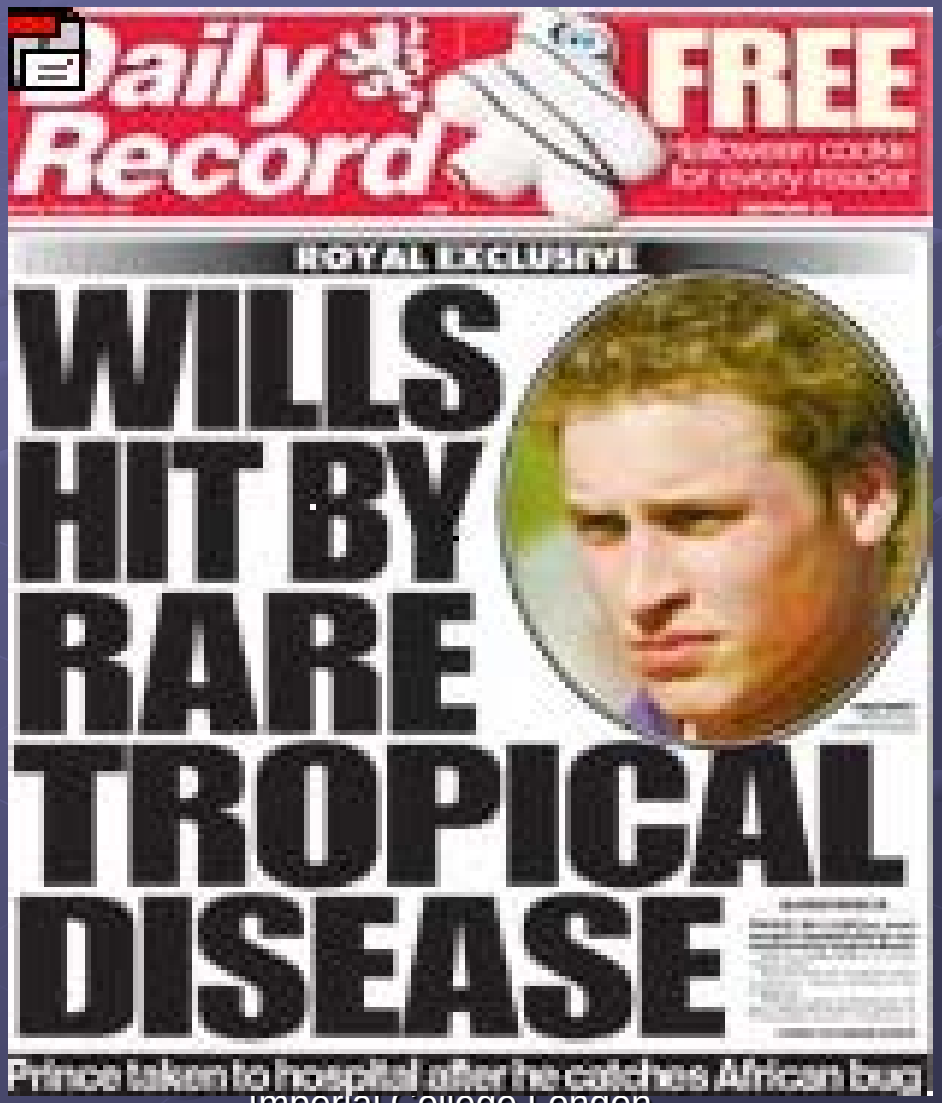


Smith & Brooker 2010. *TMIH* 15, 776-795

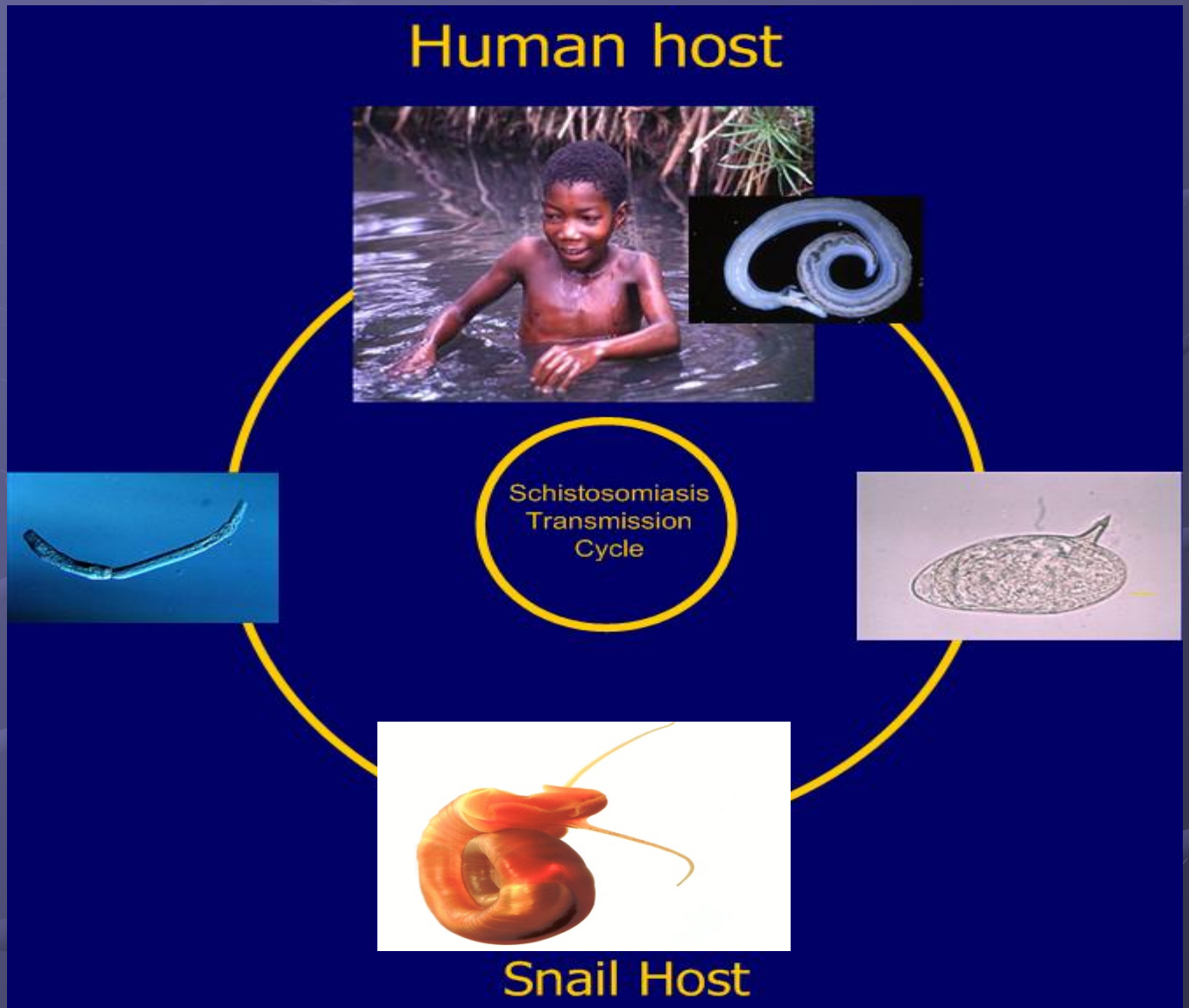
Schistosomiasis

- 200 million infected 85% or more in sub saharan Africa
- (could it be more King 2011)
- 120 million suffering with obvious symptoms
- Estimated 280,000 deaths annually

It must be important if royalty are infected



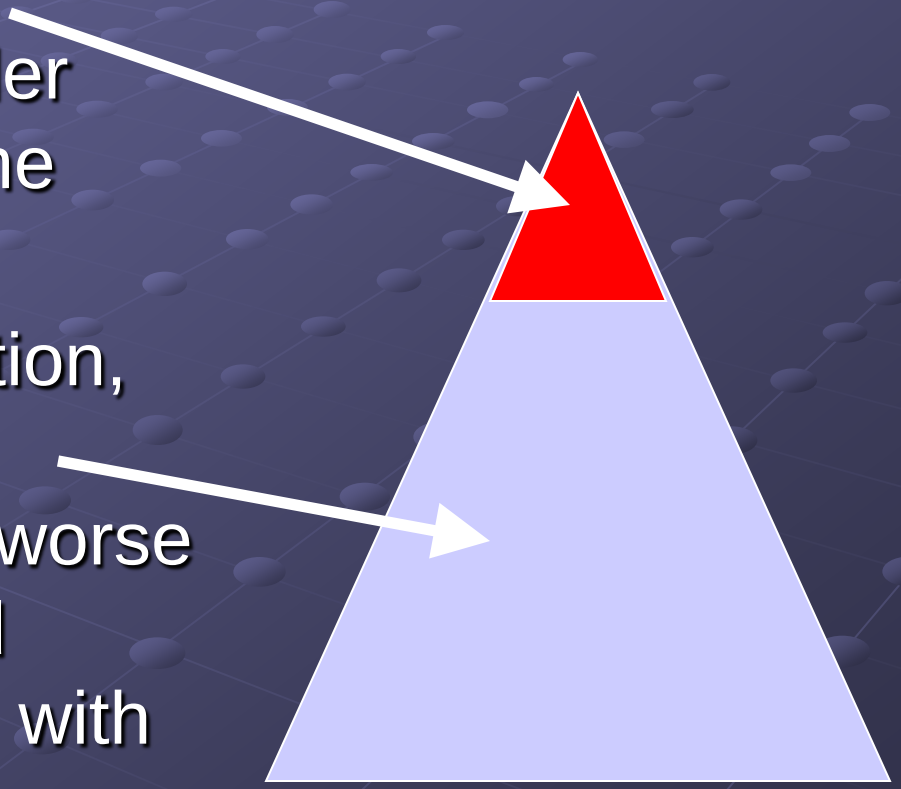
Transmission



Urine – yes if you have urinary schistosomiasis

The Iceberg

- ‘Objective’ morbidity (hepatosplenomegaly, hematuria, stunting, bladder cancer) is only the tip of the disease/disability iceberg
- Pain, diarrhea, undernutrition, and anemia are clearly associated with infection, worse with heavier infection, and reversible, at least in part, with specific therapy



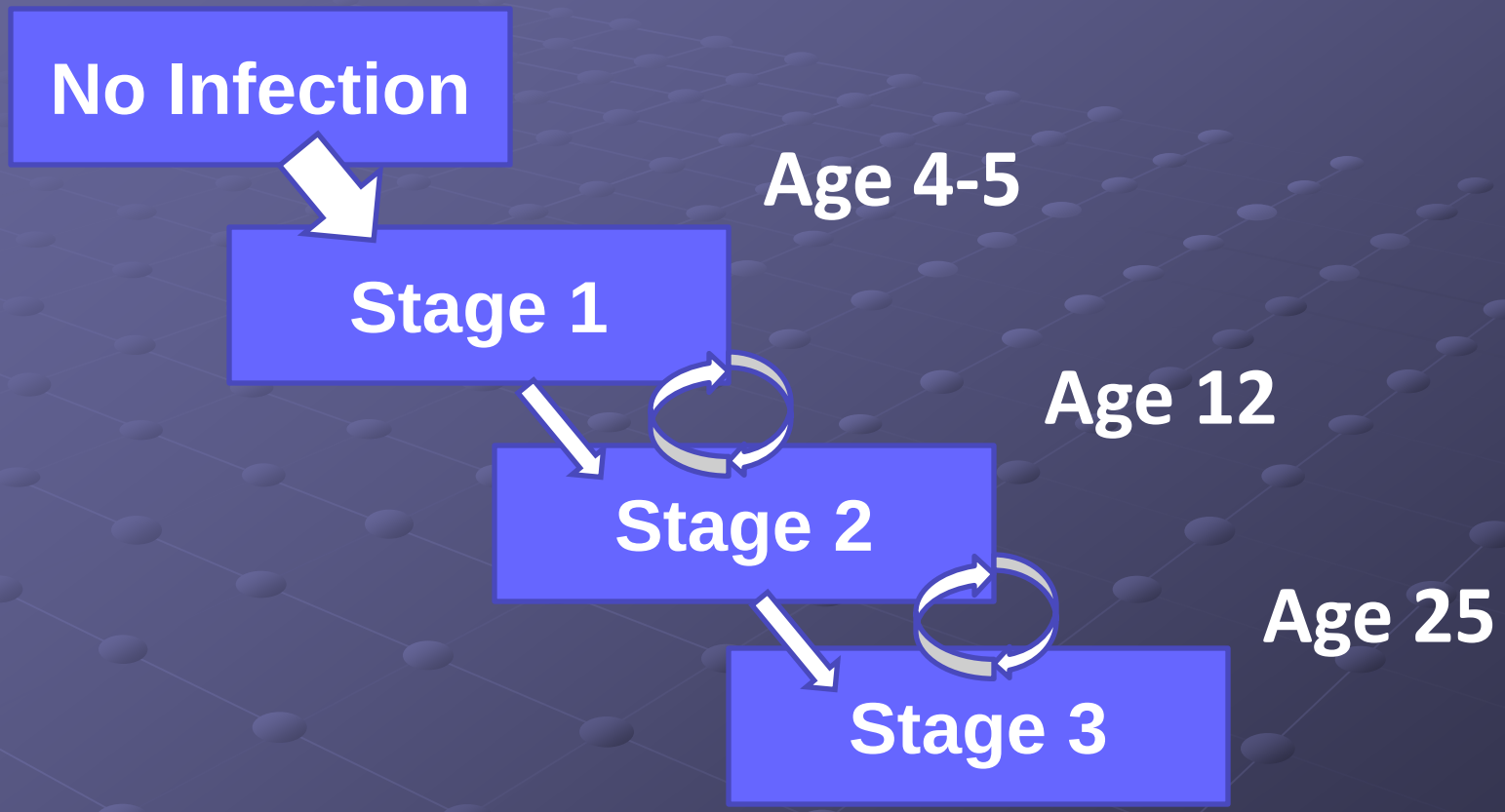
Were they correct with schistosomiasis and other parasitic infections ??

By contrast with the WHO first estimates of 0.5% disability weighting Charles King and colleagues in 2005 suggested that the true weighting could be 2 to 15 times that originally assigned

Schistosomiasisis is seen as a “silent pandemic” with under estimated disability and under estimated prevalence

Lets look at the stages of disease

Schistosomiasis the infection progression



Mild Chronic Schistosomiasis- Stage 1

Disability weight = 0.02 to 0.04

N at least 200 million maybe up to 400 million

[The 'average patient' with schisto has these]

Schistosome infection

Inflammation

Fibrosis

- Colonic Polyposis
- Bladder Polyposis
- Pain
- Fatigue
- Anemia
- Diarrhea or Dysuria
- Bloody Stool or Cystitis and ureteritis
- Reduced work capacity
- Reduced job/school performance

Intermediate Chronic Schistosomiasis- Stage 2

Disability weight = 0.10- 0.20
N maybe 30 million

Schistosome infection → Inflammation → Fibrosis

[Concurrent infection NOT required]

11% severe wasting (BMIZ < -3 or BMI < 16)

Stage 1 findings plus:

- Severe Malnutrition
- Severe anemia
- Irreversible growth stunting
- Impaired cognitive development
- Glomerulonephritis
- Seizure disorder
- Dyspareunia
- Infertility
- Secondary infection (UTI, STD, HIV)
- Vaccine failure
- Severe splenic enlargement; hypersplenism

Advanced Chronic Schistosomiasis- Stage 3

Disability weight = 0.45
N ~ 2 million
Mortality 1 per 1000 per year

Schistosome infection → Inflammation → Fibrosis → Intermediate Symptoms and/or:

Intermediate Symptoms and/or:

- Renal failure
- Bladder cancer
- Low birth weight; fetal loss
- Advanced Liver fibrosis
- Portal hypertension
- Variceal Bleeding
- Ascites
- Advanced malnutrition
- Depression
- Social stigma/divorce
- Motor dysfunction/paraparesis
- Pulmonary Inflammation and hypertension

Causes of death
(but does schistosomiasis get the credit ?)

- Renal failure
- Bladder cancer
- Hypertension
- Liver fibrosis
- Haematemesis - variceal bleeding

Schistosomiasis Disease Burden

Estimates of cases range from 200 million to up to 440 million cases (C. King 2011)

- More than 90% in Sub-Saharan Africa (Steinmann et al 2006)(out of 200+ million cases)

Aproximately two-thirds of cases caused by *Schistosoma haematobium* ("urinary-genital schistosomiasis") (Van der Werf et al 2003)

- DALY estimates (2 – 4% Stage I disability) (C. King)
  - 8.9 – 16.1 million standard DALYs*
  - 6.8 – 12.9 million unweighted, but discounted DALYs
  - 25.1 – 36.5 million unweighted, non-discounted DALYs

Distribution of *Schistosoma haematobium*

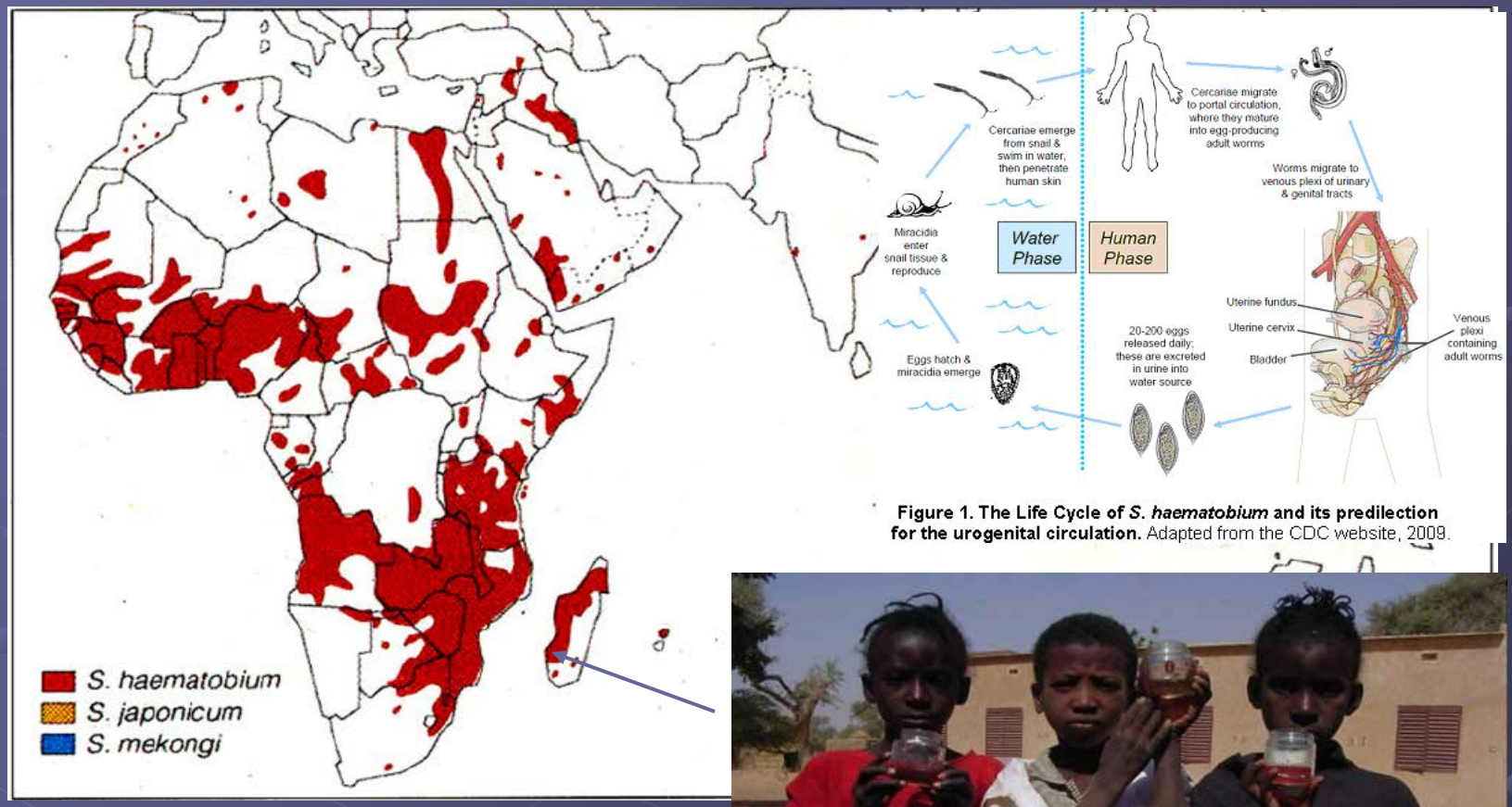


Figure 1. The Life Cycle of *S. haematobium* and its predilection for the urogenital circulation. Adapted from the CDC website, 2009.

S. Haematobium and HIV

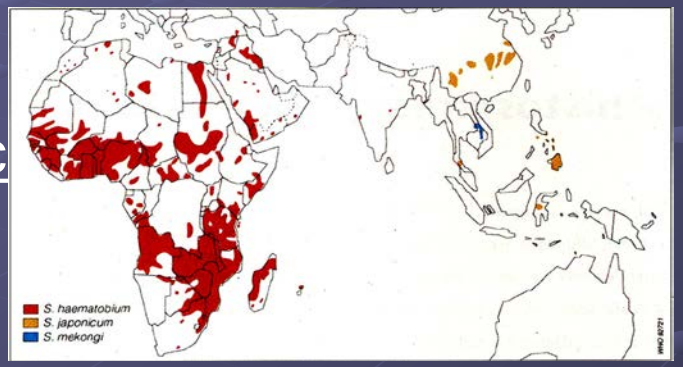
- Female Urogenital Schistosomiasis…
  - Affects young women
  - Is associated with HIV infection (Mozambique)
  - Is prevalent in the inland villages of Tanzania's Lake Victoria region with 4.0 OR (Downs et al AJTMH 2011)
  - Similar findings in Zimbabwe 2.9 OR (Kjetland et al AIDS 2006)

Integrating schistosomiasis control with PEPFAR

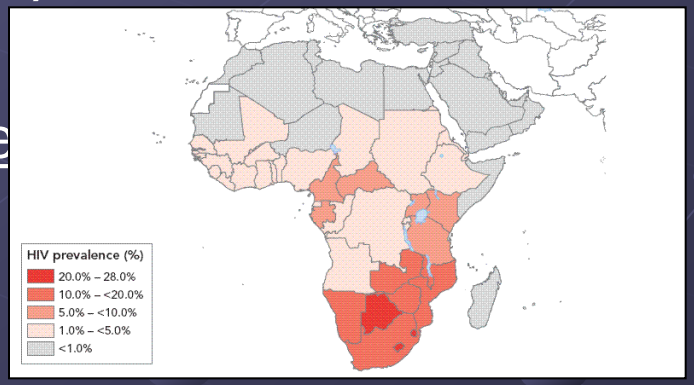
Hotez et al PLoS NTDs 2009; Noblick et al PLoS NTDs 2011

- 10 of the 15 PEPFAR countries in Africa have huge schisto prevalence & populations at risk for schistosomiasis
  - Botswana (10% Schisto prevalence)
  - Cote d'Ivoire (40% Schisto prevalenc
  - Ethiopia (7% Schisto prevalence)
  - Kenya (23% Schisto prevalence)
  - Mozambique (70% Schisto prevalence)
  - Nigeria (23% Schisto prevalence)
  - South Africa (11% Schisto prevalence
  - Tanzania (51% Schisto prevalence)
  - Uganda (20% Schisto prevalence)
  - Zambia (27% Schisto prevalence)

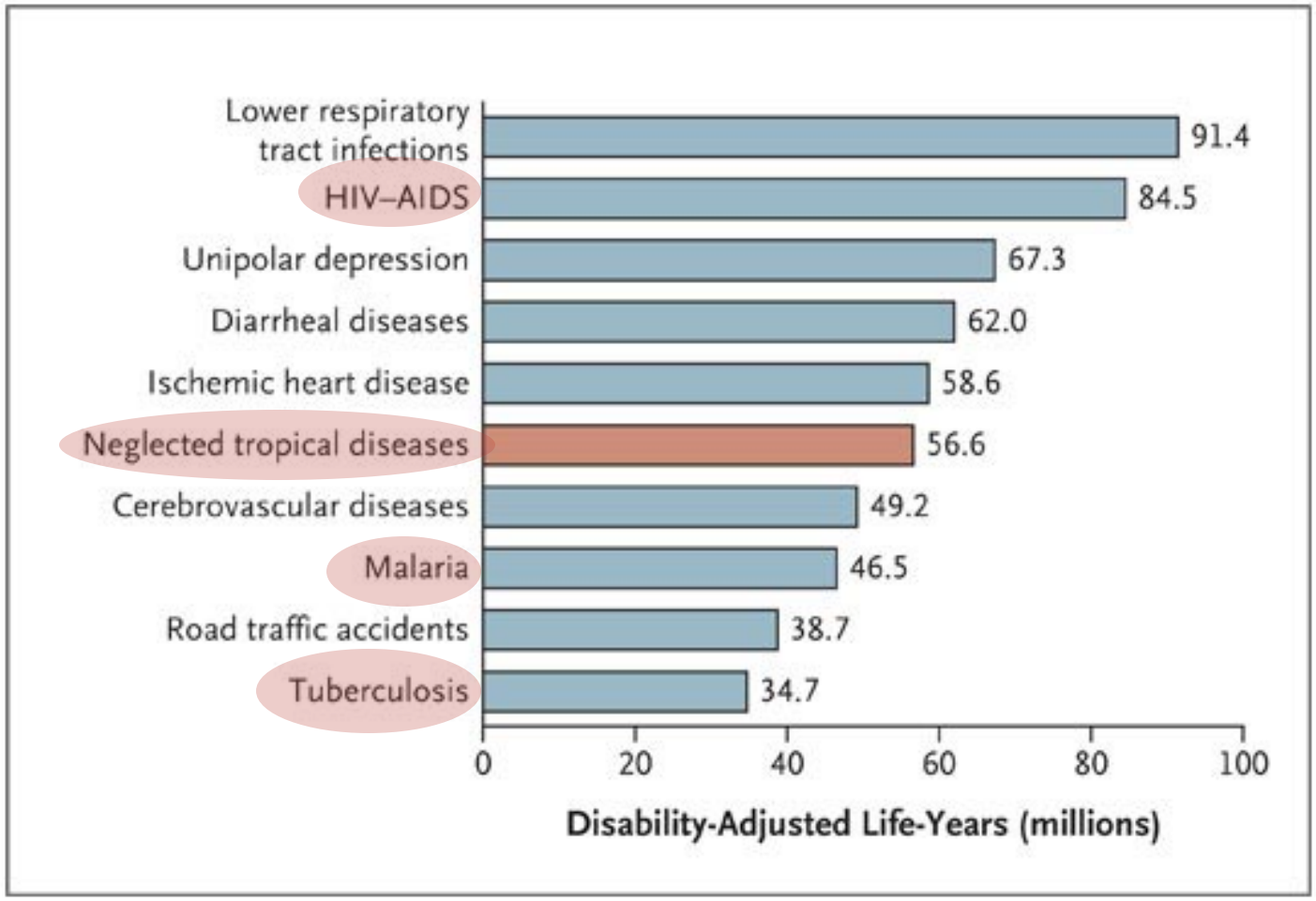
Schisto



HIV/AIDS



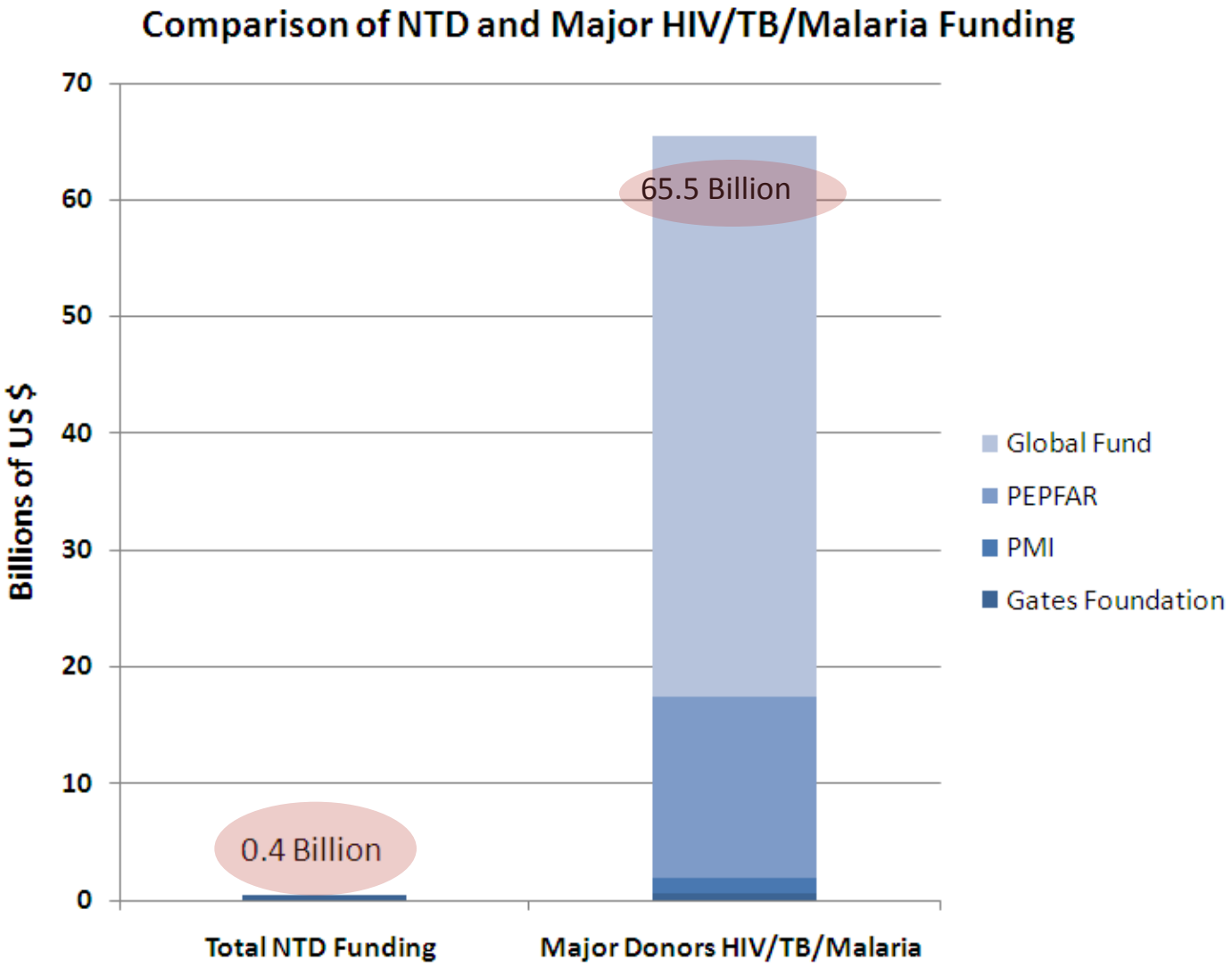
The 10 Leading Causes of Life-Years Lost to Disability and Premature Death in low income countries



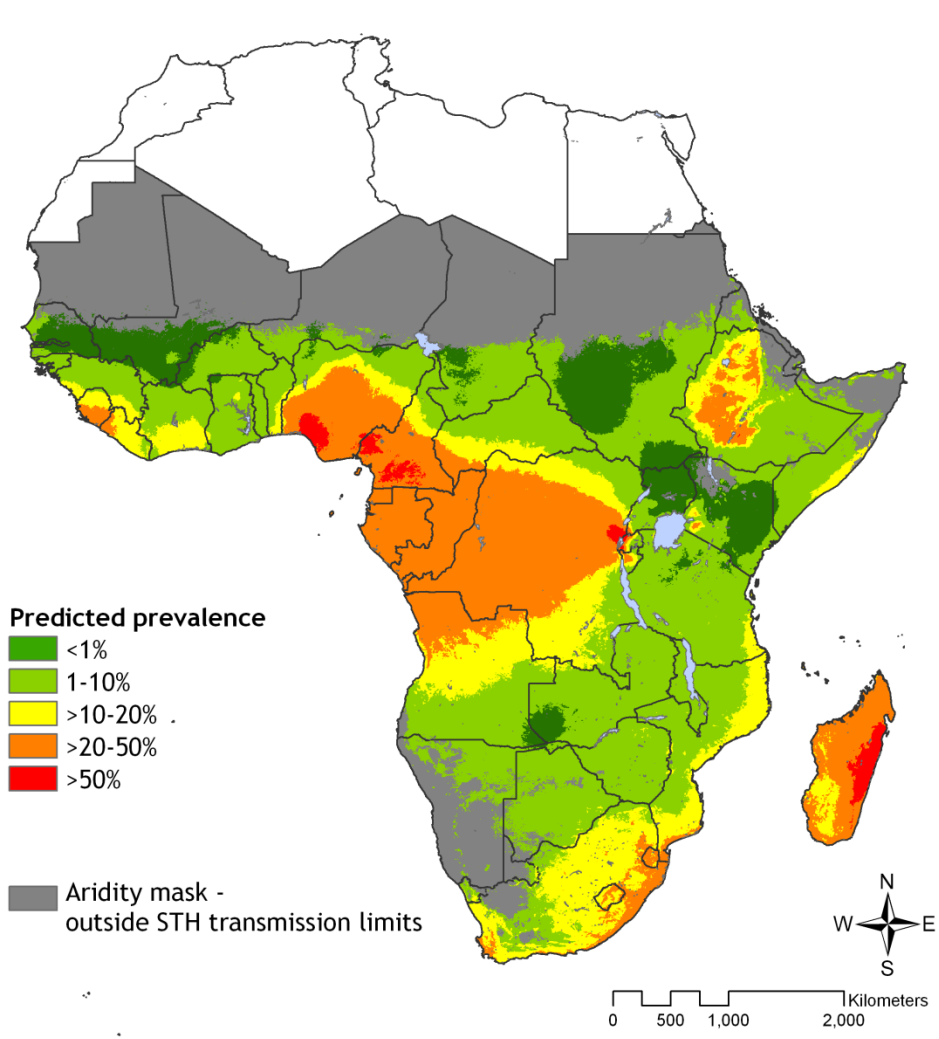
Hotez P et al. N Engl J Med 2007;357:1018-

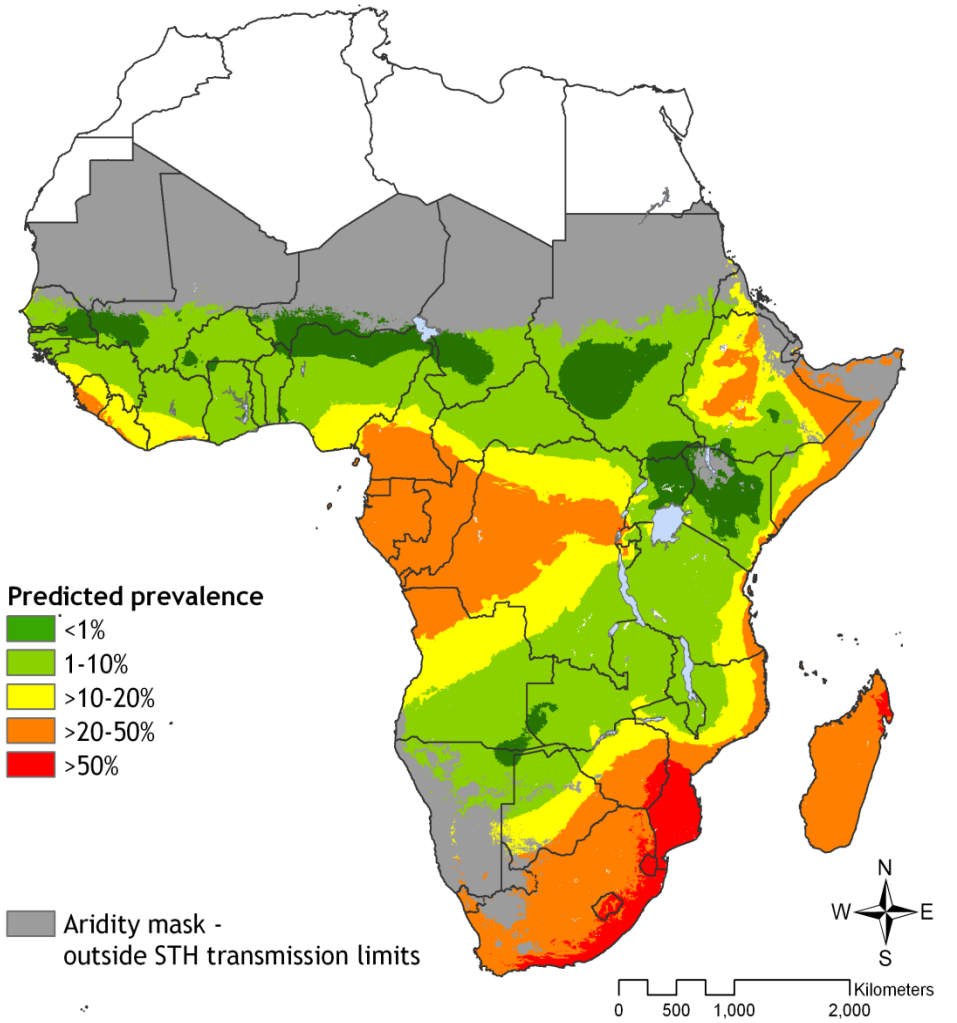
The NEW ENGLAND JOURNAL of MEDICINE

Funding of Disease Control

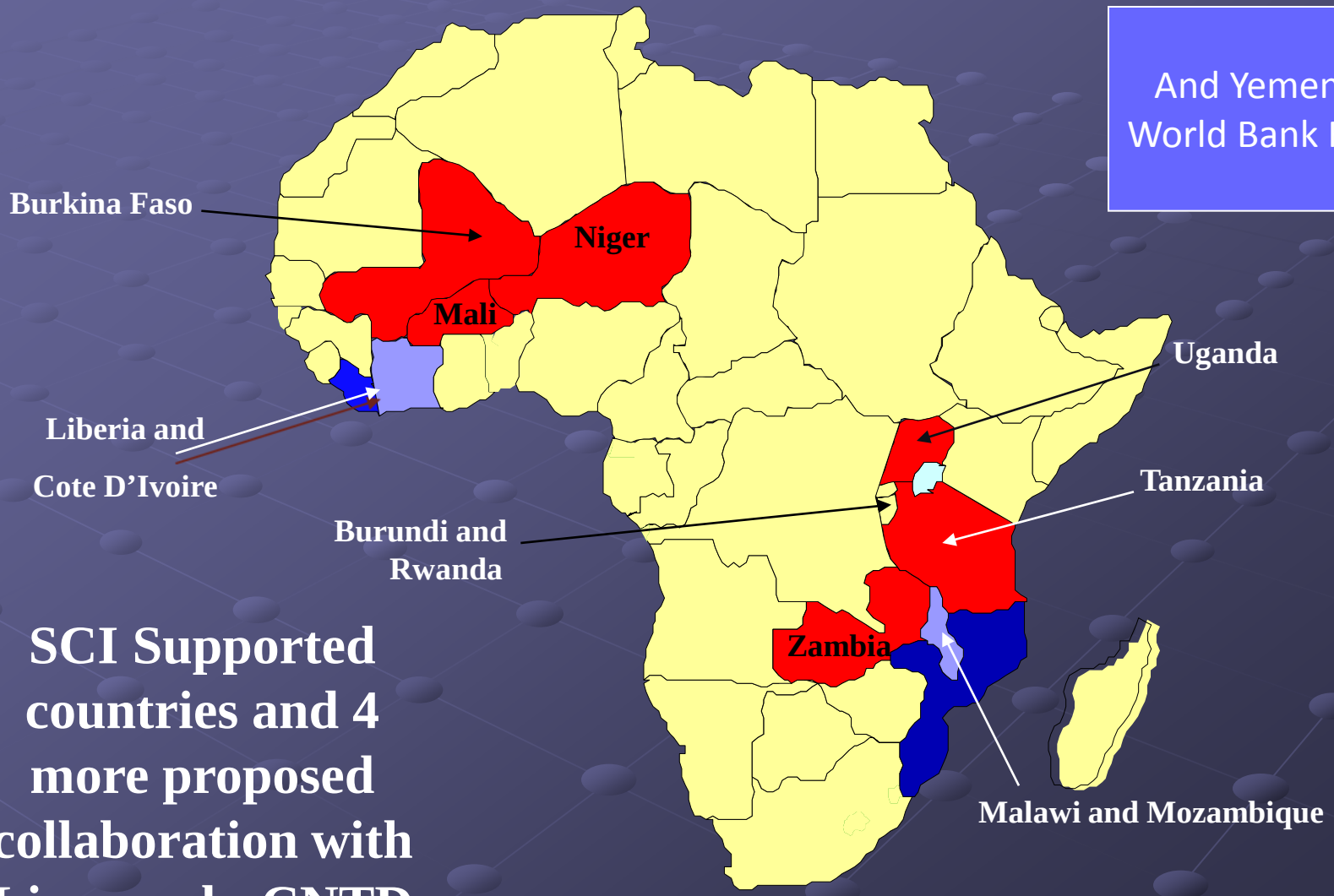


Predictive prevalence of Ascaris and Trichuris





12 Ministries of health and education have implemented control with Gates/Legatum/ DFID and SCI assistance



And Yemen with World Bank Funding

SCI Supported countries and 4 more proposed collaboration with Liverpool - CNTD

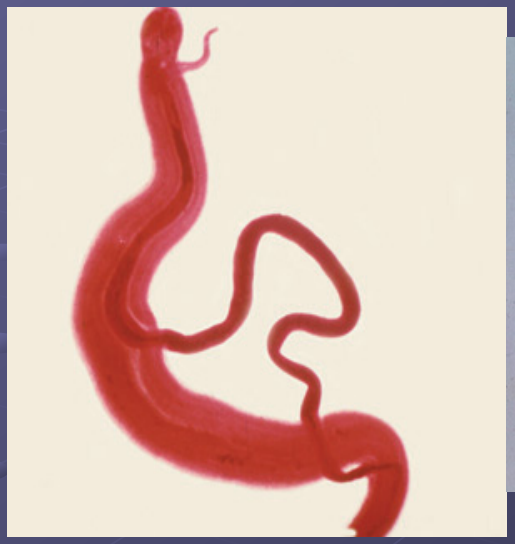
USAID/RTI/FHI are assisting 11 countries

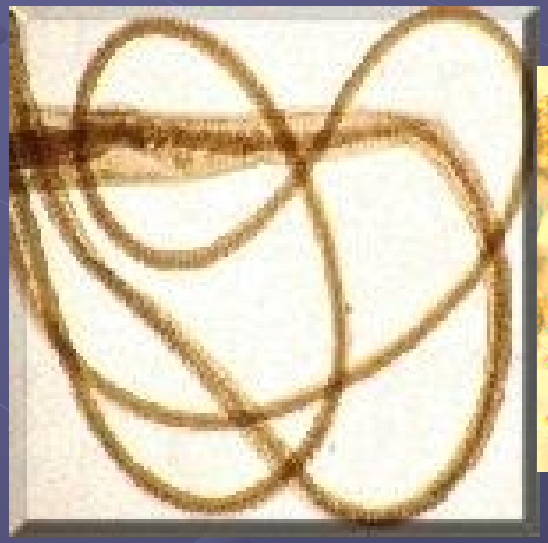
Mostly through HKI as grantees

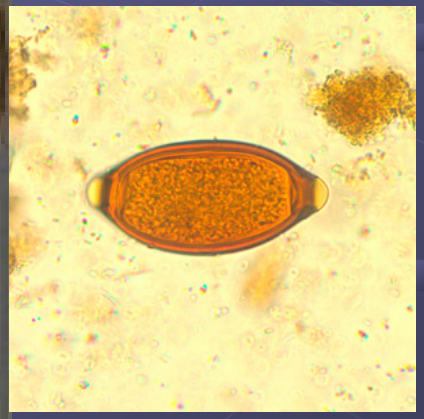
Treating school children is easy

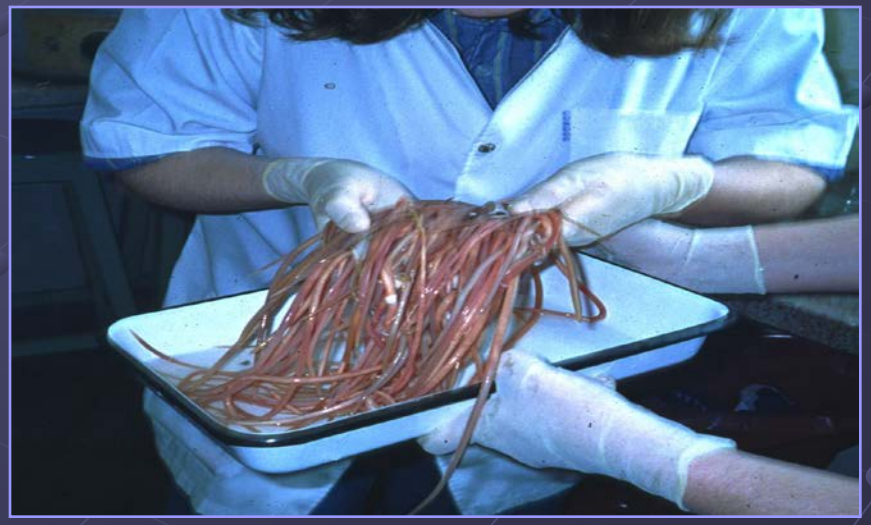
But adults also benefit from treatment through communities

The worms still need attention
60% are untreated









I would like to thank the following for assistance with this presentation and for sharing their slides

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Dr Wendy Harrison

Dr Simon Brooker

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www.schisto.org

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Thank you