Making the Case for Household Hygiene and Safe Water: Where's the Evidence?

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CDC

Global Burden of Unsafe Water

- Over 1 billion persons have no access to improved water sources

- Hundreds of millions more drink unsafe water from “improved” sources

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Post-Source Contamination

- Occurs during:
  - Transport
  - Household storage

Childhood Mortality and Morbidity From Unsafe Drinking Water

- Each year
  - Billions of episodes of diarrhea and other diseases are caused by unsafe drinking water
- Each year
  - 1.8 million persons die from waterborne disease
- Each day
  - 5,000 children die from diarrhea acquired from unsafe drinking water

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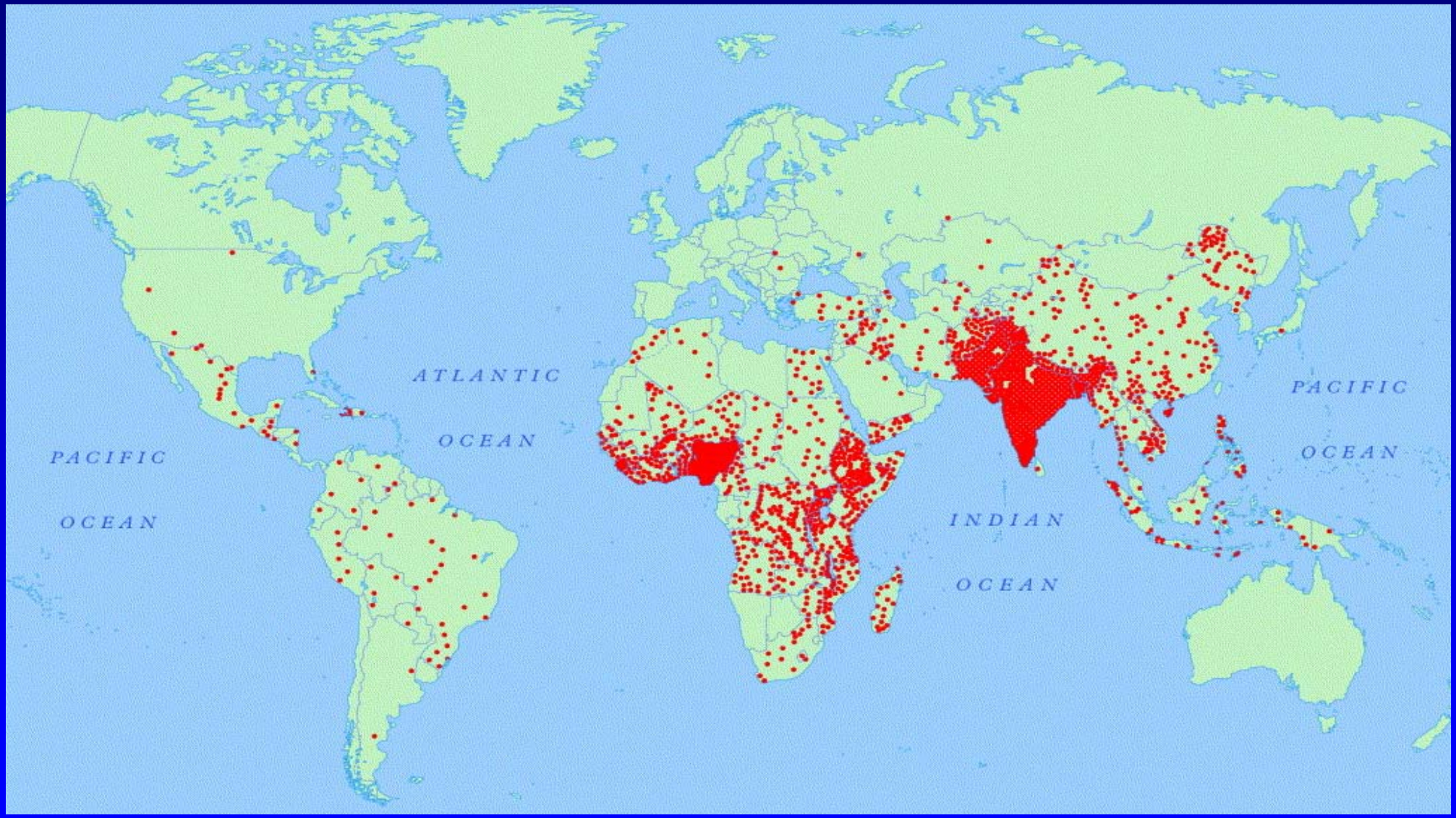
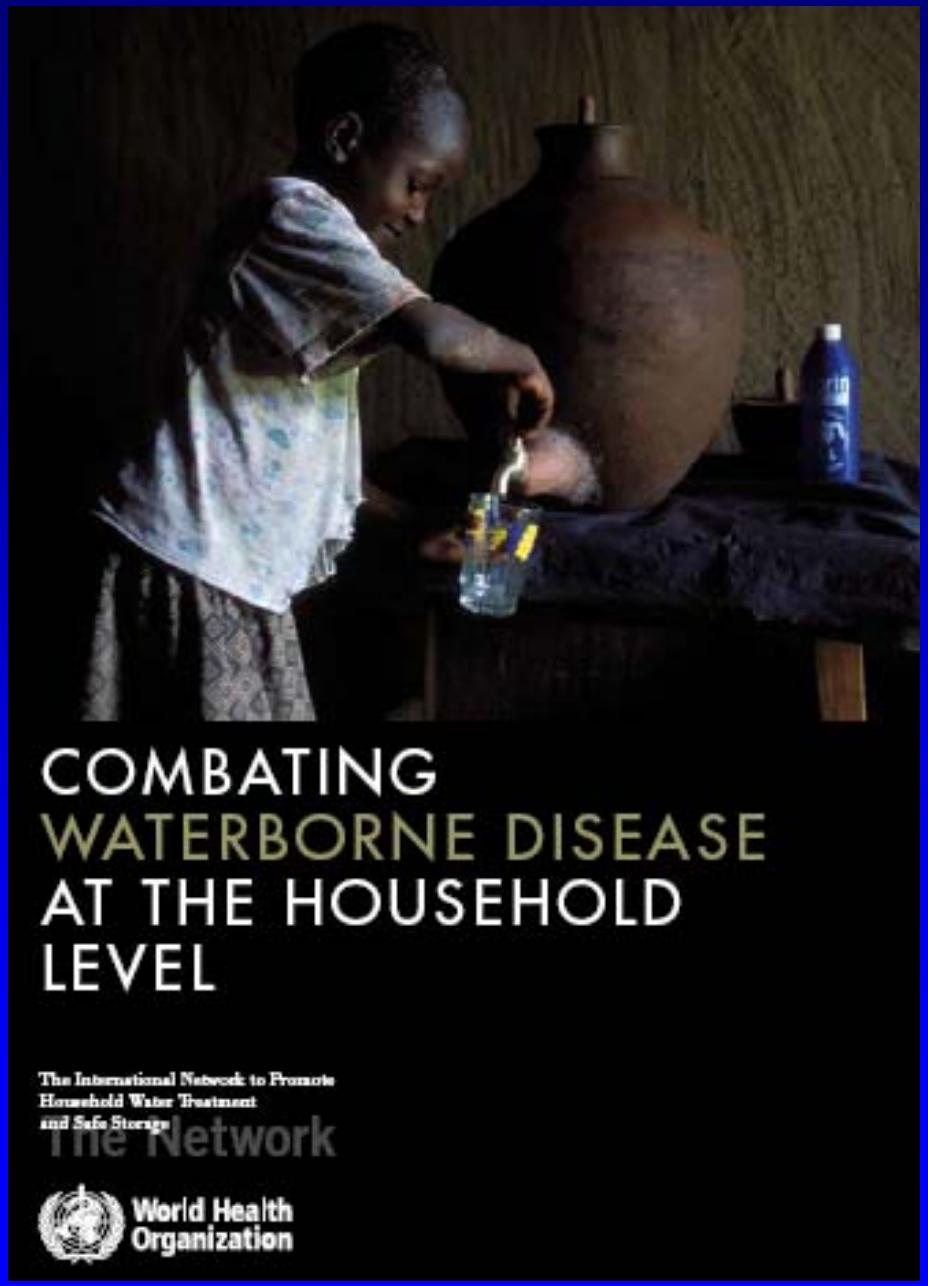
Worldwide Distribution of Child Deaths



Each dot represents 5,000 deaths.

Black, et al. Lancet 2003:361:2226-34.

CDC

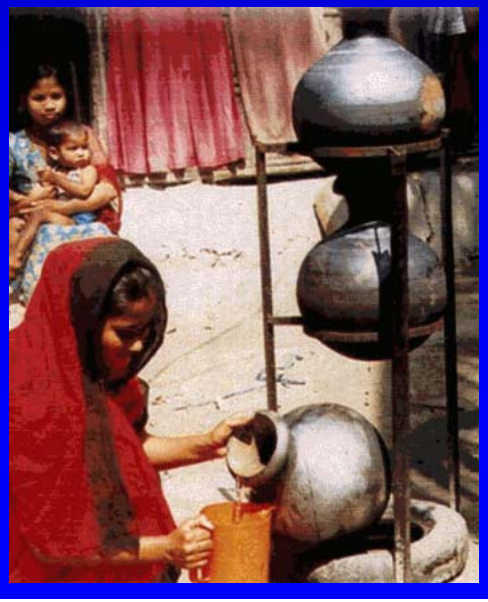


Household Water Treatment: Making Unsafe Water Safer to Drink

Chlorination

Flocculation-Disinfection

Solar Disinfection



Filtration

CDC

Safe Water Storage: Keeping Safe Water Safe to Drink

CDC Vessel

Jerry Can

SODIS Vessel

Modified Clay Vessel (Kenya)

CDC

Interventions to improve water quality for preventing diarrhea

"The review covered 38 independent comparisons from 30 trials that involved more than 53,000 people. In general, such interventions were effective in reducing episodes of diarrhea. Household interventions were more effective in preventing diarrhea than those at the source."

Clasen T, Roberts I, Rabie T, et al. The Cochrane Library, 2006 # 3

Interventions to improve water quality for preventing diarrhea

- 42 comparisons from 33 reports in 21 countries

  "Some evidence was found that household-based [water treatment] interventions are capable of … levels of effectiveness roughly comparable to certain other environmental interventions to prevent diarrhea, such as improved sanitation, hygiene (handwashing with soap) and improved water supply."

Clasen T, Schmit WP, Rabie T, et al. BMJ, April 14, 2007; 334:782-

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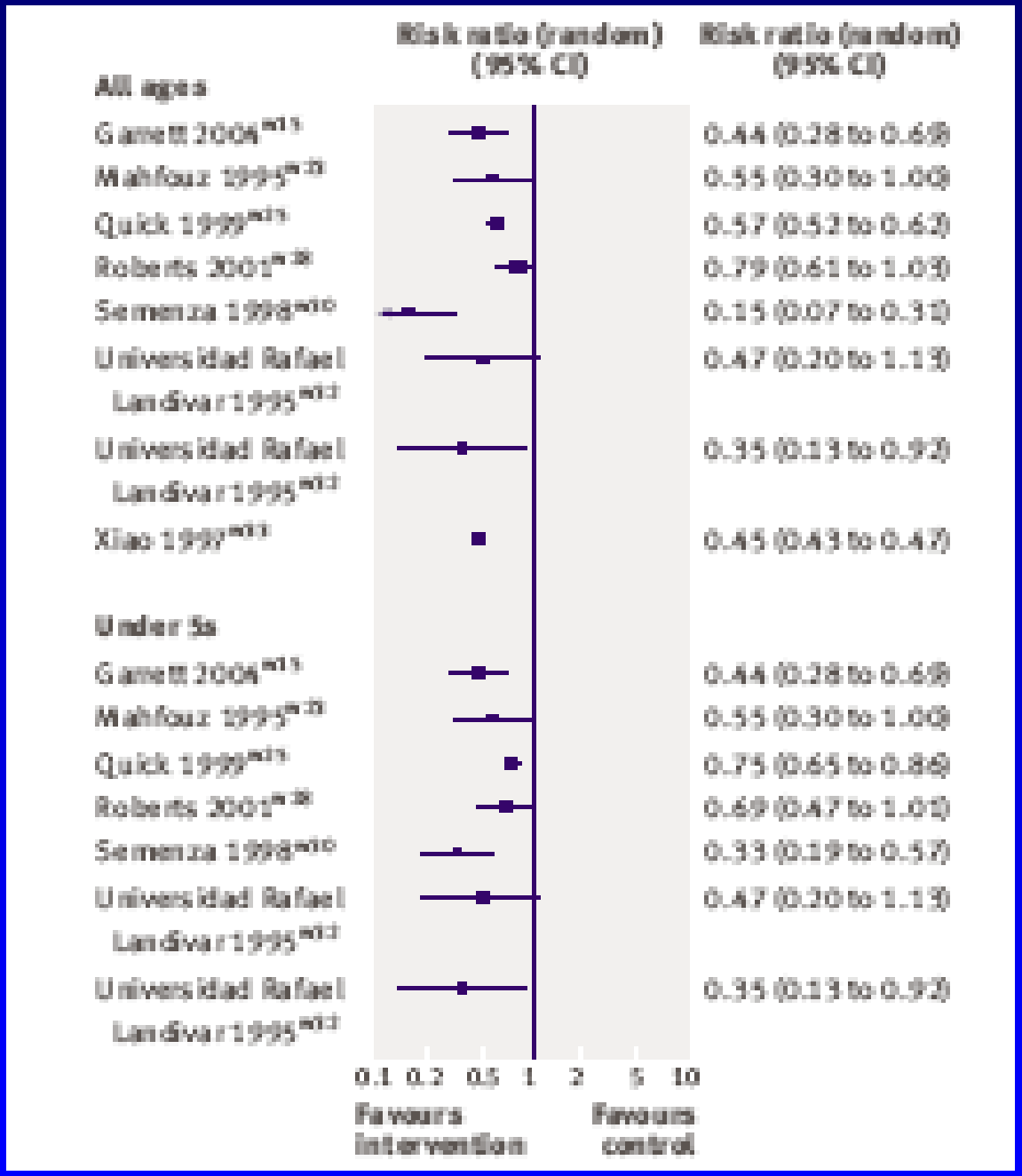

Clasen T, Schmit WP, Rabie T, et al. BMJ, April 14, 2007;334:782-

Treating water with chlorine at the point-of-use to improve water quality and reduce child diarrhea

- 21 published studies from 1985-2006

  "The intervention reduced the risk of childhood diarrhea (RR 0.71; 95% CI 0.58-0.87) and it reduced the risk of stored water contamination with *E. coli* (RR 0.20; 95% CI 0.13-0.30)."

Arnold, BF and Colford JM, Am J Trop Med Hyg; 2007;76:354-364

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HOUSEHOLD CHLORINE WATER TREATMENT META-ANALYSIS

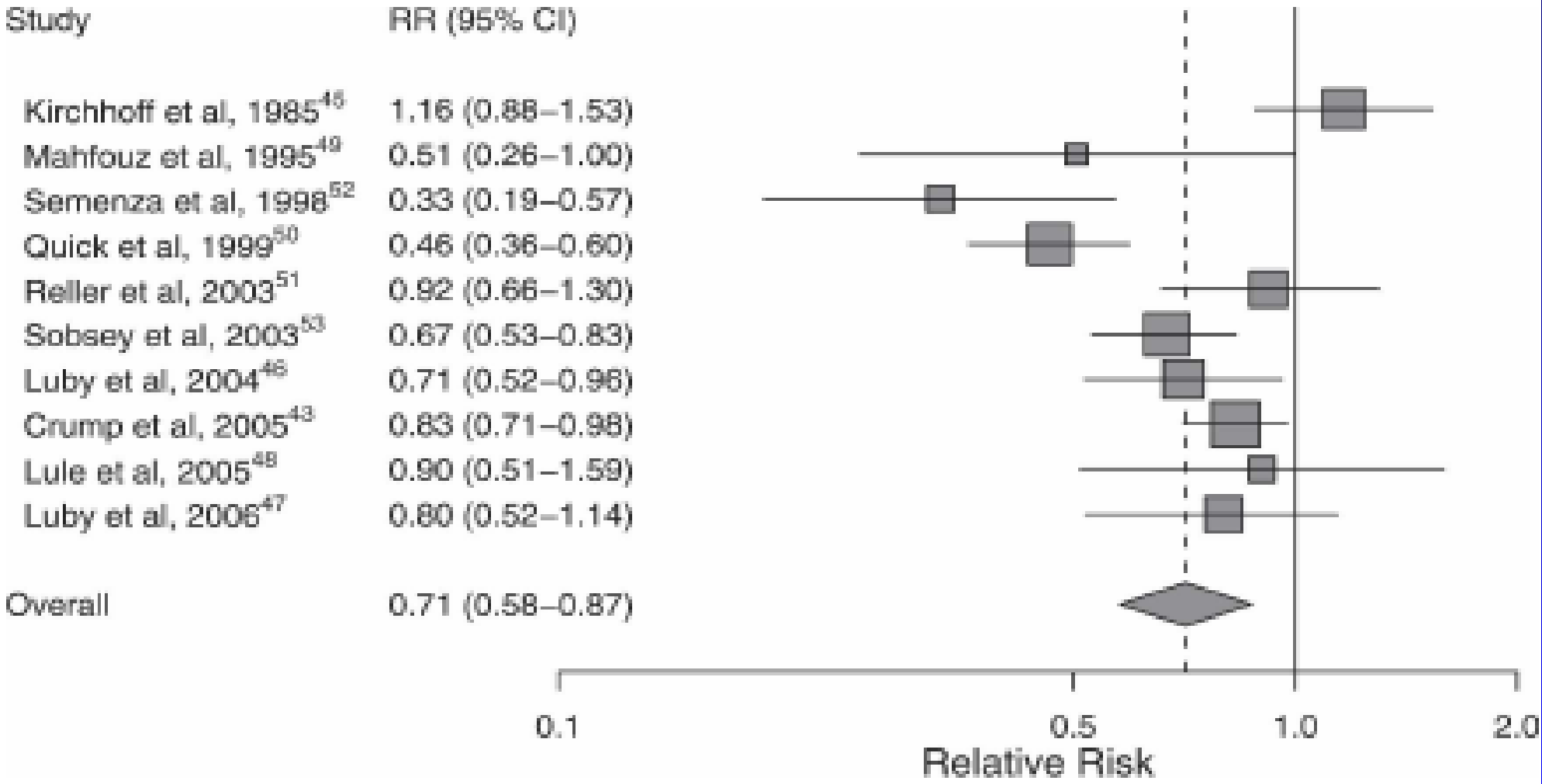
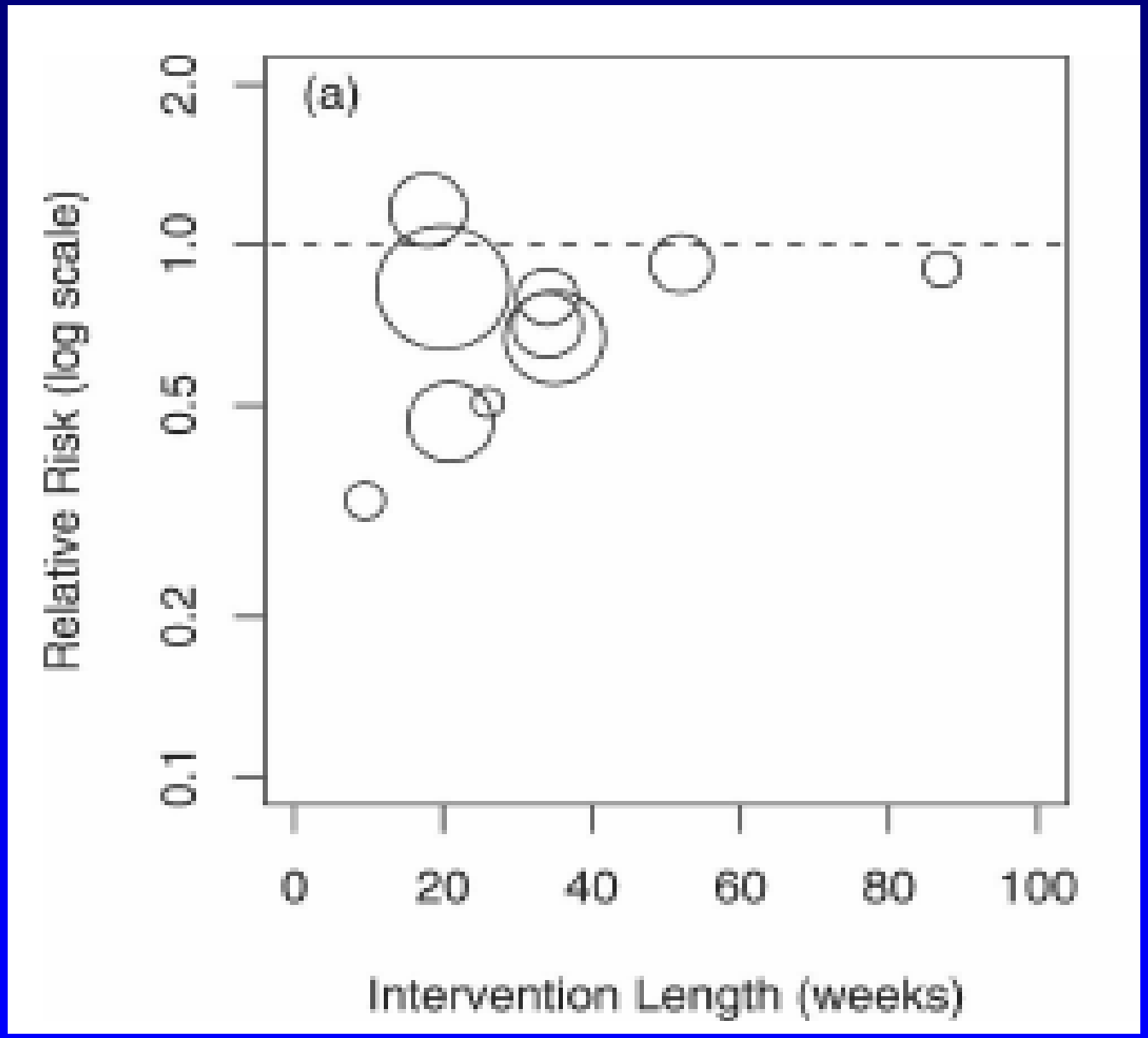
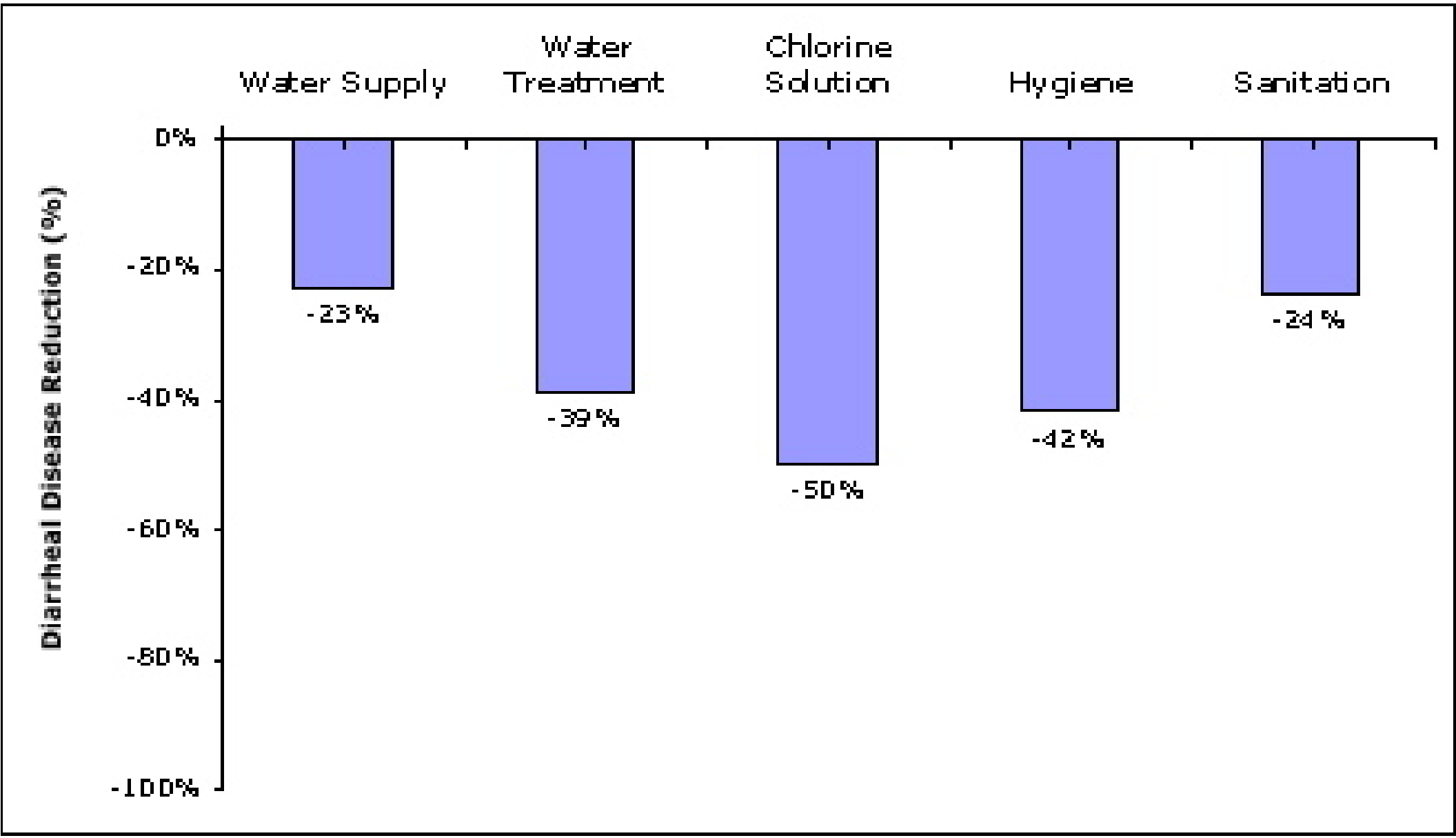


FIGURE 1. Random effects meta-analysis of point-of-use chlorine drinking water treatment and child diarrhea.

Arnold, BF and Colford JM, Am J Trop Med Hyg; 2007;76:354-364



Arnold, BF and Colford JM, Am J Trop Med Hyg; 2007;76:354-364



Fewtrell L, et al. Interventions to improve water quality for preventing diarrhea Lancet Infect Dis. 2005;5:42-52.

Crump J, Otieno P, Slutsker L, et al. BMJ Sept 3, 2005;331:478-

Effect of home-based water chlorination and safe storage on diarrhea among persons with HIV

- 509 HIV-positive individuals randomized to receive the CDC Safe Water System (SWS) or serve as controls
- Active surveillance for diarrhea for ~2 years
- SWS reduced diarrheal episodes by 25% (33% fewer days of diarrhea).

Lule, J, Mermin J, Ekwaru JP, et al. Am J Trop Med Hyg, 2005;73:926-933

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How Cost-effective is Household Water Treatment?

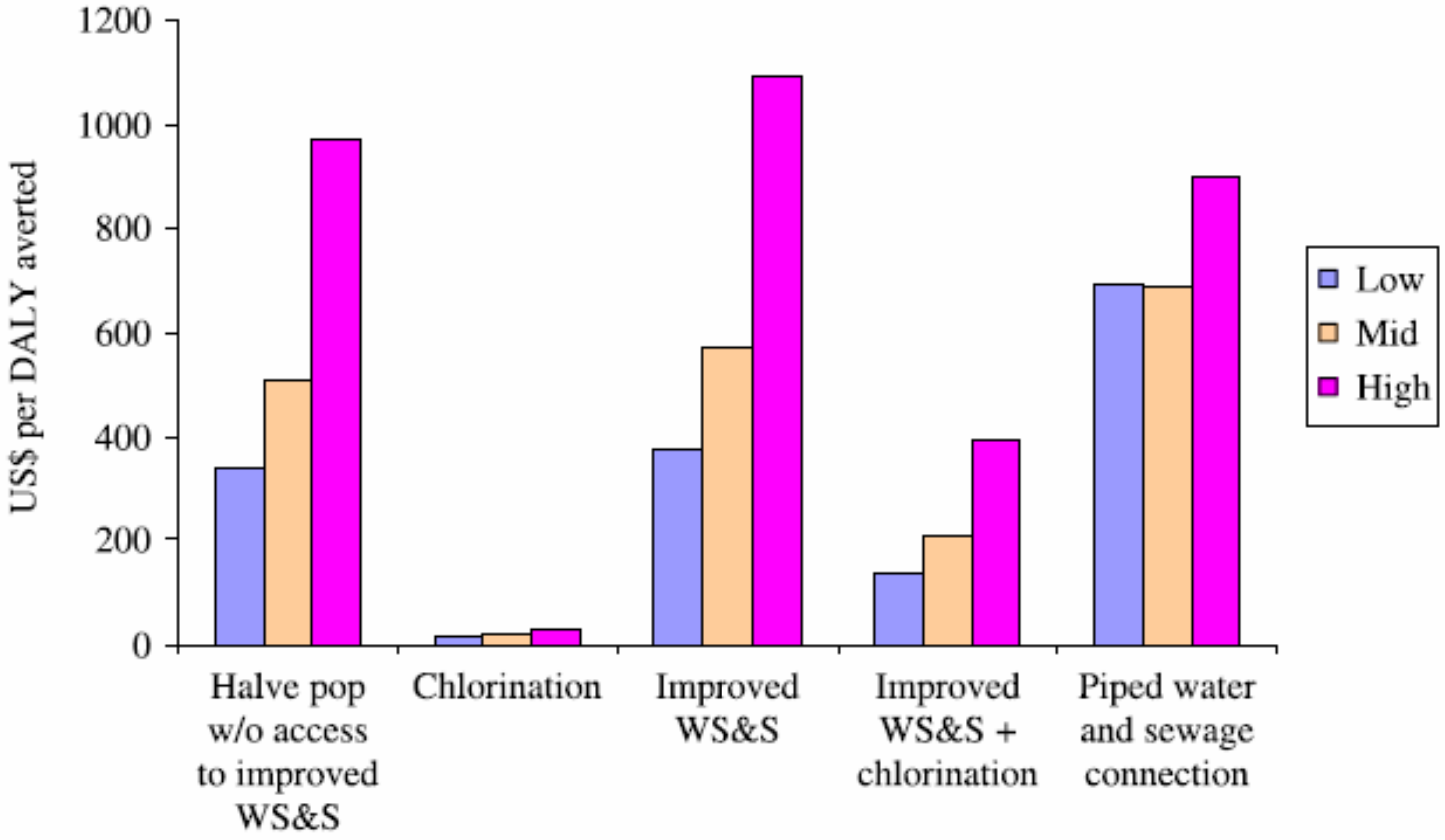

Figure 3 | Cost-effectiveness ratios under low and high assumptions in AFROD.

Haller L, Hutton G, Bartram J. Journal of Water and Health. 2007

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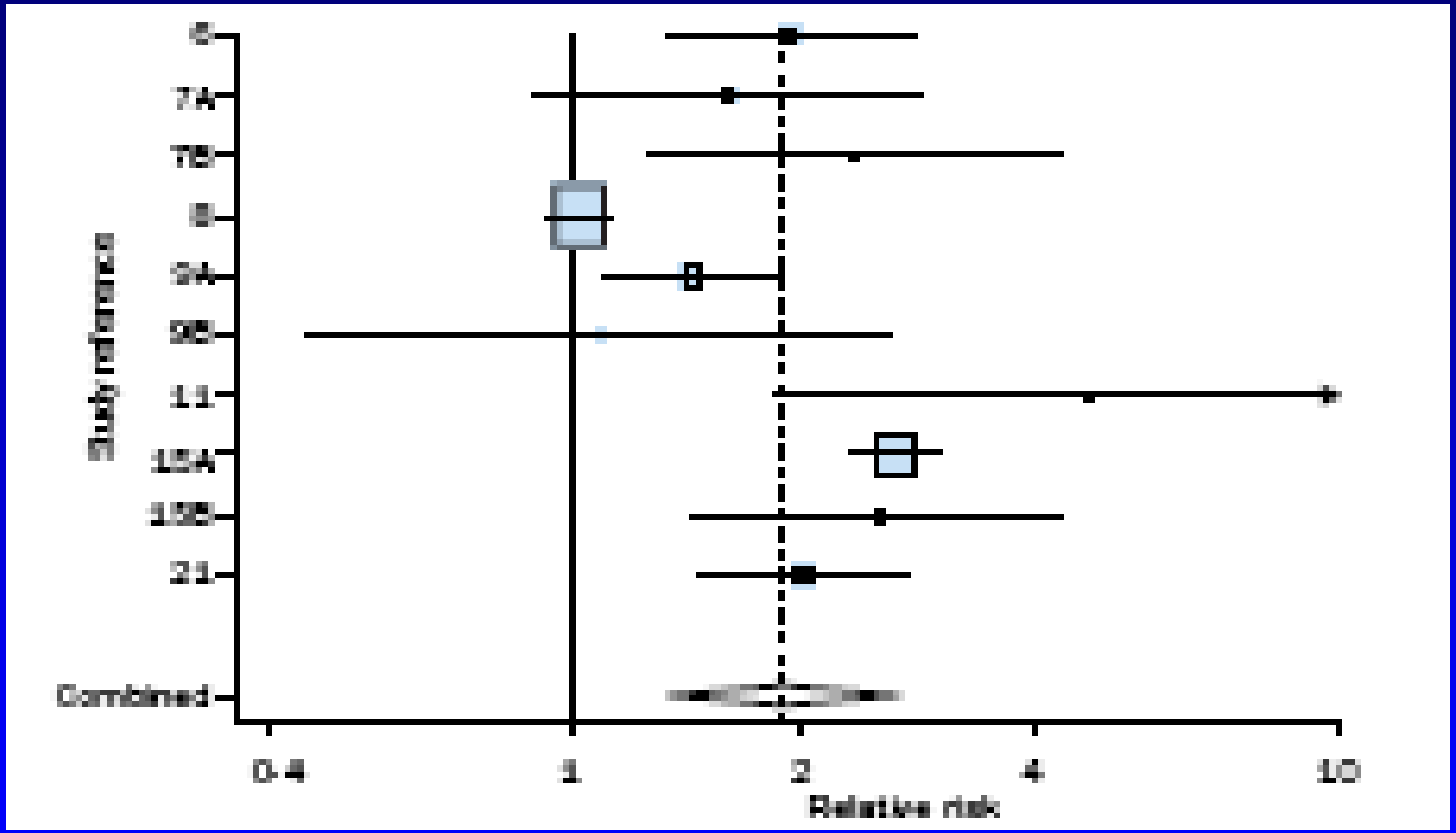
Effect of washing hands with soap on diarrhea risk in the community

- 17 studies (7 intervention trials) from 1981-2001

  "The pooled relative risk of diarrheal disease associated with not washing hands from the intervention trials was 1.85 (95% CI 1.3-2.7) implying that handwashing could reduce diarrhea risk by 47%."

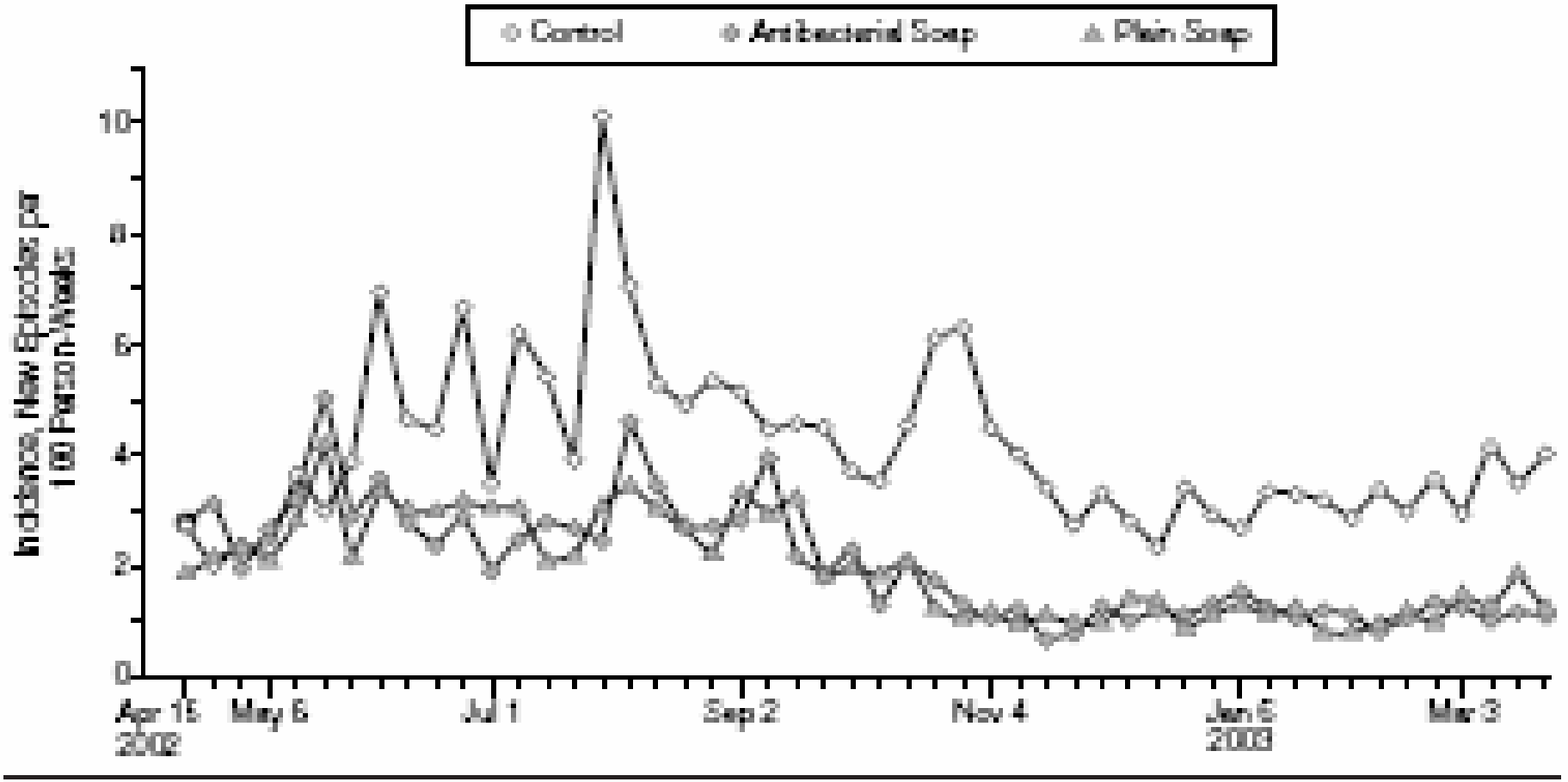
Curtis V and Cairncross S. The Lancet Infectious Diseases, May 2003;3:275-281

CDC



Curtis V and Cairncross S. The Lancet Infectious Diseases, May 2003;3:275-281

Incidence of diarrhea in children <5 years old



Luby S, Agboatwalla M, Painter J, et al. JAMA, 2004;291:2547-2554

CDC

Incidence of pneumonia in children <5 years old

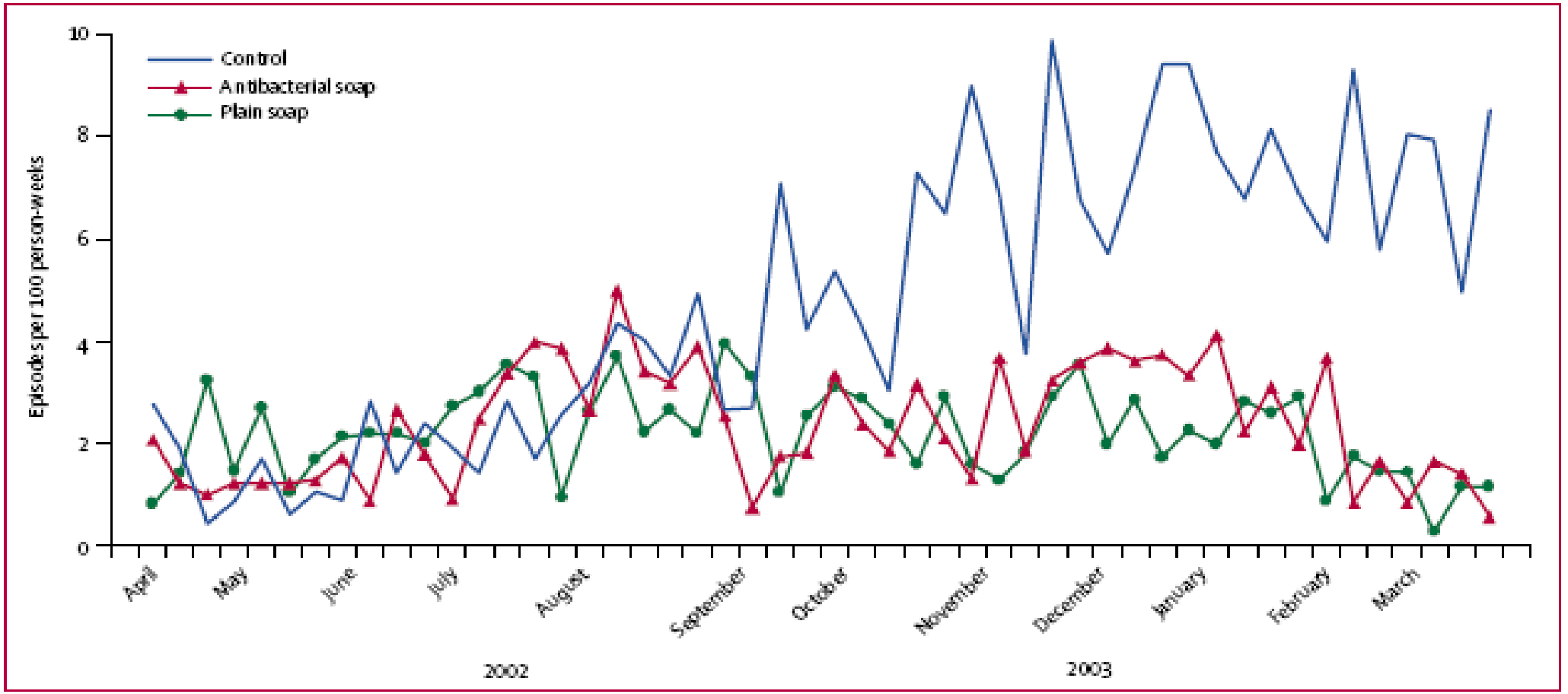


Figure 2: Incidence of pneumonia in children younger than 5 years

Luby S, Agboatwalla M, Feikin D, et al. The Lancet, 2005;366:225-233

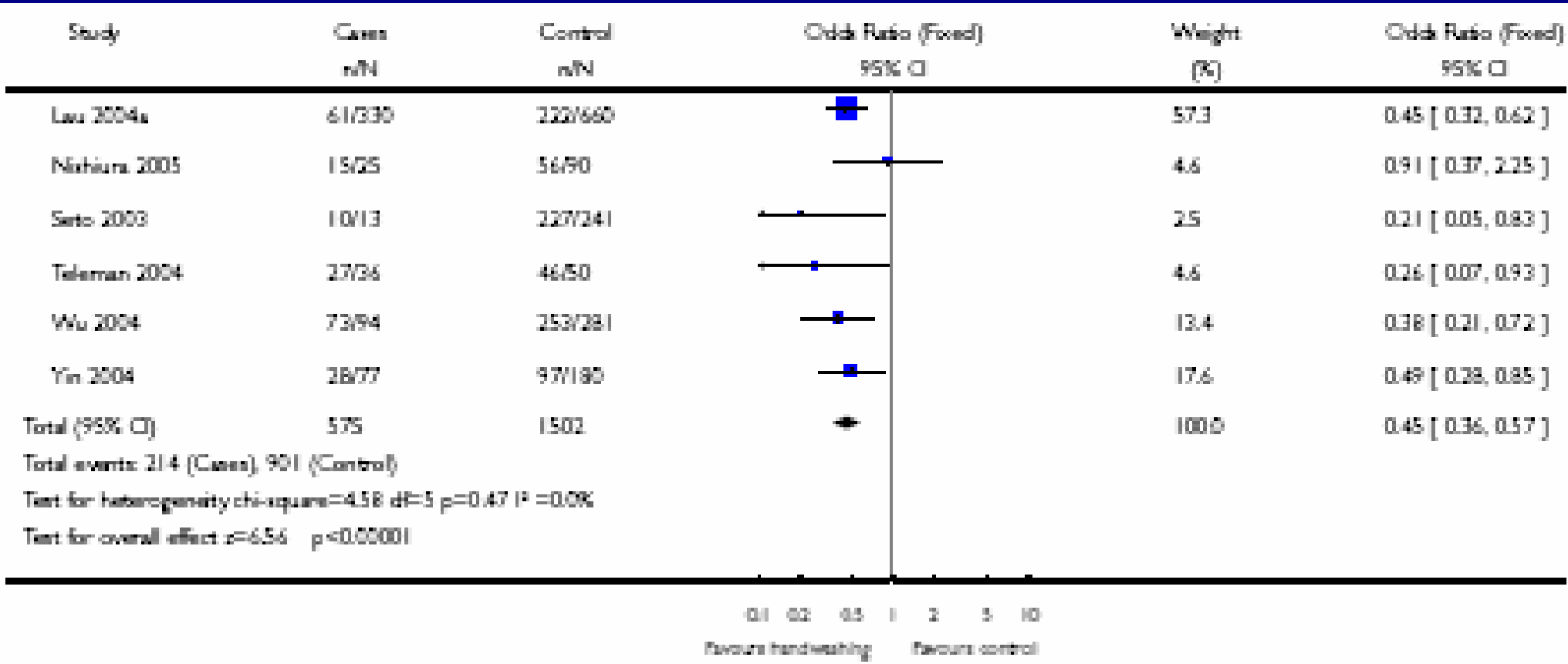
CDC

Interventions for the interruption or reduction of the spread of respiratory viruses

- 51 studies, including 6 case-control studies of frequent handwashing

  "The highest quality randomized clinical trials suggest respiratory virus spread can be prevented by hygienic measures around younger children."

Jefferson T, Foxlee R, Del Mar C, et al. The Cochrane Library, 2007 # 4



Jefferson T, Foxlee R, Del Mar C, et al. The Cochrane Library, 2007 # 4

Effect of intensive handwashing in the prevention of diarrheal illness among patients with AIDS

- 148 patients with AIDS randomized to receive an intensive handwashing intervention or as controls
- Maintained daily handwashing and diarrhea diaries
- Patients assigned to the intensive handwashing intervention group washed their hands more frequently and developed fewer episodes of illness than controls

Huang DB and Zhou J. Journal of Medical Micro, 2007;56:659-663

CDC

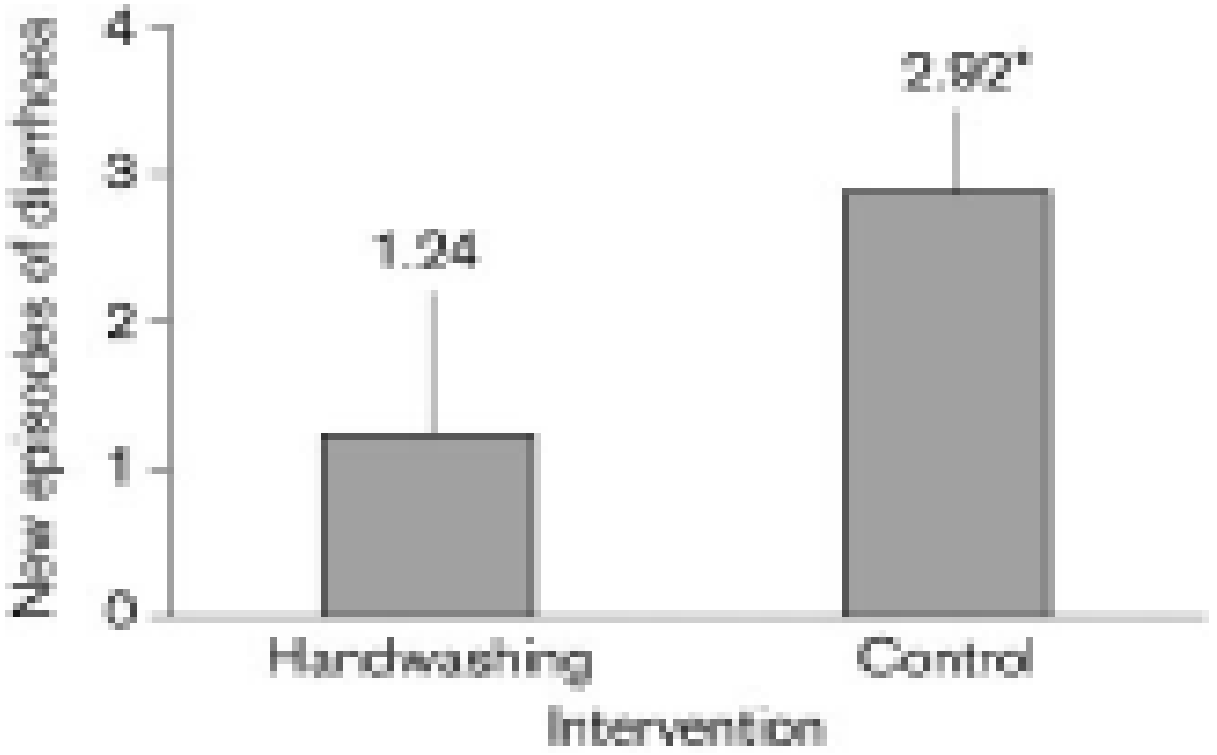


Fig. 1. Incidence of diarrhoea among patients with AIDS in the handwashing and control groups during a 1 year observation. *$P < 0.001$.

Huang DB and Zhou J. Journal of Medical Micro, 2007;56:659-663

Conclusion

- **Household water treatment significantly reduces diarrheal diseases among children and among persons infected with HIV**
- **Handwashing significantly reduces diarrheal diseases among children and among persons infected with HIV, and reduces respiratory illness and pneumonia in children**

CDC

Goal 4: Reduce Childhood Mortality

Target 5: Reduce by two-thirds, between 1990 and 2015 the under-five mortality rate