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Technical Brief 3

WASH and its Links to Nutrition

USAID Water and Development

TECHNICAL SERIES

INTRODUCTION

Under USAID's Water and Development Plan, USAID seeks to increase access to sustainable water and sanitation services, promote key hygiene behaviors, and enhance the effective management of the water resources. USAID's Multi-Sectoral Nutrition Strategy (2014-2025) describes the Agency's efforts to increase provision and utilization of high-quality nutrition services, country capacity and commitment to nutrition, multi-sectoral coordination to improve nutritional outcomes, and evidence generation and innovation for nutrition. These water, sanitation, and hygiene (WASH) and nutrition outcomes are essential to saving lives, increasing economic productivity, building resilience, promoting equity, and improving mental and social well-being.

The objective of this document is to summarize the state of the evidence and provide guidance about approaches to WASH that are likely to have greater impact on nutrition outcomes. This is motivated by new findings based on large and rigorous control trials published since guidance was last issued [1-6]. This document does not seek to summarize the findings of these trials.[1] This technical brief builds on this information and will provide an overview of the links between WASH and nutrition and discuss USAID recommendations for WASH programming.

KEY TAKEAWAYS

- There is strong evidence linking safe WASH to health and nutrition, though nutrition is only one of many development outcomes from investment in WASH services.
- USAID has identified four recommendations for WASH programming that are likely to have greater impacts on health and nutrition:
  - Implement area-wide sanitation interventions that lead to coverage at scale
  - Professionalize water service delivery working towards safely managed water services
  - Reduce barriers to social and behavior change through aspirational products and services
  - Explore ways to interrupt fecal-oral pathways from poor food hygiene, contact with animal feces, and direct soil/feces ingestion

[1] For information on the control trials, please see the consensus statement.

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BACKGROUND

Malnutrition remains a significant public health threat that requires multi-faceted and layered interventions. Undernutrition is an underlying cause of 45 percent of child deaths globally, and the lives of nearly 7.3 percent of the world's children are at immediate risk due to wasting (low weight for height). Globally, 21.9 percent of children under 2 years old are stunted (low height for age) [7]. A child's nutritional status is dependent on a variety of interconnected factors, which makes determining the causes of malnutrition and stunting complex. Known nutrition-specific interventions[2] with 90 percent coverage are estimated to address only 20 percent of stunting cases [8]. Child malnutrition both exacerbates and is affected by multiple determinants of morbidity and mortality, including; poor access to health services, inadequate childcare practices, lack of access to clean water, inadequate sanitation, poor hygiene practices, and socio-economic status. Therefore, interventions that compliment nutrition-specific interventions and address multiple factors are required to improve nutrition and health outcomes.

There is strong evidence linking WASH to child health and nutrition. However, few experimental studies report direct effects of WASH services on nutrition outcomes. This is likely due to inherent challenges in conducting randomized trials on complex interventions combining infrastructure and behavior, both of which interact strongly with local environmental and social systems [9], as well as the multi-sectoral nature of malnutrition risk factors [10]. Also, the most rigorous studies tested the effect of small-scale household level WASH interventions, requiring intensive behavior change, not large-scale changes to WASH services.

WASH and Acute Malnutrition

While this technical brief focuses on the relationship between WASH and stunting, USAID also recognizes the potential links between WASH and acute malnutrition. The causes of acute malnutrition—or "wasting"—are influenced by some of the same pathways described in this brief, among other health and nutrition factors. WASH services play an important role in the prevention and treatment of acute malnutrition. More research is needed to better understand which WASH services are most effective at improving recovery rates from acute malnutrition.

Poor WASH services and practices may impact child undernutrition through four pathways: (1) repeated episodes of diarrhea; (2) frequent and intense enteric infections; (3) poor gut health; and (4) effects from significant time spent accessing services. This section is not a systematic review of the evidence for each hypothesized pathway, but an overview of the most relevant evidence at this stage. Others have published more exhaustive reviews [11].

1. REPEATED EPISODES OF DIARRHEA

Based on evidence collected since the 1970s, WASH service improvements are estimated to reduce diarrheal disease incidence by between 16–75 percent, depending on the service level [1]. The most recent estimate found 829,000 diarrheal deaths, accounting for 8 percent of total morbidity for children under 5, and 49.8 million disability-adjusted life-years (DALYs) are attributed to poor WASH each year [12]. There is strong evidence that repeated episodes of diarrhea and severity of diarrhea in young children are associated with stunting [13]. Current or recent diarrheal episodes have also been associated with childhood anemia [14].

[2] Nutrition-specific interventions include improving nutrition of pregnant and lactating women; early initiation of breastfeeding within one hour of birth; exclusive breastfeeding for the first six months; counseling and support for continued breastfeeding along with appropriate complementary feeding from six months up to 2 years and beyond; micronutrient supplementation to women of reproductive age, pregnant women, and children; fortification, when needed; management of moderate and severe acute malnutrition; and nutritional care and support for children and women in difficult circumstances.

2. ENTERIC INFECTIONS

Enteric infections from bacteria, viruses, protozoa, and soil-transmitted helminth (STH) infections infect 1.5 billion people globally [15] and can cause reductions in appetite, nutritional deficiencies, anemia, and exacerbate malnutrition [7]. These infections may be symptomatic or asymptomatic, making them difficult to detect, diagnose, and treat. Giardia and STH infections have been associated with stunting [16-19]. STH infections are also a major cause of childhood anemia [19]. WASH services are integral to reducing the incidence of STH infections. A 2014 meta-analysis found that improved access to piped water and sanitation facilities, wearing shoes, and handwashing with soap were associated with a 33–70 percent lower odds of STH infection [20]. Recent meta-analyses reported that improvements to sanitation services specifically reduce the risk of STH and giardia infections [21-23].

3. ENVIRONMENTAL ENTERIC DYSFUNCTION (EED)

While both diarrheal disease and enteric infections can affect undernutrition through limited absorption of nutrients, evidence indicates there are other biological or non-biological factors to consider. EED is a disorder in which the intestines become inflamed, causing reduced nutrient absorption and disrupted gut immune response. Researchers have hypothesized that EED may be a critical contributing factor to poor child nutrition [24]. The effect of WASH services on EED are difficult to measure due to a lack of consensus on a clinical definition or appropriate biomarkers for EED [25]. However, observational studies in Bangladesh and Malawi demonstrated associations between some measures of EED and WASH services [26-27]. EED has also been associated with childhood anemia in children under the age of two [28]. However, the associations between EED and stunting are highly variable, conflicting, and easily confounded [29].

4. EFFECTS FROM SIGNIFICANT TIME SPENT ACCESSING SERVICES

Time burdens associated with poor access to basic water service are well documented [30]. Reducing time collecting water from distant sources or waiting in long queues have been shown to reduce diarrhea, reduce child mortality, and improve child growth [31]. The proximity to water sources and available quantity of water impacts household water consumption, especially on domestic hygiene needs (such as handwashing, bathing, cleaning, and laundry) [32]. The quantity of water consumed and the time available to care for children is affected by the availability of water [31]. Water collection-related time savings may provide more disposable time for caregivers, particularly women, to engage in childcare, grow and prepare nutritious foods, participate in income-generating activities, or enjoy leisure time.

CONCLUSIONS

In summary, safe WASH services and behaviors have many demonstrated benefits which are causally linked to health.[3] This includes time savings, reducing diarrhea, and reducing enteric infections. Each of these health benefits have some association or evidence on impacting nutrition outcomes. Other health outcomes, like EED, are poorly defined and understood. Figure 1 on page 4 describes the chain linking WASH interventions and nutrition outcomes.

However, malnutrition has multiple complex and context-specific determinants most of which are not related to WASH, and some of which are intergenerational [10,26]. It is notable that there is no evidence, as confirmed through three recent control trials, that delivering WASH interventions jointly with nutrition interventions yields better results on nutrition outcomes [2].

[3] This technical brief does not discuss benefits such as economic productivity, gender equity, other aspects of mental and social well-being, and other rights-based benefits to WASH services.

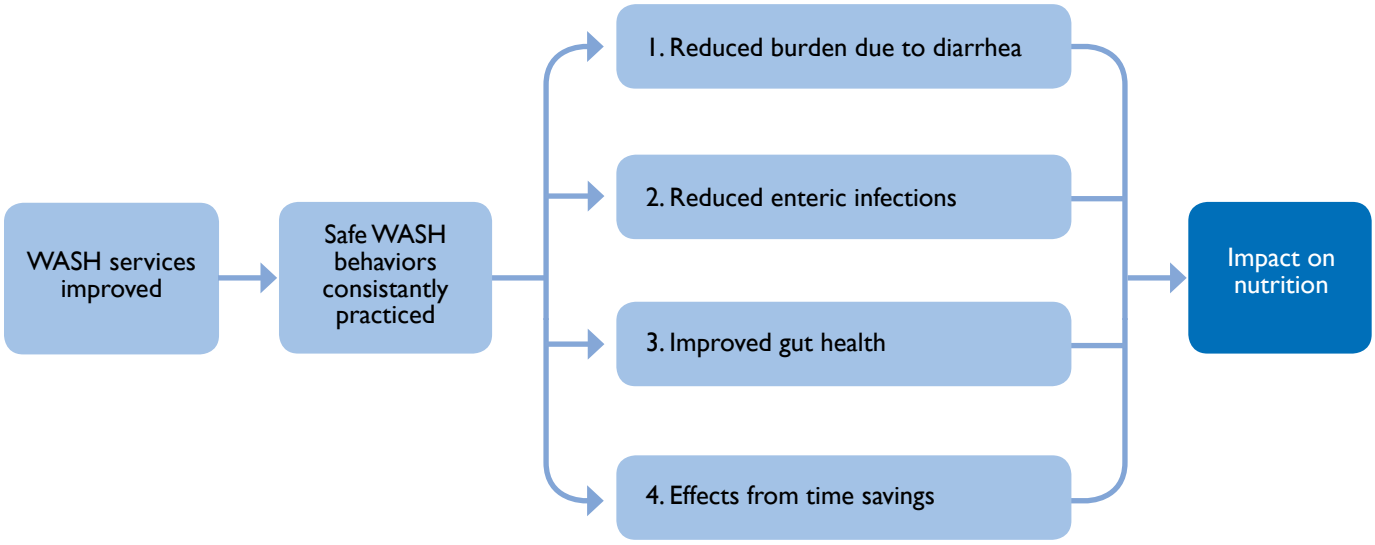

FIGURE 1: PATHWAYS LINKING WASH TO NUTRITION
Adapted from World Bank (2019). Nut-Sensitive Water Supplky, Sanitation, and Hygiene.

RECOMMENDATIONS FOR WASH PROGRAMMING

No known WASH intervention will unilaterally improve health and nutrition outcomes in every setting. However, historically, large population level gains in child health have not been achieved without significant improvements in WASH services [9]. Given the current state of evidence, USAID recommends four intervention strategies for interrupting the causal pathways described above in order to maximize improvements to health and nutrition.

RECOMMENDATION 1. IMPLEMENT AREA-WIDE SANITATION INTERVENTIONS

The level of contamination at a household is impacted by the level of contamination of the community overall. Therefore, households benefit when neighbors improve sanitation around them, termed 'herd protection.' There is both observational and experimental evidence showing that area-wide sanitation, or sanitation access thresholds at the level of entire communities, is more effective at reducing diarrhea than sanitation interventions that target individual households alone, supporting the herd protection hypothesis [1].

Although poor household-level sanitation has been found for decades to be associated with poor health and nutrition outcomes [34], subsequent observational analyses have found area-wide, community-level sanitation to be more protective than household-level sanitation [35-37]. Recent experimental studies have also suggested that child growth outcomes improve when sanitation improves at the level of entire communities [38-39]. There have been a variety of impact evaluations done in India related to community-level sanitation programs, although none achieved sufficient reductions in open defecation behaviors to expect impacts on health or nutrition [40-43].

Conversely, sanitation interventions that only engage a subset of the community (e.g., households with pregnant and lactating women) are less likely to show impacts on health and nutrition. A Cochrane Systematic Review on WASH impacts on child linear growth analyzed 14 trials, none of which took a community-level approach, finding only a small effect [44]. The recent WASH Benefits and Sanitation, Hygiene, Infant Nutrition Efficacy (SHINE) trials also focused on households with pregnant mothers (less than 10 percent of the community) and did not have impacts on linear growth, with mixed effects on diarrhea [6].

Given the state of evidence, USAID encourages programming to end open defecation and assisting communities to achieve and sustain basic sanitation services at an area-wide scale. High quality, aspirational sanitation services that serve an entire area can play a role in ensuring sanitation behaviors are sustained, avoiding slippage back to open defecation behaviors.

Putting it into Practice

Basic sanitation is fundamental to taking steps to reduce the disease environment in communities with poor health and nutrition. Programs should adopt approaches to improving the sanitation of the neighborhood and community overall. Only targeting households with pregnant mothers and children under 2 years is not recommended. It is important that approaches to improving area-wide sanitation are well-grounded in the local context, incorporating information about the local sanitation market, social norms and perceptions, demand profiles, and availability of sanitation products and services [45]. Approaches to improving rural sanitation are further discussed in USAID's Rural Sanitation Technical Brief.

RECOMMENDATION 2. PROFESSIONALIZE WATER SERVICE DELIVERY AND WORK TOWARDS SUPPLYING SAFELY MANAGED WATER SERVICES

Recent evidence suggests that point-of-use water treatment interventions are unlikely to achieve sustained reductions in childhood diarrhea or stunting due to the unreasonably high promotion intensity required in order to sustain behaviors (and therefore, achieve health and nutrition benefits) [6]. Promotion of household water treatment also increases the time burden of drinking water provision for families compared to centralized or decentralized treated systems [46]. A recent meta-analysis by Wolf and colleagues found that the greatest reductions in childhood diarrheal disease were attributed to interventions providing drinking water piped on premises with higher quality and continuous availability [1]. This finding is aligned with the objectives set forth in the Sustainable Development Goals (SDGs) for gaining access to safely managed drinking water services.

Working towards safely managed water services has the benefit of improving household access to sufficient quantities of water, improving water quality, and reducing the time-burden of household members. USAID seeks to move communities towards sustainable, safely managed drinking water services that ensure piped drinking water of acceptable quality without the need for household level water treatment. Time savings attributed to convenient water access also allows more disposable time for caregivers, particularly women, to engage in child care, grow and prepare nutritious foods, or participate in income-generating activities [31]. In most contexts, effective water quality management over the long term is most successful when managed by professional service providers as opposed to user-intensive household water treatment [47].

Putting it into Practice

No matter what service level (basic or safely managed) is targeted in a given program, non-infrastructure investments in professionalized service delivery are critical pillars to any rural water service. Moving up the ladder to safely managed drinking water services may seem like a difficult goal in many contexts, especially in rural areas. However, it should not be understated how much piped water on premises transforms lives and is highly valued in willingness/ability to pay studies [48-51]. **Programs should aim to make incremental progress towards piped water services by professionalizing the delivery of water services, strengthening policies and government capacity, and supporting the creation of small piped networks in relatively denser areas and bringing water closer to households. These interventions will be more likely to achieve health and nutrition improvements**.

More information on appropriate management models for improving rural water services can be found in USAID's Rural Water Services Technical Brief.

RECOMMENDATION 3. REDUCE BARRIERS TO SOCIAL AND BEHAVIOR CHANGE

Achieving sustained adoption of optimal WASH practices has been a persistent global challenge [52-53]. Until recently, most efforts to promote behavior change have focused on promoting health benefits of improved WASH practices, relying heavily on expensive and intensive interventions that utilize motivation and communication to promote change without sufficiently addressing structural barriers that might impede uptake of new behaviors. USAID has identified several promising strategies that can be applied to sustain behavior change in future programs, which is more likely to result in health and nutrition benefits [6]. These strategies include:

Ensure provision of convenient and consistent access to sufficient water supplies. In addition to the time savings benefits discussed in Recommendation 2 on page 5, convenient and consistent water services enable multiple aspects of domestic hygiene to occur (handwashing, food hygiene, dishwashing, cleaning floors and surfaces, laundry, bathing, and feces disposal) [31]. Long-standing evidence suggests that the quantities of water required for assuring basic personal hygiene are only realized when water services are within 100m or on-premises [53]. When household water is scarce, hygiene is the first activity to be neglected [51].

Promote the use of WASH products that are aspirational, practical, and durable. For decades the WASH sector has promoted the use of simple hygiene products such as inexpensive handwashing stations that can be fashioned from locally available materials. Mounting evidence suggests that such products are accompanied by multiple behavior change barriers that reduce the likelihood of habit formation. For example, tippy taps rarely lead to sustained handwashing practices (see box). Hygiene products that are responsive to the user's aspirations for quality, durability, and convenience have been developed [55-56], which may be appropriate in some contexts. When assessing products for promotion and use, USAID recommends that implementing partners consider the level of water and sanitation services provided and the product attributes that would facilitate sustained WASH practices (and, therefore, downstream health and nutrition effects).

Tippy Taps are not high quality, aspirational, or durable products

Tippy taps are a commonly promoted handwashing station made from local materials. They require frequent refilling with water and, although inexpensive, require frequent repair or replacement [54]. Standard tippy tap designs do not account for wastewater catchment or disposal, requiring tippy taps to be placed in less convenient locations outside the home. These product characteristics can inhibit optimal hygiene practices [54]. Additionally, these handwashing facilities are typically made from waste materials and are often not perceived as attractive or aspirational by households, reducing likelihood of sustained use [57].

Use emerging, innovative behavior change strategies. Evidence suggests that traditional approaches using interpersonal communication to impact behaviors are difficult to scale and have not been effective at improving health [6]. While intensive health promotion efforts can achieve temporary improvements in child diarrhea, recent analysis demonstrates that these promotion interventions cannot be expected to achieve lasting reductions in childhood diarrhea or stunting because it is not feasible to sustain the required promotion intensity (~two in-person visits per month) [6].

Furthermore, health benefits from WASH products and services are not common motivators for household investment and use, outside of emergency settings. Instead, a variety of social norms, emotional drivers, and economic motivators are more commonly associated with household adoption of WASH products and services.

For example, a study in Benin found that privacy, safety, and prestige were top drivers for latrine adoption, while a study in Ghana found that convenience and cleanliness were top motivators [58-59]. Another study in Brazil cited modernization, accessibility, and privacy among the top household motivators [60].

Alternative behavior change strategies such as "nudging" have shown to be just as effective as promotion and education [61]. Nudges focus on the "choice architecture" surrounding a behavior, aiming to alter the context (often the physical environment) in which a behavior occurs rather than the conscious decision–making process related to the behavior [61]. Strategies that address structural barriers to behavior change can help establish habits that are maintained even in the absence of behavior change campaigns. USAID recommends that activities develop holistic behavior change interventions that include both communication and non-communication methods, instead of relying only on health promotion and health education activities.

Putting it into Practice

Activities seeking to design more systematic and effective WASH behavior change programs should, first, have a solid grasp of the water and sanitation coverage in an area before deciding which behaviors to address. In areas where water access is a challenge but latrine coverage is moderate, behaviors such as disposal of child feces could be promoted. Second, activities should undertake a review of the existing evidence highlighting the factors unique to the local context affecting each behavior to determine if additional research is needed. Third, activities should choose a behavior change framework to guide the evidence review and to inform the design of interventions that leverage efforts to increase access to water supply to reduce barriers to behavior change, promote aspirational, practical, and durable products and use emerging behavior change strategies. This may include examples like the Elephant, Rider, Path Framework or FOAM (Focus on Opportunity, Ability, and Motivation) [62].

RECOMMENDATION 4. EXPLORE WAYS TO INTERRUPT FECAL-ORAL PATHWAYS FROM POOR FOOD HYGIENE, GEOPHAGY, AND DIRECT SOIL/FECES INGESTION

The household environment remains highly contaminated in many contexts, and implementing basic household sanitation may not do enough to reduce this contamination. Children are exposed to contaminated food, soils, floors and dirty objects. Traditional WASH programs do not include interventions that target these [57].

The F-Diagram has historically been used to illustrate fecal-oral transmission [63]. However, there is growing recognition that new or underemphasized fecal-oral transmission pathways may contribute to poor child outcomes. These pathways are demonstrated in USAID's modified F-diagram, depicted in Figure 2 on page 8. The new pathways (in bold) include feces of livestock and other animals that may enter the domestic environment, direct ingestion of dirt by infants and young children spending significant time on the floor, and contaminated items that infants and young children may mouth (fomites) [66]. Additionally, fecal-oral transmission through poor food hygiene (such as unwashed produce) is a significant contributor to fecal contamination in many contexts [67]. Interventions to improve food hygiene are highly context-specific but may be important factors impacting child health and nutrition.

New approaches must be explored to disrupt unaddressed fecal-oral pathways, but there is limited evidence on interventions that successfully impact child health and nutrition outcomes. Proximity to animals in the home has been positively associated with some measures of EED and reductions in child growth [27,64]. Thus, improved animal management practices may be required. A study reported that households had less contaminated child toys in villages with great than 50 percent toilet coverage, handwashing facilities with soap, no open defecation, safe disposal of child feces, and no animals present in the household [65].

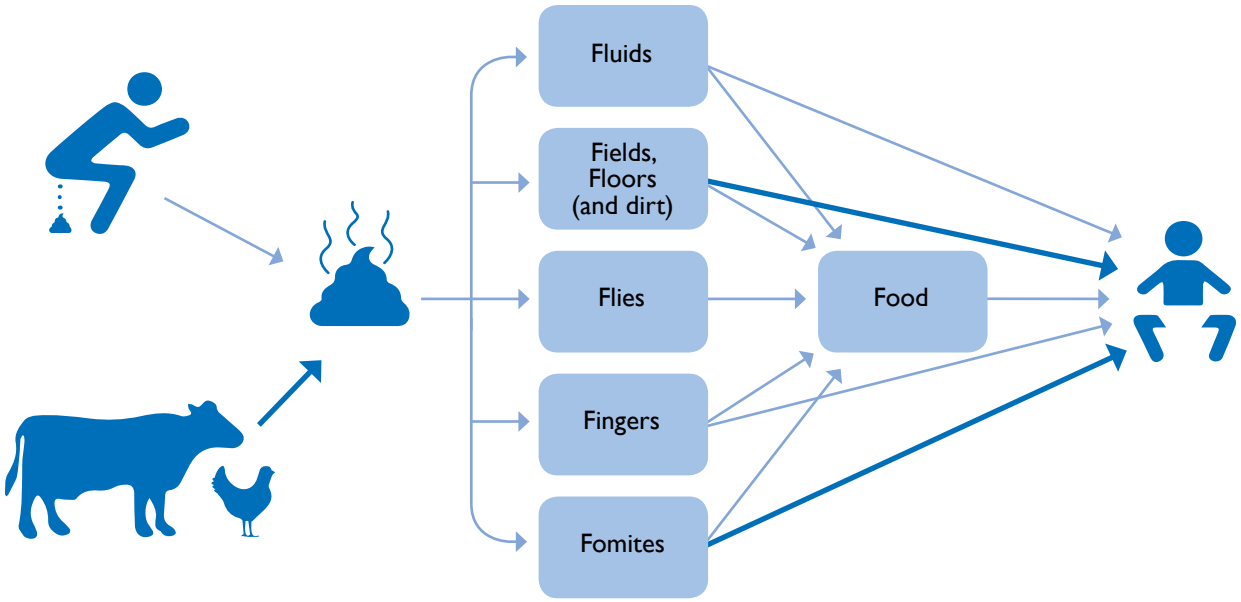

FIGURE 2: MODIFIED F-DIAGRAM
Source: USAID (2018). *Toward a Hygienic Environment for Infants and Young Children: A Review of the Literature*

Putting it into Practice

USAID is not aware of interventions, products, or approaches to address these fecal-oral pathways, which demonstrate efficacy in the field, biological plausibility and household demand. Therefore full-scale interventions related to these neglected pathways are not recommended. Accordingly, programs with research capacity should explore formative research activities that can better inform future implementation. Innovations in this space should incorporate the multi-sectoral nature of these interventions and their impacts on livelihoods, dietary diversity, early childhood development, and any burden to caretaker's time.

Recognizing that the primary fecal-oral transmission pathways may differ by context, USAID encourages context-specific research that include ways to interrupt fecal-oral transmission and reduce overall environmental contamination. USAID implementing partners are encouraged to validate which transmission pathways are most important in any given context and test potentially promising interventions. Programs without significant research capacity should consider focusing on Recommendations 1, 2, and 3 of this technical brief.

CONCLUSION

Although much research and learning is required to fully understand WASH-related contributions to nutrition outcomes, the summarized evidence and recommendations outlined in this technical brief are meant to guide USAID activities towards more effective and sustainable WASH outcomes with higher likelihood of impacts on health and nutrition. USAID recognizes that poor WASH services and practices may affect child malnutrition through four pathways: (1) repeated episodes of diarrhea; (2) frequent and intense enteric infections; (3) poor gut health; and (4) burden of time-poverty.

Given the current evidence, USAID recommends four strategies for WASH programming aiming to achieve benefits to health and nutrition:

1. Implement area-wide sanitation interventions with a focus on ending open defecation and assisting communities to achieve and sustain basic sanitation services.

2. Professionalize water service delivery and work toward supplying safely managed water services through incremental upgrades that connect households to piped networks with appropriate management models.

3. Reduce barriers to social and behavior change through aspirational products and services. This can be achieved by working towards convenient and consistent access to sufficient water supplies, applying the use of WASH products that are aspirational, practical, and durable in the local context, and using emerging, innovative behavior change strategies.

4. Explore ways to interrupt fecal-oral pathways from geophagy and direct soil/feces ingestion by validating which pathways are most important in any given context (through formative research) and testing potentially promising interventions.

USAID also recognizes that WASH interventions alone are not sufficient to achieve global nutrition targets. Interventions must address the multiple complex and context-specific determinants of malnutrition including risk factors beyond WASH such as those that impact intrauterine growth restriction, prenatal maternal malnutrition, or poor infant and young child feeding practices. However, there is no evidence that delivering WASH interventions conjointly with nutrition interventions yields better results, notably where the interventions do not align with the recommendations above. Activities must keep in mind the intergenerational cycle of malnutrition that may result in attenuated benefits.

The links between WASH and child/population-level health have long been established, but USAID is committed to the application of emerging evidence to improve programming to maximize impact across sectors. The recommendations herein are based on evidence to maximize health and nutrition impacts from WASH programming. Furthermore, USAID recognizes that health and nutrition are only a subset of the development outcomes derived through investment in safely managed WASH services. Investment in WASH is critical to a wide range of additional benefits to mental and social well-being, economic productivity, poverty reduction, gender equity, conflict prevention, and environmental sustainability.

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