Additional Resource Intro A

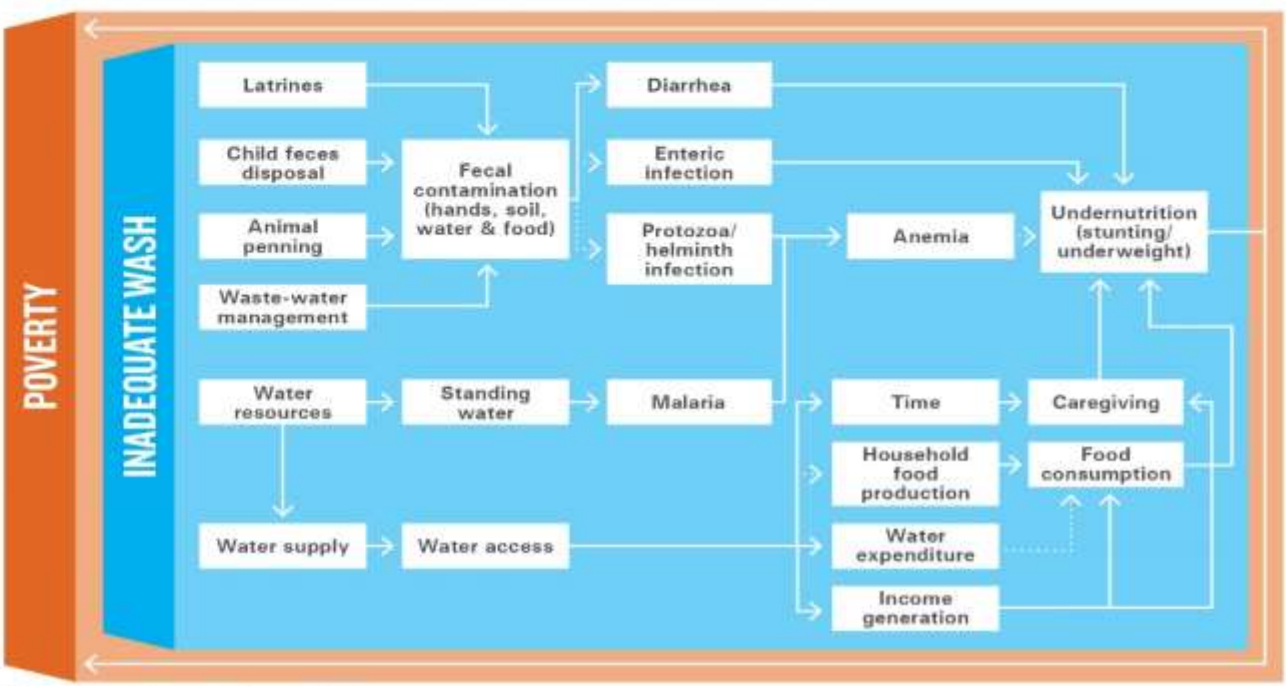
Summary of the evidence base for synergized WASH and Nutrition programming

[Adapted from Chapter 2 of *Improving Nutrition Outcomes with Better Water, Sanitation and Hygiene: Practical Solutions for Policies and Programmes*, UNICEF/USAID/WHO, 2016]

Links between WASH and undernutrition

Lack of access to WASH can affect a child's nutritional status in many ways. Existing evidence supports at least three direct pathways: via diarrheal diseases, via intestinal parasite infections and through environmental enteric dysfunction. WASH may also impact nutritional status indirectly by necessitating walking long distances in search of water and sanitation facilities and diverting a mother's time away from child care (Fenn et al., 2012). These multiple pathways between WASH practices and malnutrition are illustrated in the diagram below.

FIGURE 2. PATHWAYS LINKING WASH AND NUTRITION OUTCOMES



Adapted from Chase and Ngure (2016).

Diarrhea

Diarrhea is a leading cause of mortality and morbidity among children under five years of age. Although mortality from diarrhea in this age group has fallen steadily over the past decades, from 1.5 million deaths in 1990 to 622,000 deaths in 2012, diarrheal morbidity has remained stable, with 1.7 billion cases occurring annually (Fischer Walker et al., 2012; Liu et al., 2012). Children under five years of age in low-income countries experience, on average, 2.9 episodes of diarrhea per year, with the highest incidence rates in the first two years of life — the critical window for a child's development (Fischer Walker et al., 2012).

Diarrhea and undernutrition form part of a vicious cycle. Diarrhea can impair nutritional status through loss of appetite, malabsorption of nutrients and increased metabolism (Caulfield et al., 2004; Petri et al., 2008; Dewey and Mayers, 2011). Frequent episodes of diarrhea in the first two years of life increase the risk of stunting and can impair cognitive development (Grantham-McGregor et al., 2007; Victora et al., 2008). At the same time, undernourished children have weakened immune systems, which make them more susceptible to enteric infections and lead to more severe and prolonged episodes of diarrhea (Caulfield et al., 2004).

Intestinal parasitic infections

Soil-transmitted helminth infections — roundworm, whipworm and hookworm — affect millions of people worldwide (WHO, 2013c). Soil-transmitted helminth infections are directly caused by poor sanitation. Helminth eggs and larvae can survive for months in the soil and can infect humans when ingested (e.g., via contaminated water or food), by contact with fomites or by direct contact with the skin when walking barefoot on contaminated soil (hookworm larvae).

Soil-transmitted helminth infections can affect nutritional status by causing malabsorption of nutrients, loss of appetite and increased blood loss. Heavy infections with whipworm and roundworm can impair growth (O'Lorcain and Holland, 2000). Hookworm infections are a major cause of anemia in pregnant women and children. As many as one third of pregnant women in Africa are at risk of hookworm-related anaemia (Brooker, Hotez and Bundy, 2008), which in turn increases the risk of preterm delivery and low-birthweight babies and, eventually, child undernutrition (Black et al., 2013).

Environmental enteropathy

Enteric pathogens can impair nutritional status even in the absence of symptoms like diarrhea. Children living in poor sanitary conditions are exposed to a high load of pathogens, especially between the ages of six months and two years, when they start crawling on the floor and putting objects into their mouths (Ngure et al., 2014). Chronic ingestion of pathogens can cause recurring inflammation and damage to the gut, leading to malabsorption of nutrients. This condition is often referred to as environmental enteropathy or environmental enteric dysfunction (Humphrey, 2009). Researchers suggest that environmental enteric dysfunction may be an important cause of poor growth and may compromise the efficacy of nutritional interventions (Humphrey, 2009; Korpe and Petri, 2012). Several reviews highlighting the mounting evidence for links between unhygienic environments and gut dysfunction have recently been published (Humphrey, 2009; Korpe and Petri, 2012; Prendergast and Kelly, 2012).

Evidence on the impact of WASH on nutritional status

WASH, diarrhea and soil-transmitted helminth infections

A large number of systematic reviews have been conducted to assess the impact of WASH interventions on the incidence and prevalence of diarrhea (Esrey, Feachem and Hughes, 1985; Esrey et al., 1991; Fewtrell et al., 2005; Clasen et al., 2016, 2010; Arnold and Colford, 2007; Ejemot et al., 2008; Waddington et al., 2009; Norman, Pedley and Takkouche, 2010). The magnitude of the effect that WASH interventions have on diarrheal mortality and morbidity varies depending on a number of factors, including the type and quality of the interventions, populations targeted, pathogens circulating in the environment, study design and methodological quality.

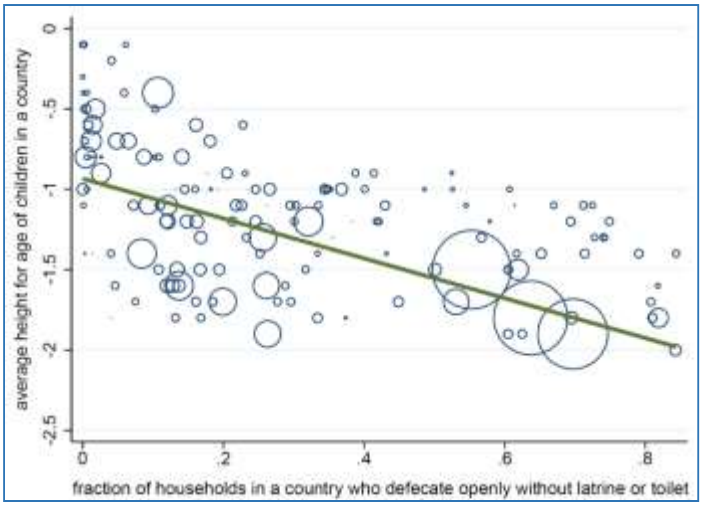
According to the most recent global burden of disease estimates, access to improved WASH could prevent 361,000 diarrheal deaths per year among children under five years of age, representing 58% of the total deaths from diarrhea in this age group. This analysis also suggests that the greatest reductions in diarrheal mortality (up to 73%) can be achieved through services that provide safe and continuous piped water supply and through sewerage connections that remove excreta from both households and community environments (Prüss-Ustün et al., 2014).

Furthermore, recent meta-analyses have found that improving a range of WASH services and practices in households reduces the incidence of soil-transmitted helminth infections by, on average, one third (Ziegelbauer et al., 2012; Strunz et al., 2014).

WASH and nutritional outcomes

Generally, less evidence and fewer rigorous trials exist on the link between WASH and improved nutritional status compared with WASH and the incidence of diarrhea or soil-transmitted helminth infections. Nevertheless, there has been a growing interest in better understanding and measuring the effect of WASH on nutritional outcomes, and new research results provide insights into the relationship.

Observational studies have found associations between the frequency of open defecation and the prevalence of stunting. An analysis of data from 140 demographic and health surveys (DHS) in 65 countries reported that over half of the variation in average child height between countries was explained by the frequency of open defecation (Spears, Ghosh and Cumming, 2013). Another analysis of 171 surveys in 70 low- and middle-income countries found that increasing access to and use of improved sanitation and improved water sources reduced the risk of stunting (Fink, Gunther and Hill, 2011). In a cluster randomized trial of 121 villages in Mali, children in communities that reduced open defecation through the community-led total sanitation (CLTS) approach suffered comparatively less stunting than those in comparison villages (Alzua et al., 2015).



Spears et al, 2013

Only a few rigorous study designs (i.e., randomized controlled trials) have been employed to measure the effect of WASH on nutritional outcomes. A Cochrane review identified five cluster-randomized controlled trials to measure the effect of WASH interventions on nutritional status (Dangour et al., 2013). These five studies, conducted in low-income settings, found evidence for a small but statistically significant effect of WASH interventions on stunting. The interventions were limited to water quality and hygiene and were of short duration, and no study considered the effect of a complete package of WASH interventions (Du Preez, McGuigan and Conroy, 2010; Du Preez et al., 2011).

Whereas the Cochrane review suggests that WASH interventions can improve nutritional status, a number of large studies have recently been completed or are under way in Africa and Asia that will provide more robust evidence on how and by how much different WASH interventions influence nutritional outcomes and identify the most effective ways of linking WASH with nutrition interventions (WASH Benefits in Bangladesh and Kenya, SHINE in Zimbabwe). The MapSan (Maputo Sanitation) study is a controlled before-and-after study of the health impacts on children of shared sanitation interventions in low-income neighborhoods in Maputo, Mozambique (Brown et al., 2015). The study aims to explore whether exposure to enteric pathogens and health outcomes varies with population density and to address the debate as to whether shared or compound sanitation can be considered 'improved'. The baseline phase was completed in January 2016 and the follow-up phase runs until January 2017. Data collected includes children's height and weight and stool samples for the measurement of soil-transmitted helminths.

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