

# CONVINCING BUT INCONCLUSIVE: A Systematic Literature Review and Key Informant Interviews (KIIs) Conclude Need for Fresh Approach to Identifying Drinking Water Interventions that Achieve Health Benefits

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## Background

- Safe water is a critical component for improving health.
- Limited knowledge exists of the comparative advantages of various types of intervention approaches, and factors that contribute to impact.
- Little understanding on what's been proved conclusively about different intervention approaches, and how these findings relate to global development priorities.

## Objectives

- Understand the health impact that's been demonstrated for various types of drinking water interventions and how the various interventions compare.
- Identify factors that contribute to or interfere with intervention impact.
- Identify gaps in knowledge that would advance sector understanding of the requirements to achieve health impacts through safe water interventions.

## A Mixed-Methods Approach

**Systematic literature review** of published papers describing water interventions to assess comparative effectiveness of different interventions on diarrhea

- Search of 8 databases using specific terms to identify controlled interventions aiming to improve access or quality of drinking water to reduce diarrhea. Studies analyzed:
  - Level of Delivery – Household v. Compound v. Community v. Municipal
  - Study Approach – Hardware v. Software v. Mixed to improve consumer's water quantity or quality
  - Cost to Consumer – Free v. Consumer Costs Subsidized v. Consumer Supports all Costs
- Meta-analysis to estimate impact of different approaches.

**Key informant interviews (KIIs)** with global health and development experts to document perceptions about effective drinking water intervention approaches

- KIIs included: researchers, implementers and policy makers; men and women; high and low income country of origin
- Structured guide to assess:
  - factors critical to successful drinking water interventions,
  - challenges that prevent interventions from being successful,
  - recommendations to improve the implementation and documentation of drinking water interventions.

## Results: Literature Review

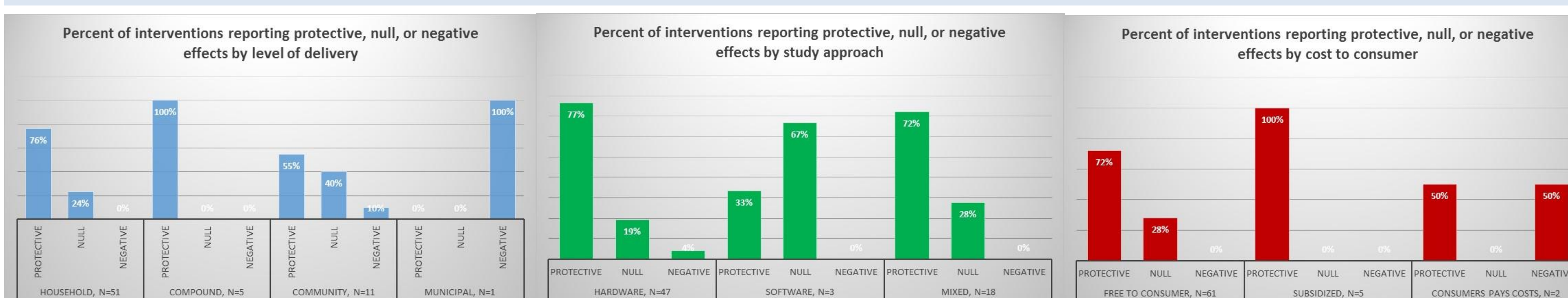
- 49 studies evaluating 68 trials in low and middle income countries (LIC/MIC) identified and included in the review.
- Range of studies was limited (**TABLE 1**):
  - Most interventions (51/68) targeted households, with few targeting community or municipal delivery.
  - Most supplied physical hardware (65/68) to improve water quantity or quality, while few (22/68) focused on behavior change or social marketing.
  - Most (61/68) provided resources to improve water for free, with few providing water that was subsidized or full cost.
- **Majority of studies (50/68) employed similar combination of strategies: free resources to households.**

**Table 1.** Distribution of intervention characteristics for 68 trials by level of delivery, approach, and cost to participant.

Cost to participant for improving water quantity or quality	Approach	Level of Intervention allocation			
		House, n=51	Compound, n=5	Community, n=11	Municipal, n=1
Free: no cost to participant, n=61	Hardware	35	5	2	1
	Software	3	0	0	0
	Mixed	12	0	3	0
Subsidized: participant pays some costs, n=5	Hardware	1	0	1	0
	Software	0	0	0	0
	Mixed	1	0	2	0
Cost: participant pays all costs, n=2	Hardware	0	0	1	0
	Software	0	0	0	0
	Mixed	0	0	1	0

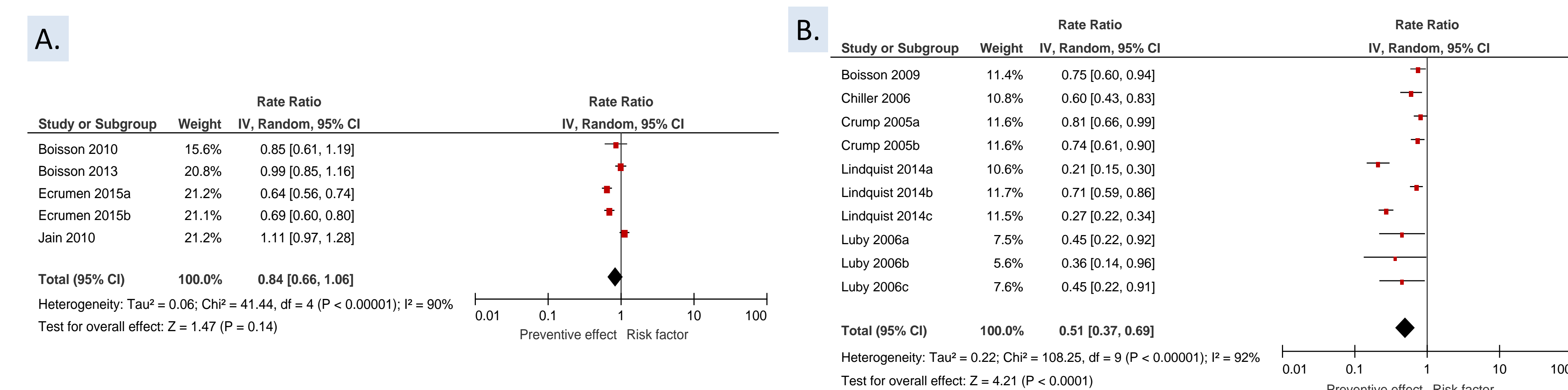
- Most studies 74% (n=50/68) reported significant decreases in diarrhea
- No meaningful differences in reported impact by comparison of sub-groups (>= 3 trials) (**FIGURE 1**) where :
  - Targeted households, compounds, or communities
  - Hardware only v. hardware approaches with behavior change elements
  - Free resources v. resources at subsidized cost
- Studies reported diverse size and range of effects ( $I^2 > 60\%$ ), so quantitative estimates could not be reported.

**Figure 1.** Percent of trials reporting protective, null, or negative effects on diarrhea, by type of approach



- Study designs may have contributed to bias in reported effects.
  - 40% of blinded trials (5 trials, Figure 2A) reported positive effects, compared to 100% of un-blinded trials (10 trials, Figure 2B)
  - 67/68 trials used self-reported diarrhea as an outcome measure
- Studies were inconsistent in reporting other information, such as compliance in intervention use, limiting our ability to explore factors that contribute to or interfere with intervention impact

**Figure 2.** Impact of blinded (A) and unblinded (B) water interventions on diarrhea. All ages. Prevalence rate ratios



## Results: KIIs

- Little evidence on critical elements of intervention design including:
  - Developing financially sustainable delivery systems; creating demand; motivating habitual safe water consumption;
  - Impact of social marketing or costs of water supply to end consumer on consumer behavior and health
- While any technology can be effective if simple and appropriate for recipients, focus on technical aspects of interventions misses the bigger picture
  - Poor uptake and compliance in use, and poor water storage are major impediments to reducing diarrhea
  - Free water services are not sustainable, and people value and are willing to pay acceptable price for water

## Conclusions

- Water interventions generally described positive health impacts, but there was insufficient data on some types of interventions to draw strong conclusions about the comparative effect of various strategies.
- Little is understood about the various factors (such as consumer education, messaging, pricing) that contribute to health impacts as only technology interventions providing free safe water in un-blinded studies have been conducted at any meaningful scale.
- Protective results may be over-reported due to use of self-reported outcomes and pervasiveness of un-blinded studies (and variance between reported results of un-blinded and blinded studies).
- More research is needed using:
  - Objective health outcomes, or alternative indicators
  - Assessments of safe water consumption at the point of use, such as water quality testing

## Next Steps

- Complete a process map of community water supply interventions to understand the drivers (hardware and software) that can impact health, and evaluate their relative effectiveness to determine most important strategies to achieve desired health outcomes
- Design a study to identify most effective approaches in community water supply that increase participation of all consumers, consistency and exclusive use of safe water for all consumption purposes, and the adoption of safe water storage, transportation and handling practices to maintain water quality.

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