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Sanitation, Hygiene and Environmental Cleanliness for Child Development

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About The Sanitation Learning Hub

For over ten years, IDS's Sanitation Learning Hub (SLH, previously the CLTS Knowledge Hub) has been supporting learning and sharing across the international sanitation and hygiene (S&H) sector. The SLH uses innovative participatory approaches to engage with both practitioners, policy-makers and the communities they wish to serve.

We believe that achieving safely managed sanitation and hygiene for all by 2030 requires timely, relevant and actionable learning. The speed of implementation and change needed means that rapidly learning about what is needed, what works and what does not, filling gaps in knowledge, and finding answers that provide practical ideas for policy and practice, can have exceptionally widespread impacts.

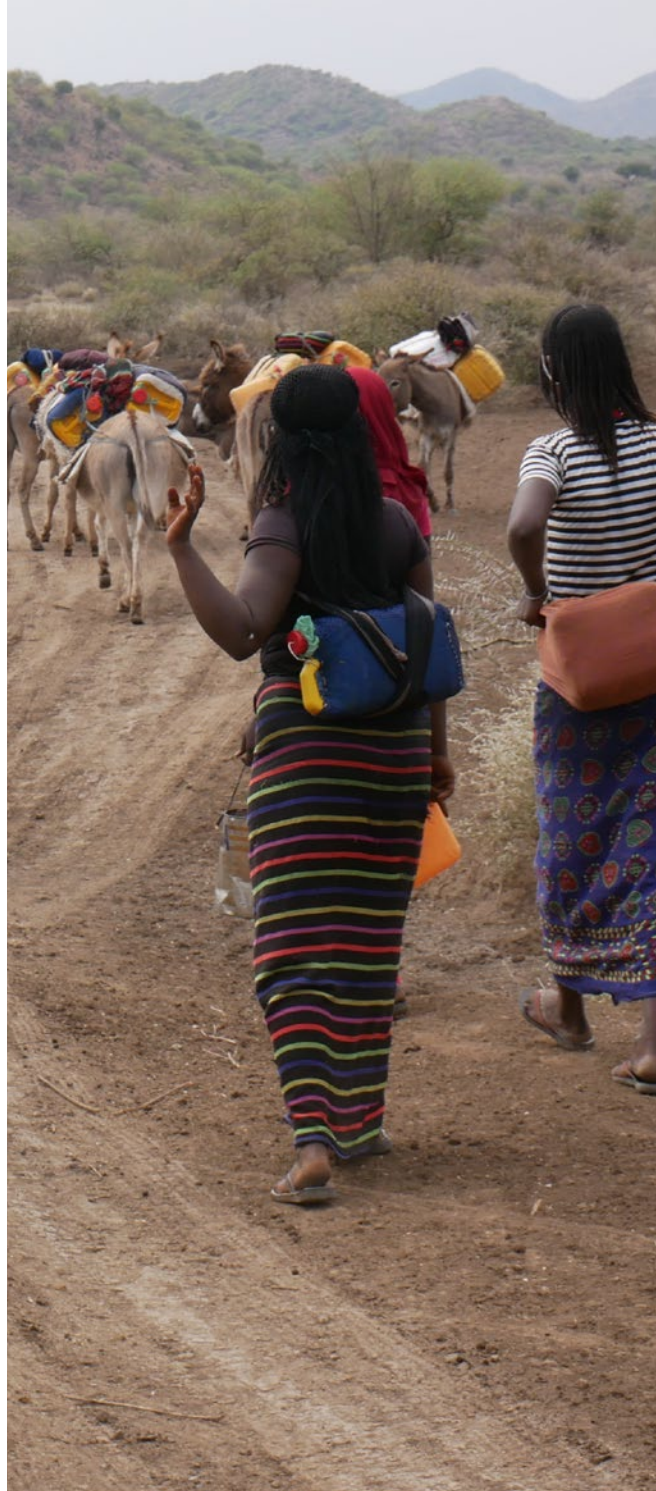
Our mission is to enable the S&H sector to innovate, adapt and collaborate in a rapidly evolving landscape, feeding learning into policies and practice. Our vision is that everyone is able to realise their right to safely managed sanitation and hygiene, making sure no one is left behind in the drive to end open defecation for good.

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A child washing his face in a river in Woyinima village, Jabi Tehnan, West Gojjam, Ethiopia, December 2018

This page: Sanitation Learning Hub/Maria Gerth-Niculescu
Women come back to their village with donkeys after fetching water, Chifra rural area, 4 Feb 2020



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Acronyms and initialisms

CLTS	Community-Led Total Sanitation
ECD	Early childhood development
EED	Environmental enteric dysfunction
PDR	Laos People's Democratic Republic
RCT	Randomised control trial
S&H	Sanitation and Hygiene
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WASH	Water, sanitation, and hygiene
WASH FIT	Water and Sanitation For Health Facility Improvement Tool
WHO	World Health Organization

Table 1.
Definitions of key terms used in the guide

TERM	DEFINITIONS
Antimicrobial resistance	Antimicrobial resistance occurs when bacteria, viruses, parasites, and fungi no longer respond to medicines traditionally used to fight the infections they cause. This results in infections becoming difficult or impossible to treat, increasing disease spread, and risk of serious illness or death.
Baby WASH	Baby WASH encompasses an area of behavioural and technical WASH interventions that seek to reduce exposure of young children to faecal pathogens in their first two years of life. It includes safe play spaces, good food hygiene for children and infants, safe disposal of child faeces, and minimising contact between animals, animal faeces, and children.
Enteric pathogens	Enteric pathogens are pathogens that cause intestinal infections with and without diarrhoea and include bacteria, viruses, protozoa, parasites, and fungi.
Environmental enteric dysfunction (EED)	EED is a subclinical disorder that is thought to be driven by exposure to enteric pathogens, leading to inflammation and damage to the lining of the gut. This increases the risk of infection and can affect absorption.
Geophagy	Geophagy is the consumption of soil, dirt, and soil-like materials including clay and termite mounds.
Linear growth	Linear growth involves the measurement of a child's height compared to their age and is based on standardised average measures that have been calculated over time. Linear growth is tracked compared to a healthy individual of that age. If a child is two standard deviations below the mean height for their age they are considered stunted.
One Health	One Health is a growing academic field that recognises the interlinkages between human, animal, and environmental health and promotes collaboration across multiple sectors to take action on cross-disciplinary issues.
Stunting	A child is stunted if they are two standard deviations below the mean height for their age.
Transformative WASH	Transformative WASH is the aspiration to comprehensive and safe WASH services and behaviours that adequately reduce exposure to harmful pathogens and provide safe environments to support the good health and wellbeing of all, including animals. A definition of Transformative WASH has not yet been fully agreed but it is a drive to consider more holistic approaches to WASH that move beyond basic water, toilet, and handwashing approaches, as well as infrastructure, to include complex behaviours across many settings.
Undernutrition	Undernutrition includes the conditions of stunting, wasting, and being underweight and is caused by insufficient energy intake and reoccurring illness such as diarrhoea.
Zoonotic disease	Zoonotic diseases are those that can pass from animals to humans. Examples include rabies and bird flu.



Introduction

A long-standing goal of water, sanitation, and hygiene (WASH) professionals has been to improve the health and lives of children. The health consequences from insufficient access to WASH are wide reaching and impact a range of diseases, infections, and other concerns (WHO 2019). It is well accepted that WASH is a critical determinant of child health and development (Piper et al. 2017). However, recent high-profile randomised control and case control studies assessing the impact of basic WASH interventions on child health and development outcomes have shown either mixed results or no effect (Pickering et al. 2019; Knee et al. 2021). While the results do not undermine the potential impact of WASH on child development, they have led WASH and health professionals to revisit and reconceptualise how WASH might best drive impact on child development (Cumming et al. 2019; Wilson-Jones et al. 2019). The reconceptualisation of what is required from a WASH perspective to see sustainable improvements in child development outcomes has led to the concept of Transformative WASH, which still needs further defining and understanding.

This *Frontiers of Sanitation* draws on the Transformative WASH concept to explore and outline what may be required of WASH implementation stakeholders in efforts to support child development outcomes. The *Frontiers* explores the multiple ways in which inadequate sanitation, hygiene, and environmental cleanliness can affect physical and cognitive development in children. It explores areas beyond hand hygiene to consider food hygiene and broader environmental cleanliness, and beyond human faeces to consider animal faeces. What this means for practice is then discussed to outline how the WASH sector can improve current practice to best support improvements to child development outcomes and in particular opportunities for children to both survive and thrive.



Methods

We took a scoping review approach to capture the depth and breadth of key literature, defined as literature including WASH–health–child-development interactions and programmatic examples. To guide inclusions and to acknowledge the complex WASH–health–child-development interlinkages, we present a modified table based on the *WHO’s Guidelines for Sanitation and Health* (2018) that outlines direct impacts, sequelae, and early childhood development effects and implications. This table also captures relevant health and broader early childhood development effects and implications found in the literature, such as specific health conditions and economic, educational, and social implications that fall outside basic WASH and child development key word searches, but are relevant to consider. Academic literature, grey literature, and programmatic documentation were included. To note, WASH was used as a general search term and often found in the literature. However, due to the focus on sanitation, hygiene, and environmental cleanliness, the quality, availability, and quantity of water is not specifically assessed here, although it does play a role in child development.

We additionally conducted targeted semi-structured interviews with five experts including research, programming, and government representatives from a range of geographic areas in Europe, Asia-Pacific, North America, and Africa. The interviews were designed to gather emerging insight, evidence, and any additional documented and non-documented research and programming knowledge. The expertise of those interviewed covered: hygiene behaviour change; urban nutrition and WASH; One Health; gender, rights and inclusion; and WASH and health programming.

Why is child development important and what are the links with WASH?

Many factors play a role in supporting children to thrive. Child development is influenced and affected by a complex interplay of environmental and biological elements, including genetic, educational, socio-cultural, and living environment factors (Jensen et al. 2019). It is primarily in the nexus between children and their environments that WASH plays an important role.

WASH can interact with child growth and development in complex ways at all age stages. WASH actors also need to think beyond the collective ‘WASH’ term, as each WASH component – water, sanitation, and hygiene – has different and compounding links with child health and development. Limited WASH can cause repeated illnesses such as diarrhoea during the first two years of life, and cause children to miss school due to WASH-related illness or due to inadequate facilities for managing menstruation. Implications of WASH-related infections early in life can also have lifelong implications for education and economic attainment. While there is no widely accepted conceptual framework for understanding WASH associations across the life-course of childhood to the age of 18, researchers who have examined WASH associations during this life period propose that the associations cut across areas such as nutrition, gut pathology, socioeconomic and maternal factors, home and school environments, and a range of related behavioural factors (Piper et al. 2017). While these associations are all important and relevant and need further exploration, this Frontiers focusses on early childhood development, specifically the first 1,000 days of life from conception to the age of two. This is a critical moment in child development, particularly for WASH. Ensuring good health when a baby is developing in utero and during the first few years of life can set a child up to survive and thrive into later childhood and adulthood.

To understand how sanitation, hygiene, and environmental cleanliness interlink with early childhood development, it is important to examine the links between child development and child health. To conceptualise the breadth of implications, we have adapted the WHO’s (2018) grouping of the health impacts of unsafe sanitation to also consider the impacts of hygiene and environmental cleanliness. The groupings cover direct impacts (mainly infections); sequelae, which are the consequences of those infections;

and broader early childhood developmental effects and implications. While the list presented in Table 2 is not extensive, it outlines some of the considerations in some settings. There may be other relevant aspects across all three groupings. The table is designed to provide insight into the complexity and the multi-faceted way in which inadequate sanitation, hygiene, and environmental cleanliness impact on child development, rather than to be exhaustive in content.

Table 2. Potential linkages between sanitation, hygiene and environmental cleanliness on early childhood development*

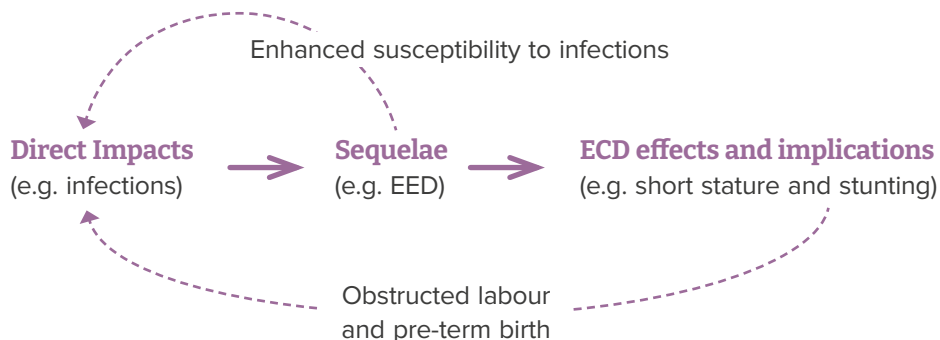
DIRECT IMPACTS (INFECTIONS)	SEQUELAE	EARLY CHILDHOOD DEVELOPMENT EFFECTS AND IMPLICATIONS
Faecal–oral infections Diarrhoeas (incl. cholera) Dysenteries Poliomyelitis	Stunting, growth faltering	<i>Limited early life stimulation and interaction due to WASH-related burden on caregivers (for example time spent collecting water)</i>
Helminth infections Ascariasis, Trichuriasis, Hookworm infection Cysticercosis Schistosomiasis	Wasting	<i>Increased health care costs Bonded labour Delayed motor development</i>
Insect vector diseases (vectors breed in faeces and solid waste) Trachoma Dengue Yellow fever	Environmental enteric disfunction Anaemia	<i>Adverse health outcomes (poor nutrition during pregnancy, stunted mothers)</i>
Hygiene-related Pneumonia Trachoma Hepatitis A Typhoid	Impaired cognitive functioning	<i>Longer term implications including poor educational outcomes, lower wages</i>
Animal transmission (Bites e.g. rodents, domestic animals) Wounds Rabies	Antimicrobial resistance	<i>Obstructed labour, pre-term birth and low birth weight (if stunted in childhood)</i>

*adapted from WHO 2018

The health concerns highlighted in Table 2 are interconnected and can feed into one another, exacerbating effects and causing intergenerational impacts. This is diagrammatically represented in Figure 1. For example, stunting in early childhood can lead to short stature, which puts women at higher risk of birth complications including pre-term birth and low birthweight children, which in turn can impact the child's longer-term development. If a child has environmental enteric dysfunction (EED), they are more susceptible to infections and more likely to develop diarrhoea, increasing their risk of stunting. Malnourished children are also more susceptible to pneumonia and diarrhoea, again reaffirming a vicious cycle of infection and malnutrition (Walson and Berkley 2018).

Figure 1.
Diagram of how direct impacts, sequelae and Early Childhood Development (ECD) effects and implications are interlinked and interrelated*

*This is a simplistic representation and does not include all components or links



Impacts across the life course are not limited to health concerns. In Bihar, India, women reported that health care costs related to diarrhoeal diseases and malnutrition led to women falling into bonded labour (Oosterhoff and Burns 2020). Reduced household spending capacity for food due to WASH and health related costs can impact child nutrition and development, as can the time caregivers must spend away from playing with, and providing critical stimulation to, young children. If WASH is adequately addressed, the impacts could be far felt. WASH alone cannot solve child development challenges, but the issues are connected and interdependent and must be tackled as such.

The changing landscape of WASH-nutrition-child development

The direct impact of poor nutrition on development means stunting must essentially be eliminated if children are to fully thrive. In 2020, World Bank, WHO, and UNICEF data estimated that 149.2 million children worldwide are stunted (UNICEF 2021). Stunting is irreversible and not only affects a child's development but has long-term impacts on educational outcomes and economic potential. Undernutrition, particularly stunting, is one of the most comprehensively explored areas linking sanitation, hygiene, environmental cleanliness, and child development outcomes. As with child development, the causes of stunting are multifactorial and interconnected, encompassing biological, environmental, and social elements. WASH is thought to play a role in several ways, including:

- Reducing exposure to harmful pathogens through access to safe WASH services and practices (Zavala et al. 2021);
- Allowing nutrients from food to be used for growth and development, not for fighting WASH-related illness (Chambers and von Medeazza 2014);
- Ensuring there is sufficient water for diverse food production (Chambers and von Medeazza 2014) and animal watering (Matilla et al. 2018); and
- Allowing household income to be spent on food rather than WASH or health needs (Chase and Ngunjiri 2016).

In 2013, a seminal Lancet study found that if 10 nutrition-specific interventions were scaled to 90 per cent coverage, stunting would only be reduced by 20 per cent (Bhutta et al. 2013). This led to renewed attention to the potential impact of nutrition-sensitive interventions, such as WASH, on child linear growth and stunting. The evidence that WASH has a role to play in stunting is strong, with many studies showing associations between poor WASH conditions and stunting. There is also good evidence of the role of WASH in reducing diarrhoeal disease and soil transmitted helminths (Cumming and Cairncross 2016). Despite this,

debate has continued among WASH, health, and nutrition specialists on the role WASH can play in nutrition programmes. Studies that assess impacts of simple WASH interventions such as the introduction of an improved toilet, household water treatment, or handwashing at critical times show mixed results. Some studies show effects, while others do not, and the quality of data varies (Bekele et al. 2020). Recently, three high profile randomised control trials (RCTs) assessing the impacts of WASH and nutrition interventions on child growth were published and none showed any impact of combined basic WASH interventions on child linear growth across varied settings (Luby et al. 2018; Null et al. 2018; Humphrey et al. 2019). The results of these studies have been met with debate and led the WASH and nutrition sectors to reconceptualise how the provision of WASH could support improvements in child linear growth. Academics and practitioners published a consensus statement outlining the interpretation and implications of the trials' data (Cumming 2019), and, alongside responses from the WHO, UNICEF (WHO and UNICEF 2018), and WASH-implementing organisations such as WaterAid (Wilson-Jones et al. 2019), raised questions about whether the methodologies adopted adequately represented real-world WASH programming settings and were appropriately designed to address pathogen transmission specific to each context. There remains debate on whether impact research on WASH should adopt RCT methodologies, or how this can more optimally be done, especially for reassessing basic WASH interventions only. Analysis around the issue proposes that more Transformative WASH is likely required for WASH to contribute effectively towards reducing stunting; that basic, low-cost WASH interventions alone, in some settings, will not reduce faecal contamination sufficiently to achieve the health and development gains aspired to by WASH implementers.

Literature and practice are adapting to the concept of Transformative WASH. More sophisticated F-diagrams explaining faecal–oral transmission routes have been developed to encompass animal faeces and transmission routes for infants. Figure 2a is an F-diagram specific to Baby WASH developed by USAID from a literature review on hygiene environments for infants and young children (USAID 2018). The WHO's *Guidelines on Sanitation and Health* (2018) reconceptualises the F-diagram to consider sanitation systems as a whole and how various steps along the sanitation chain can result in excreta in the environment. It also includes non-faecal–oral elements (e.g. feet and skin). See Figure 2b.

Figure 2a.
Example of modified F-diagram from USAID

Source: USAID 2018

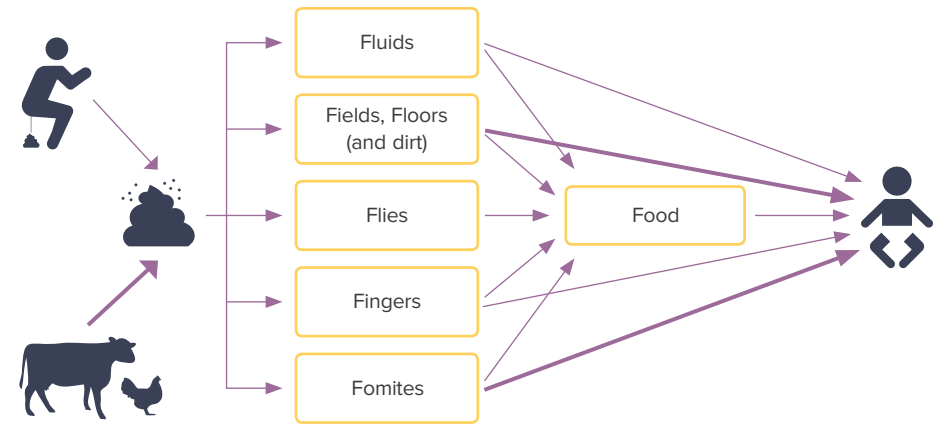
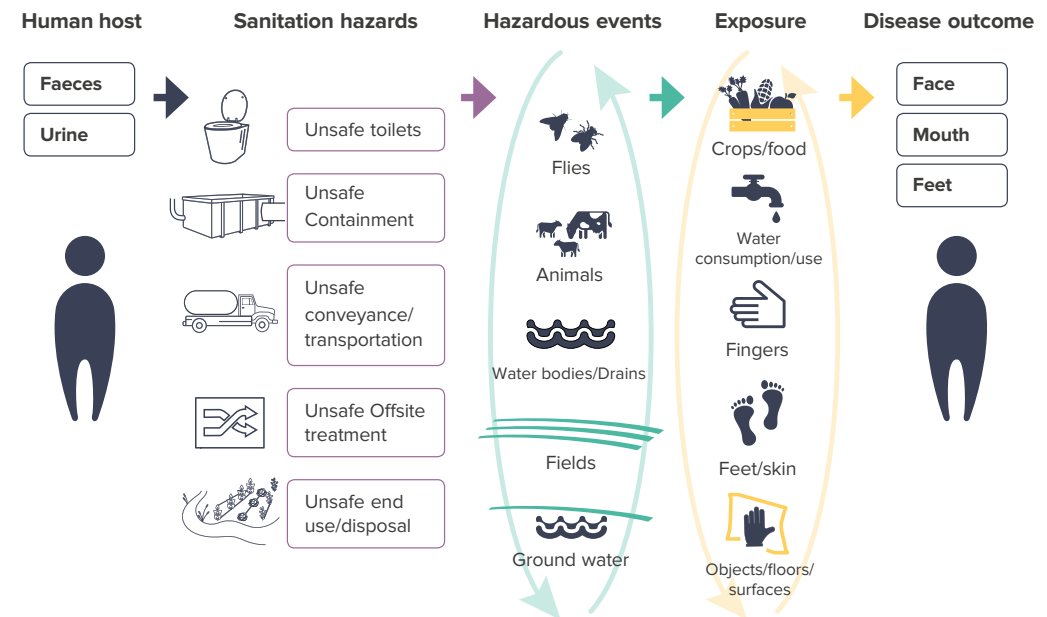


Figure 2b.
The health impacts from unsafe sanitation through various transmission pathways

Source: WHO 2018



Conceptual frameworks for WASH and nutrition have also evolved. One example is shown in Figure 3. This is not a complete WASH and nutrition conceptual framework, as it focuses only on how WASH interventions and behaviours are linked to exposures that in turn may lead to EED, illness, and stunting. It differs from previous conceptual frameworks because it outlines WASH services more holistically, in line with safely managed WASH services. It encompasses WASH systems, not merely basic WASH infrastructure. The framework also clearly demonstrates the interconnectedness of WASH systems and behaviours in reducing exposure to potentially harmful pathogens.

“Early childhood development and nutrition are really complex outcomes, and if they are complex outcomes they also will probably require complex interventions.”

One Health specialist

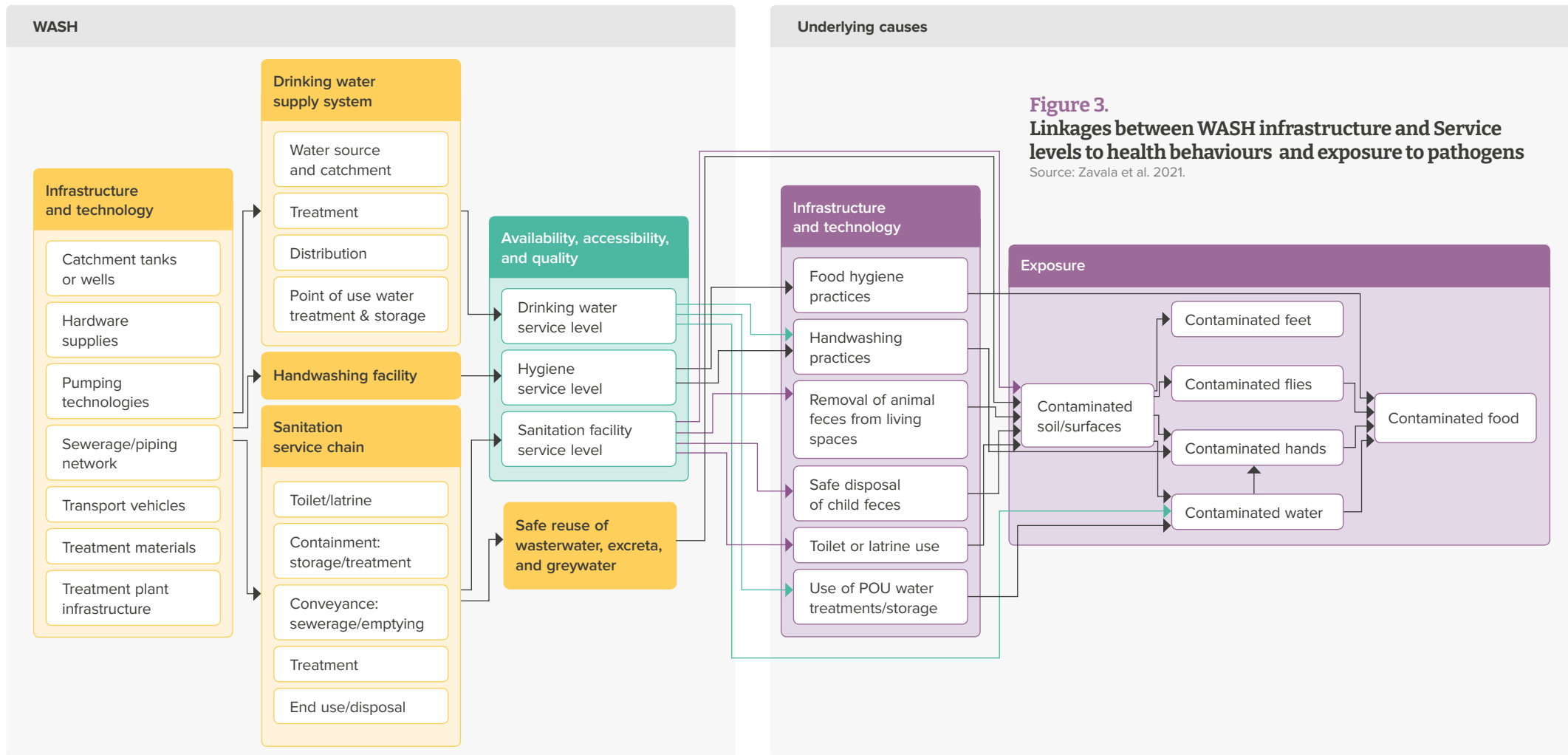


Figure 3. Linkages between WASH infrastructure and Service levels to health behaviours and exposure to pathogens
Source: Zavala et al. 2021.

One framework cannot encompass all the detail required to understand the linkages between WASH, nutrition, and child development and the various upstream and downstream influencing elements. Macro elements such as local governance structures, social norms, adequate financing, and leadership sit upstream of WASH services. There is also more nuance to consider, linking exposures to consider types of pathogens, the specific health issues they cause, and their links to development. Capturing this nuance is important and highlights how the WASH sector must conceptualise its work to contribute meaningfully to child development outcomes.

Based on the interlinkages explored between WASH, health, and early childhood development above, there are emerging areas of evidence and practice that warrant exploration. Below is a list of approaches that are emerging in the literature and that are important to understand to inform WASH practice in the future. These are:

- **Looking towards high-level coverage of WASH services at the whole-of-community level and reaching coverage thresholds required to reduce faecal contamination in the environment (Wolf et al. 2019);**
- **Shifting beyond basic services to delivering safely managed services;**
- **Looking at interventions that address safe food production, irrigation, and hygienic consumption of food;**
- **The role of animal faeces and zoonotic diseases, including the presence of animals faeces, animals as mechanical vectors of human pathogens, animal faeces as breeding sites for flies, and consumption by animals of human faeces that then form part of a lifecycle of a pathogen (WHO 2018);**
- **Health of the mother during the gestational period;**
- **Specific Baby WASH interventions that address the WASH needs of young children; and**
- **Effective measures for sustained behaviour change.**

These areas will be explored further below, including additional areas that are emerging in WASH and health domains.

Emerging considerations for WASH for child development

WASH and young children

The concept of the first 1,000 days and its importance to nutrition has led to the WASH sector thinking more specifically about potential exposures during the first two years of a child's life. The concept of Baby WASH has emerged to consider these specific WASH-related needs. In order to understand what can be done for babies and infants, it is first necessary to know what the risks are.

Geophagy: This is the ingestion of soil, mud or dirt, which frequently occurs among young children. Geophagy in households with poor sanitation has been linked to reduced child cognitive development outcomes and EED (George et al. 2015; George et al. 2021). This consumption of soil or dirt presents a risk to children, especially if soil is contaminated with human or animal faeces and other potential pathogens, such as helminth eggs, in settings with limited or no sanitation services. Studies have shown that young children often spend long periods of time playing on the ground and frequently ingest soil and put their hands or fomites in their mouths (Ngure et al. 2013). Handwashing of children is also often not common or frequent.

Geophagy has also been reported to be commonly practised among pregnant women across the world, especially in Africa, where up to 84 per cent of women practice geophagy in some communities (Njiru et al. 2011). Reasons include: adhering to cultural beliefs around improving pregnancy outcomes; eating soil and clay to reduce hunger; to assist with nausea during pregnancy; and to consume specific micronutrients such as iron. Impacts on pregnant women's health depends on how contaminated the soil is with human and animal faeces (Kambunga et al. 2019). While evidence remains scarce, this behaviour could risk exposure to harmful pathogens that can affect development in utero and subsequently maternal and child nutrition, health and development outcomes.

Safe disposal of child faeces: Assists in reducing faecal contamination in the environment. Safe disposal of infant and young child faeces has gained attention as children are often more exposed to enteric pathogens, are more likely than adults to defaecate openly, or have their faeces improperly disposed of where other children may also be present or play. Children's frequent mouthing of fingers and fomites also indicates they are more likely than adults to ingest child faeces. Beliefs, perceptions, and cultural norms relating to the safety and disposal of child faeces have been reported. Studies have reported beliefs that child faeces are safe and do not need to be disposed of like adult faeces. One such study in Somalia reported that caregivers believed that child faeces had no germs and could not harm anyone (Shire et al. 2020). In Tanzania, beliefs were reported around the dangers of disposing child faeces in the same ways as adult faeces. Using shovels for disposing of child faeces was thought to lead to a child being harmed, for example, it could lead to scratches on the child's back. Throwing child faeces in a latrine was also a concern, with caregivers reporting feeling like this action would be like throwing the child into the latrine (Chebet et al. 2020). Households with and without improved sanitation have both reported, in some settings, not disposing the faeces of children under the age of three safely. A Cochrane review found that child faeces management may be effective in preventing diarrhoea but it did not find adequate evidence that it reduced soil transmitted helminth infections (Majorin et al. 2019). This lack of evidence is partly due to the low number of studies that have focussed on child faeces management.

The WHO and UNICEF Joint Monitoring Programme recognises appropriate disposal of children's faeces as 'depositing or rinsing the child's stools into an improved toilet or burying them'. Solid waste is also considered if that waste is safely managed and minimises exposure risk to human or animals (UNICEF and WHO 2019). While these data are collected in some household surveys, it is not always routinely collected in national information systems. Child faeces management is increasingly being adopted into sanitation programmes, though it is still not widespread. Further evidence is required to consider which approaches drive improvements in child faeces disposal, and to understand how improving child faeces management can reduce faecal contamination in the environment.

Food hygiene

Food hygiene can impact child development, particularly at the time when infants are weaned from breastfeeding and food is introduced. Risks also exist if formula or other feeding alternatives are being prepared with contaminated water, hands, or utensils. Poor food hygiene and contaminated complementary food has been associated with diarrhoea and the spread of harmful pathogens (Chidziwisano et al. 2019). There is also evidence that diarrhoeal disease is more common in infants around the time of weaning (Barrel and Rowland 1997). While the full scope of food hygiene expands beyond WASH to include the safety of food from production, across food supply chains to point of consumption, for this publication, the focus is on point of consumption at the household.

Food hygiene within household requires multiple considerations. Food can become contaminated in many ways, including: exposure to unwashed hands and utensils; if utensils are washed or dried with contaminated water and cloths respectively; through flies if not covered when stored; through being washed with contaminated water or not being washed at all (e.g. when human or animal faeces have been used as fertiliser); if it is not properly cooked or reheated; and if water is not boiled before use for infant food such as formula. Kitchen hygiene overall is important. Preparation and storage should be off the ground, surfaces kept clean, and animals, including rodents, separated from areas where food is stored, prepared, and consumed. Studies that have implemented behaviour change strategies across a number of these desired behaviours have shown 1) that behaviours can change, and 2) a reduction in food contamination (SHARE and LSHTM 2016). Again, it is important to understand existing behaviours, the local context, and what might be the main risks of contamination in that setting to design the most effective approaches to improving food hygiene.

WASH in all settings

WASH and child development literature often focusses on WASH within households and communities. Unsurprisingly, households are not the only settings in which young children and their caregivers spend time. Settings such as health care facilities, early childhood centres, formal and informal workplaces (of caregivers), and public spaces are also areas where children may spend time. Such settings pose risks to children and pregnant mothers.

Health care facilities: safe WASH in health care facilities is important to a child's health and subsequent development, particularly during birth. If health care facilities do not have a safe water supply, safe sanitation, good hygiene, a clean environment, and sufficient waste management, they will be unable to deliver quality and safe care. This puts the mother and child at risk of infections and sepsis. Most recent data show that a quarter of health care facilities globally have no water service; one in ten has no sanitation services; and one in three do not have adequate infrastructure to support hand hygiene where care is provided (WHO and UNICEF, 2019). Infrastructure alone will not address the risk of infection to mothers and newborns; good hygiene practices are also necessary. Even when the necessary infrastructure is in place, hand hygiene can be limited during labour and delivery (Nalule et al. 2021).

The exact transmission pathways and impacts of limited WASH on newborn infections and the longer-term health and development outcomes of these infections require further exploration. Improving WASH in health care facilities may improve child health and development in several ways including: reducing the risk of infection during birth and the immediate postnatal period; minimising the spread of infection and antimicrobial resistant infections to and from children; and supporting women and caregivers to trust the health system and seek care when it is needed.

Early childhood centres: WASH in early childhood settings has not been extensively explored. No globally available data exist and the health and development impacts are not yet fully understood. Where data have been collected, WASH conditions have been found to be poor. A study in South Africa assessing WASH in early childhood centres found that only 11 per cent of respondents reported washing hands under running water with soap, and over three quarters reported that children shared bowls of water to wash hands as no running water was available (Melariri et al. 2019). Almost 80 per cent of facilities reported having improved sanitation, and the use of potties varied. In a third of facilities, 6 to 10 children shared a potty and in 9 per cent of facilities, 20 children shared a potty. Potties were not frequently cleaned, with approximately a third of facilities not cleaning potties after every use. Considerations for WASH within early childhood centres extends beyond basic infrastructure as with WASH at the household level. Concerns about areas such as food hygiene, safe play spaces, mouthing of contaminated fingers/fomites, and safe management of child faeces are also relevant.

Rwanda provides one example where government-level action is being taken to develop and endorse guidelines for WASH in early childhood development centres (Ministry of Gender and Family Promotion, Republic of Rwanda 2019). The guidelines cover different types of early childhood development centres including home-based centres, model centres, and cost-effective centres. They provide guidance on water, sanitation, handwashing, and the waste management infrastructure required in these settings. While there are specifications for toilet and handwashing infrastructure for small children and children with disabilities, the guidance does not include behaviour-change-related strategies or areas of concern, such as the cleanliness of play spaces or food hygiene. As further efforts are made towards guidance and policy related change, it will be important to consider a holistic approach that supports WASH for all ages and all considerations (including food hygiene and play spaces). This will need to move beyond infrastructure requirements to include desired behaviours, as well as the systems to support and sustain WASH in these settings.

Other settings: WASH in workplaces, whether formal or informal, has been underexplored in the WASH literature, though some studies looking at menstruation have assessed WASH where women work (Burnet Institute, WaterAid and the International Women's Development Agency 2016). With an increasing drive for women to participate in the workforce, support for women with young children to engage in the workforce is increasing in formal and informal settings. Legislation around providing supportive workspaces for women with young children is limited and where it does exist it is not often enforced (Oddo and Ickes 2018). Without such supportive measures in place and without data on WASH in formal and informal workplaces, the potential impact remains unclear. Public spaces where children play are also neglected. Few studies that looked at areas where children play in public were found in the review process. One study of children in public play spaces in an urban setting in Kenya found that public play spaces were sites of exposure of harmful pathogens through children ingesting contaminated soil and being exposed to unsafe surface water. Children played at multiple sites (Medgyesi et al. 2019). Sanitation programmes often focus at the household level and thus ignore these settings. Concepts of community-wide WASH need to be more holistic in terms of the sanitation and hygiene measures that need to be in place across all environments where children play and spend time.

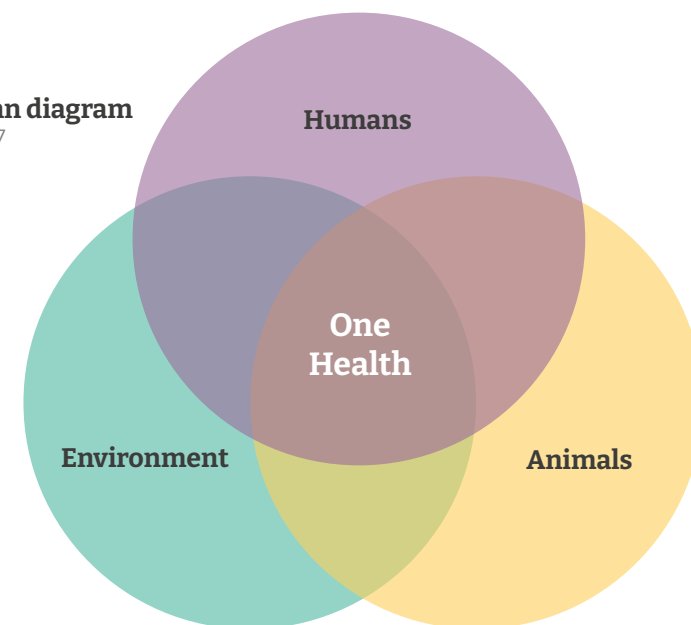
Role of animals in WASH-related diseases

Animal faeces are thought to contribute to the majority of faecal matter in the environment (Prendergast et al. 2019; Berendes et al. 2018). As the geophagy section described, in households where animals roam freely or animal faeces is present, children are at risk of ingesting animal faeces. Consuming this faeces increases the risk of EED and child development deficiencies. Animals can also be mechanical vectors through dispersing both human and animal faecal matter around environments, for example with their feet. In addition, the presence of animals also plays a role in the spread and emergence of antimicrobial resistance (World Health Organization, Food and Agriculture Organization of the United Nations, and World Organisation for Animal Health 2020). The immediate solution might seem to be penning animals to separate them from children. In reality, it is much more complex. Depending on the disease outcome in question, effectiveness of animal interventions varies. There are also economic considerations at play. Even when human sanitation is improved and animals are penned, if contact with animals is still high within the household, effectiveness may not be dramatically reduced. The quality of penning is also a factor: even if households have pens that contain all animals, their faecal waste needs to be safely managed. Many animals such as pigs and chickens are foraging animals and penning them places additional costs on households to purchase food that the animals might otherwise find foraging. It also increases demands on water supplies to fill troughs for animals (Matilla et al. 2018). More research and collaboration with other sectors, such as the agriculture and animal health actors, are required to understand what might work where, and which solutions might be optimal in which settings.

One Health is an approach that has been developed to understand and act upon the interlinkages of the health of humans, animals, and the environment. Focusing only on animal faeces does not do justice to WASH and One Health and their implications for child development. One Health encompasses human–animal–environment interactions as shown in Figure 4. So far, we have discussed how animals might impact human health but not how this interaction affects animal health, which in turn can also feedback to human health outcomes. We have only looked at faeces and not other zoonotic diseases that may be relevant. This complex interaction and area of research and practice requires further research and guidance.

Figure 4.
One Health Venn diagram

Source: Davis et al. 2017



What do we need to know more about?

Alongside the gaps in evidence identified above (e.g. WASH and zoonosis, transmission routes in health care facilities, WASH services in non-household settings, effective management of young child faeces), several areas relevant to child development revealed only limited literature and evidence in practice. They are listed here due to their relevance for further exploration.

- Urban WASH and child development.
- Gender, rights and inclusion in joint WASH and child development programmes.
- The impact of limited WASH during pregnancy on child development.
- Antimicrobial resistance and its potential threat to progress on WASH and child development

In addition, there were areas excluded from this review due to scope setting, including humanitarian and fragile settings, and specific research and practice among mobile, migrant, and refugee populations.



What is required of the WASH sector to improve child development outcomes?

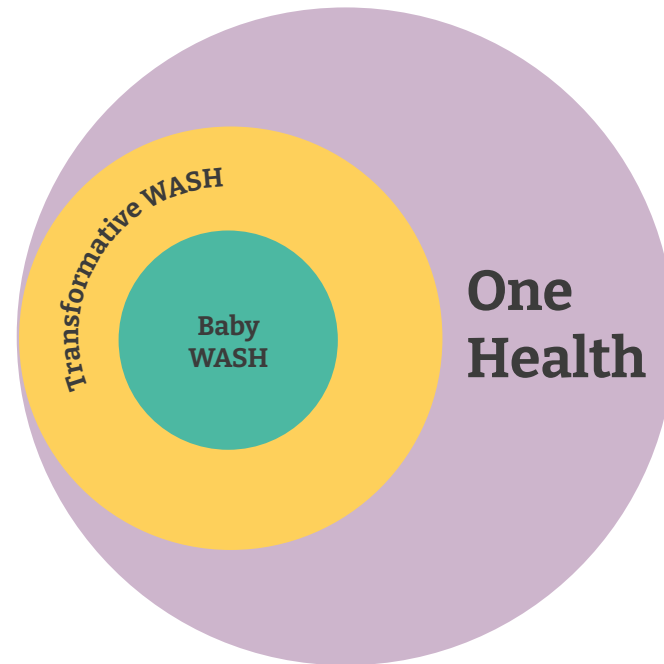
The synthesis of the evidence indicates that the interlinkages between sanitation, hygiene, and environmental cleanliness are messy, complex, and dynamic. Simple, cheap, and quick interventions may work to some extent in specific settings but there are also no ‘silver bullets’, and different settings will also require different approaches.

Adaptations to WASH practice to address child development are more frequently being adopted and reflected in global guidance. There is no one specific agreed way forward; it will take complex and new ways of working with other sectors, expanding WASH practice to areas such as animal health, and addressing complex behaviours. There will also be a need for incentives to boost cross-sectoral working.

Three main concepts/approaches are emerging in the literature as relevant for tackling WASH in a more comprehensive way for child development outcomes: Transformative WASH; One Health; and Baby WASH. These three concepts each have distinct considerations. As already described above, Baby WASH is a set of interventions and approaches to target the WASH needs of young children specifically; One Health is an approach that tackles animal, environmental, and human health jointly, and Transformative WASH is an aspiration for comprehensive WASH services and practices that minimise environmental contamination and pathogen transmission. All three are connected and Figure 5 has been designed to visualise how they may overlap and interrelate. Baby WASH is encompassed in Transformative WASH which is encompassed by One Health.

Figure 5.
The interrelatedness of Baby WASH, Transformative WASH and One Health

Source: Nossal Institute for Global Health



While there is further research and programmatic guidance required to understand what constitutes these three concepts/approaches fully, some practical approaches that cover aspects of all three are currently being actioned. These examples are discussed below and could be adopted more widely for addressing child development outcomes through WASH.

Understanding transmission pathways

To put the most effective set of interventions in place, WASH implementers need to know what is driving exposure to harmful pathogens. In technical terms, this means better understanding potential enteric infection transmission routes, understanding local pathogen prevalence, and using this information to design what gets prioritised in comprehensive WASH programmes. Experts who were interviewed acknowledged that tools to address this more effectively, and at scale, are still being developed and tested.

“Embrace the messiness and complexity of real life and avoid reductionism.”

One Health specialist

Existing research indicates that this knowledge is useful. One study in Peru has shown that improved water and sanitation interventions along with covered flooring reduced diarrhoea risk and decreased risks of zoonotic infection transmission (Colston et al. 2020). Each intervention did not do this equally, or for the same pathogens. Researchers in the study used sophisticated techniques to understand changes in risk that may not be replicable at scale, such as screening stools of participants in the study. Such methods may not be practical at scale, but research into understanding transmission pathways and their impact in different contexts may be useful for prioritising WASH interventions.

Baby WASH

As discussed above, an area of WASH work that has emerged from WASH, nutrition, and child development action is 'Baby WASH'. While there is no clear definition of this term, it encompasses an area of behavioural and technical WASH interventions that look to reduce the exposure of young children to faecal pathogens. Specific guidance on what these interventions entail is becoming more common, and programmes and policies are starting to adopt young-child-specific WASH components. UNICEF has developed a Learning Note from Eastern and Southern Africa (2020) providing programmatic guidance on Baby WASH. The learning note outlines three principles for Baby WASH: 1) that it be context specific and tailored to the setting and local needs; 2) that it is integrated with other health, early childhood development (ECD), and nutrition initiatives; and 3) that it is based on high quality evidence. Clear evidence on specific impacts of Baby WASH interventions is scarce.

It is still not completely clear which elements disrupt the transmission of harmful pathogens to children. What is known is that understanding local disease burdens, potential pathways that might need to be disrupted, mechanisms that lead from exposure to pathogens to adverse complex outcomes (e.g. poor cognitive development and nutritional outcomes), and local practices and beliefs is essential. When this is better understood, recommendations on specific programming areas into which WASH aspects need to be integrated, and which WASH elements are most important, will be clearer.

One important component of the UNICEF learning note is the recognition of the gendered nature of caregiving and domestic duties for children. It specifically highlights the importance of gender transformative approaches that are designed to not increase the burden on women and girls, and that work to create more equal distributions of domestic and caregiving responsibilities among men and women, and all caregivers.

Specific intervention strategies that encompass Baby WASH include:

- Childbirth: safe and clean environments where women deliver, including the practice of specific hygiene actions during labour and delivery, and handwashing of mothers and caregivers during this period
- Breastfeeding: ensuring women can wash hands, that children's mouths and hands stay clean and that pacifiers are kept clean, sterile, and stored safely.
- Hygienic preparation of food: covers many areas including clean hands and preparation surfaces for cooking, safe storage of food, safe water used to wash food, especially for food that is consumed raw, boiling water for preparation of baby food and baby drinks, controlling vectors and vermin in food preparation and eating areas, keeping cooking utensils clean and safely stored, and managing waste safely.
- Play spaces: keeping animals separate from children's play spaces, cleaning surfaces such as floors from dirt or soil, and keeping harmful items from children's reach.
- Hand hygiene: handwashing with soap at critical times as well as after disposing of child faeces, before breastfeeding, after handling animals or their faeces, and, in line with COVID-19 guidelines, after blowing or touching the nose and after returning home.
- Household cleanliness: regular cleaning of surfaces, including toilets, floor, and sink with soap and water, feet or shoes cleaned, inspected, or removed before entering housing, and looking to control disease vectors (e.g. flies and rodents).
- Separating children from animals: cleaning compounds or houses of animal faeces regularly and working to separate animals and young children under the age of three.

- Keeping children from contaminated soil: ensure improved sanitation including ending open defecation, secure good drainage of waste, ensure waste pits are available for animal manure, consider impact and mitigation of flooding, ensure household water treatment, look at ways to physically separate children from soil and faeces, and regularly clean compounds.

The Baby WASH concept and the interventions outlined above are not designed to be a one-size-fits-all approach. The learning note stresses the need for gender-responsive approaches, and to operate collaboratively with multiple sectors including nutrition, education, and health. The note also supports strong capacity development at all levels and emphasises the need to support and empower caregivers in the design and delivery of programmes. Countries should develop Baby WASH guidelines to guide action. Ethiopia has already developed Baby WASH guidelines, which are described further in Case Study 1. Linking policy and programmatic efforts in this way supports institutionalising WASH for young children and fosters government leadership and investment to drive and sustain change.

“Really simple, low-cost, rapidly deployed behaviour change interventions just don’t have the impact that we think they will ... It’s a compromise that we are making in terms of scalability and intensity. A lot of things that have dialled back on intensity in order to improve scalability, just haven’t necessarily reached the impact they expected.”

Behaviour change specialist

Case Study 1. Baby and Mother WASH Implementation Guidelines Ethiopia

The government of Ethiopia has prioritised a multi-sectoral approach to nutrition and WASH since the One WASH national programme in 2012 and the Seqota Declaration in 2015, which are commitments by the government of Ethiopia to achieve universal WASH coverage and end stunting in children under two years of age by 2030, respectively. The multisectoral nature from a WASH perspective sees nutrition sit across multiple WASH teams within the Ministry of Health, across WASH-related ministries, and extending into other areas such as education and agriculture. To focus specifically on WASH, nutrition, and ECD, the government of Ethiopia developed baby and mother WASH implementation guidelines to raise public awareness on Baby WASH, support collaboration between sectors, and mainstream Baby WASH into relevant policies, strategies, and guidelines. The guidelines are also designed to scale best practice and learnings from within and outside Ethiopia. Areas covered in the guidelines include child faeces disposal, handwashing with soap, food hygiene, protective play, WASH in health care facilities, food hygiene, and household sanitation. Links are made with girls in schools too, particularly for menstrual health and hygiene. There is recognition that the guidelines need to be underpinned by strong evidence and research is encouraged alongside implementation.

Several components are innovative and explore areas for integrated WASH and ECD programmes to consider. One is the inclusion of indicators to measure Baby WASH to track progress for policies such as the Health Sector Transformation Plan and the One WASH national programme. The data are collected through existing data mechanisms such as the health management information system, as well as nationwide surveys and periodic reviews. The indicators include:

National level

- No. of policies, strategies, pieces of legislations, and guidelines revised to incorporate Baby WASH.
- Existence of framework for integration of sector actors in Baby WASH.

Regional and zonal level

- No. of revised strategies and guidelines revised to incorporate Baby WASH.
- Existence of regional framework for integration of regional sector actors in Baby WASH.
- Reduction of diarrhoea incidences in ODF Woredas.
- Reduction of trachoma incidence in children.

Woreda and kebele level (process indicator)

- No. of trainings/information sessions given including Baby WASH messaging
- % of parents who correctly highlight the importance of child faeces disposal, handwashing, and face-washing at critical times.

The guidelines outline how to work with communities and how to integrate Baby WASH interventions into wider WASH and health and nutrition programmes, and are utilised by decision makers working in government offices, aid agencies, NGOs, and as influential leaders, teachers, and health extension workers who work at household and community level. Roles and responsibilities among health, education, agricultural, and WASH ministries are outlined at all levels (from national to Kebele levels) and other actors such as civil society, communities, women's organisations, and the private sector are also involved. Implementation has commenced

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offices, aid agencies, NGOs, and as influential leaders, teachers, and health extension workers who work at household and community level. Roles and responsibilities among health, education, agricultural, and WASH ministries are outlined at all levels (from national to Kebele levels) and other actors such as civil society, communities, women's organisations, and the private sector are also involved. Implementation has commenced and early evaluation shows that guidelines have been disseminated and translated at regional levels and communications have reached over 1 million people. Success has relied on the implementation being integrated into existing programming down to community levels, having high level leadership involved in the approval and oversight of the guidelines at national and regional levels, and having a specific technical focal point in the Ministry of Health to oversee the implementation. Adopting an approach that built on existing, established programmes has supported success and facilitated the streamlining of the guidelines into government planning and budgets.

The guidelines will undergo a review in late 2021 to adjust for lessons learnt during early implementation. A survey is underway to collect data to inform these amendments. Challenges remain in designing indicators that capture Baby WASH adequately in routine systems, especially composite indicators for WASH, sourcing the required funding for capital infrastructure requirements at health care facilities, and maintaining leadership and commitment from all sectors and departments across all levels of government. The guidelines are not standalone and are supported by other elements of the Seqota Declaration, including a focus on promoting and supporting gender equality through the delivery of education programmes.

Collaboration with nutrition, health, ECD, and education actors

Over recent years there has been major progress in the effective undertaking of joint WASH, health, and nutrition initiatives. Coordination has been reported at all levels including global, high profile collaboration such as that between Scaling Up Nutrition and Sanitation and Water for All (Scaling Up Nutrition n.d.). Coordination and integration are not easy and are not often supported financially through government or donor programmes (WaterAid, SHARE, Action Against Hunger 2017). However, some successful examples have been collated in an Action Against Hunger and WaterAid report from 2019, which drew from approaches in Ethiopia, Cambodia, and Madagascar.

The ingredients required for successful integration of WASH into nutrition and early childhood programmes that emerged from these case studies included:

- leadership at all levels, including at the highest level in government;
- having policies that support integration and developing costed plans to guide action;
- ensuring that strong financing and government systems are in place to deliver integrated approaches at all levels;
- putting strong data systems in place to track progress and targeted action where it is most needed; coordinating at sub-national levels, not just national levels;
- sharing knowledge about what works at national and sub-national meetings and conferences; and
- ensuring strong accountability is in place, with transparency, and roles and responsibilities clearly defined.

There are projects underway at the moment, supported by the World Bank, which adopt complex convergence processes, including in Laos People's Democratic Republic (PDR) (a short description can be found at Multi-Sector Convergence Approach to Reducing Malnutrition in Laos PDR (worldbank.org)). While still in their infancy, capturing and sharing learning as they develop will assist in understanding how integrated programmes at scale can operate and how they drive change to improve child nutrition

and development. One specific programme example from Cambodia, which has been evaluated, is described in Case Study 2 (Save the children 2020).

Case Study 2. Nourish – an integrated approach to nutrition in Cambodia

A USAID-funded project in Cambodia, led by Save the Children, was implemented 2014–2020 in three provinces. The project was called Nourish and it brought together health, nutrition, agriculture, and WASH actors. The programme worked with the national and local government in Cambodia to strengthen integrated community delivery platforms for integrated programming to address nutrition. The programme focussed on creating demand for WASH, agriculture, and nutrition practices, services, and products. This was done through interventions such as CLTS, social and behaviour change communication, and social protection initiatives such as conditional cash transfers. The project also worked with private sector actors to develop and supply WASH and agriculture products and worked to build capacity of subnational governments and civil society.

The project was successful in addressing undernutrition and associated risk factors. Stunting was reduced by 19 per cent and desired behaviours across all aspects of the programme increased. Many lessons were reported from the project. Valuing community resources and using community-driven plans were critical to building successful integrated community platforms for the project. Using social and behaviour change communication assisted in integrating actions across all sectors. Behaviours were prioritised that prevented communities from being overwhelmed by messages from multiple sectors. The project also built trust in the health systems through village health support workers. Conditional cash transfers and subsidies for sanitation among the most vulnerable assisted in supporting all, even the poorest, through the project.

WASH in other settings

While WASH in early childhood centres is underexplored, there is comprehensive guidance available on improving WASH in health care facilities. Guidance includes WHO and UNICEF's Water and Sanitation For Health Facility Improvement Tool 'WASH FIT' (WHO and UNICEF 2018) and WHO and UNICEF's Water, Sanitation and Hygiene in Health Care Facilities: Practical Steps to Achieve Universal Access report (WHO and UNICEF 2019), which provides eight practical steps to support countries to drive action on WASH in health care facilities. WHO and UNICEF have also created a portal that contains these documents and more guidance on addressing WASH in health care facilities at www.washinhcf.org. This guidance is grounded in approaches designed to work with and through the health system and to support global knowledge sharing.



What can WASH practitioners do?

Findings in this *Frontiers of Sanitation* indicate that tackling child development through WASH is complex and requires further exploration and continual adaptation to WASH practices as evidence continues to emerge. However, there are some overarching practical actions that can be adopted by WASH practitioners to better design and implement programmes to contribute to improving child development outcomes. They are:

1. Underpin all programmes with gender, inclusion, and rights approaches

The WASH sector has well established approaches to addressing gender equality and inclusion but their adoption in integrated WASH, nutrition, and child development programmes and research is limited and, in some cases, completely absent. Given the gendered nature of the first 1,000 days, WASH practitioners must adopt approaches that support gender transformation, adopt mainstreaming and targeted approaches to inclusion to ensure gains meet the needs of all, and support tackling broader social and structural inequalities. This can be achieved through translating existing inclusive guidance for WASH to integrated programmes, including considerations for children with disabilities. Programmes and research must be designed holistically with the cross-cutting elements of gender

and inclusion at the centre. Programming funding should also be designed to support transformative, inclusive approaches for WASH, nutrition, and child development.

2. Ground responses in local contexts

Understanding local disease burdens, the most risky exposure pathways, and sociocultural dynamics should form part of programming approaches. Solutions cannot be developed externally and applied; rather they should build on local knowledge, aspirations, practices, leadership, systems, and health needs. They should support strengthening local governance and ownership. Processes should be embedded to survey and understand local needs and strengths from the outset of a programme, and throughout its implementation. For child development, particular areas to consider are animal rearing practices, food hygiene practices, the needs of young children, and behaviours such as the disposal of child faeces. Programmes must be periodically reviewed and adapted accordingly, as local contexts are dynamic and change over time.

3. Expand the traditional 'WASH package'

Expanded definitions of what WASH packages include must become the norm. Strategies for minimising animal faeces and animal transmission of pathogens in the environment should be considered. Responses should include the needs of young children and include relevant Baby WASH approaches. Where required, programmes should include food hygiene interventions and WASH in all settings should become core parts of WASH policies and programmes. Expanded WASH packages should be grounded in local needs and context.

4. Area wide and systems focus for WASH implementation

WASH needs to continue to shift from basic service provision to district and community wide coverage of safely managed services. This is not to say small gains are not valid – they are – but in their own individual right are unlikely to be sufficient to drive gains in child health and development. Driving WASH change at this scale will require ambitious targets, coordinated investment, and strong governance at all levels. While this recommendation is relevant for all WASH programming, achieving this is particularly important for child development outcomes.

5. Extend WASH programmes to include other settings

Community wide WASH must consider WASH in all settings including ECD centres and health care facilities. Other settings must be included in WASH monitoring mechanisms so gaps are known and in district and national WASH planning. Draw on existing guidance such as WASH FIT to inform programming and coordinate with relevant sectors to adopt systems approaches that support the strengthening of WASH systems alongside health and education systems.

6. Use health data to inform WASH programming

Disease-burden data should be incorporated into WASH planning and prioritisation processes so efforts are targeted and designed where needs are greatest. These data will also support understanding how to disrupt disease transmission through understanding which diseases are most prevalent. Health data is often captured in national health monitoring mechanisms such as health management information systems, demographic health surveys, and periodic surveys such as UNICEF's Multiple Indicator Cluster Surveys. Local health departments and health facilities also often have relevant disease-burden data to inform WASH programming.

7. Coordinate with and integrate into health, nutrition, ECD, and education programmes

Joint efforts can bring joint gains. WASH alone will not drive long-term change to child development; addressing child development needs are complex and should be addressed as such. WASH actors should look to coordinate more effectively with relevant actors at all levels – both with leadership at the national level and through local community delivery platforms. WASH practitioners do not need to adopt complex skills across multiple sectors; rather they can adopt more joined up approaches including: defining joint goals with other sectors and working jointly to achieve those goals; participating in joint monitoring and accountability processes; engaging in coordination mechanisms at national and subnational levels; and integrating activities where possible at the community level.

8. Complex, adaptive behaviour change strategies

Behaviour change needs to occur and be well connected with technological interventions. This Frontiers highlights that handwashing behaviour alone may not be sufficient to reduce disease transmission, although it is an important component. Behaviour change strategies need to focus on the specific needs of young children and new aspects such as animals, food hygiene, and other settings including health care facilities and ECD centres.

9. Conduct basic and implementation research

We are still not fully clear on what works, where, and how. There is still much to understand about the ways in which pregnant women and young children are impacted by unhygienic environments. This is also true for the role of animals, animal faeces, and zoonotic diseases. Research should not be focussed solely on transmission and risks. Focus should be put on how to implement new strategies, what is effective in driving behaviour change, and which technologies are best in specific settings. Embed research into policies as outlined in the Ethiopia Baby WASH case study, and include research in programme design and implementation. Share learning with all relevant sectors.

“We are expanding what fits into the envelope of WASH and I think overall that is a net positive.”

Behaviour change specialist



Summary of key learnings

1. The interlinkages between sanitation, hygiene, and environmental cleanliness for child development outcomes are complex, and evolve as more evidence emerges. While there is a growing understanding of these interlinkages, they continue to be context specific and will require multi-faceted and locally adjusted WASH approaches to achieve positive child development outcomes.
2. WASH delivered in a traditional way, addressing only basic WASH interventions, is not likely to be sufficient to support children in both surviving and developing to their full potential. WASH implementers must ideally understand needs from the perspectives of cross-sectoral development priorities and health more broadly, as well as WASH specifically, including the various influencing factors and incentives in place. Drawing on this insight, implementers will be able to design WASH approaches that consider additional elements such as food hygiene, animal faeces, WASH in non-household settings, and the specific WASH needs of young children, relevant to each context.
3. The WASH sector must continue to strengthen its collaboration with other sectors. Examples of cross-sector working are becoming more common, particularly for WASH and nutrition. Learning from the various successes and failures of these approaches, considering both processes and outcomes, can further inform how the WASH sector can engage with other actors, such as those in animal health and food hygiene sectors, and those active in varied settings such as health care facilities and early childhood education centres.

4. Concepts and approaches, namely Transformative WASH, Baby WASH and One Health, have emerged in recent years to provide insight into how the complexities of WASH, health, and child development can be both understood and addressed. These approaches can provide conceptual understanding as to how the WASH sector could and should operate in conjunction with others and adapt its ways of working to best support the health and development of children.
5. There is still much to learn. Research and evidence around how to best understand context-specific infection risks and how to effectively block the transmission of harmful pathogens are required. There is a need not only for research to understand transmission pathways, but more extensive documentation and evaluation of context-adjusted WASH approaches, particularly those addressing emerging areas such as food hygiene, animal faeces, and Baby WASH. Embedding learning and knowledge sharing into routine practice is critical to support the growing evidence base, and will be essential to continue to inform and refine how the WASH sector can support child development outcomes most effectively.

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