

Position paper:

Implications of recent WASH and nutrition studies for WASH policy and practice

Introduction

In 2018, the WASH sector was surprised by three new high-quality studies (WASH Benefits, Kenya [1] and Bangladesh [2] and SHINE, Zimbabwe [3]) that showed little or no impact of selected WASH interventions on reducing childhood diarrhoea and stunting. Some practitioners, researchers and funders have reacted by questioning the value of investing in WASH compared to other public health interventions and how future WASH implementation can be improved to achieve greater health gains.

The studies are an important new contribution to the evidence base which have provoked a timely and important discussion, and number of commentary papers [4,5,6,7,8] reflecting on the study designs, their findings and calling for “transformative” WASH interventions.

The purpose of this paper is two-fold:

- to summarize the studies and the responses, contextualizing their findings within the wider body of evidence and,
- to distill the implications for future WASH investments, including WASH and nutrition co-programming, to guide practice, policy and research.

This paper accompanies a recorded interview [9] with the heads of WASH for WHO and UNICEF and the lead author of a consensus statement from leading WASH researchers [10].

What did the studies find?

The three very similar randomized controlled trials sought to understand if WASH interventions, either individually or in combination with nutrition interventions, could influence stunting and diarrhoea. The interventions were deployed in low-income high-burden rural settings enrolling pregnant women and their children *in utero* with follow up between 18 and 24 months. The trials were carefully planned and executed and they exhibit high internal validity.

The shared headline findings of the three studies are that the selected WASH interventions (Table 1) had no effect on child growth and only mixed effects on diarrhoea. Only the Bangladesh study showed a reduction of diarrhoea. These results are challenging because similar WASH interventions are often deployed in low-income rural settings with the expectation of improving child health by reducing incidence of diarrhoea and contributing to a reduction in stunting, although this is rarely the sole justification. Other wellbeing benefits such as time savings, school attendance and reduction in violence and stress as well as efficiency gains from co-programming with nutrition are also used to justify WASH investments.

While the studies provide good evidence for the selected interventions in the settings in which they were deployed care should be taken not to generalize results to all settings, or to generalize the selected interventions to be representative of all “basic” WASH interventions.

Table 1: Summary description of water, sanitation and hygiene (WASH) and nutrition interventions evaluated under the WASH Benefits and SHINE trials

Trial	Water	Sanitation	Hygiene	Nutrition
<i>WASH-Benefits trial, Bangladesh</i>				
<i>Intervention arm</i>	<i>Household water chlorination and promotion</i>	<i>Latrine improvements and promotion</i>	<i>Handwashing stations with soap and hygiene promotion</i>	<i>Nutrient supplementation and promotion</i>
<i>SDG classification</i>	<i>n/a</i>	<i>Basic</i>	<i>Basic</i>	<i>n/a</i>
<i>Details of intervention</i>	<i>A 10-L storage vessel with supply of disinfectant tablets</i>	<i>An 'improved' two-pit water-sealed latrine, plus potties and child stool collection device</i>	<i>Two handwashing stations per household, near latrine and kitchen, with regular supply of soap</i>	<i>Daily small-quantity of lipid-based nutrient supplement and promotion of appropriate and safe complementary feeding</i>
<i>WASH-Benefits trial, Kenya</i>				
<i>Intervention arm</i>	<i>Point of collection water chlorination and promotion</i>	<i>Latrine improvements and promotion</i>	<i>Handwashing station with soap, and hygiene promotion</i>	<i>Nutrient supplementation and promotion</i>
<i>SDG classification</i>	<i>n/a</i>	<i>Basic</i>	<i>Basic</i>	<i>n/a</i>
<i>Details of intervention</i>	<i>Communal chlorine dispenser and supply of bottled chlorine</i>	<i>An 'improved' single pit latrine with plastic slab and hole-lid, plus potty and child stool collection device</i>	<i>Two handwashing stations per household, near latrine and kitchen, and quarterly supply of soap</i>	<i>Daily small-quantity of lipid-based nutrient supplement and promotion of appropriate and safe complementary feeding</i>
<i>SHINE trial, Zimbabwe</i>				
<i>Intervention arm</i>	<i>Household water chlorination and promotion</i>	<i>Latrine construction and promotion</i>	<i>Hand-washing stations with soap and hygiene promotion</i>	<i>Nutrient supplementation and promotion</i>
<i>SDG classification</i>	<i>n/a</i>	<i>Basic</i>	<i>Basic</i>	<i>n/a</i>
<i>Details of intervention</i>	<i>Monthly delivery of chlorine solution</i>	<i>A ventilated improved pit latrine constructed</i>	<i>Two handwashing stations per household, near latrine and kitchen, and monthly delivery of soap</i>	<i>Daily small quantity of lipid-based nutrient supplement and promotion of appropriate and safe complementary feeding</i>

Source: Cumming et al. (2019)

Why were the studies not as effective as expected?

The reasons for lower than expected impact diarrhoea and stunting could be myriad. WASH is a very broad category of interventions with different interventions more or less appropriate in different settings. These same interventions might have had a greater effect in settings where baseline conditions for WASH and disease were different. Or, conversely, a different package of more ambitious WASH interventions might have had a greater impact in the same setting.

The studies themselves and subsequent commentary have put forward a number of factors that may have contributed to poor

results including; incomplete community coverage, lack of continuous water through household connections, continued exposure to animal and child faeces, poor food hygiene, ineffectiveness of chlorination against some key pathogens (notably *Cryptosporidium*), and the short time between interventions and follow-up assessments. In addition, the interventions did not replicate investments in the enabling environment or “system” for sustained service delivery as typically implemented by WASH practitioners.

In essence, it is likely that the interventions failed to interrupt all pathways for contamination of the environment and thus systematically prevent human exposure to faecal pathogens.

Box 1: WASH and health outcomes analyzed using a faecal contamination index (FAECI)

Wolf and co-authors plotted results of all large well designed WASH trials against an index of contamination at end line – 16 being a very contaminated environment and three being a clean environment. The results show a non-linear relationship in which interventions that do not achieve a clean environment have little or no impact on diarrhoea (relative risk near one). Improvements made in studies with an index score higher than eight may have been a necessary incremental step but were insufficient to reduce diarrhoea. The findings underscore the need for entire community coverage, higher service levels and interventions to address multiple exposure pathways to achieve to achieve clean environments. The study also found that less than 24% of people in low- and middle-income countries live in communities with >95% coverage with basic sanitation.

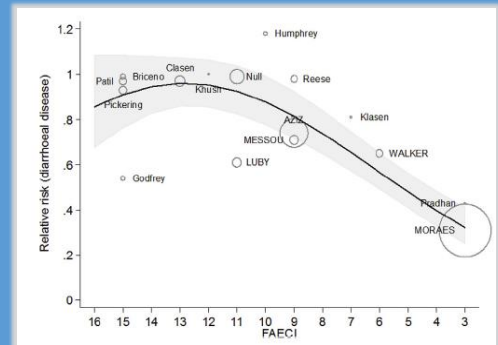


Figure 1: Relative risks of diarrhoeal disease as a function of the FAECI

This phenomenon is shown in another recent analysis that mapped results of WASH randomized controlled trials (RCTs) against a faecal contamination index [11] (Box 1). The findings suggest that unless the intervention achieves a clean environment, significant reduction in diarrhoea and by extension stunting (Figure 1) are unlikely. Furthermore, given the uncertainty and context specificity of how microbes move in the environment, it may not be realistic to expect health impacts over the timeframe of many trials and programmatic interventions.

How do the findings fit within the wider body of evidence on WASH?

Historically, large population-level reductions in diarrhoea and stunting have not been achieved without WASH. Furthermore, the established understanding of how sanitation-related pathogens are transmitted (Box 2) is not undermined by these findings.

WHO systematically analyzed over 1000 studies between 2012 and 2017 to develop the new Guidelines on Sanitation and Health (2018) [12].

The reviews covered key infectious diseases associated with sanitation as well as nutrition and well-being outcomes. Overall, the body of evidence indicates a protective effect of sanitation on infectious diseases and nutrition outcomes and suggests greater impacts when entire community coverage of sanitation is achieved. However, health gains are typically smaller than anticipated, and the overall quality of evidence is low. Significant evidence gaps remain, particularly on the role of food contamination and the contribution of animal waste to disease transmission.

Moreover, findings from the 2014 burden of disease estimates [13] sent a strong signal that provision of “improved” water and sanitation technologies (as defined by the WHO/UNICEF JMP) could only deliver modest health gains, and that more substantial health improvements can only come with entire community coverage with higher service levels. These new higher service levels are now well established within monitoring ladders for SDG 6.1 and 6.2 and are also reflected in the new Guidelines on Sanitation and Health.

Box 2: Updated f-diagram of WASH disease transmission

The f-diagram for WASH disease transmission was first popularized in 1958 in WHO's *Excreta Disposal for Rural Areas and Small Communities*. While it has served the sector well, the diagram simplified sanitation as a single barrier and represented exposure from contaminated water, soil, insects and hands as simple discrete events. The updated f-diagram in the Guidelines on Sanitation and Health retains the simple graphical style but adds by unpacking sanitation hazards at each step of the sanitation chain and by representing the complex interplay between environmental contamination and the mode of exposure (hazardous events) to reach a new host.

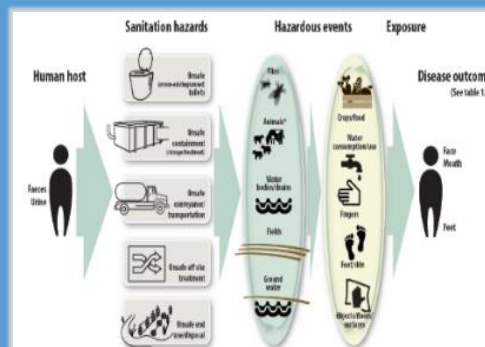


Figure 2: Transmission of excreta-related pathogens

What are the implications for WASH programming?

The findings of WASH Benefits and SHINE are not a reason to do less on WASH. Conversely, the historical significance of WASH in disease control, the strong conceptual basis for WASH (Box 2) and the need for WASH to reduce the potential for outbreaks in addition to breaking endemic transmission all indicate that the WASH sector collectively needs to do more and better to reach the ambitious targets of the SDGs.

The findings, together with the wider body of evidence, reinforce that the new ambitious higher service levels of safely managed water and sanitation services within the SDGs are needed to deliver health benefits such as reducing diarrhoeal disease. Interventions that improve services and contribute to health through improvements in wellbeing (e.g. time savings, school attendance, and preventing anxiety) are valuable even if they do not sufficiently reduce pathogen exposure to reduce enteric infections (Box 1). In these circumstances, as a minimum, interventions should reach everyone in a community with at least basic WASH services and incorporate future upgrading to safely managed services in the

programme design (Box 3). The quality and sustainability of lower service levels is key to avoid backsliding and loss of the initial investment before upgrades can happen. To ensure this happens, implementers should consider investing more resources into planning, coordination, and follow-up. The objectives of this more robust planning process are to broker any collaborations needed to scale coverage in communities to 100%, to sustain technical assistance and monitoring of programme implementation, and to increase support for transitions to higher service levels.

The findings also highlight blind spots in typical WASH programming – particularly the role of animal waste and faecal contamination of food during irrigation and food preparation that are often overlooked in WASH programme design.

Many have called for transformative WASH in response to the studies but with some ambiguity around what is meant. While the consensus is that this implies interventions that lead to a comprehensively clean environment (Box 1), the path to this result is not universally agreed. Some believe transformative WASH would be reached through innovative technologies, some through

Box 3 Definitions and normative guidance on safe WASH

Monitoring definitions for basic and safely managed drinking-water and sanitation services are defined as:

- **Safely managed drinking-water** - water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination
- **Basic drinking-water** – water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing
- **Safely managed sanitation** - use of improved sanitation facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite
- **Basic sanitation** - use of improved facilities that are not shared with other households
- **Basic hygiene** - availability of a handwashing facility on premises with soap and water

Normative guidance for implementation are found in the *Guidelines for Drinking-water Quality* [14] and *Guidelines on Sanitation and Health* [12].

risk-management approaches, and some through strengthening of WASH systems or through a combination of the above.

While “transformative WASH” is not yet well defined, it is clear that it must be context-specific (i.e. responding to local sociocultural, economic and environmental factors) and risk-based (i.e. responding to local disease burden and transmission patterns). A critical element of context-specific and risk-based programming will be the use of local health data to identify the specific diarrhoeal diseases and other WASH-related infections common in the area. Interventions can then be tailored to focus on the pathways most relevant to interrupt transmission of specific pathogens. This approach challenges WASH actors to move beyond delivering predefined interventions (e.g. toilets, chlorination and generic behavior change approaches) to instead design interventions with context-specific risks in mind.

The new Guidelines on Sanitation and Health recommend context-specific risk management approaches to identify and manage all transmission pathways (Box 2) and describe the role of the health sector in surveillance and the use of data to target and tailor interventions.

Other key health sector functions include contributing health protective norms and standards, community level WASH promotion and ongoing monitoring of WASH status.

In addition, “transformation” is needed in the implementation environment, collectively referred to as systems. WASH programmes need to include greater investment in the systems of governance for leadership, policy, planning, financing, market development, capacity development and monitoring for course correction and improvement at both national and local level. Interventions need to be delivered at the scale of administrative areas, with programmes covering entire districts, municipalities, cities and provinces. East Asian countries have most recently demonstrated this type of transformative governance to deliver large scale and sustainable improvements in WASH and health [15].

The fact that diarrhoea mortality has decreased dramatically over time but morbidity has remained relatively constant suggests that the health sector is getting better at life-saving treatment but neglecting preventive measures that are ultimately more cost effective [16] and necessary to sustain disease control. The health

sector needs to work more on prevention and supporting WASH actors through their core functions described in the Guidelines on Sanitation and Health to improve health outcomes from WASH investments.

Finally, water and sanitation services are fundamentally public goods in need of public financing to deliver co-benefits for health as well as social and economic development [17]. WASH needs to be seen as a complementary not a competing intervention. As such, it's not a matter of choosing between interventions such as WASH, nutrition, vaccines or drug distributions. Instead it is necessary to improve how these interventions work together. These findings underscore that targeting and coordinating WASH service delivery with disease control programmes is essential to achieve and sustain disease reductions.

Specifically, what are the implications for WASH and nutrition co-programming?

Primarily, the new studies show that the selected WASH interventions (which did not sufficiently address some of the key transmission pathways) overlaid with nutrition interventions are not enough to achieve synergies and that improving WASH alone is unlikely to significantly reduce the high burden of stunting. The studies challenge whether there is an additional health benefit of co-programming WASH and nutrition interventions and indicates that co-programming cannot be justified solely on the basis of increasing health impacts.

However, the studies also show that co-programming did not lead to lower health impacts for WASH and joint messaging didn't diminish the uptake of hygiene messages [18]. Experience also shows that working together at community level can offer efficiencies in programme delivery, reduce the burden on

community health workers and increase wellbeing benefits for households using better WASH services.

These studies are not a call to stop working together but rather to programme together more effectively. Simply working in the same geographic areas is not enough. Outcomes for children and vulnerable populations requires more active targeting of risks. Contextualized, risk-informed programming is critical to ensure risks are analyzed and transmission pathways relevant to the context are prioritized.

WASH practitioners need to aim for higher levels of service moving whole communities up the ladder and investing in capacity of services providers and local level governance to sustain use. This implies moving beyond targeting open defecation free status and household water treatment. It calls on actors to tackle sustainability through other context-specific approaches (e.g. including market-based sanitation) and addressing all elements of the quality, accessibility, acceptability and affordability of WASH services.

What are the implications for future WASH research on outcomes for diarrhoea and stunting?

The primary research question raised by the studies is why the WASH interventions failed to improve key child health outcomes as hypothesized. These interventions made some improvements in infrastructure and demonstrated a successful shift in behaviours but these were not enough to transform the environment and sufficiently reduce pathogen exposure.

Future research efforts need to define "transformative WASH" that would more completely block disease transmission and build

the evidence base for effective delivery models in high-burden settings. “Transformative WASH” will depend on the context, respecting the principles of safely managed WASH, and will entail a comprehensive package of WASH interventions tailored to address the local exposure landscape and enteric disease burden as well as social and environment conditions. The FAECI analysis [11] indicates that randomized controlled trials of health impacts are premature if the intervention being studied is unlikely to be transformative. In such circumstances research on intermediate outcomes such as reduced faecal contamination and exposure would offer greater insights.

Detailed exposure assessment in different settings will help to understand how people are exposed to different infectious agents and therefore what interventions are most relevant. Rigorous intervention studies focusing on reducing faecal contamination and exposure as well as enteric disease over a longer timeframe are needed for interventions that achieve community-wide safely managed water and sanitation services as called for under the new SDG framework. Interpretation of results will benefit greatly from a detailed description of both the intervention and the enabling environment in which the intervention was delivered that is often not well studied or described in the literature.

Furthermore the scope of WASH warrants re-examination:

- Safe management of child faeces is an essential component of an effective sanitation service chain but has been inconsistently addressed [12]. It is also clear that animal faeces contribute to diarrhoeal disease in humans. Evidence gaps remain on

how to best address these issues that require change of individual and collective beliefs and practices but perhaps more importantly demands coordinated action to optimize health impact.

- The provision of clean play spaces to separate the youngest children from consumption of soil and feces seems to be a critical intervention. However, no intervention studies to date have documented a clean play space option that is culturally accepted, practical, efficacious, and easily cleanable. [8]
- Aspects of food hygiene in the home and faecal contamination of food crops on farms and in markets (though use of excreta and wastewater for fertilizer, irrigation and washing) are often not included in WASH interventions despite evidence showing that produce is a dominant exposure pathway in many settings [19]. Inclusion of food hygiene and safe use of wastewater and excreta in programmes and research as well as closer co-ordination with food safety and agriculture programs is need to address exposure though contaminated food.
- Although environment enteric dysfunction (EED) is hypothesized to be a key underlying cause of stunting, EED remains a poorly understood condition. Key questions persists regarding the exact causes, measurement, and reversibility of EED, as well as its specific relationship to undernutrition.

Lastly, constructive interaction between researchers and those working in policy and practice is needed to strengthen implementation science and to ensure that the process of designing studies and interpreting and applying results incorporates the perspectives of those designing and delivering policy and programmes.

References

1. Null C, Stewart CP, Pickering AJ, Dentz HN, Arnold BF, Arnold CD, et al. Effects of water quality, sanitation, handwashing, and nutritional interventions on diarrhoea and child growth in rural Kenya: a cluster randomized controlled trial. *Lancet Glob Health*. 2018; 6(3): e316–29. ([www.thelancet.com/pdfs/journals/langlo/PIIS2214-109X\(18\)30005-6.pdf](http://www.thelancet.com/pdfs/journals/langlo/PIIS2214-109X(18)30005-6.pdf))
2. Luby SP, Rahman M, Arnold BF, Unicomb L, Ashraf S, Winch PJ, et al. Effects of water quality, sanitation, handwashing, and nutritional interventions on diarrhoea and child growth in rural Bangladesh: a cluster randomized controlled trial. *Lancet Glob Health*. 2018; 6(3): e302–15. ([www.thelancet.com/journals/langlo/article/PIIS2214-109X\(17\)30490-4/fulltext](http://www.thelancet.com/journals/langlo/article/PIIS2214-109X(17)30490-4/fulltext))
3. Humphrey JH, Mbuya MN, Ntozini R, Moulton LH, Stoltzfus RJ, Tavengwa NV, et al. Independent and combined effects of improved water, sanitation, and hygiene, and improved complementary feeding, on child stunting and anaemia in rural Zimbabwe: a cluster-randomised trial. *Lancet Glob Health*. 2019; 7(1): e132–47. ([www.thelancet.com/journals/langlo/article/PIIS2214-109X\(18\)30374-7/fulltext](http://www.thelancet.com/journals/langlo/article/PIIS2214-109X(18)30374-7/fulltext))
4. Cumming O, Curtis V. Implications of WASH Benefits trials for water and sanitation. *Lancet Glob Health*. 2018; 6(6): e613–e614. (www.ncbi.nlm.nih.gov/pubmed/29706563)
5. Arnold BF, Null C, Luby SP, Colford JM Jr. Implications of WASH Benefits trials for water and sanitation - Authors' reply. *Lancet Glob Health*. 2018; 6(6):e616–e617. (www.ncbi.nlm.nih.gov/pubmed/29706562)
6. WaterAid. WaterAid's reflections on the results of the WASH benefits Trials – Kenya and Bangladesh. 2018. (www.communityledtotalsanitation.org/resources/wateraid-s-reflections-results-wash-benefits-trials-kenya-and-bangladesh)
7. Maleta KM, Manary MJ. WASH alone cannot prevent childhood linear growth faltering. *Lancet Glob Health*. 2019; 7(1): e16–17. (www.ncbi.nlm.nih.gov/pubmed/30554752)
8. WASH and Nutrition – an intimate and complex relationship: A Discussion Paper. UNICEF; 2019 (in press).
9. SIWI Sofa interview 8410 part 1: Recent evidence on health outcomes of WASH: implications for policy (<https://vimeo.com/354875412>)
10. Cumming O, Arnold BF, Ban R, Clasen T, Esteves Mills J, Freeman MC, et al. The implications of three major new trials for the effect of water, sanitation and hygiene on childhood diarrhea and stunting: consensus statement. *BMC Med*. 2019; 17(1):173. (<https://bmcmmedicine.biomedcentral.com/articles/10.1186/s12916-019-1410-x>)
11. Wolf J, Johnston R, Hunter PR, Gordon B, Medicott K, Prüss-Ustün A. A Faecal Contamination Index for interpreting heterogeneous diarrhoea impacts of water, sanitation and hygiene interventions and overall, regional and country estimates of community sanitation coverage with a focus on low- and middle-income countries. *Int J Hyg Environ Health*. 2019; 222(2):270–282. (www.ncbi.nlm.nih.gov/pubmed/30503228)
12. WHO Guidelines on Sanitation and Health. Geneva: World Health Organization; 2018. (https://www.who.int/water_sanitation_health/publications/guidelines-on-sanitation-and-health/en/)
13. Preventing diarrhoea through better water, sanitation and hygiene: exposures and impacts in low-and middle-income countries. Geneva: World Health Organization; 2016. (who.int/water_sanitation_health/publications/gbd_poor_water/en/)
14. WHO Guidelines on Drinking Water Quality. Geneva: World Health Organization; 2017. (www.who.int/water_sanitation_health/water-quality/guidelines/en/)
15. WaterAid. Achieving total sanitation and hygiene coverage within a generation – lessons from East Asia. 2016. (<https://washmatters.wateraid.org/publications/achieving-total-sanitation-and-hygiene-coverage-within-a-generation-lessons-from-east>)
16. Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage. Geneva: World Health Organization; 2012. (www.who.int/water_sanitation_health/publications/global_costs/en/)
17. Selina Lo, Sylvestre Gaudin, Carlos Corvalan, Alexandra J. Earle, Odd Hanssen, Annette Prüss-Ustun, Maria Neira & Agnès Soucat. 2019: The Case for Public Financing of Environmental Common Goods for Health, Health Systems & Reform, DOI: 10.1080/23288604.2019.1669948. (www.tandfonline.com/doi/full/10.1080/23288604.2019.1669948)
18. Gimaiyo G, McManus J, Yarri M, Singh S, Trevett A, Moloney G, et al. Can child-focused sanitation and nutrition programming improve health practices and outcomes? Evidence from a randomised controlled trial in Kitui County, Kenya. *BMJ Glob Health*. 2019; 4(1):e000973. (<https://gh.bmi.com/content/4/1/e000973>)
19. SaniPath. (<http://sanipath.org/about/overview/>)