

Water, sanitation and hygiene to prevent child stunting and anaemia

Child stunting and anaemia

Child stunting is a serious problem, affecting almost one in four children aged <5 (151 million children). Stunting reduces child survival; it is associated with 15-17% of deaths among children aged <5. It also leads to long-term cognitive deficits, reduced educational

attainment, and lower adult economic productivity. Adults who are stunted are at higher risk of having children who are stunted. Globally, stunting is estimated to cost \$177 billion per annual birth cohort.

It is thought that stunting is caused predominantly by inadequate diet, and recurrent illness. There is also some evidence to

Key points

- Child stunting is a serious problem, affecting one in four children aged <5 globally, causing deaths, cognitive deficits, reduced educational attainment and lower adult economic productivity
- The SHINE trial was a large, cluster randomised trial carried out in rural Zimbabwe investigating whether:
 - improved Infant and Young Child Feeding (IYCF) would reduce stunting and anaemia among children
 - improved water, sanitation and hygiene (WASH) would reduce stunting and anaemia among children
- The SHINE WASH interventions were behaviour change modules delivered to pregnant women and mothers of infants by village health workers, and provision to households of pregnant women/ infants of:
 - A Ventilated improved pit (VIP) latrine built within 6 weeks of enrolment
 - Two hand-washing stations
 - A washable plastic mat and play yard to separate children from animals
 - A monthly delivery of soap and chlorine solution
- The WASH intervention had no effect on stunting, anaemia or diarrhoea, despite the interventions being implemented with high fidelity, and significant behaviour change taking place
- Access to WASH that ensures privacy and dignity is a basic human right
- Optimal WASH prevents human exposure to faecal pathogens which cause disease
- Research is needed to
 - test new approaches to WASH that tackle faecal exposure in infants and young children
 - better understand all the causes of stunting and test interventions to tackle these causes
 - provide high quality evidence on whether or not community coverage of sanitation can reduce stunting, anaemia and diarrhoea among children

The SHINE trial

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The WASH intervention

The SHINE trial WASH intervention included:

- Behaviour change modules delivered to pregnant women and mothers of infants by village health workers covering:
 1. Safe disposal of faeces
 2. Hand-washing with soap at key times
 3. Protection of infants from geophagia (eating soil) and ingesting animal faeces
 4. Chlorination of drinking water, especially for the infant
 5. Hygienic preparation of complementary food

Households of pregnant women/infants in clusters randomised to this intervention also received:

- A Ventilated improved pit (VIP) latrine built within 6 weeks of enrollment
- Two hand-washing stations
- A washable plastic mat and play yard to separate children from animals
- A monthly delivery of soap and chlorine solution



Play yard and play mat

suggest that stunting may be associated with environmental enteric dysfunction (EED). EED is a subclinical disorder of the gut that may cause reduced absorption of nutrients and chronic inflammation, both of which could prevent healthy growth. EED is thought to be highly prevalent in low-income countries.

Anaemia is common in Africa and Asia, particularly in children aged between 12 to 24 months. It affects around half of children in Africa and Asia. Anaemia is the 15th leading cause of lost disability-adjusted life-years globally. Anaemia can cause tiredness and lethargy, and in children it can delay cognitive and behavioural development. The most common cause of anaemia in young children is iron deficiency, which causes around half of anaemia in children under the age of 2.

WASH for reducing stunting

Analysis from cohort studies suggests that preventing all episodes of diarrhoea in a child in its first two years of life could correct about 7% of the growth deficit.

Observational studies have shown an association between linear growth and

SHINE participants

The SHINE trial monitored the health of 3,686 HIV-unexposed babies. Among households taking part in the trial:

- Around half of household members practiced open defecation
- One third of households had an improved latrine
- Very few had electricity from the grid
- Two thirds had a solar panel
- 40% of households obtained drinking water from an unimproved source
- Among HIV-negative women, 40% had a return-trip to water >30 minutes.
- Volume of water collected was 9.5 L per capita per day
- Mothers were well-educated
- Most mothers were married
- 10% of mothers were infected with *S. haematobium*
- Mean infant birth weight was 3.1 kg (9% <2.5kg)
- 88% of infants were delivered in health facilities



Ventilated improved pit latrine and handwashing station

sanitation conditions, suggesting that improving water, sanitation and hygiene may help reduce stunting. Until recently, there have been no randomised trials looking at the effect of improving water, sanitation and hygiene on child health.

This briefing paper looks at the evidence around a water, sanitation and hygiene (WASH) intervention tested in the SHINE trial, for reducing stunting and anaemia. It focuses on HIV-unexposed infants. A companion briefing paper examines these interventions in HIV-exposed infants.

Delivery and uptake of the SHINE WASH intervention

Delivery of the WASH intervention was good:

- mothers received a median of 15/15 planned intervention visits delivered by Village Health Workers between enrolment and 12 months postpartum.
- 98% of households in the WASH arms received VIP latrines and hand-washing stations
- >92% of households in the WASH arms received play mats and play yards
- >79% of households in the WASH arms received $\geq 80\%$ of planned soap and chlorine solution deliveries

At 12 months, uptake of the WASH interventions was also good:

- Open defecation was $<1\%$ among WASH household members (compared to 41% in non-WASH arms)
- Nearly all WASH households had an improved latrine
- 86% of WASH householders had a well-trodden path to the improved latrine, and the latrine was not being used for storage (compared to 24% in the non-WASH arms)
- 84% of HIV-unexposed and 83% of HIV-exposed WASH households had a hand-washing station with observed soap/rubbing agent and water (compared to 3% in the non-WASH households)
- 44% had water with a free chlorine concentration of ≥ 0.1 ppm (compared to 0.8% of non-WASH households)
- 27% of HIV-negative mothers and 23% of HIV-positive mothers in WASH households reported ever seeing their child ingest soil (compared to 73% of mothers in non-WASH households), and 3% chicken faeces (compared to 21% in non-WASH households)

Effectiveness of the SHINE WASH intervention

Despite good uptake of the WASH intervention, it had no effect on growth or anaemia outcomes, including stunting. There was also no evidence of reduced diarrhoea or respiratory tract infections in the WASH arms, and no significant difference in mortality.

How do these results fit with the wider evidence base?

These findings on stunting are consistent with the findings of two other trials that tested the same hypothesis (WASH Benefits Bangladesh and WASH Benefits Kenya), but go against the findings of observational studies that have reported an association between child growth and sanitation.

The finding that the WASH intervention in SHINE did not reduce diarrhoea at 12 or 18 months goes against the findings of Cochrane Reviews from 2015, which found that water chlorination and hand-washing promotion reduced diarrhoea by around 25%. This may be because the studies that found a significant benefit in the Cochrane Review had a very high intervention

dose: behaviour change promoters had daily to fortnightly contact with study participants. This is much greater than the monthly contact delivered in SHINE. It may be that adherence to hand-washing and household level water chlorination interventions, which are dependent on sustained behaviour change, is too low to reduce diarrhoea when behaviour change messages are delivered less frequently than monthly.

Implications of the SHINE results for WASH programmes

The SHINE results suggest that implementing elementary WASH interventions (improved pit latrines, handwashing promotion and point of use water chlorination) at a household-level is unlikely to be sufficient to increase child linear growth. Integrating these interventions together with IYCF is unlikely to increase child linear growth more than implementing IYCF alone. This suggests policy and programming organisations should not promote integration of current elementary household-level WASH interventions with infant feeding interventions for the purpose of improve linear growth or reducing stunting.

The evidence that point of use water treatment and handwashing promotion reduce diarrhoea comes from studies that have had very intensive contact between behaviour change promoters and participants. Once the intervention ends, the effect on child diarrhoea has not been sustained. These approaches are unlikely to be feasible or sustainably implemented in large-scale WASH programmes.

WASH is important, and the findings of the SHINE trial suggest we need to do more and better WASH than SHINE was able to achieve, if we are to improve child health. Investment in WASH is important.

What do the WASH results mean?



The WASH intervention did not reduce stunting or anaemia, despite the interventions being implemented with high fidelity, and significant behaviour change taking place

We need research to identify much more effective ways to reduce babies' and young children's exposure to faecal pathogens

Household-level interventions like those in SHINE do not protect babies enough

Evidence gaps

We need to develop and test new approaches to WASH that tackle faecal exposure in infants and young children

Children in the WASH arms of SHINE were apparently still exposed to considerable levels of pathogens, despite good uptake of the intervention, since diarrhoea was not reduced. Research is needed into new WASH solutions that can effectively protect children from pathogens, and allow them to thrive. For example, SHINE did not test provision of on-plot, sustained, high-quality water supply, which is an aspiration of the Sustainable Development Goal 6. This would avoid the need for household-level water treatment and simplify frequent handwashing. Transformative WASH may require complete separation of domestic animals from children's living environments, as cohabitation of domestic animals is a primary pathway for pathogen transmission, especially among young children who frequently put hands and objects in their mouths.

We need a better understanding of the causes of stunting

It is not clear from the SHINE trial whether the intervention failed to reduce stunting because the intervention itself was not effective enough, or whether the hypothesised pathway (that reducing faecal ingestion does not reduce environmental enteric dysfunction, or that reducing environmental enteric dysfunction

does not improve linear growth) was incorrect. Ongoing laboratory analysis of EED biomarkers from the SHINE trial will investigate this. Further research is needed to better understand the causes of stunting, in order to identify approaches that can prevent it.

Further evidence is needed to confirm whether or not community-level sanitation interventions can reduce stunting

In the SHINE the interventions were delivered at the household rather than community level. It may be that a higher level of community sanitation coverage is needed to have an impact on growth. One trial of Community Led Total Sanitation in Mali reduced open defecation among adults and significantly increased length for age Z-Score by 0.18 among children under the age of 5 (but did not reduce diarrhoea). The results of other trials of community-based sanitation have shown no effect on linear growth.

Conclusions

The SHINE trial failed to show a benefit on child stunting, anaemia, or diarrhoea from a household level WASH intervention including provision of improved pit latrines, handwashing stations and point of use water treatment along with behaviour change modules, despite good uptake of the interventions. These results should encourage policymakers, programmes and funders to reappraise approaches to WASH to identify and deliver interventions that are more effective in reducing child exposure to faecal contamination and spark increased investment in research and development of new approaches to tackling the huge problem of stunting.

Recommendations

Research is needed to:

- Increase understanding of the causes of stunting
- Develop and test new approaches to WASH that tackle faecal exposure in infants and young children (Transformative WASH)
- Provide high quality evidence on whether or not Community Approaches to Total Sanitation can reduce stunting, anaemia and diarrhoea among children

Further reading

Humphrey JH, Mbuya MNN, Ntozini R 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](#). The Lancet Global Health. 2018.

Maleta KM & Manary MJ. [WASH alone cannot prevent childhood linear growth faltering](#). The Lancet Global Health. 2018.

South A, Humphrey JH, Prendergast AJ. [Infant and Young Child Feeding to prevent stunting and anaemia](#). SHINE briefing paper number 1. 2018.

South A, Humphrey JH, Prendergast AJ. [Reducing stunting among HIV-exposed uninfected children](#). SHINE briefing paper number 3. 2018.

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