# Controlling Neglected Tropical Diseases: What's the Role of Water, Sanitation and Hygiene (WASH)?


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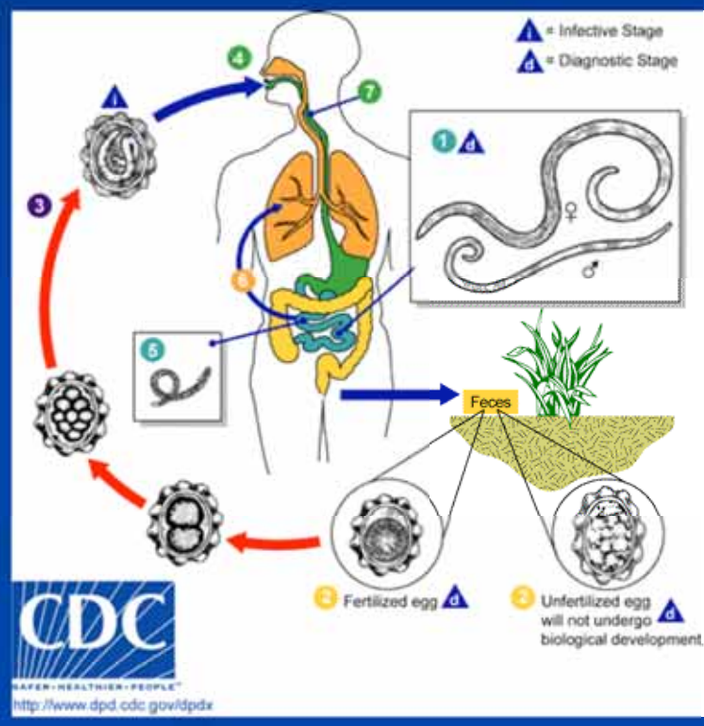
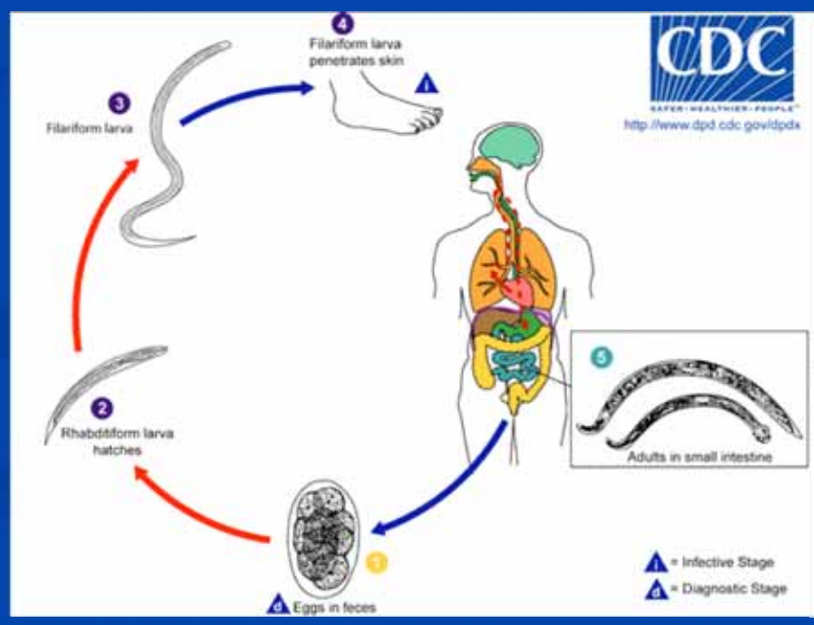
# WASH 'Confessions'

- Focus on diarrheal disease
  - Appears easier to measure
  - Easier to attribute mortality
  - Recent growing attention to nutrition and other health impacts
- Difficulty measuring conditions
  - Improved sanitation – not always sanitary
  - Improved water – not always safe
  - Hygiene = Hand washing?
  - Only household conditions, not public
- Modest targets
  - MDGs cut by half the % without

# Connecting WASH and Soil Transmitted Helminthes (STH)

- Parasite biology directly links poor disposal of human excreta and exposure – *Ascaris*, *Trichuris*, hookworms
- Systematic reviews have demonstrated that sanitation, hygiene and water supply can reduce STH infections - Asaolu, Ofoezie. 2003. The role of health education and sanitation in the control of helminth infections, Acta Tropica.
  - Found that hygiene education is essential
  - Impacts differ based on the types of sanitation intervention



# City-wide Sewerage and Helminths

- Barreto, et al. 2010. Impact of a Citywide Sanitation Program in Northeast Brazil on Intestinal Parasites Infection in Young Children, Env Health Persp
- Examined the effect of city wide sanitation in Salvado, Brazil on prevalence of Ascaris and Trichuris, using a quasi-experimental before and after design (1999-2004)
- Ascaris prevalence declined from 24.4 to 12% and Trichuris from 18 to 5%
  - Majority of effect due to intervention related variables
  - Household hygiene and water variables had minimal contribution
  - Household sanitation explained 13% and 9% of the reductions
  - Neighborhood sanitation coverage explained 40% and 30% of the reduction
- Public sanitation exposures were more important than private

# Additional Exposure Pathways: Wastewater Reuse and STH

- Wastewater reuse is a growing issue in peri-urban settings where wastewater is available and agricultural activities are still common
- Trang et al examine the effect of wastewater and and excreta use in agriculture in peri-urban Vietnam
- Cross-sectional study
- Not having a latrine – risk for *Ascaris* (RR=2.42) and hookworm (RR=2.5)
- Using excreta compost <1 month old – risk for *Trichuris* (RR=3.42)
- Year-round contact with wastewater – risk for *Trichuris* (RR=2.14)

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**Helminth infections among people using wastewater and human excreta in peri-urban agriculture and aquaculture in Hanoi, Vietnam**

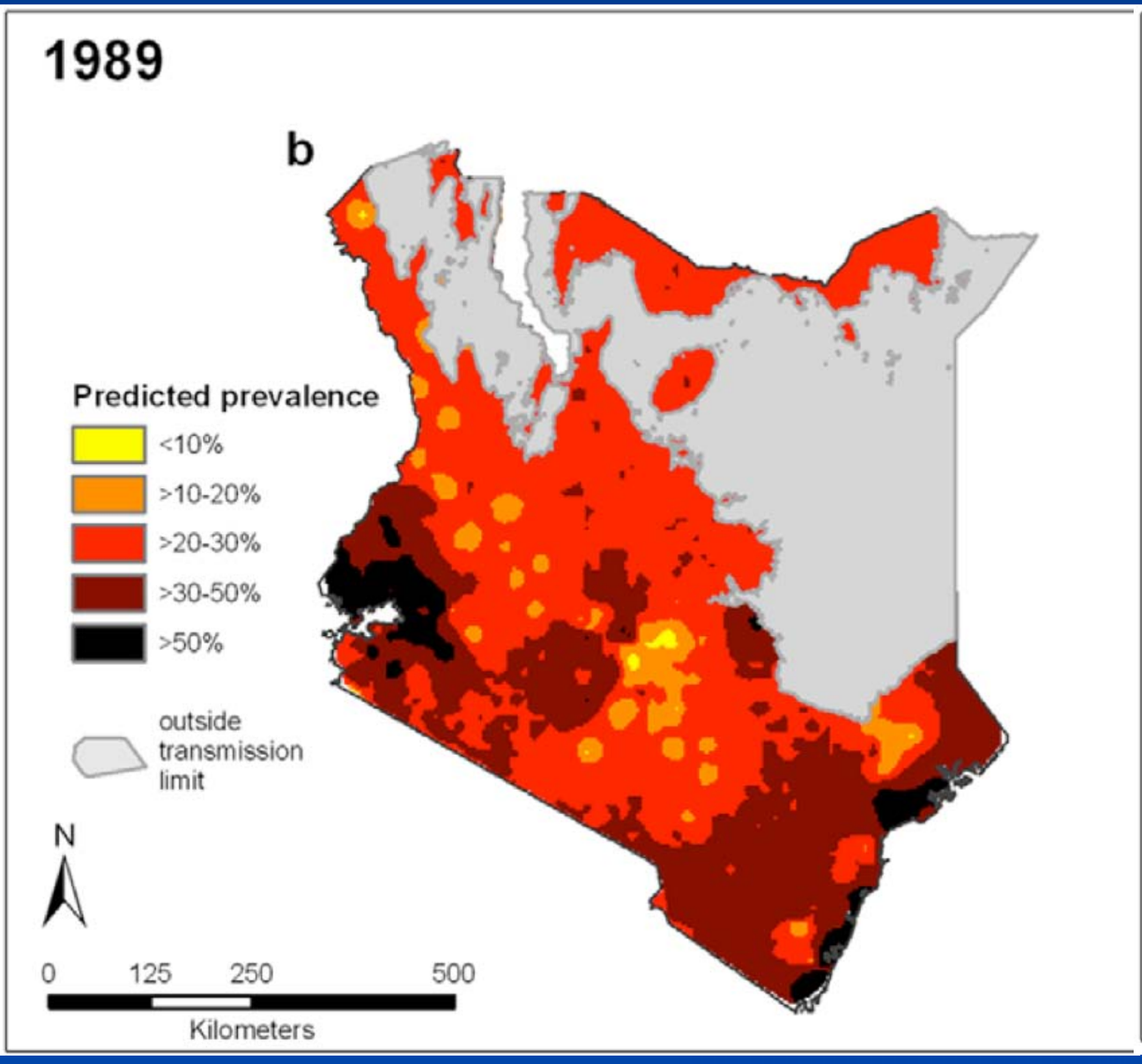
Do Thuy Trang[1,2], Kåre Mølbak[3], Phung Dac Cam[1] and Anders Dalsgaard[4]

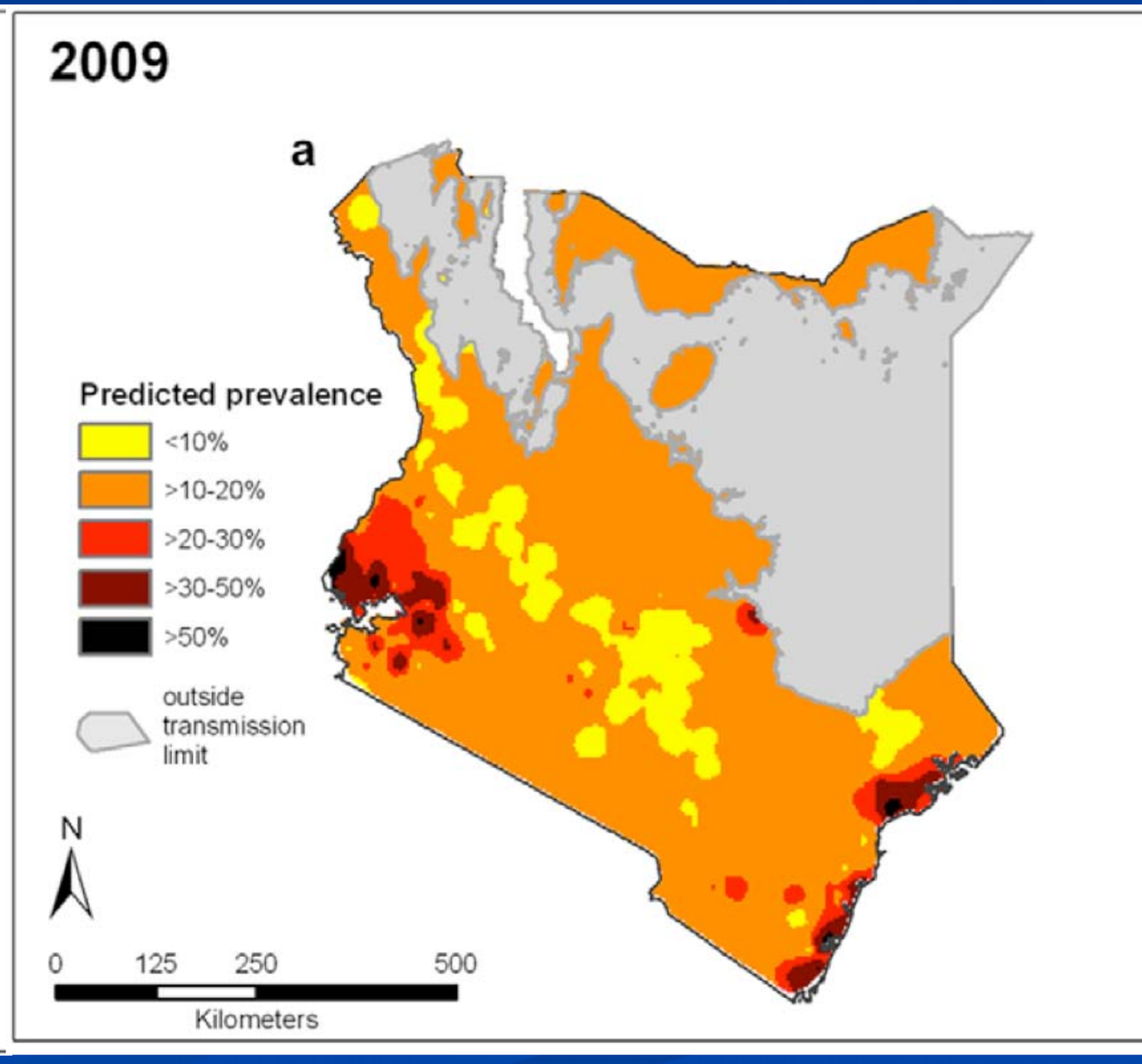
# Why Worry about WASH if De-worming is so Effective?

- Prior to development of safe, effective, low cost chemotherapy, environmental controls were critical for STH
- WASH interventions can be much more challenging than de-worming
  - Higher cost
  - More infrastructure and supply chain capacity
  - More dependent upon behavior change

- Can WASH improve the effectiveness of de-worming?
- Can WASH address some of the challenges of de-worming?

# Progress on STH Control: Predicted Prevalence in Kenya




**Citation:** Pullan RL, Gething PW, Smith JL, Mwandawiro CS, Sturrock HJW, et al. (2011) Spatial Modelling of Soil-Transmitted Helminth Infections in Kenya: A Disease Control Planning Tool. PLoS Negl Trop Dis 5(2): e958. doi:10.1371/journal.pntd.0000958

# Challenges for De-worming: A Role for Sanitation?

- Rapid scaling up of anti-helminthic drug administration raises concerns about potential resistance
- As rates continue to decline (through de-worming) and secular change, it is important to define 'end games' when MDA is no longer necessary

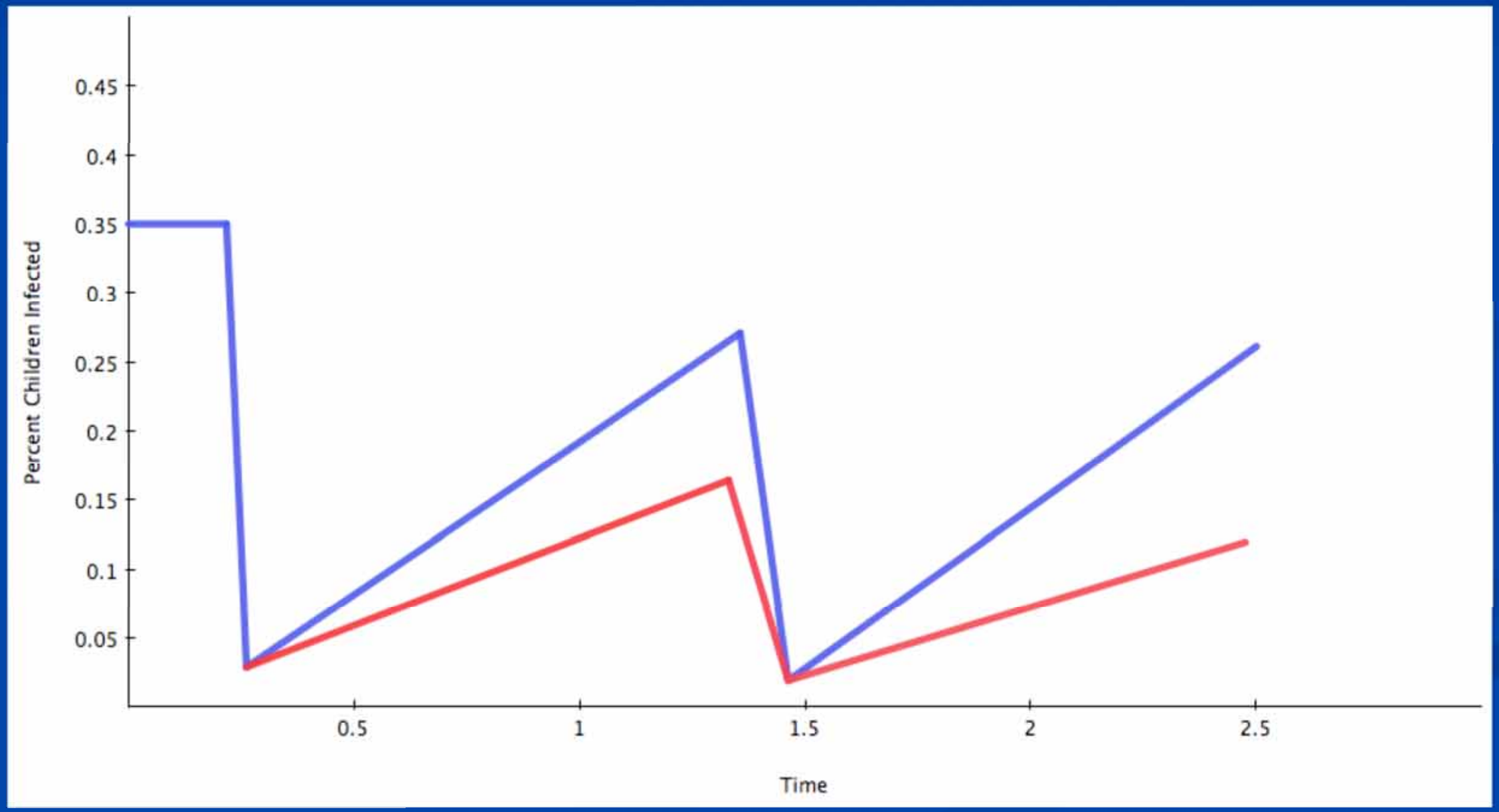
- For both of these, understanding the impact of school and household sanitation on force of transmission and intervention effectiveness is essential

- Can sanitation reduce the duration of mass treatment? Would that reduce risks of resistance?

# Do WASH Improvements Increase the Effectiveness of De-worming?

- Limited direct experimental evidence
- Cluster randomized trial of the impact of school based sanitation and hygiene in western Kenya (SWASH+)
- Primary outcome is reinfection with *Ascaris*, *Trichuris* and hookworm
- All children were treated with 400mg Albendazole
- Schools are randomly assigned to intervention and control
- Supported by BMGF; Collaboration with CARE
- Freeman, Clasen, Akoko, Brooker, Rheingans.

# Does WASH Reduce Re-infection After De-worming?



# Main Effects on Re-infection

- No effect on *Trichuris*, possibly due to limited treatment efficacy
- Sanitation reduced *Ascaris* reinfection prevalence (OR=0.52) and intensity of infection in girls
  - No effect in boys
- Reduced hookwork intensity of infection and trend to reduced prevalence for boys
  - No effect in girls

- Individual and household factors are likely effect modifiers

# Effect Modifiers

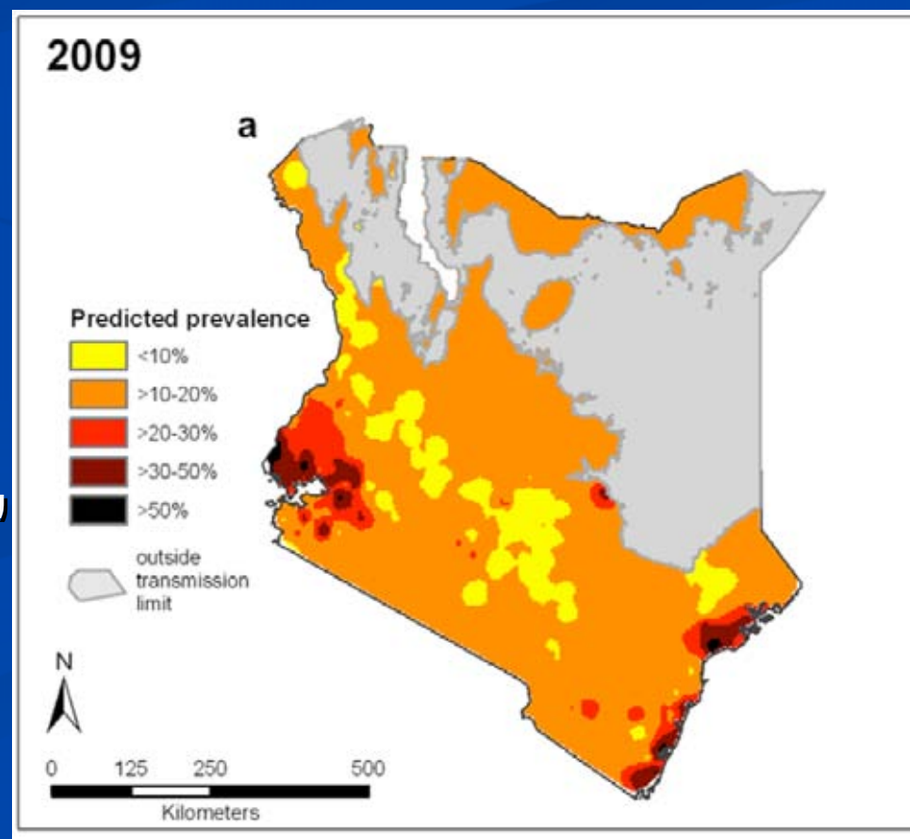
- *Ascaris*
  - For girls, the impact was greater among those without improved water or handwashing facilities at home
- Hookworm
  - Girls and boys without shoes benefited more from the intervention
  - Girls and boys without latrines at home had greater reductions than those without
- School WASH increases the effectiveness of de-worming for those with worse conditions
- Need to consider the impact of public and private WASH exposures

# Sanitation is More than Toilets

- Latrine cleanliness is a challenge and risk
  - Logistical challenge
  - Can affect comfort and use
  - Source of exposure
- Lack of anal cleansing materials
  - Limited budgets
  - Few coping strategies for kids
  - Can result in increased hand contamination

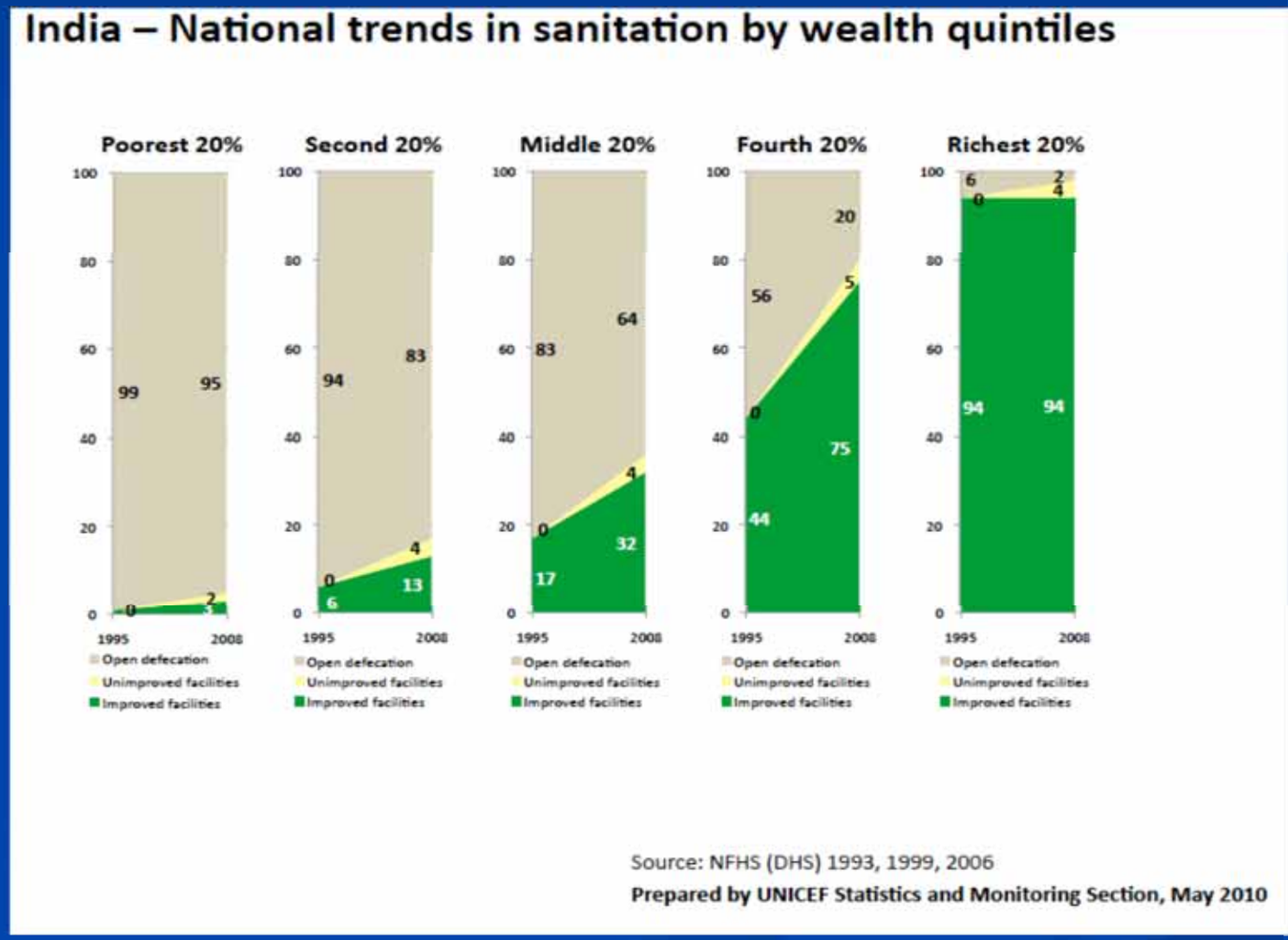
# Implications for Long-term Impacts of De-worming?

- Baird, Kremer, Hicks, Miguel. 2011. Worms at work.
- Examined the long-term economic impacts of de-worming programs in western Kenya
- Found income improvements among wage earners, and improved business outcomes for the self-employed
  - No evidence of economic impact among individuals who remained in agriculture
- Is this due continued exposure to STH, and related to inadequate sanitation



# Water and Sanitation Disparities and Helminths

- Globally and nationally, water and sanitation access are inequitably distributed
- If water and sanitation modify the effect of anti-helminth treatment, the burden is likely to be borne by the poor –
- Improving sanitation may be essential for ensuring equity of de-worming



# Summary

- Multiple elements of WASH exposures can affect NTD transmission and control
  - 'Public' exposures may be at least as important as 'private'
  - Improved sanitation may not be enough – wastewater management, latrine cleanliness and other factors matter
- WASH interventions and understanding may enhance the sustainability of NTD control
- WASH interventions can enhance the equity of NTD control

# NTDs and WASH Integration: Intervention Delivery

- Challenging to integrate different intervention approaches like school WASH and MDA

- Different institutions and ministries

- Different different skills and disciplines

- Opportunities?
  - Integrated intervention design
  - Integrated monitoring
  - Joint accountability

# NTDs and WASH Integration: Applied Research

- For STH and other NTDs, water sanitation and hygiene are key transmission components and effect modifiers
- For WASH interventions, helminth control is a key outcome – but often ignored

- Need scientific leadership to better characterize what we know and what we need to know at the intersection

- Opportunities?
  - Collaborative studies on transmission dynamics
  - Integrated modeling to improve intervention design

# NTDs and WASH Integration: Advocacy and Policy

- Sectors often see themselves competing or focus on limited outcomes and endpoints

- Key NTD funders are also WASH funders
  - BMGF investment in sanitation
  - DFID investment in SHARE Research Consortium

- Opportunities?
  - Demonstrate joint benefits
  - Scientific leadership on the connections
  - Collaborative operations research