



# Water.org: Meta Study of Existing WSS Research

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## Thematic paper on Health and Safety

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## List of Abbreviations

EED	Environmental Enteric Dysfunction
FI	Financial Institution
HH	Household
LMIC	Low and Middle Income Countries
MHM	Menstrual Hygiene Management
MWSU	Multiple Water Source Use
RAG	Red, Amber, Green
RCT	Randomized Controlled Trial
SDG	Sustainable Development Goal
STH	Soil-transmitted Helminth
ToC	Theory of Change
WASH	Water, Sanitation and Hygiene
WC	WaterCredit
WHO	World Health Organization
WSS	Water Supply and Sanitation

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## Version Control

Version number	Date	Author	Comments
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3	14 <sup>th</sup> December 2021	Joseph Thompson	Final

## 1. Introduction

### 1.1 Scope of the Meta Study

The objectives of the Meta Study are “to organize, synthesize and translate the (internal) evidence base into meaningful insights that compel action across donor and sector stakeholders” and “to inform Water.org’s future research and learning agenda by identifying key evidence gaps where additional insights and research are needed”. These objectives reflect the breadth of the (internal) evidence that already exists and highlights where evidence between Water.org activities and outcomes related to these thematic areas remains weak. Recommendations are also made in terms of Water.org’s future learning agenda as well as improving Water.org’s programming to strengthen its potential contribution to the five thematic areas.

### 1.2 Health and safety

Health and safety covers 3 different areas:

- WSS improvements leads to direct health benefits for individual households.
- WSS improvements leads to direct safety benefits for individual households.
- WSS improvements lead to reduced stress and increased wellbeing.

Health is generally considered the primary outcome associated with water, sanitation, and hygiene (WASH). The World Health Organization defines health as the state of physical, mental, and social wellbeing (WHO, 2017), with water supply and sanitation (WSS) improvements having the potential to impact each of these dimensions. It should be noted that the mental health dimension is a developing, broad, and complex field, and strongly informed by contextual factors (White, 2018; Cooper et al., 2019). Consequently, for the purposes of this review, the focus is placed on stress and its relation to WSS when considering mental health. There are also noted overlaps with physical and mental health when considering ‘wellbeing’, with definitions provided to guide discussion in this area.

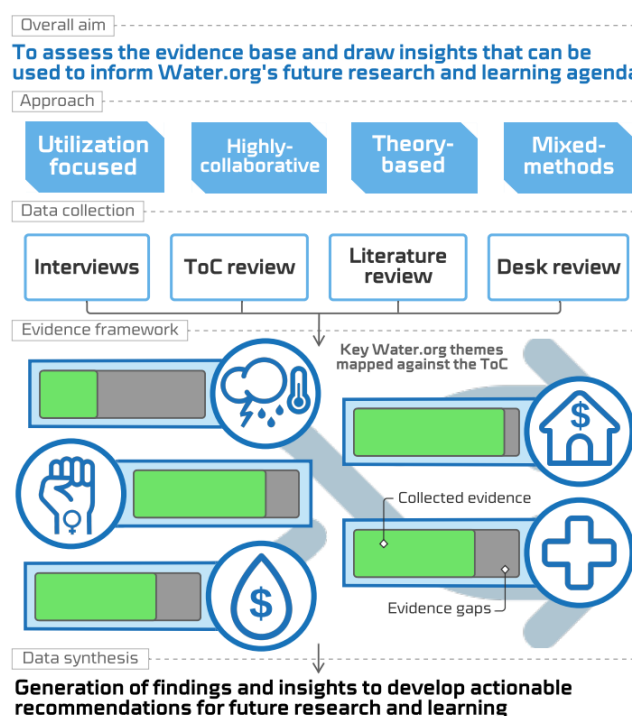
### 1.3 Methodology

Figure 1 summarizes the approach and methodology applied for the meta study.

Six stages of work were carried out:

1. Review and reformulation of the thematic theories of change and development of a Theory of Action;
2. Deep dive document and data review for internal evidence. This incorporated a sense check with Water.org core team to identify whether any additional data was available;
3. External literature review to source evidence on associated sub-themes including any gaps identified with the internal evidence;

Figure 1. Meta-study approach and methodology



4. Drafting of the Thematic Paper;
5. Co-creation workshop to develop and refine the associated Theory of Change;
6. Finalizing the Thematic Paper.

**Analysis framework:** The reformulated theory of change and associated sub-themes was used as the analysis framework.

**Internal evidence data sources:** The meta study analyzed both primary (interviews with country program managers) and secondary data, quantitative (WaterPortal data and mwater data) as well as qualitative analysis (evaluation reports and other such publications).

**External evidence data sources:** External literature was sourced using Google Scholar, reference lists in sourced literature, personal libraries, and cross-over and sharing of literature from one thematic area search to another. Both internal and external evidence were entered into a data capture tool for further analysis.

**Scoring the evidence:** Each sub-theme is given a Red, Amber, Green (RAG) rating. A grey color block depicts that the rating is not applicable.

Table 1. Color classification of RAG rating

<b>Internal data</b>	Strong evidence	<b>External data</b>	Strong evidence
	Emerging evidence		Emerging evidence
	Mixed evidence		Mixed evidence
	Weak evidence		Weak evidence
	Not applicable		Not applicable

**Internal quality control:** in addition to the sense checking by Water.org, three discrete internal quality control steps have been taken: an internal workshop sharing the internal and external evidence to identify and discuss thematic findings and cross-cutting aspects; and 2 rounds of quality assurance of the report (draft and final).

**Internal and external evidence:** two icons are included in the text to denote whether a data source is internal to Water.org or external:

 = internal evidence       = external evidence

## 1.4 Structure

The remainder of the report is structured as follows:

**Section 2** provides a summary of findings.

**Section 3** provides detailed findings for each of the sub-themes of (insert theme).

**Section 4** provides a concluding statement.

**Section 5** details the thematic Theory of Change (ToC).

**Section 6** sets out a series of practical recommendations for consideration by Water.org.

**References** are then detailed.

## 2. Summary of findings

There is mixed evidence of WSS improvements leading to positive health outcomes.

- Ex** **The transmission pathways, impacts of disease, and role WSS and hygiene play in preventing infection are well established.** The pathogen routes for feces- and water-related disease are clearly outlined and understood (Cairncross et al., 2013; Bartram and Hunter, 2015; Hutton, 2015). Approximations for the global burden of WASH-related disease are also monitored by the WHO, with the key diseases identified in this review including diarrhea, helminths / parasitic worms, trachoma, respiratory infection and COVID-19, among others.
- Ex** **There is substantial evidence of WSS improvements leading to shorter-term health outcomes.** Closer proximity of water sources has led to a reduction in water carriage and the negative health outcomes that it can bring, such as musculoskeletal health risks (Florack et al., 1993; Sorenson et al., 2011). It is also associated with increased levels of water consumption, with positive impacts on health outcomes as a result, including reduced dehydration, incidence of trachoma, gastrointestinal-related disease, and diarrhea (Jalan and Ravallion, 2003; Prüss-Üstün et al., 2014; Geere et al., 2018).
- In** Water.org data (from mWater) supports the global evidence on the links between WSS improvements and short-term positive outcomes. There is strong evidence to suggest that WSS improvements made through WaterCredit have reduced time taken for borrowers to access WSS and that in many areas, the quality of water provided has also potentially increased (as assessed by the water user).
- Ex** **Positive health outcomes have also been linked with handwashing with soap.** Positive health outcomes have also been linked with handwashing with soap. Ejemot-Nwadiaro et al. (2021) compared results across 15 RCTs of community-based handwashing promotion interventions and found a decrease in episodes of diarrhea of 30% among children. Other reviews that incorporate findings from non-RCT based studies have found higher reductions of up to 48% (Fewtrell et al., 2005; Waddington and Snilstveit, 2009; Cairncross et al., 2010). One noted gap that is noted from this Meta Study research is the extent to which handwashing and hygiene more broadly are included in Water.org programming. One evaluation (IRC Consult, 2021) reports that only 63% of borrowers had received health and hygiene education, whilst in the IKEA evaluations only 32% of borrowers had participated in hygiene education in India and 40.2% in Indonesia (Water.org and Grameen Foundation, 2020). The WaterPortal data indicates that only 4,072 loans have been distributed to end borrowers for handwashing facilities out of the total 5,994,736 loans for all improvements.
- In** this Meta Study research is the extent to which handwashing and hygiene more broadly are included in Water.org programming. One evaluation (IRC Consult, 2021) reports that only 63% of borrowers had received health and hygiene education, whilst in the IKEA evaluations only 32% of borrowers had participated in hygiene education in India and 40.2% in Indonesia (Water.org and Grameen Foundation, 2020). The WaterPortal data indicates that only 4,072 loans have been distributed to end borrowers for handwashing facilities out of the total 5,994,736 loans for all improvements.

**There is some data to support the impact of WSS improvements on longer-term health outcomes.**

**Recommendation:** To fully realize potential health outcomes, more emphasis should be placed on hygiene. Emphasize on hygiene software (information, education, and training) rather than hardware (physical infrastructure, e.g. a handwashing basin), and place an equal priority on hygiene when planning water and sanitation interventions.

- Ex** Some studies have observed reductions in diarrheal disease as a result of water, sanitation, and hygiene (Wolf et al., 2014; Fewtrell et al., 2005; Cairncross et al., 2010). Likewise the Water.org mWater data points to positive health outcomes, with survey 2.0 indicating that 97.4% of respondent's had observed a positive change in their family's health since the water and/or sanitation improvement was installed (n=1,569). Reports such as Water.org and World Bank (2015) cite that 25% of borrowers reported reduced illness, with several evaluations also showing health benefits from the data collected (The MasterCard Foundation and Water.org, 2015; Institute for Sustainable Futures, 2019; Pories, 2016). These findings include a reduction in disease, a reduction in
- In**

person-hours spent caring for sick members of the household, less money spent on medical needs, and reduced rates of hospitalization. The data for these findings is predominantly derived from self-reporting based on recall, however, which is considered a poor way of measuring health outcomes.

**Recommendation: Making health claims based on internal data is a potentially problematic endeavor.** The broader WASH sector faces significant challenges in assessing health impact in a robust fashion, with studies at this scale falling outside of what is appropriate or resource-effective for Water.org. This limits the degree to which strong internal evidence on health can be gathered.

**In**

**That said, there are also inconclusive and negative health outcomes reported.** Several Water.org evaluation findings include higher hospitalization rates (Mansour and Sánchez-Trancón, 2019), no change or an increase in household members getting sick (Barenberg et al., 2019), and an increase in medical bills (Davis and Gilsdorf, 2016) after WSS improvements had been constructed. Likewise, the IKEA Bangladesh evaluation (Water.org, 2018) did not note any significant findings for change in incidences of water-borne diseases as a result of the program. This mixed picture is also reflected in the external literature, where one systematic.

**Ex**

review observed lower-than-expected health gains and poor quality of evidence across previous studies (WHO, 2018). More recently, three high quality randomized controlled trials (RCTs) were conducted to assess the impact of WASH with and without nutrition, and observed minimal/no change in rates of diarrhea and stunting (Null et al., 2018; Luby et al., 2018; Humphrey et al., 2019).

Several explanations for inconclusive health outcomes have been put forward, with insufficient WSS community coverage gaining the most traction.

**Ex**

**Community coverage is considered a key factor behind the lack of positive health outcomes.** A study by Wolf et al. (2019) looked at the level of environmental contamination at the endline of several WASH studies and found that diarrhea reductions were highest in environments with lower excreta contamination and no reductions found when contamination was above a certain threshold. Current thinking, therefore, posits that unless a clean environment is achieved through sufficient community coverage coupled with higher service levels, significant reductions in diarrhea and stunting (by extension) are unlikely to occur (WHO and UNICEF, 2019).

**Recommendation: Community coverage and clean environments constitute key components for positive health outcomes and should be considered in tandem with WaterCredit programming.** WC is not designed to provide access for all and not conducive to community saturation in and of itself. There is a role Water.org can play, however, in supporting those whose responsibility it is to provide access (e.g. the government) and efforts to bolster this – incorporated with a focus on community coverage – should be explored.

**Ex**

**Several other gaps that may impact health outcomes have been identified for further research:**

- The time required to realize longer-term health outcomes (WHO and UNICEF, 2019).
- Multiple water source use (MWSU) may also undermine health outcomes (Daly et al., 2021).
- Mixed evidence on the impact that point-of-use water treatment (Arnold and Colford, 2007).
- Safe management of child and animal feces, including the provision of clean play spaces to limit consumption of soil and contact with excreta (WHO and UNICEF, 2019).
- Food hygiene and the contamination of crops in fields and markets with feces (Esteves Mills and Cumming, 2016).
- Insight into the link between EED and stunting (WHO and UNICEF, 2019).

External factors such as unfolding crises threaten the attainment of positive health outcomes.

**Ex** **The COVID-19 crisis has had a significant impact on health outcomes.** Both the primary and secondary impacts of COVID-19 have had significant implications for the WASH sector and its work towards improving public health, though the full effects are not yet clear.

**Ex** **The climate crisis continues to affect WASH health outcomes and will get worse over time.** Epidemiological studies anticipate that waterborne diseases will become more prevalent due to an increase in climate-related hazards (Cann et al., 2013; Kohlitz, 2018). Water quality is adversely affected by flood damage to water infrastructure, sanitation facilities, and contamination through agricultural and industrial waste (Talbot et al., 2018), whilst drought creates water shortage and leads to situations of water scarcity (Paudel et al., 2021).

Health is an important motivator behind investing in WSS improvements but not as significant as other factors.

**Ex** **The role of health as a key motivating factor behind WSS investments is possibly oversold.** Improving public health is often cited as a central driver for WSS (Aiello et al., 2008; Whaley & Webster 2011), though evidence suggests that other factors are more influential such as increase safety, comfort, cleanliness, and convenience (Schouten and Mathenge, 2010). This has led some to argue that this points to a misalignment between the motivations of development professionals and local actors (Marshall and Kaminsky, 2016; Curtis et al., 2009). This was mirrored in the Water.org data, which identified ‘better health’ (48.3%) as a secondary driver to ‘convenience’ (64.4%) (n=3,226).

**In**

There is strong evidence that WSS improvements lead to perceptions of increased safety for individuals.

**Ex** **Reduced travel time for WSS-related activities is associated with increased feelings of safety.** Time spent on meeting WSS needs leaves people vulnerable to physical or verbal abuse, rape, and assault, especially women and children (Cowan, 2011; Sorenson et al, 2011). Other risks include rough terrain (particularly when carrying water) and attack from dangerous animals (IPSOS & GWC, 2018). Sanitation facilities are also perceived as improving safety due to the privacy they offer – particularly for women and girls during menstruation (Heller, 2014). The Water.org data from mWater supported these notions, with comfort (90.4%) and pride/dignity (84.6%) selected as the top two changes observed by survey participants as a result of their WSS improvement (n=1,569).

**In**

**Ex** **The degree of safety they can provide is determined by a set of factors.** Physical characteristics improve safety, such as proximity to household, clear pathways free of obstacles, lighting for night-time, wheelchair access, and using the facilities (Wilbur and Jones, 2014). Inadequate access to WASH facilities is also associated with a heightened vulnerability to various forms of violence (Sommer et al., 2014), and WASH facilities can serve to reduce vulnerability in this respect (House et al., 2014). There are limitations to the level of safety WASH facilities can provide, however, as WASH is not typically the root cause of violence (SHARE, 2021).

**Ex** **Safety is considered a significant driver behind WSS investments.** Personal safety ranked highest in Lagerkvist et al. (2014)’s study on motivators for construction sanitation facilities in Kenya, ahead of health. Likewise, a systematic review of papers outlining motivations for community sanitation found that ‘privacy’ and ‘safety’ featured the highest frequency of times (Novotný et al., 2017).

**In** Water.org data provided mixed results on safety as a key driver, however, with the mWater data separating aspects of safety into different elements (e.g. ‘safety from humans’, ‘safety from



animals’, ‘convenience’). Data from focus group discussions highlight safety as one of the primary motivations behind taking on a toilet loan, however (Institute for Sustainable Futures, 2019).

There is a clear relationship between water supply and sanitation, stress, and wellbeing.

**Ex** **Inadequate access to WSS is associated with higher levels of emotional stress.** A wide number of publications have explored the impact stress can have on activities such as water carriage (Aihara et al., 2016; Geere et al., 2018; Gimelli et al., 2018; Thoma et al., 2021; Cooper et al., 2019;) and open defecation (Shiras et al., 2018; Sclar et al., 2018; Ross et al., 2021). Limited WSS is also linked to a heightened vulnerability to violence which relates to stress (House et al., 2014; Sommer et al., 2014).

**Ex** **Water insecurity and scarcity are considered significant stressors for individuals.** Research indicates that water insecure communities experience higher levels of anxiety and depression (Brewis et al., 2021), and are more prone to arguments, heightened disagreements, and violence (Choudhary et al. 2020; Adams et al., 2021). Qualitative data from Water.org evaluations describe issues with fights and disputes over water, arguments at queues for communal resources prior to the installation of WSS improvements (Water.org et al., 2017). Community management of WSS can also contribute to higher stress levels, as a result of perceived unfairness in water distribution (Esteves Mills and Cumming, 2016; Brewis et al., 2021) and practices such as water borrowing, which is associated with feelings of shame, fear, and indebtedness (Wutich et al., 2008).

**In** **Improved WSS can lead to an increase in factors associated with wellbeing – an approach that broadens thinking around the benefits of access to WSS.** Research into wellbeing is a relatively nascent field in the WASH sector that is being framed within the context of water and sanitation insecurity (Caruso et al., 2017; Wutich et al., 2020; Thoma et al., 2021; Ross et al., 2021). Criticisms of SDG6 have noted its focus on avoiding morbidity and mortality, rather than enabling people to build capacity and pursue positive outcomes (Gimelli et al., 2018).

**Recommendation: Incorporating wellbeing frameworks into programming could provide a holistic view of the benefits WASH improvements can bring to HHs and communities.** Approaching WSS from a wellbeing angle moves beyond looking at reductions in morbidity and mortality and encompasses a spectrum of benefits individuals can reap from WaterCredit. Whilst elements of wellbeing can be applied to programming, this is a nascent field in WASH research and commonly-agreed notions of best practice have not yet materialized.

**Ex** **There is a link between the loans for WSS and stress, but lacks clarity.** 75.5% of mWater respondents reported less stress regarding management of their water compared to before their water improvement (n=1,122), due primarily to reduced worries concerning water, shorter waiting times inline, and increased ease for taking care of family. 11.6% did report an increase in stress, however, and no further data to explain why this is the case. Experiences of stress related to loan repayment were reported in one Water.org evaluation, that observed some clients in India and Indonesia resorting to negative coping mechanisms to manage loan repayment (Water.org and Grameen Foundation, 2020).

Table 2. Robustness of the internal and external data for the WSS and improved health and safety sub-themes

Sub-themes	Internal Data	External Data
WSS leads to direct health benefits		
WSS leads to direct safety benefits		
WSS leads to reduced stress and increased wellbeing		

### 3. Findings

#### 3.1 WSS improvements leads to direct health benefits for individual households

Table 3. RAG rating for evidence of improved WSS and health benefits

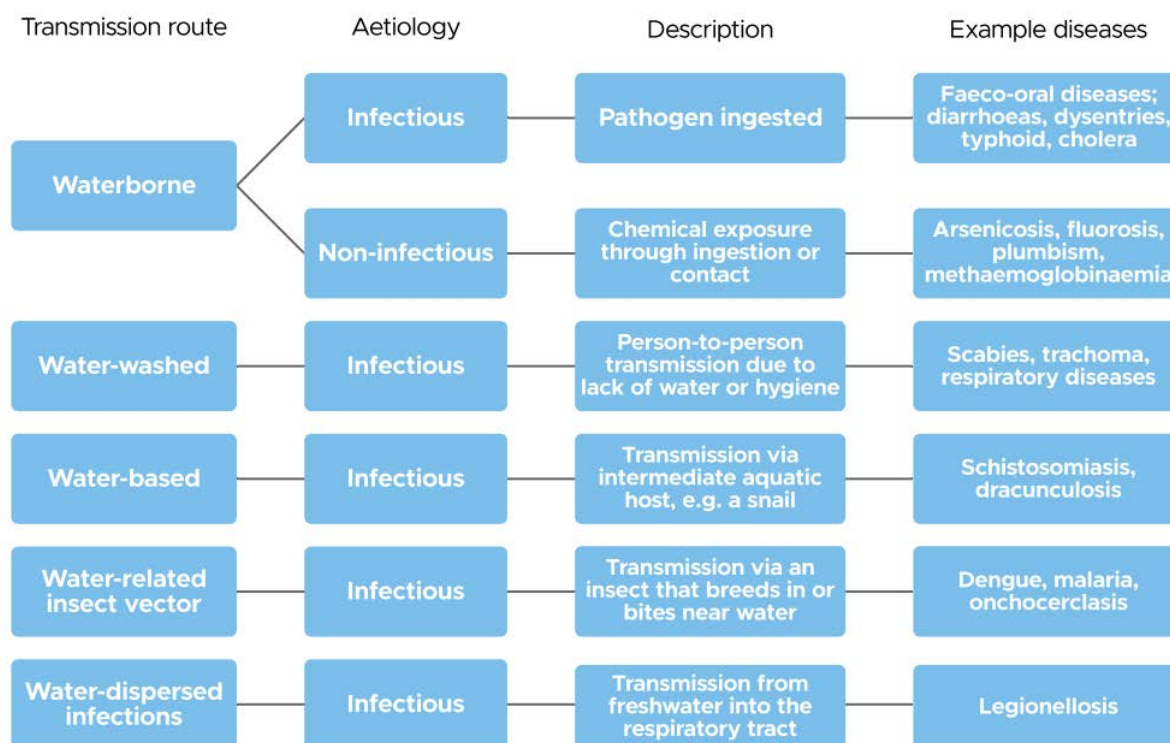
<p><b>Internal data</b></p> <ul style="list-style-type: none"> <li>mWater survey data provides largely positive results. Health-related questions were only asked in a few countries, however.</li> <li>Evaluation data provides a mixed picture, with positive, inconclusive, and negative health outcomes observed.</li> <li>The quality of the data (both mWater and from evaluations) is questionable (largely self-reported) and difficult to verify.</li> </ul>	<p><b>External data</b></p> <ul style="list-style-type: none"> <li>How feces- and water-related disease spreads is well-understood, as well as the theoretical role WASH plays in preventing this.</li> <li>Mixed evidence generated for positive health outcomes, however. Quality of evidence also considered poor.</li> <li>Recent high-quality RCTs failed to notice a significant WASH-related impact on diarrhea.</li> <li>Calls from literature for greater attention to community coverage and clean environments.</li> </ul>
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There is a clear understanding of how WSS prevents the transmission of disease and a strong evidence base to support this.



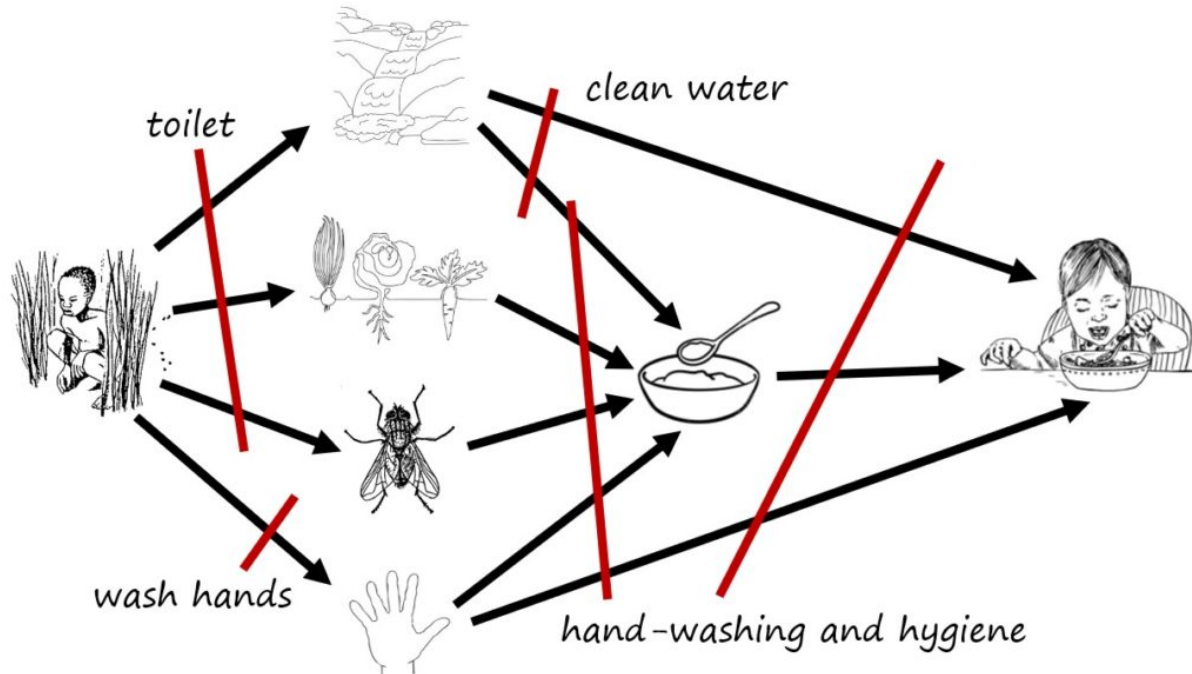
**The transmission pathways, impacts of disease, and role WSS and hygiene play in preventing infection are well established and understood.** The routes of transmission for feces- and water-related diseases are closely related and “best imagined as a web of pathways influencing each other” (Cairncross et al., 2013). The modified Bradley classification (Figure 1) illustrates the five main transmission pathways of water and excreta-related diseases (Bartram and Hunter, 2015; Hutton, 2015).

Figure 2. Modified Bradley Classification (Bartram and Hunter, 2015)



Regardless of the route the pathogen takes, it is clear that the presence of inadequately disposed of feces is a key factor in the transmission of disease (Cairncross et al., 2013). The movement of pathogens from excreta to human contact is often depicted by the ‘F-diagram’, as seen below in Figure 2.

Figure 3. F-diagram (water1st)<sup>1</sup>



**Ex** The F-diagram shows the multiple pathways for fecal contaminants to travel and how, through the combination of water supply, sanitation, and handwashing interventions, transmission can be broken. By doing so, at least three of the five water-related transmission routes are interrupted – principally waterborne, but also water-washed and water-based – reducing the burden of disease and leading to improved health outcomes (Vigh et al., 2020). The main diseases that are most strongly associated with poor access to water supply, sanitation, and hygiene are as follows:

#### Diarrhea

**Ex** **Infectious diarrhea constitutes the most significant proportion of the global burden of disease from these transmission pathways (Prüss-Üstun et al., 2014) and includes cholera, shigellosis, amoebiasis, salmonellosis, and other viral and protozoal intestinal infections.** Diarrheal disease is the second leading cause of death in children under five, with approximately 1.7 billion childhood cases and 525,000 deaths in children under five every year (WHO, 2017). Diarrhea is also a leading cause of child malnutrition and other enteric infections (Lin et al., 2013; Checkley et al., 2008; Guerrant et al., 2008; Brown et al., 2013). It is estimated that “safely managed sanitation services could prevent up to 6 billion cases of diarrhoea ... between 2021 and 2040” (WaterAid, 2021) and that 88-90% of the diarrheal disease burden could be avoided through good WASH practices (Nounkey and Dharod, 2021; Cairncross et al., 2013).

**Ex** **There is also evidence to link diarrhea and malnutrition.** An association with diarrhea and environmental enteric dysfunction (EED) has been identified, a subclinical disorder of intestinal function. It is hypothesized that EED leads to nutrient malabsorption, preventing the body from fully

<sup>1</sup> <https://water1st.org/problem/f-diagram/>

benefiting from key vitamins and minerals, resulting in undernutrition and stunted growth. This is most vital to children in their first 1,000 days of life (Esteves Mills and Cumming, 2016) and the knock-on effects of stunting include long-term cognitive deficits and a 20% mortality rate for children under 5 (Humphrey, 2009). Stunting affects approximately 144 million children under-5 globally (Zavala et al., 2021).

#### *Helminths / parasitic worms*

**Ex** **Helminth infections are transmitted through eggs in faecal matter in water (schistosomiasis), affecting 240 million people worldwide (WHO, 2021), and in soil (soil-transmitted helminths (STHs)), affecting 1.5 billion people worldwide (WHO, 2020).** They are associated with several negative health outcomes, including anemia, limited growth, and cognitive development (O’Lorcain & Holland 2000; De Silva et al., 2003; Bethony et al., 2006; Prüss-Üstün et al., 2006; Ziegelbauer et al., 2012). Two commonly found STHs – hookworm and roundworm – have been found to cause maternal anemia and low birth weight (Brooker et al., 2008; Noronha et al., 2012), and schistosomiasis is linked with ectopic pregnancy, undernutrition, and anemia (King et al., 2005; Swai et al., 2006; Esteves Mills and Cumming, 2016). There is strong evidence to suggest that infection from both schistosomiasis and STHs can be prevented through improved access to WSS (Esrey et al., 1991).

#### *Trachoma*

**Ex** **Trachoma is a disease of the eye caused by a bacterium infection and is an endemic public health concern in 44 countries.** If left untreated, trachoma can result in blindness and is responsible for the visual impairment of approximately 1.9 million people worldwide (WHO, 2021). Infection is spread through person-to-person contact and flies that have had contact with discharge from the nose or eyes of an infected person. Trachoma can be treated early on with antibiotics and infection contained through improved sanitation (fly control) and water supply for hand and face hygiene practices.

#### *Respiratory infection and COVID-19*

**Ex** **Respiratory infections affect the airways and other structures of the lung and are associated with a lack of handwashing** (Hutton and Chase, 2016). At the onset of the COVID-19 pandemic, contact contamination (fomites) was identified as a major transmission route and handwashing with soap was posited as one of the main preventive measures against infection. This was particularly challenging given that an estimated 40% of households globally did not have access to handwashing facilities with soap at the start of the pandemic (Sanitation and Water for All, 2020). Later evidence questioned the prominence of fomites as an infection pathway (Mondelli et al., 2020), with research revealing transmission via aerosolized droplets to be a more significant route of infection. Subsequent hygiene practices, such as face masks and social distancing, were introduced to combat this (Thompson, 2020). The impact of COVID-19 has been profoundly felt since its inception, spreading rapidly from country to country, and is responsible for approximately 4.7m deaths to date, globally (Worldometer, 2021).

There is mixed evidence of WSS improvements leading to positive health outcomes.

**Ex** **Shorter-term health outcomes have been observed relating to water source proximity, particularly for women and girls.** Fetching water is a physically challenging task and is typically carried out by women and children (Thoma et al., 2021). It comes with an array of musculoskeletal health risks and other potential injuries, including spinal damage, hernia, and genital prolapse, as well as an increased risk of spontaneous abortion (Florack et al., 1993). Water collection requires significant

calorific expenditure that can inhibit weight gain and affect people’s quality of life (Sorenson et al., 2011). It is an activity that can also heighten women’s risk of sexual assault (Geere et al., 2018) and increase their vulnerability to environmental and climate stressors, such as pollution (Thoma et al., 2021).

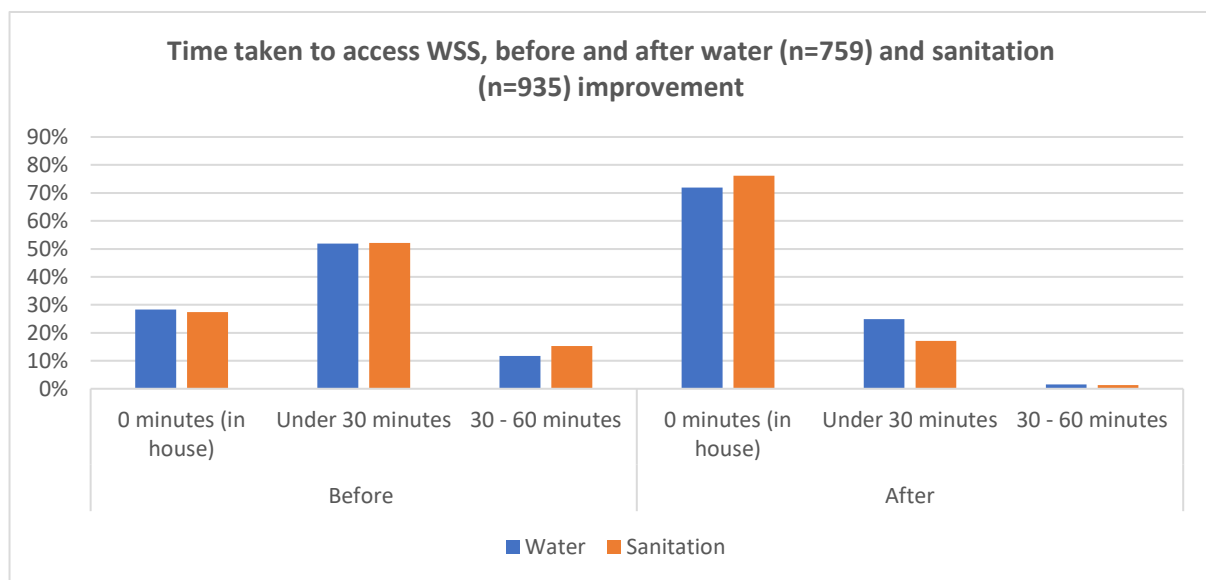
**Ex**

**Closer proximity of water to the household reduces these risks and correlates with higher levels of water consumption** (Howard et al., 2020; Frempong et al., 2021). Dehydration from a lack of access to water and from not drinking due to poor latrine access (especially for women and girls) can affect personal hygiene and enhances the risk of reproductive and urinary tract infections linked to anemia and pre-eclampsia (Schieve et al., 1994; Minassian et al., 2013), as well as higher risks of infection during childbirth and post-partum (Esteves Mills and Cumming, 2016). Increased quantities of water at home are associated with reduced incidence of trachoma, gastrointestinal-related disease, and diarrhea (Jalan and Ravallion, 2003; Prüss-Üstün et al., 2014; Geere et al., 2018). Higher quality water is also associated with improved health outcomes (Wolf et al., 2014).

**In**

Water.org data (mWater) supports the global evidence on the strong links between WSS improvements and short-term positive outcomes. Figure 3 shows data from five countries, displaying estimated changes in time taken to access WSS before and after the construction of the improvement.

Figure 4. Graph showing time taken to access WSS before and after the improvement was constructed (Water.org mWater)



As can be seen, the majority of Water.org customers before their improvement took up to 30 minutes to access WSS, compared to over 70% having access within their house after their improvement has been constructed. According to the data, 73.9% of loan recipients for water improvements stated that the quality of the water had improved and 25.6% stating it was the same as before (n=759). The main changes observed include ‘less dirty / muddy water’ (54.5%), ‘does not smell bad’ (35.2%), ‘clean collection point’ (28.9%) (n=560). Whilst these justifications are based on perception rather than water quality testing, the above evidence taken collectively suggests that the Water.org improvements have enabled a reduction in time taken to access WSS and a potential increase in water quality. Given the established association between proximity to water sources and short-term health outcomes in the literature, it can therefore be assumed that the reduction in time to access WSS holds similar health benefits for Water.org customers.

**Ex** Some studies have linked WSS improvements to positive longer-term health outcomes. A systematic review undertaken by Wolf et al. (2014) of studies from 1970 to 2013 found the following case reductions for diarrhea as a result of water supply and sanitation interventions (Table 3).

Table 4. Estimated reduction in diarrheal disease as a result of different WSS improvements (Wolf et al., 2014)

Intervention	Reduction in diarrheal disease (and consequent disease) compared to unimproved facility
<b>Water supply</b>	
Improved community water source	34%
Basic piped water	45%
Piped water, high quality	79%
<b>Sanitation</b>	
Improved on-site sanitation, no formal excreta management (100% coverage)	28%
Improved sanitation with formal excreta management (100% coverage)	69%

The study shows noticeable differences in disease reduction depending on the WSS improvement implemented. These findings are supported by three other systematic reviews that estimated an average reduction of 32-36% in diarrhea as a result of improved sanitation (Fewtrell et al., 2005; Waddington and Snilstveit, 2009; Cairncross et al., 2010). Hutton (2015) estimates that the number of deaths avoided through basic water supply is approximately 34% of the 500,000 annual deaths (170,000 lives saved per year) and for sanitation, it is 28% of the 280,000 annual deaths (80,000 lives saved per year).

**In** Again, positive health outcomes are also reflected in the Water.org evaluations and mWater survey data. Data from the mWater survey across five countries showed that 62.1% of customers observed a positive change in their family’s health since the water and/or sanitation improvement were installed (n=1,569), 97.4% of which described improvements in health (n=975). Reports such as Water.org and World Bank (2015) cite that 25% of borrowers reported reduced illness, with several evaluations also showing health benefits from the data collected (The MasterCard Foundation and Water.org, 2015; Institute for Sustainable Futures, 2019; Pories, 2016). These findings include a reduction in disease, a reduction in person-hours spent caring for sick members of the household, less money spent on medical needs, and reduced rates of hospitalization.

**Ex** It should be noted that the data for positive health findings are primarily based on self-reporting based on recall. Whilst useful for some metrics, this method is generally considered to be a poor method for measuring health outcomes. In two studies that assessed the accuracy of self-reporting for diarrheal morbidity, it was found that recall beyond 3-6 days led to significant levels of under-reporting, with the number of cases consistently higher using one-week recall versus two-week recall (Ramakrishnan, 1998; Overbey et al., 2019). This limitation features alongside other potential issues (such as courtesy bias) that serves to undermine the health outcome data – particularly for the longer-term outcomes.

**In** Some of the health outcomes reported were inconclusive and/or negative. Several Water.org evaluation findings include higher hospitalization rates (Mansour and Sánchez-Trancón, 2019), no change or an increase in household members getting sick (Barenberg et al., 2019), and an increase in medical bills (Davis and Gilsdorf, 2016) after WSS improvements had been constructed. Likewise, the IKEA Bangladesh evaluation (Water.org, 2018) did not note any significant findings for change in incidences of water-borne diseases as a result of the program. These factors together limit the level of confidence we can place in the above findings and the degree to which they can be applied across all Water.org’s country programming.

- Ex** **Positive health outcomes have also been linked with handwashing with soap.** Ejemot-Nwadiaro et al. (2021) compared results across 15 RCTs of community-based handwashing promotion interventions and found a decrease in episodes of diarrhea of 30% among children. Other reviews that incorporate findings from non-RCT based studies have found higher reductions of up to 48% (Fewtrell et al., 2005; Waddington and Snilstveit, 2009; Cairncross et al., 2010). The impact of hygiene is therefore significant and is understood to be particularly effective at reducing transmission of pathogen between members of a household (Kang and Aldstadt, 2019). Handwashing with soap is understood to have less impact on diarrhea than water or sanitation as standalone interventions, however (Wolf et al., 2018).
- In** **There is limited evidence available on changes in handwashing behavior through Water.org programming.** Only the mWater survey in Bangladesh contains a question on handwashing, and whilst it shows a minor increase in frequency following hygiene promotion, the information is self-reported and not possible to verify. Handwashing is a notoriously difficult activity to measure, with household observation considered the most robust method for monitoring purposes (Ram, 2013).
- In** **One notable gap identified from this Meta Study research is the extent to which handwashing and hygiene more broadly are not included/omitted from Water.org programming.** One evaluation (IRC Consult, 2021) reports that only 63% of borrowers had received health and hygiene education, for example, whilst in the IKEA evaluations only 32% of borrowers had participated in hygiene education in India and 40.2% in Indonesia (Water.org and Grameen Foundation, 2020). In this latter evaluation, it was also reported that clients in India were 4 percent less likely to wash hands before eating compared to the control group (ibid). According to interviews with Water.org Program Managers, the majority of loans are for water supply or sanitation improvements, with little focus on handwashing facilities specifically. The WaterPortal data supports this finding, indicating that only 4,072 loans have been distributed to end borrowers for handwashing facilities out of the total 5,994,736 loans for all improvements. That said, it was also noted during one interview that many sanitation facilities in the Philippines include a water connection to the toilet that effectively serves as a handwashing facility. It is therefore difficult to comment on the extent to which hygiene is incorporated into WC programming, though the emphasis appears to be more on software rather than hardware, with hygiene prioritized second to water supply and sanitation. This trend may be changing, given the global attention given to handwashing with soap to combat COVID-19 over the past 18 months.
- Ex** **One systematic review observed lower-than-expected health gains and poor quality of evidence across previous studies.** The study was carried out by WHO and systematically reviewed over 1,000 studies from 2012 to 2017 covering infectious diseases related to sanitation, nutrition, and well-being outcomes. It also observed a number of key gaps in the literature, such as the role of food contamination and the role animal waste plays in disease transmission (WHO, 2018). When looking at the global statistics, whilst there is a clear reduction in diarrheal-related mortality rates since 2004 (Prüss-Üstün et al., 2014), morbidity rates have remained fairly constant (WHO and UNICEF, 2019). This suggests that there has been an improvement in the management of diarrheal disease (particularly oral rehydration) but a somewhat limited impact from preventive measures, such as WASH interventions.
- Ex** **More recent studies have been unable to find significant longer-term positive health outcomes as a result of WASH interventions.** Three high-quality RCTs (Null et al., 2018; Luby et al., 2018; Humphrey et al., 2019) were undertaken to understand the impact WASH interventions (either with or without nutrition interventions) could have on stunting and diarrhea. The headline findings from all three studies were that the WASH interventions had no influence on child growth and mixed

effects on diarrhea, with only the Bangladesh study registering a minor reduction in cases (WHO and UNICEF, 2019). Given the high internal validity and fidelity of the trials, the results were both disappointing and surprising. Subsequent reflections on the studies concluded that the findings did not challenge the logic that underpins WASH and the understanding of the transmission routes, but pointed to issues regarding the imperfect water and sanitation community coverage (Cumming and Curtis, 2018).

Several explanations for inconclusive health outcomes have been put forward, with insufficient WSS community coverage gaining the most traction.

**Ex** **Community coverage is considered a key factor behind the lack of positive health outcomes.** A study by Wolf et al. (2019) looked at the level of environmental contamination at the endline of several WASH studies and found that diarrhea reductions were highest in environments with lower excreta contamination and no reductions found when contamination was above a certain threshold. Current thinking, therefore, posits that unless a clean environment is achieved through sufficient community coverage coupled with higher service levels, significant reductions in diarrhea and stunting (by extension) are unlikely to occur (WHO and UNICEF, 2019). The research also calculated that less than 24% of the population in lower- and middle-income countries live in communities with basic sanitation coverage over 95% (Wolf et al., 2019). Evidence from other studies suggests that herd protection against diarrhea can be achieved through community-level sanitation coverage – particularly in sparsely populated and remote areas (Harris et al., 2017; USAID, 2018).

**Ex** These discussions have culminated in calls for ‘transformative WASH’, which entails adopting context-specific and risk-based approaches to work towards a comprehensively clean environment (Pickering et al., 2019). Here, interventions are tailored to the local needs, focusing on interrupting the transmission of pathogens through identifying and targeting the relevant pathways responsible for the local disease burden. By using local health data to inform design, transformative WASH attempts to move beyond predefined interventions and initiate WASH activities that have been specifically informed by the contextual situation (WHO and UNICEF, 2019).

**Ex** **Longer-term health outcomes may not also be realized until several years after implementation.** WHO and UNICEF (2019) note that given the complexity and local-specificity of how microbes operate in the environment, expecting improvements in health outcomes over the time windows of many WASH programs may not be realistic. Kang and Aldstadt (2019)’s study into the time-dependent effects of WASH interventions on diarrheal disease found that handwashing with soap had the most impact in the short-term, with all three having similar success rates in the long-term. The length of time required for observable change is likely dependent on the type of intervention and associated disease that is being targeted. When assessing the relationship between diarrhea and stunting, for example, it is believed that longer study periods of 18-60 months are required (Bekele et al., 2021).

**Ex** **Multiple water source use (MWSU) may also undermine health outcomes.** There is strong evidence that a large proportion of households across low and middle-income countries (LMICs) rely on MWSU (Daly et al., 2021). The practice of supplementing primary improved water sources with unimproved water sources presents potential pathways for pathogens that are currently unmonitored and could serve to undermine positive health outcomes. Consumption of high-quality water throughout the year is required to realize the health benefits associated with improve water sources (Elliott et al., 2017), with even occasional drinking of contaminated water having detrimental health impacts (Brown & Clasen, 2012; Enger et al., 2013). A continual supply of water is also linked with increased handwashing and hygiene practices (Devoto et al., 2012) and reductions in



episodes of diarrhea (Dos Santos et al., 2015; Overbo et al., 2016). Seasonal changes in water availability are likely to influence MWSU, particularly during the dry season.

**Ex** **There is mixed evidence on the impact that point-of-use water treatment, such as chlorination, can have on improving water quality.** A systematic review and meta-analysis of studies that assessed diarrheal health outcomes for children using chlorinated water at point-of-use found that the 21 trials included saw a general decrease in the risk of diarrhea and reduced the risk of contamination with *Escherichia coli* (Arnold and Colford, 2007). The review did note that the majority of trials were relatively short (median length of 30 weeks), however, and that the longer trials observed a diminishing in the effectiveness of chlorinated water against diarrheal episodes as the studies progressed (ibid). The effectiveness of chlorine against key pathogens (such as *Cryptosporidium*) has been challenged more recently, with calls for further research to understand this better (WHO and UNICEF, 2019).

**Ex** **Several other gaps that may impact health outcomes have been identified for further research.** These include:

- Safe management of child and animal feces, including the provision of clean play spaces to limit consumption of soil and contact with excreta (WHO and UNICEF, 2019).
- Food hygiene and the contamination of crops in fields and markets with feces, with calls for food hygiene to be integrated into both WASH and nutrition interventions (Esteves Mills and Cumming, 2016).
- Insight into the link between EED and stunting – specifically the causes, how to measure, how reversible the condition is, and its relationship with undernutrition (WHO and UNICEF, 2019).

**In** Reflecting on these explanations in light of Water.org’s portfolio, it seems likely that some – if not all – bear relevance for WaterCredit programming. Based on interviews undertaken with Program Managers, it is the research team’s understanding that the majority of financial institutions (FIs) concentrate efforts at the household level and do not collect data to understand or work towards community coverage. Community saturation is therefore not the objective and considered to not be a feasible focus given some of the financing constraints faced by FIs and households. As noted during the ToC workshop, however, the WC program is not intended to be implemented in isolation and is reliant on engaging with government and other stakeholders to maximize and support access to improved WSS. Though arguably outside of WC’s mandate, strengthening these linkages with external actors to ensure coverage is secured at the community level should be encouraged to fully realize the potential longer-term health outcomes improved WSS can provide.

[External factors such as unfolding crises threaten the attainment of positive health outcomes](#)

**Ex** **The COVID-19 crisis has had a significant impact on health outcomes.** Both the primary and secondary impacts of COVID-19 have had significant implications for the WASH sector and its work towards improving public health, though the full effects are not yet clear. One major setback has been the difficulty in implementing community-based programming approaches due to infection prevention control measures, such as physical distancing and gathering in large groups (Thompson, 2020). It has also affected communities’ ability to use shared facilities due to the risk of potential infection (Howard et al., 2020). This is anticipated to have a negative impact on progress towards Sustainable Development Goal (SDG) 6, with the (WHO and UNICEF, 2021) Joint Monitoring Program report highlighting the need for WASH efforts to quadruple if targets are to be met by 2030.

**Ex** **One potential positive gain for the sector, however, has been the heightened focus on hand hygiene.** At the onset of the pandemic handwashing with soap was heralded as the “first line of

defense against the disease” and national-scale hygiene campaigns were established in nearly every country in the world (World Bank, 2020). It’s not clear what effect these messages will have on handwashing behavior in the long-term but it has arguably served to boost the profile of hygiene (and by extension, WASH) and its connections with the health sector.

**Ex** **The climate crisis continues to affect WASH health outcomes and will get worse over time.** Epidemiological studies anticipate that waterborne diseases will become more prevalent due to an increase in climate-related hazards (Cann et al., 2013; Kohlitz, 2018). Water quality is adversely affected by flood damage to water infrastructure, sanitation facilities, and contamination through agricultural and industrial waste (Talbot et al., 2018), whilst drought creates water shortage and leads to situations of water scarcity (Paudel et al., 2021). It has been estimated by WHO (2014) that climate change will cause an additional 48,000 deaths due to diarrheal disease in children under 15 by 2030. These projections are considered conservative by some, however, as they do not include mortality from diarrhea caused by issues such as undernutrition and water availability (Hutton and Chase, 2016). Further discussion on the impacts of climate change on WSS can be found in the Climate Change Thematic Review.

Health is an important motivator behind investing in WSS improvements but not as significant as other factors.

**Ex** **The role of health as a key motivating factor behind WSS investments is possibly oversold.** Improving public health is often cited as a central driver for WSS (Aiello et al., 2008; Whaley & Webster 2011). Despite this, evidence suggests that health is less of an incentive for the adoption of WSS to inhabitants in urban and rural settings than this implies (Schouten and Mathenge, 2010). Some have argued that this points to a misalignment between the motivations of development professionals and local actors (Marshall and Kaminsky, 2016; Curtis et al., 2009). Indeed, a study conducted in Kenya by Lagerkvist et al. (2014) found that wellbeing benefits such as personal safety, private space, cleanliness and convenience were significant determinants ranked ahead of health reasons.

**In** **Water.org data appears to align with findings from the literature.** According to the mWater survey data, just under half of Water.org respondents (48.3%) cited ‘better health’ as a reason for taking out a loan for their WSS improvement (n=3,226). This was the second most commonly cited reason behind ‘convenience’ (64.4%) and ahead of ‘to save time’ (43.6%). Whilst health scores highly here, it appears to not be the primary reason for taking on loans for WSS improvements.

### 3.2 WSS improvements leads to direct safety benefits for individual households

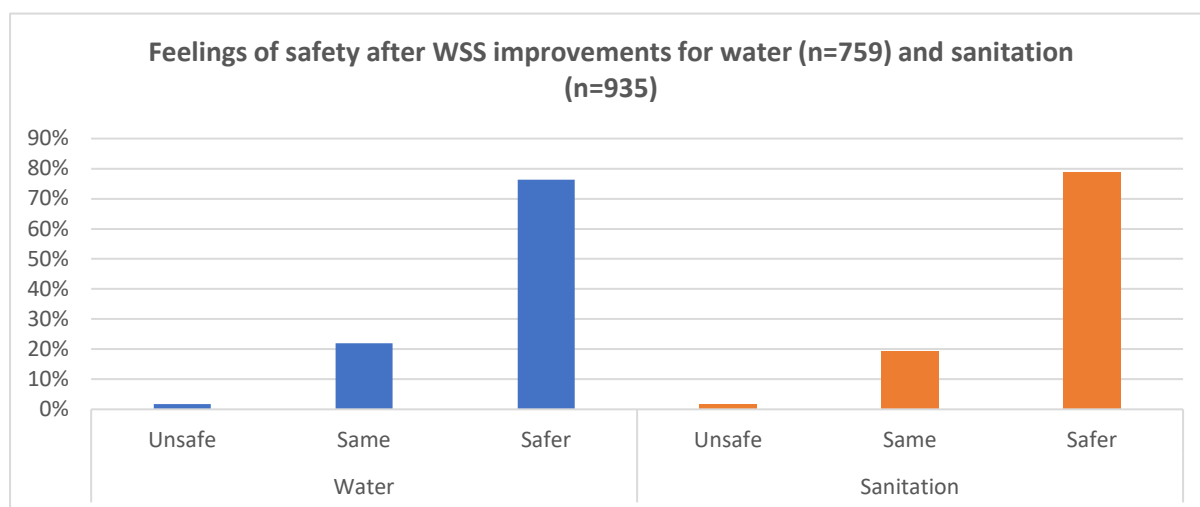
Table 5. RAG rating for evidence of improved WSS and safety benefits

<p><b>Internal data</b></p>	<ul style="list-style-type: none"> <li>▪ Perceptions of safety have increased following WSS improvements.</li> <li>▪ Reduced travel time / the closer proximity of WSS improvements is significant for increased perceptions of safety.</li> <li>▪ Both water and sanitation have contributed to this, particularly sanitation.</li> <li>▪ Privacy is the main aspect that felt safer following their WSS improvement.</li> </ul>	<p><b>External data</b></p>	<ul style="list-style-type: none"> <li>▪ Reduced travel time from closer proximity to source point key for water.</li> <li>▪ Privacy offered by toilets key for sanitation.</li> <li>▪ Physical design of WSS and access influences the level of safety it can offer.</li> <li>▪ WASH facilities can reduce vulnerability to violence.</li> <li>▪ Safety a main driver for investment in WSS.</li> </ul>
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There is strong evidence that WSS improvements lead to perceptions of increased safety for individuals.

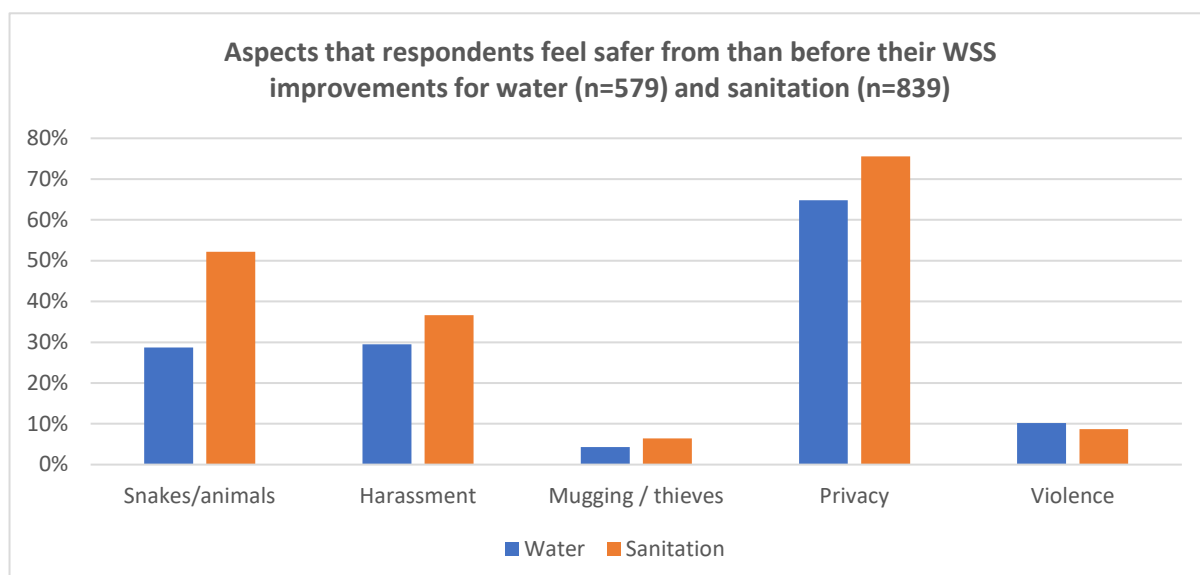
- Ex** **Reduced travel time for WSS-related activities is associated with increased feelings of safety.** Time spent on meeting WSS needs leaves people vulnerable to physical or verbal abuse, rape, and assault, especially women and children (Sorenson et al, 2011). Other risks include rough terrain (particularly when carrying water) and attack from dangerous animals (IPSOS & GWC, 2018). Children who are left unattended at home whilst family members are out on WSS-related activities are also more vulnerable (House et al., 2014). Better access to WSS minimizes these risks through less travel and/or travel at less dangerous times (SIWI, 2005). One study found that a third of women reported a decrease in issues relating to a lack of safety after using a closer water source, as well as greater involvement in community activities (IPSOS & GWC, 2018). Another study noted an improvement in social relations following better access to water (Joshi and Fawcett, 2001).
- Ex** **Sanitation facilities are also perceived as improving safety due to the privacy they offer.** Privacy is frequently cited as one of the primary reasons people construct latrines in LMICs (Lagerkvist et al., 2014; Novotný et al., 2017). Having facilities at home but also in public spaces such as work and school is particularly important for women and girls during menstruation due to the privacy toilets provide for menstrual hygiene management (MHM) (Heller, 2014). When asked what changes participants had observed since the construction of their Water.org WSS (mWater survey, n=1,569), ‘improved comfort’ was selected the most (90.4%), followed closely by ‘improved pride/dignity’ (84.6%), ‘improved social status’ (80.7%), and ‘improved school attendance of children’ (68.6%). This suggests that comfort and dignity – both of which are closely tied to safety – are among the main aspects Water.org customers appreciated about their WSS improvements and is further corroborated by findings from several Water.org-commissioned evaluations; (Water.org and Grameen Foundation, 2020; Institute for Sustainable Futures, 2019; Water.org, 2018; Mansour and Sánchez-Trancón, 2019). A commonly cited figure from Water.org is that 39% of sanitation loan recipients reported an increase in feelings of safety (World Bank Group and Water.org, 2015), with one customer stating that the “toilet inside the house is safe for us. Before safety and privacy were an issue. Old family members were affected most by this. Before at night, they had to go outside” (Institute for Sustainable Futures, 2019:24).
- In** The Water.org data shows a clear increase in feelings of safety following the construction of both water and sanitation improvements. Similar levels of safety were reported for both WSS, with slightly more regarding their sanitation facilities as ‘safer’ (78.9%) than water (76.3%) (Figure 4).

Figure 5. Graph of the feelings of safety following the construction of WSS improvements (Water.org mWater)



These findings align with an evaluation carried out in India in which 61% of participants cited safety as one of the major benefits from their WSS loan at the endline, ranked third after ‘saves time’ (78%) and ‘less physical drudgery’ (62%) (Pories, 2016). Likewise in the IKEA India evaluation, 95.6% of WC borrowers reported feeling safer as a result of having a sanitation facility, significantly higher than the 35% endline target and 1.8% more than the control group (93.8%) (Water.org and Grameen Foundation, 2020). The aspects that respondents felt safer from were more variable across water and sanitation, with more participants reporting scoring more safety aspects for sanitation than for water (see Figure 5).

Figure 6. Graph of safety aspects following the construction of WSS improvements (Water.org mWater)



‘Privacy’ scored the highest for both water (65%) and sanitation (76%). For water, this was followed by two closely scored aspects: ‘harassment’ (30%) and ‘snakes/animals’ (29%), whereas for sanitation, ‘snakes/animals’ came second by a more significant margin (52%), followed by ‘harassment’ (37%). Respondents considered the risk of ‘mugging / thieves’ and ‘violence’ to be considerably lower in contrast, with these options selected no more than 10% for both water and

sanitation. These data trends broadly align with findings from the literature reviewed, particularly regarding the high percentage that selected privacy for sanitation.

The degree of safety WSS improvements can provide is determined by the quality of the program design and implementation.

**Ex** **The physical characteristics of WSS improvements can determine the level of safety it provides.** These include aspects of infrastructure design that help with getting to the facilities – proximity to household, clear pathways free of obstacles, lighting for night-time, wheelchair access, and using the facilities – specifically for sanitation: a secure lock, sufficient space, something to hold onto, lighting, something to sit on for those who cannot squat etc. (Wilbur and Jones, 2014). Such considerations are crucial for equity and inclusion to accommodate the range of user needs. WaterAid provides guidance on how to audit latrines and water points to maximize their safety and utility to a range of users, including factors that relate to independent usage, people with disabilities, and adolescent girls, women, and children of different ages (WaterAid, 2021a).

**Ex** **WASH can reduce vulnerability to violence, though there are limitations on the level of safety it can provide.** Inadequate access to WASH facilities is associated with a heightened vulnerability to various forms of violence (sexual, psychological, physical, sociocultural) (Sommer et al., 2014). Examples of violence linked to WASH can include risk of harassment whilst defecating in the open, taboos around menstruation, vulnerability to abuse, assault, and rape whilst travelling for WASH purposes; with coping mechanisms including waiting till dark to relieve themselves or collect water (House et al., 2014). Whilst good access to WASH facilities can positively impact these issues, there is a limited influence WASH can have as it is typically not the root cause of violence (SHARE, 2021). The focus, therefore, is on maximizing the extent to which WASH can minimize vulnerabilities to violence, particularly for women and girls.

Safety is considered an important motivator behind investing in WSS improvements.

**Ex** **As mentioned previously, safety is considered a significant driver behind WSS investments.** Personal safety ranked highest in Lagerkvist et al. (2014)'s study on motivators for construction of sanitation facilities in Kenya, ahead of health. Likewise, a systematic review of papers outlining motivations for community sanitation found that 'privacy' and 'safety' featured the highest frequency of times (Novotný et al., 2017). The Water.org data (mWater) cites 'convenience' as the main influencing factor (64.4%), with 'safety from humans' selected by 10.1%, and 'safety from animals' selected by 7.8%. One Water.org evaluation conducted in India found that 61% of customers who took on a loan for sanitation purposes cited 'improved safety' as a reason, compared to 20% for water (Water.org et al., 2017). Given the strong association safety has with convenience and other related wellbeing factors, it's difficult to effectively separate them in any meaningful way. Generally speaking, however, the Water.org data appears to support the notion that safety is a significant driver behind investing in WSS improvements for WaterCredit customers.

**In**

### 3.3 WSS improvements lead to reduced stressed and increased wellbeing

Table 6. RAG rating for evidence of improved WSS, reduced stress, and increased wellbeing

<p><b>Internal data</b></p> <ul style="list-style-type: none"> <li>Data on stress relating to water management exists, though results are somewhat mixed (75.5% = less stressed, 11.6% = more stressed). Additional data required to unpack.</li> <li>Limited data on stress relating to loan repayment, with one evaluation noting negative coping strategies.</li> </ul>	<p><b>External data</b></p> <ul style="list-style-type: none"> <li>There is a clear relationship between stress and WSS.</li> <li>Stress is often considered in relation to water and sanitation insecurity, with most work concerning water.</li> <li>Community water management also a contributor to stress.</li> <li>'Wellbeing' is a nascent area but</li> </ul>
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	<ul style="list-style-type: none"> <li>Some data on wellbeing outcomes captured in the mWater survey, but provides limited insight.</li> </ul>		<p>holds promise for new thinking on approaches to WSS.</p>
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There is a clear relationship between water supply and sanitation, stress, and wellbeing.

**Ex** **Inadequate access to WSS is associated with higher levels of emotional stress.** Alongside the detrimental physical health outcomes associated with poor access to WSS, there are also negative mental health outcomes described here within the context of stress. A wide number of publications have explored the impact stress can have on activities such as water carriage (Aihara et al., 2016; Geere et al., 2018; Gimelli et al., 2018; Thoma et al., 2019; Cooper et al., 2019;) and open defecation (Shiras et al., 2018; Sclar et al., 2018; Ross et al., 2021). Limited WSS is also linked to a heightened vulnerability to violence which relates to stress, as discussed in the previous section (House et al., 2014; Sommer et al., 2014).

**Ex** **Improved WSS can lead to an increase in factors associated with wellbeing.** Research into wellbeing is a relatively nascent field in the WASH sector that is being framed within the context of water and sanitation insecurity (Caruso et al., 2017; Wutich et al., 2020; Thoma et al., 2021; Ross et al., 2021). Whilst no single definition of wellbeing has been widely adopted, taking a wellbeing approach is understood to involve considering water and sanitation outcomes alongside a range of related outcomes that hold relevance and meaning to WSS users (Caruso et al., 2017). These include areas such as agency, empowerment, education, and economic productivity – important dimensions to quality of life that could feature within the WSS causal chain (ibid). One example of this is time-saving made from the installation of WSS in a household, enabling opportunities for other activities to be undertaken, such as income-generating opportunities, leisure, and domestic tasks. This particular area is explored in more detail in other thematic reviews such as household finances and women’s empowerment and equity.

Water insecurity and scarcity are considered significant stressors for individuals.

**Ex** **Evidence suggests poor access and low levels of water availability can lead to physical and psychosocial stress.** Situations of water insecurity, defined as the inability “to access and benefit from affordable, adequate, reliable, and safe water” (Jepson et al., 2017), and water scarcity, defined as “the absolute lack of water” (Wutich et al., 2020:2), have a clear link to elevated levels of emotional and psychological distress. Research indicates that water insecure communities experience higher levels of anxiety and depression (Brewis et al., 2021), and are more prone to arguments, heightened disagreements, and violence (Choudhary et al. 2020; Adams et al., 2021). Some studies have observed that water insecurity is closely correlated with other types of material deprivation that, when taken separately, also predicted higher levels of depression and anxiety, such as debt, job insecurity, food access, low income, and housing issues (Patel & Kleinman, 2003; Lund et al., 2010; Wutich et al., 2020). Water scarcity and food insecurity in particular have a complex but interlinked relationship (Wutich et al., 2020); over half of the global population experiences water scarcity for at least one month per year (Adams et al., 2019), while 800 million people are impacted by food security (Jones, 2017).

**In** Qualitative data from Water.org evaluations describe issues with fights and disputes over water, arguments at queues for communal resources (Water.org et al., 2017), with one client stating that “both oral and physical [fights occurred], and many times led to the containers breaking” (Institute for Sustainable Futures, 2019:25). Both interviewees stated that disagreements had ceased since the installation of the water connection. These reflections correspond with data from the literature,

though more substantial evidence is required to comment on the degree to which Water.org programming has helped in addressing such issues.

**Ex** **With the onset of climate change, current levels of water insecurity are projected to worsen.** There is a clear relation between seasonal environmental changes and water insecurity (Charlson et al., 2021), and climate-related hazards, rapid urban growth, and governance failures are set to exacerbate this further (Rosinger et al., 2020). As a result, climate-related migration has increased, with water insecurity operating as a ‘push’ motivator for households to move due to water availability disruptions that affect health, agriculture, and relationships (Stoler et al., 2021). These trends are anticipated to increase over time as communities become increasingly water insecure. More detail on the impact of climate change on water insecurity can be found in the Thematic Paper on climate change as part of this Meta Study.

[Community management of WSS can lead to conflict and stress, particularly where water insecurity is commonly experienced.](#)

**Ex** **The management of water and perceptions of fair distribution are linked to experiences of stress.** Perceived unfairness in the water system, the absence of regulation, and the establishment of water rights have all been associated with heightened levels of anxiety, depression, and psychosocial stress (Esteves Mills and Cumming, 2016; Brewis et al., 2021). According to one study (Wutich et al., 2008), struggles to negotiate access to water were found to be more stressful than the experience of water scarcity itself. In a similar vein, increased levels of stress have been linked to issues concerning shared sanitation facilities. A study in Mozambique found that stress was reported due to a lack of safety and privacy, a sense of disgust about the conditions of latrines, and failure to manage the latrines (Shiras et al., 2018).

**In the face of water insecurity, water borrowing is a common practice but brings its own set of challenges.** Water borrowing is defined as “asking for water from another household or neighbor and receiving it with or without an expectation of anything in return” (Rosinger et al., 2020:2). Studies reveal an adverse relationship between water borrowing and stress and other negative mental health outcomes. Feelings of shame and fear attached to asking and being rejected, as well as the indebtedness that often comes with the transaction (Wutich, 2011; Brewis et al., 2021). Evidence from studies suggests that water borrowing is a common feature in most water insecure communities, however, and occurs most frequently during dry seasons (Rosinger et al., 2020). Water borrowing has also been found to occur as a response to wider failures relating to poor water quality and availability, with the distance to water source another key determining factor influencing rates of water borrowing (ibid).

[WSS improvements can also be looked at through the lens of social and emotional wellbeing.](#)

**Ex** **Considerations for wellbeing have been put forward as a conceptual framework to broaden thinking around the benefits of access to WSS.** Several papers contend that addressing water insecurity should look beyond infrastructure and service provision and encompass notions of empowerment, aspiration and dignity (Goldin, 2013; Cooper et al., 2019). Criticisms of SDG6 have noted its focus on avoiding morbidity and mortality, rather than enabling people to build capacity and pursue positive outcomes (Gimelli et al., 2018). By adopting a framework oriented around wellbeing, several authors contend that it shifts ideas around water security from simply ‘the right to water’ to the hydro-social relationships and the impacts they have on human and community wellbeing (Jepson et al., 2017; Cooper et al., 2019). As Brewis et al. (2021) note, applying a wellbeing approach to water institutions would likely result in the fair distribution of water resources being considered more important than the provision of more water or better quality water. This area of

research is still in its early stages of development and the relationship between water insecurity and wellbeing are not currently fully understood, but several studies are beginning to show a clear relationship between access to high-quality water and household wellbeing (Kangmennaanga and Elliott, 2021).

**Ex** **Wellbeing approaches have also been applied to sanitation, but evidence is only emerging.** Several pieces of cross-sectional research have been undertaken on MHM and provide detailed data on the links between psychosocial wellbeing of adolescent girls and feelings of anxiety, stress, and shame, as well as school absenteeism (Sommer, 2009; Sommer & Ackatia-Armah, 2012; Crichton et al., 2013; Sommer et al., 2014). A systematic review of the relationship between sanitation, mental health, and social wellbeing found that privacy or safety had a positive impact on a user's wellbeing (Sclar et al., 2018). Ross et al. (2021) developed a wellbeing framework to assess the quality of life benefits sanitation can offer, with five core attributes identified: health, shame, disgust, privacy, and safety. Evidence on sanitation insecurity and wellbeing is less developed than the water insecurity discussions, however, and warrants further research.

**In** **There is some Water.org data relating to stress and wellbeing that suggests WC programming is contributing positively to wellbeing outcomes.** According to recent mWater data from the 3.0 survey, 75.5% of respondents report that the management of household water is less stressful than before their water improvement (n=1,122). Out of these responses, 54% attributed the decrease in stress to 'less worried about having enough water', 50% to 'no longer have to wait in line', and 39% to 'easier to take care of my family' (n=744). 11.6% from the original question did report more stress, however, and it's not clear why this is the case based on the available evidence.

**In** Another question in the mWater (2.0) survey asks participants about observed changes since the construction of their improvements. The highest response selected was 'improved comfort' (90.4%), followed by 'improved pride/dignity' (84.6%), 'improved social status' (80.7%), and 'improved school attendance of children' (68.6%) (n=1,569). All four of these responses arguably contribute to varying degrees to a sense of wellbeing, with improved comfort the most appreciated change out of the four. Qualitative data from the Institute for Sustainable Futures (2019) supports these findings, with customers describing an increase in their social reputation, an increase in respect, and a reduction in feelings of shame associated with not having a toilet in the house. This indicates that Water.org programming contributes to customers' sense of wellbeing in some way, though a more comprehensive approach is required to understand this better.

There is limited evidence on the relationship between improved HH finances, following a WC loan, and stress.

**In** **For some households, HH finances do appear to have improved as a result of taking out a WC loan.** According to mWater (2.0) survey data, 40.9% of clients saw a change in income following their WSS improvements (n=1,253). Out of these respondents, 92% reported an improvement in their overall income (n=554). Explicit data on stress reduction as a result of improved income has not been collected, however, and no external evidence has been identified to substantiate this.

**In** **Experiences of stress related to loan repayment were reported in one Water.org evaluation.** A minor proportion of survey respondents reported frequent arguments with their spouses about loan repayment (7% in India and 4% in Indonesia). Financial stress was also widely cited, with 36% of clients in India adopting negative coping mechanisms to manage loan repayment, and 12% in Indonesia (Water.org and Grameen Foundation, 2020). Regression analyses found that the likelihood



of adopting a negative coping mechanism was 1.7 times higher amongst rural clients in India and 2.9 times higher in Indonesia compared to urban clients (ibid).

#### 4. Concluding statement

The research highlights the challenges being faced by the WASH sector as a whole, in terms of understanding and how to define, capture, and report health and safety outcomes. Furthermore, it provides insights into the extent that the components of health and safety, whether separately or combined, feature as drivers for change in terms of investing in improved WSS, and the role WSS financing plays in this. Water.org evidence broadly reflects the nuances emerging across the wider sector evidence. Looking forwards, there is opportunity to contribute to the debate and discussions around transformative WASH and the focus on community coverage, as well as the emerging approach of wellbeing through which to consider WASH-related outcomes.

#### 5. Theory of Change

The below diagram depicts the Theory of Change (ToC) for the health and safety theme that was co-constructed by the research team and Water.org together during the ToC workshop. The ToC builds from the foundational outcomes (blue boxes) up to the theme-related outcomes (red boxes + other

Figure 7. Key for the ToC  
 shows how change is expected to occur both in regard to the  
 o maps out the linkages between  
 connections, and the strength of  
 ort (please see the key for further

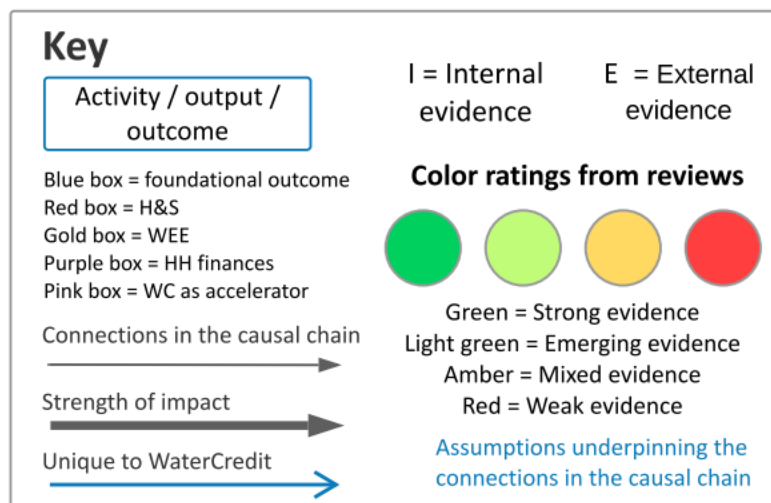
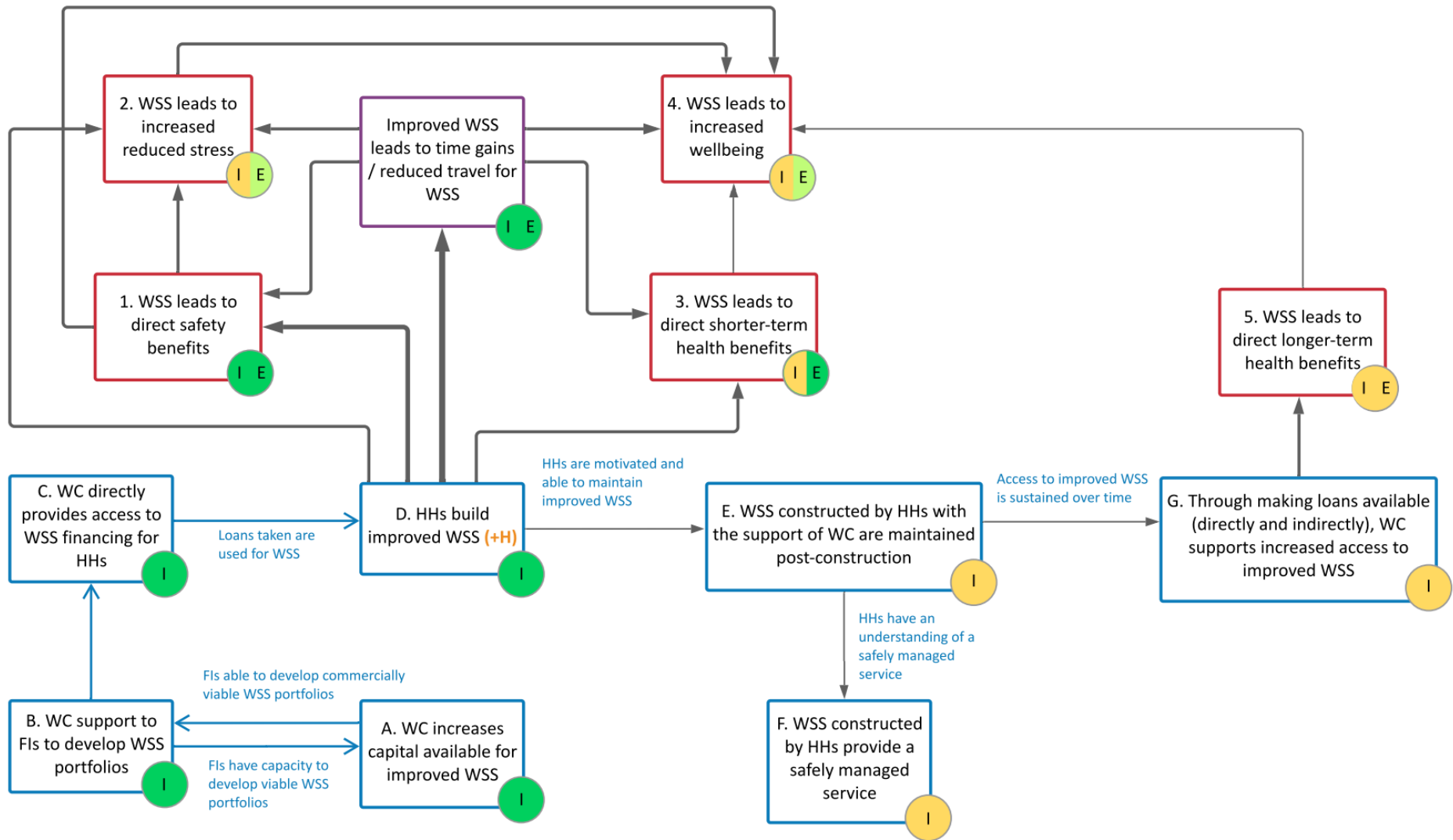


Figure 8. ToC co-constructed for the health & safety theme



## 6. Recommendations

**To fully realize potential health outcomes, more emphasis should be placed on hygiene.** WaterCredit programming appears to focus primarily on water supply and sanitation, with hygiene facilities comparatively deprioritized and hygiene promotion disseminated in an inconsistent fashion. There is a strong evidence base to support the important and complementary role hygiene plays alongside water and sanitation in blocking transmission routes for water- and excreta-related disease. This includes – first and foremost – handwashing with soap, but also extends to food hygiene, MHM, and guidance on hygienic water and sanitation practices. This is particularly pertinent at the moment, amidst the COVID-19 pandemic, in which hand hygiene has received heightened attention and been positioned as a key protective measure against infection. Putting more emphasis on hygiene programming as part of Water.org’s suite of improvements will likely increase the impact that can be had on health outcomes.

**Community coverage and clean environments constitute key components for positive health outcomes and should be considered in tandem with WaterCredit programming.** Current thinking from the literature contends that minimal health benefits can be attained without community-wide coverage and environments free from fecal contaminants. It is noted that WC programming on its own is not designed to achieve community saturation and that this arguably falls outside of WC’s purview. There is still a potential role for Water.org to play here in supporting actors whose mandate it is to ensure access for all (e.g. the government), however. Systems strengthening work, subsidy support to the bottom of the pyramid and other initiatives can all contribute to this. We are cognizant that substantive work in this area is already underway, and therefore recommend that community coverage be adopted as a targeted result as part of this, to help the existing portfolio of WC programming maximize its potential health outcomes.

**Incorporating wellbeing frameworks into programming could provide a holistic view of the benefits WASH improvements can bring to HHs and communities.** Approaching WSS from a wellbeing angle moves beyond looking at reductions in morbidity and mortality and encompasses a spectrum of benefits individuals can reap from WaterCredit. Based on the themes selected for exploration as part of this Meta Study, it is clear Water.org already has some interest in approaching its WASH portfolio from this perspective. This includes positive outcomes from both involvement in WaterCredit and WSS-related benefits, such as household finances (time savings, direct and indirect income gains), climate change (improved resilience, knowledge to combat hazards), and women’s empowerment and equity (increased school attendance, empowerment). Whilst current wellbeing research is founded upon a broad range of human development frameworks, its consideration within the WASH sector is relatively recent and, as such, no commonly referenced framework has been put forward as best practice. We are therefore hesitant to suggest a specific approach to adopt, but wish to flag this as an area that potentially warrants further research.

**Making health claims based on internal data is a potentially problematic endeavor.** Self-reported health data based on recall alone will not provide a dataset that can be reliably used to measure health outcomes. The broader WASH sector faces significant challenges in assessing health impact in a robust fashion, with the more in-depth studies typically associated with high costs and time investments. Studies on such a scale with the requisite rigor are likely not an appropriate or resource-effective exercise for Water.org to explore. This therefore limits the degree to which strong internal evidence on health can be gathered.

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