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WASHPALS #2 SOCIAL AND BEHAVIOR CHANGE RESEARCH AGENDA

FINDINGS FROM A RAPID DESK REVIEW AND STAKEHOLDER ENGAGEMENT

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Cover photo credit: Woman preparing food in Chiradzulu, Malawi (FHI360)

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

A&T	Alive & Thrive
BCC	Behavior Change Communication
FH	Food Hygiene
GESI	Gender Equality and Social Inclusion
HACCP	Hazard Analysis and Critical Control Point
HAZ	Height-for-Age Z-Score
HE	Hygienic Environment
HQ	Headquarters
HW	Handwashing
IP	Implementing Partner
IYC	Infants and Young Children
LMIC	Low- and Middle-Income Country
LSHTM	London School of Hygiene & Tropical Medicine
NCG	Nurturing Care Group
NGO	Nongovernmental Organization
RCT	Randomized Controlled Trial
RFSA	Resilience and Food Security Activity
RP	Research Partner
SBC	Social and Behavior Change
SME	Subject Matter Expert
USAID	United States Agency for International Development
WASH	Water, Sanitation, and Hygiene
WASHPaLS	Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability

1.0 INTRODUCTION

The United States Agency for International Development (USAID) Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability (WASHPaLS) #2 project seeks to enhance global learning and adoption of the evidence-based development programming needed to achieve United Nations Sustainable Development Goal 6.2. WASHPaLS #2 partners with governments, the private sector, development partners, and other stakeholders to support learning and improvements in the water, sanitation, and hygiene (WASH) sector and address challenges to use, quality, equity, sustainability, and scale of sustainable sanitation services and adoption of sound hygienic practices, primarily in rural areas. WASHPaLS #2 global research focuses on three themes: area-wide sanitation, market-based sanitation, and social and behavior change (SBC) to promote hygienic behaviors and environments.

Within the theme of hygienic environments (HEs), SBC, and building on research undertaken by WASHPaLS I between 2016 and 2021, WASHPaLS #2 set out to conduct research focused on interrupting contamination and transmission pathways that specifically threaten infants and young children's (IYC's) health and growth, concentrating on the following intervention areas:

- Improving the HE through (1) improved flooring inside and/or outside homes, (2) safe disposal of IYC feces, and (3) reducing IYC's exposure to poultry and animal feces in the home setting;
- Nudging handwashing (HW) behaviors in the home setting; and
- Improving food hygiene (FH).

WASHPaLS #2 notes that the primary distinction between HE efforts versus those related to HW and FH is that the former concerns practices that make the general environment cleaner and thereby reduce the fecal load present on hands, in food, and in water, while the latter (HW and FH) consists of practices that break transmission pathways linked directly to the body.

This report summarizes findings from a desk review and expert consultations undertaken in Year 1 to further define and shape the direction of the HE and SBC research, which resulted in adjustments to the proposed focus of the research. WASHPaLS #2 plans to conduct at least two research studies, one on HE and the second on the intersection between HW and FH.

1.1 OVERALL APPROACH TO REFINING THE SBC IMPLEMENTATION RESEARCH AGENDA

The WASHPaLS #2 research agenda builds on the research conducted under WASHPaLS 1, specifically the 2018 literature review conducted on HEs and HW (USAID, 2018), as well as the WASHPaLS 1 report *Toward a hygienic environment for infants and young children: Limiting early exposures to support long-term health and well-being* (USAID, 2022). The research team undertook a rapid scan of new or complementary literature, conducting three searches—one each for HE, HW, and FH—using the parameters outlined in the search template (Annex A).

WASHPaLS #2 leveraged research utilization and implementation research approaches to refine an SBC research agenda that will generate *usable* evidence for programmatic uptake (FHI 360 n.d.; USAID n.d.b.). Research utilization begins with the end in mind and engages key stakeholders from the outset so that the process of evidence generation and uptake is inclusive of and responsive to local as well as global research priorities (Kim et al. 2018; Peters et al. 2014). In addition to determining if a specific program or intervention works, implementation research adopts a more systems-level evaluation outlook and seeks to understand how, why, when, and for whom programs or interventions work (Kim

et al. 2018; Peters et al. 2014). Combined, these two approaches help to generate findings that are suitable for programmatic uptake and scaling interventions across multiple contexts.

The approach adopted by WASHPaLS #2 in refining the SBC research agenda also aligns with USAID's broader locally led development and decolonization approaches, which seek to shift decision-making and leadership to local stakeholders (USAID n.d.c.; Sharwar et al. 2022). Engaging implementing partners (IPs) from the outset, with a focus on IPs working in local contexts, and using an inclusive process that embraces decolonization and gender equality and social inclusion (GESI) principles is pivotal to the WASHPaLS #2 SBC implementation research approach. This includes gathering IP input into refining the research agenda, collaborating with researchers from implementing contexts as co-investigators (both in function and roles), and bridging capacity between in-country implementation teams and local experts and the WASHPaLS #2 SBC research team to strengthen the research so that it accounts for and is more applicable to the local context. Annex B presents the stakeholder interview guide developed and provides further detail on the subject matter experts (SMEs) engaged in this review, including profiles of informants, the number of people interviewed, and the geographies in which they are working. Annex C provides a summary of stakeholder and IP input to finalize the SBC research agenda and identify potential partnerships. Application of this approach means that the proposed research questions and objectives outlined in this report, as well as research components, such as study design and/or methods, may still shift based on WASHPaLS #2's full and equitable collaboration with its IPs and local co-investigator(s).

Section 2.0 presents findings on HEs, and Section 3.0 covers HW and FH. In each section, the literature review is presented first, followed by a summary of the stakeholder input, and concludes with the proposed research questions and objectives. Section 4.0 presents overall conclusions and an outline of next steps in WASHPaLS #2 SBC research activities.

1.2 SBC AND BEHAVIOR CHANGE COMMUNICATION

Traditionally, WASH programs have relied strongly on behavior change communication (BCC) approaches, such as intensive interpersonal communication activities and high dose/frequency group level BCC, to realize sanitation and hygiene behavior change. Such BCC often is resource-intensive and can require a level of sustained engagement and investment that is not always feasible given programmatic cycles and available human and financial resources. However, SBC interventions span a spectrum, requiring varying levels of BCC. In recent years, research has shown the potential success of the use, placement, and/or presentation of technologies that alter the choice architecture so that behavior change is habitual or unconscious (e.g., (1) the introduction of indoor flooring, which enables and compels householders to keep floors cleaner, thereby improving HEs for IYC; or (2) the introduction of a HW station near food preparation zones, which enables and compels caregivers to wash their hands) (USAID 2022). An SBC intervention that alters the choice architecture requires only a minimal level of BCC, namely, to promote the adoption and appropriate use of a given technology. Alternatively, SBC interventions that introduce enabling technologies aim to make behavior adoption and sustainment easier by removing identified structural, environmental, or physical barriers (e.g., chicken coops, potty scoops, child-friendly latrines) (USAID 2022). These types of interventions require relatively more BCC, but not at levels as intense or as frequent as traditional BCC approaches that aim to increase behavior change adoption by addressing psycho-social drivers of SBC (e.g., knowledge, attitudes, social norms) (USAID 2022). See Figure 1 for examples of the role of technology and environment along a behavior change spectrum. To generate findings that can help maximize the efficiency and sustainability of programs seeking to improve HEs, HW, and FH, WASHPaLS #2 will pursue research that will generate evidence on how to minimize more resource-intensive SBC/BCC intervention approaches.

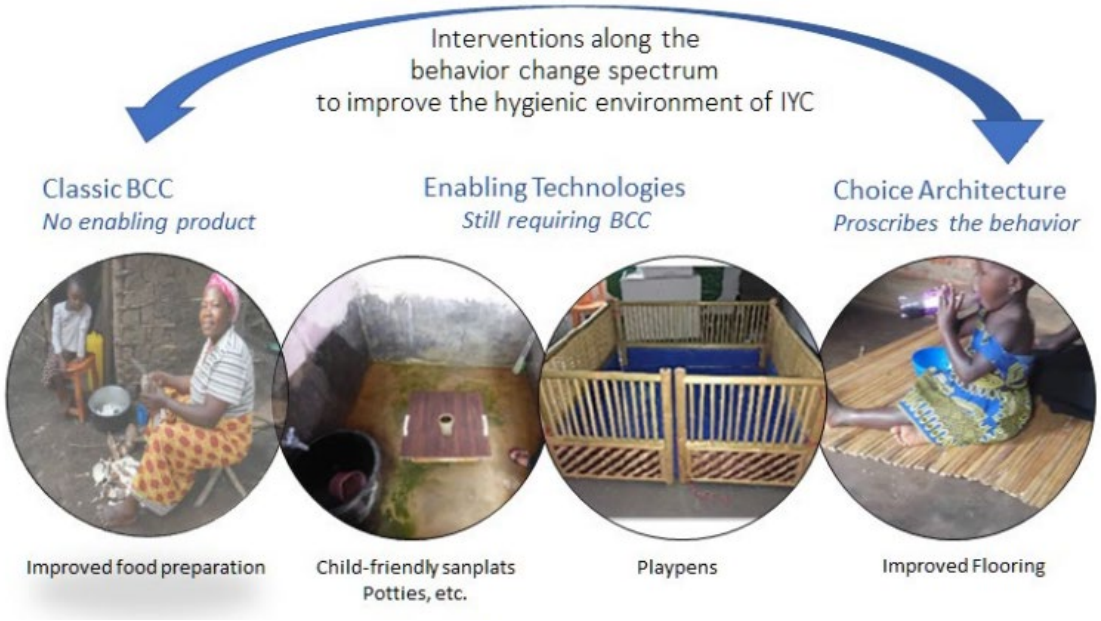


Figure 1. The Role of Technology and Environment along a Behavior Change Spectrum (Replicated from USAID 2022)

2.0 HYGIENIC ENVIRONMENTS

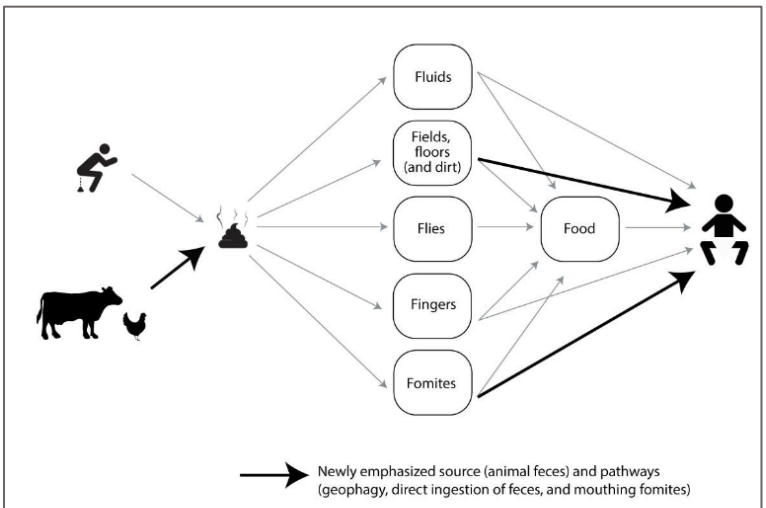
USAID (2022) provides a summary of the scientific and grey literature on sources of household fecal contamination, pathogen transmission pathways, and interventions to interrupt contamination and transmission pathways that specifically threaten the health of IYC.

While pathogen pathways and disease transmission paradigms and solutions have traditionally focused on uncontained adult feces to reduce fecal contamination of household environments, more recent evidence points to IYC feces and animal feces as problematic yet understudied sources of fecal contamination (USAID 2022). Unsafe disposal of IYC feces, i.e., when feces are not deposited into any kind of toilet or latrine, is common in many low- and middle-income countries (LMICs) (Rand et al. 2015; Freeman et al. 2016; Majorin et al. 2014; Miller-Petrie et al. 2016; Mara et al. 2010; George et al. 2016; Gil et al. 2004). Furthermore, widespread housing of poultry and livestock in close proximity to or inside of dwellings can lead to extensive environmental contamination that, in turn, may have negative impacts on child health (Ercumen et al. 2017; Ercumen, Mertens, et al. 2018; Ercumen, Pickering, et al. 2018).

2.1 TRANSMISSION OF FECAL PATHOGENS TO IYC

Transmission of human and animal fecal pathogens occurs along established vectors, including (1) soil, (2) water, (3) hands, (4) foods, (5) flies, and (6) fomites (Wagner and Lanoix 1958). However, a growing body of literature has documented that modes of exposure (i.e., transmission pathways) through these vectors are specific and more extensive for the IYC cohort, as shown in Figure 2 and summarized below.

1. **Direct ingestion of soil** by IYC in low-resource settings is common. Observational studies in Bangladesh (George et al. 2015; Kwong et al. 2021) and Kenya (Shivoga and Moturi 2009) reported soil ingestion among children under the age of four.



This diagram is a derivative of Figures 1 and 3 in Penakalapati et al., 2017, under a Creative Commons CC-BY 4.0 Usage Agreement with the American Chemical Society.

Figure 2. Transmission of Fecal Pathogens to IYC

2. Fecal contamination of **drinking water** sources, including piped water sources, is widespread and affects an estimated 1.8 billion people globally (Bain et al. 2014). Studies have shown that contamination of water, including stored household drinking water, from human and animal feces presents a significant risk to child health and the transmission of zoonotic and human pathogens (Odagiri et al. 2016; Schriewer et al. 2015).

3. In addition to soil and water, **hands** are a source of fecal pathogen transmission. Hand mouthing is frequent and common among young children (Kwong et al. 2016; Kwong et al. 2021) and can be particularly problematic in low-resource settings where the hands of both caregivers and children often are contaminated with fecal pathogens acquired through toilet use, unsafe IYC feces disposal, animal feces in the home environment, sweeping, cleaning dishes, food

preparation, and bathing (Ercumen et al. 2017; Ercumen, Mertens, et al. 2018; Ercumen, Pickering, et al. 2018; Mattioli, Davis, and Boehm 2015; Pickering et al. 2010; Pickering et al. 2011).

4. **Food** also is a pathway for fecal contamination, whereby pathogens may be introduced through contaminated water, hands, or utensils or result from cross-contamination from other foods or improper storage. In addition, food offers an optimal environment for pathogens to grow to infectious levels (Motarejemi et al. 1993; Woldt and Moy 2015). Research has shown that food fed to IYC to complement breastfeeding can be particularly risky because these foods tend to have high moisture content, are typically stored at warm temperatures—a hospitable environment for bacterial growth—and are introduced at a critical time in child development (Islam et al. 2012; Saha et al. 2010). Freshly prepared foods had lower fecal indicator bacteria counts compared to foods saved for feeding later in the day (Kung'u et al. 2009).
5. **Flies** carry fecal contamination picked up from feeding on human and animal feces and can transfer this fecal matter to food (Islam et al. 2012; Kung'u et al. 2009; Afifi et al. 1998). Several studies show an association between fly density and diarrhea (Collinet-Adler 2015; Cohen et al. 1991; Fotedar 2001; Hald et al. 2004; Holt et al. 2007), but fly-control programs can help control the concentration of flies and reduce disease transmission (Chavasse et al. 1999).
6. **Fomites**—inanimate objects that can serve as vectors of disease transmission—also are a source of fecal contamination that is transmitted to IYC through their mouthing of the object (Kwong et al. 2016; Kwong, Ercumen, Pickering, Arsenault, et al. 2020; Kwong, Ercumen, Pickering, Unicomb, et al. 2020; Stanton and Clements 1986; Vujcic et al. 2014). In addition to mouthing toys, touching and mouthing cloth also may serve as a pathway for fecal transmission (Stanton and Clements 1986; Hoque et al. 1995).

2.2 EVIDENCE ON INTERVENTIONS TO IMPROVE HYGIENIC ENVIRONMENTS

To date, interventions to interrupt the transmission of fecal contamination have largely focused on water treatment and provision, the use of household sanitation, and HW (Cairncross et al. 2010; Luby et al. 2018; Null et al. 2018). In a recent systematic review, researchers concluded that "WASH interventions reduced risk of diarrhoea in children in LMICs. Interventions supplying either water filtered at POU [point of use], higher water quality from an improved source on premises, or basic sanitation services with sewer connection were associated with increased reductions [in diarrhea]" (Wolf et al. 2022, 48). Previous studies claimed that in settings heavily contaminated with feces, these interventions alone may not have been sufficient to reduce diarrhea among IYC because they either did not target the sources or pathways primarily responsible for transmission of fecal pathogens to IYC or they did not result in sufficiently widespread, sustained sanitation and hygiene behaviors overall (Cumming et al. 2019; Pickering et al. 2019; Clasen et al. 2012; Null et al. 2018; Kwong et al. 2021).

Promising interventions to interrupt contamination and transmission pathways that specifically threaten IYC health include poultry cooping and other animal husbandry practices that contain and manage animal feces, as well as safe disposal of IYC feces. Improved flooring (indoor and outdoor) and playpen/playmats can also improve HEs for IYC by providing clean surfaces and safe spaces for them to play on (USAID 2022). In recent years, research has assessed the feasibility and impact of these interventions and whether such interventions are biologically plausible for *sufficiently* interrupting particular transmission pathways (Piper et al. 2017; USAID 2022; USAID and EarthEnable 2021).

Sections 2.2.1–2.2.3 describe interventions that seek to reduce the levels of fecal contaminants present in the general household environment through IYC feces management, poultry cooping, and use of

playmats/playpens and improved flooring, respectively. Section 2.3 then summarizes the evidence on combined WASH interventions to improve HEs.

2.2.1 INTERVENTIONS TO IMPROVE IYC FECES MANAGEMENT

Research on IYC feces management indicates that the combination of behavior change interventions focusing on influential determinants of behavior (identified through formative research), together with increased access to "enabling technologies" (products that facilitate improved practices, such as potties or modifications to latrines), may be effective at changing IYC feces management and latrine training behaviors (USAID 2022). Studies also reinforce the need for technologies that are tailored to the local context and specific to the age cohort of users, particularly accounting for children's developmental stages, independence, and mobility levels (USAID 2022). Given that unsafe IYC feces disposal practices are common in low-resource settings, this is a key behavior to address in efforts to improve HEs of IYC and interrupt fecal pathogen transmission. However, studies have not yet assessed the impact of IYC feces management on child health outcomes nor their impact on exposure of IYC to fecal pathogens (USAID 2022).

2.2.2 INTERVENTIONS TO ENCOURAGE POULTRY COOPING

Animal feces are significant sources of zoonotic bacteria (particularly enteropathogenic *E. coli*, *Campylobacter,* and *Salmonella*) and protozoa (e.g., *Cryptosporidium* and *Giardia)* (Kotloff et al. 2013). Animal feces are more widely spread in contexts where free-range animal husbandry is practiced and more concentrated when animals are corralled within environments where children sleep and play. A few studies have documented animal feces contamination in all fecal-oral pathways explored in both public and household domains, and, not surprisingly, an increase in fecal contamination corresponds with a higher number of animals owned (Boehm et al. 2016).

Research has shifted from a focus on the feces of domestic animals in general to a focus on poultry feces. Microbiological studies of soil samples have established their contribution to high levels of pathogenic bacteria (Simango 2006; Marquis et al. 1990) and other fecal bacteria in the domestic environment (Pickering and Davis 2012; Ngure et al. 2013), especially in rural and peri-urban settings where free-scavenging poultry are common (Marquis et al. 1990; Ngure et al. 2013). Household poultry production and egg consumption can be important as livelihood and nutritional safety nets (Wong et al. 2017) and for improving childhood nutrition and dietary diversity (Kaur, Graham, and Eisenberg 2017); however, they can also expose children to pathogens—through geophagy or direct consumption of chicken feces (Ngure et al. 2013; Reid et al. 2018)—that may cause diarrheal illness, stunting, and death, with exposure depending largely on where poultry are housed (Kaur, Graham, and Eisenberg 2017; Zambrano et al. 2014).

Overnight corralling of poultry within the household dwelling may increase the risk of exposure to pathogens and negate the nutritional benefits of poultry rearing for IYC health (Headey and Hirvonen 2016). Studies recommend that poultry interventions ensure that chickens are kept separately from where children sleep (Shanta et al. 2017), and that programs supporting women's chicken production efforts be required to support women's decision-making capacity and male involvement in decision-making related to the intervention, as both of these factors increase behavioral change and sustainability (USAID n.d.a.; USAID 2021). Notably, a neighborhood-based environmental assessment and planning intervention conducted by the International Centre for Diarrhoeal Disease Research, Bangladesh successfully encouraged poultry-raising households to build improved poultry sheds, confine poultry outside of household dwellings at night, reduce/prevent poultry feces in household dwellings, and dispose of poultry feces in a dedicated location (USAID 2021).

However, significant barriers exist to implementing these recommendations. Research in both Bangladesh and Uganda found that even households with dedicated spaces for poultry only (including chicken houses and fenced-in outdoor spaces for poultry, coops, and baskets) still contain high rates of observable poultry feces in household compounds, given the often preferred and more economically viable free-range rearing of chickens to allow for foraging (USAID 2021). Thus, a key barrier to improving poultry management practices is that rural households in low-resource settings are frequently rearing poultry at a scale too small to justify significant capital investments, such as those required for cooping, vaccination and deworming, and/or supplemental feeding. At the same time, backyard chicken rearing is still occurring at a scale large enough to contaminate the home and communal environment and pose a significant health risk for children under five (USAID 2021; Rosenbaum et al. 2021). More research is needed to identify successful approaches to overcome barriers to adopting new poultry and poultry feces management practices. Studies are also needed to identify the benefits of these practices given the duration and extent of poultry feces exposure for IYC in indoor versus outdoor spaces.

2.2.3 INTERVENTIONS ON PLAYMATS/PLAYPENS AND IMPROVED FLOORING

Studies indicate that caregivers generally considered the use of playmats and playpens to prevent the ingestion of soil and feces feasible and acceptable and felt that they provided multiple perceived benefits (Alonge et al. 2020; Rosenbaum et al. 2021; Budge, Hutchings, et al. 2021; Budge, Parker, et al. 2021; Reid et al. 2018; Fundira 2019). However, frequency and duration of use varied across the studies (when reported), ranging from 10 to 360 minutes/day of use in studies that measured duration. Without clearer delineations in the dose-response relationship for pathogen infection among IYC in low-resource settings, it is unclear if removing IYC from the environment outside the playpen/playmat for given periods of time is effective in reducing diarrhea (Rosenbaum et al. 2021; USAID 2022), and this would certainly be context-specific. Thus, the evidence suggests that the use of playmats and playpens, while not effective as a standalone intervention, may be combined with other strategies to improve the HE, including those interventions discussed in previous and later sections. More research is required to determine if the degree of reduction in pathogen levels in preliminary studies is large enough to improve the health of IYC (Budge, Hutchings, et al. 2021; Budge, Parker, et al. 2021; Reid et al. 2018).

The feasibility and appeal of improved flooring, changes in hygiene-related behaviors in households with improved floors, and lower loads of fecal-contaminated dust on improved floors suggest that this is a motivating and biologically plausible technology to improve HEs for IYC (USAID and Earth Enable 2021; USAID 2022). In addition, research points to gender-specific, non-health benefits of improved floors, such as reduced workload and increased status and respect (USAID and Earth Enable 2021; USAID 2022). More research is needed to inform strategies for increasing uptake of improved flooring. Implementers and market actors may frame affordable, non-concrete improved floors as aspirational endpoints rather than incremental steppingstones toward cement floors. However, given that children spend most of their daylight hours outside and have higher mouthing frequency outside than inside (Bauza et al. 2018; Bauza et al. 2017), future research must explore the impact of indoor flooring on reducing overall IYC exposure to pathogens. Research could also seek to identify outdoor surface improvements, such as patios, porches, or even play/feeding mats, that may improve HEs for IYC and may increase overall protection when combined with interventions, such as animal feces management.

2.3 EVIDENCE ON COMBINED WASH INTERVENTIONS TO IMPROVE HYGIENIC ENVIRONMENTS

Researchers and IPs have called for more comprehensive WASH interventions—transformative WASH or WASH++—which may be needed to achieve a major impact on child health (Cumming et al. 2019; Pickering et al. 2019; Vila-Guilera et al. 2021). Transformative WASH interventions seek to create enabling environments that provide access to basic WASH services and infrastructure, address the

infant-specific exposure pathways, and, importantly, change overall WASH norms (Palomares 2018). In this regard, transformative WASH speaks to a renewed focus on incremental change, understanding how WASH works within contexts, and addressing the need to foster broader SBC centered on principles of GESI (Ross 2020).

Overall, researchers posit that comprehensive, area-wide packages of WASH interventions tailored to address the local exposure landscape and enteric disease burden are needed (Cumming et al. 2019; Pickering et al. 2019; Vila-Guilera et al. 2021). This includes area-wide sanitation (a systems-based, outcome-driven framework to achieve equitable, universal access and use of safely managed sanitation and hygiene in a given administrative area, such as a district [USAID 2023]), improved access to adequate quantities of quality water, and proper hand hygiene, as well as some combination of HE- or IYC-specific interventions, such as playpens or feeding mats. Researchers also state that transformative WASH interventions must consider connected factors across socio-ecological levels (Brofenbrenner 1977), including sociocultural, economic, and institutional factors that contribute to infant enteric infection risks (Vila-Guilera et al. 2021). Notably, researchers point to additional research methodologies that extend beyond randomized controlled trials (RCTs) as critical for building the evidence base on the impacts of transformative WASH that addresses the mechanisms of change within contexts and across social systems (Burton et al. 2021; Vila-Guilera et al. 2021). These recommendations inform the proposed study design and methods, as presented below.

There remains a considerable evidence gap on the effectiveness of multicomponent WASH interventions that address IYC HEs across socio-ecological levels—as there are many approaches to improving HEs—that could potentially include traditional WASH as well as some mix of the interventions described above (USAID 2022). Research designs that test multicomponent interventions need to consider the influence of contextual factors as well as work to ensure external validity and generalizability of findings (Cumming et al. 2019). In the case of complex public health interventions, studies need to elucidate contextual factors that may diminish or potentiate effect.

In addition, BCC research indicates that addressing multiple messages (focusing on "too many behaviors") at once may lead to message fatigue, information overload, and/or lack of behavior initiation and maintenance. Little data exists on generalizable thresholds of behaviors or intensity of dosage, and optimizing the needed dosage or intensity of messages depends on social, demographic, cultural, political, and economic factors, all of which should be embedded within the context of place and time (Ory et al. 2010; Voils et al. 2014). Likewise, little data exists on how "clustering" multiple behaviors around a uniting and motivating "theme" impacts this threshold for overload. For multicomponent interventions, programs may include multiple strategies for fostering broader SBC, ranging from BCC to modifying choice architecture, nudging behaviors with enabling technologies, fostering social norm change, and implementing behavioral economic strategies that encourage behavior uptake through reporting and reward systems.

The additive or synergistic effects of different WASH interventions on child health are complex and not well understood. A systematic review of studies examining the effects of WASH interventions alone and combined with nutrition interventions on child growth in LMICs found that non-RCTs showed effect on height-for-age Z-score (HAZ) from WASH interventions alone, but RCTs did not (Bekele, Rawstorne, and Rahman 2020). The authors concluded that WASH interventions alone improved HAZ when delivered over 18–60 months and for children under two years of age. Combined WASH with nutrition interventions showed a strong effect on HAZ and a borderline effect on weight-for-age Z-score; therefore, integrating both interventions may effectively improve child growth outcomes (Bekele, Rawstorne, and Rahman 2020). More research is needed to test the potentially synergistic effects of multiple interventions to improve HEs and IYC health.

2.4 INSIGHTS FROM STAKEHOLDER AND IP INTERVIEWS ON HE INTERVENTIONS

To inform the development of the research question(s) on HEs and as a complement to the literature review, the review team conducted stakeholder interviews to gather inputs on global research priorities and potential partnering opportunities for HE research.

2.4.1 SAFE DISPOSAL OF IYC FECES

Safe disposal of IYC feces emerged as a high-interest topic, both in terms of adapting latrines for young child use as well as for inclusion in strategies to establish open-defecation-free zones. Most notably, as pointed out by USAID technical SMEs and programmatic SMEs, there are considerable gaps in data on young child latrine use, including how and how often they are being used. SMEs reinforced what is documented in the literature, highlighting the need to better understand how to promote IYC latrine socialization along with developing enabling technologies. Likewise, SMEs noted that safe disposal strategies for the youngest cohorts (too young to access latrines) remain a challenge, with no "best practice" yet established regarding various strategies, such as use of scoops and agricultural hoes, management of soiled nappies, and improvised potties. In short, while promising research conducted under WASHPaLS 1 showed considerable uptake of IYC latrine use when enabling technologies were adopted, SMEs confirmed the need to complement the research with an examination of the factors that contribute to safe infant feces management, latrine socialization, and longer-term use among this population.

The IP stakeholders involved in this review readily embraced this topic, and the consulted WASH and nutrition projects have planned activities to address safe disposal of IYC feces. In addition, the consultation identified Resilience and Food Security Activity (RFSA) projects as conducive for studying HE interventions broadly or as a multicomponent study, given that RFSA interventions address IYC nutrition, sanitation and hygiene, and livestock management, including the safe and productive management of livestock feces. RFSA cross-sectoral programming often spans WASH HE objectives of reducing IYC and adult feces in the environment while also promoting HW and agricultural livelihood objectives, including the containment of animals and safe and productive management of their feces. Some projects indicated planned activities for latrine improvements, including those to better accommodate young children. Other very low-cost interventions might be possible, but resource constraints and the sustainability of any hardware introduced will need to be carefully considered.

2.4.2 ANIMAL PENNING OR COOPING

Animal penning or cooping was primarily discussed with the global WASH research and IP stakeholders, specifically the RFSA project teams, as well as university-based researchers at UC Berkeley and University of Florida Innovation Lab. Agriculture and nutrition researchers observed drastic reductions in droppings and feathers from research conducted in Burkina Faso with poultry hygiene management efforts that focused on keeping chickens out of the home. While outdoor daytime cooping or penning can be a promising practice, the biggest impediment is the cost of feeding (instead of no-cost free-range feeding). Thus, interventions that aim to use cooping or penning as an intervention will need to ensure that participants can bear feeding costs and are offset either by an increase in productivity or subsidized efforts to reduce the costs of feeding. Global research stakeholders indicated stronger evidence for the feasibility of nighttime cooping, with initial studies indicating a reduction in fecal contamination in homes. However, they noted the biggest barriers to outdoor cooping are householders' fear of theft and/or animal predators. Additionally, in the context of behavior change, there is evidence of the effectiveness

of increasing knowledge and perception of risk, as well as of improving attitudes and self-efficacy about the safe disposal and use of animal feces.[1]

2.4.3 FLOORING AND OTHER SAFE SURFACE IMPROVEMENTS

One SME indicated that future research studies on improved flooring (indoor and outdoor) should focus on feasibility and efficacy. Several IPs pointed out that improved flooring is an expensive intervention or product, and one that should be provided through private sector/market-based approaches rather than integrated into development partner or country programs. This impacts the ability to study this intervention where there is not already a robust local market supporting significant demand for and distribution of flooring products.

Several IP interventions included the (planned) promotion of "safe surface interventions," such as feeding mats and playpens, even if they would not categorize them as such. While some USAID SMEs expressed doubt toward the biological plausibility of playpens given limited usage, many other SMEs and IPs regarded them as possibly part of a comprehensive "BabyWASH approach" due to their appeal and the potential of playmats/feeding mats for reducing contaminated soil consumption during feeding. As such, the research team deems studies that seek to establish biological plausibility and feasibility of these interventions more appropriate for the WASHPaLS #2 SBC research agenda given the current state of the evidence.

Inclusion of flooring and/or other safe surface interventions as part of several interventions in a complex evaluation will generate evidence on the feasibility of these interventions within sociocultural contexts and programmatic settings.

2.5 KEY EVIDENCE GAPS AND RESEARCH QUESTIONS ON HYGIENIC ENVIRONMENTS

In summary, given the plausible but limited impact of any HE intervention on its own as supported by the literature, and given the questions on feasibility and practical application of the interventions highlighted by the SME consultations, this review points to the need for more process evaluations to support research on multicomponent HE interventions. The sector also requires research on the impacts and causal mechanisms within programs of introducing multiple HE interventions. This research should contain studies on the fidelity of implementation and factors that influence the ability to take interventions/technologies to scale, including, as noted in Section 1.1, the role of SBC and BCC programming to support adoption and sustainment of key behaviors linked to the improvement of IYC-specific HEs. Such multicomponent studies should consider selecting two or more from a range of potential interventions (see Table 1), ideally targeting behaviors and enabling technologies to manage IYC and animal feces, at a minimum.

[1] The team notes that the insights from SMEs described in this section are broadly supported by the literature, in particular Lowe et al. 2022; McKune et al. 2020; and Passarelli et al. 2021.

TABLE 1. BEHAVIORS AND ENABLING TECHNOLOGY TO SUPPORT HYGIENIC ENVIRONMENTS FOR IYC	
BEHAVIOR	**ENABLING TECHNOLOGY**
Keep animals outside children's sleeping rooms at night and away from children's common play spaces during the day	• Night sheds for poultry • Corrals for ruminants
Prevent children from contacting soil and feces	• Playmats • Playpens • Improved flooring
Infant and animal feces disposal and management	• Child potties • "San mats"—mats specifically for defecating on • Animal feces scoops/hoes – Deep, covered pit – Composting away from domestic environment – Raised, covered storage (basket/bucket)

Source: USAID 2022

In addition, further evidence is needed on the efficacy (i.e., under controlled conditions) and effectiveness (i.e., in real-world settings) of specific interventions to support transformative WASH programming, including:

- Effectiveness of indoor flooring to reduce IYC exposure to fecal pathogens;
- Feasibility (i.e., whether financially and technically possible) of outdoor surface improvements (patio, porch, or courtyard) to reduce IYC exposure to fecal pathogens;
- Efficacy of integrating IYC feces management strategies (including latrine improvements, potties, mats, and other interventions) to reduce overall fecal contamination of the broader household environment and improve IYC health; and
- Efficacy of animal husbandry interventions to reduce fecal contamination of household environments, including chicken cooping and animal penning.

Based on the evidence and the input from stakeholders and IPs, WASHPaLS #2 recommends the following research questions on improving HEs:

- What are the direct, indirect, and additive impacts of IYC feces management, animal feces management, and safe surface interventions (including the possibility of improved flooring) for improving IYC HEs?
- What are the effects of SBC interventions in driving the uptake of HE behaviors at household and community levels?

WASHPaLS #2 will explore these questions with local IPs, using a context-appropriate research design to be finalized in collaboration with them.

3.0 HANDWASHING AND FOOD HYGIENE

This section summarizes insights gained from the literature review and iterative consultations with the SMEs, which point to the need for further research on combined interventions to ensure sustained practice of HW with soap and FH, particularly in the caregiving context.

3.1 CRITICAL CONTAMINATION PATHWAYS THROUGH HANDS AND FOOD

In low-income settings, children often have a marked increase in diarrheal disease resulting from mouthing soiled hands and objects or from food contamination, particularly around six months of age when complementary foods are introduced (Ogbo et al. 2018). The consumption of pathogens through hands and foods may also cause vomiting. Both diarrhea and excessive vomiting lead to nutrient loss and dehydration, which can cause malnutrition and enteropathy. Other severe complications of diarrhea and vomiting include anemia, increased infections through malnutrition, and death (Kwong, Ercumen, Pickering, Arsenault et al. 2020; Siddiqui, Belayneh, and Bhutta 2021).

Hands and food are critical in fecal-oral contamination. As noted in Section 2.1, hands play a direct role in the fecal-oral pathway whereby pathogens are transferred from contaminated surfaces to hands (e.g., from drains, soil, floor, and other soiled areas), a mechanism that depends on the frequency of contact and the concentration of microbes on contaminated surfaces. Following hand exposure, children ingest those pathogens through mouthing of contaminated hands (Wang et al. 2017; Woldt and Moy 2015).

IYC are also exposed to fecal pathogens through foods contaminated at multiple points, from production to consumption. The cooking phase is one critical contamination point at the household level, essentially from the use of unclean utensils, poor food-preparation surface hygiene, and cross-contamination from water and other food. In the post-preparation stage, food can be exposed through unclean feeding and storage utensils, exposure to insects and dust, or improper storage temperatures (Kung'u et al. 2009; Wang et al. 2017). The storage of cooked food is particularly crucial, as it could be an entry point for pathogens, even when hygienic practices are observed during meal preparation. Because the physical (e.g., warm temperature and humidity) and chemical (e.g., nutrient content) properties of food make them an ideal medium for pathogen growth and reproduction, any post-preparation contamination of complementary foods is exacerbated when they are stored at ambient temperatures for long periods (Saha et al. 2010; Woldt and Moy 2015), especially after more than four hours (Kung'u et al. 2009). Food contamination during the cooking and the post-cooking phases can be compounded in the absence of proper hand hygiene, allowing pathogens to transfer from hands and food (Wang et al. 2017; Woldt and Moy 2015).

Complementary foods for IYC are particularly susceptible to contamination in resource-limited settings, as suggested by levels of contamination reported in various studies. For instance, 53 percent of IYC food samples tested positive for *Enterococcus* spp. in a study in Mozambique (Bick et al. 2020). Risk factors for child food contamination were identified, including type of food, food preparation practices, and hygiene behaviors. In Bangladesh, *E. coli* was found in around 40 percent of IYC complementary food samples collected in urban and rural areas (Islam et al. 2012). Hence, complementary foods are a major source of fecal contamination for IYC in resource-limited settings (Wang et al. 2017). Several factors drive complementary food susceptibility to contamination. First, some complementary foods involve cooking processes that are potentially hazardous, like grinding ingredients with unclean utensils or handling food with bare hands, especially in contexts where hygiene practices are sub-optimal (Ehiri et al. 2001). Second, complementary food susceptibility to contamination is high compared to food destined for adults because of the addition of ingredients in post-cooking to improve palatability and the nutritional benefits of foods. In Nigeria, a study found that this process usually involves the addition of microbiologically sensitive ingredients like soybean powder or ground crayfish (Ehiri et al. 2001). Third,

pre-prepared food mixture, a common form of complementary food, requires the addition of water before consumption. In contexts where water quality is poor and households lack the time and means to boil water to prepare IYC meals, consumption of pre-prepared food mixture indirectly increases IYC's susceptibility to pathogen exposure (Kung'u et al. 2009).

The mechanisms discussed above are exacerbated by other risky practices by caregivers that are highly prevalent in some settings, including handfeeding of infants, limited HW with soap, inappropriate storage of food, and inadequate or no reheating of infant food (Bick et al. 2020; Biran et al. 2022; Simiyu et al. 2020; Takanashi et al. 2009). As a result, good FH practices, defined as the "measures and conditions necessary to control hazards and to ensure fitness for human consumption of a foodstuff taking into account its intended use," are critical to improve IYC health (van der Velde 2011). Additionally, FH is an under-appreciated pathway to reduce diarrheal disease among IYC and, as indicated in USAID's Multi-Sectoral Nutrition Strategy 2014–2025 (FANTA 2015), is a cross-cutting issue that should be integrated across sectors, including WASH. As such, the Strategy recommends that given current evidence, programs should develop evidence-based guidance on practical, feasible ways to address FH in low-resource environments, including SBC interventions (FANTA 2015).

3.2 EVIDENCE ON HW AND FH INTERVENTIONS

Addressing the hand and food pathways of fecal-oral contamination requires intervention packages targeting both HW and FH. Interventions to increase recommended HW practices *generally* (without particular focus on particular HW junctions) have focused primarily on the provision of soap and HW stations together with some SBC (GHP 2021), in accordance with research supporting the importance of increasing knowledge and risk perceptions, ensuring the availability of appropriate hardware, *and* making sure that social support is provided (Watson et al. 2021). More recent SBC interventions go beyond increasing knowledge and awareness and look at environmental nudges that may facilitate uptake and sustainability of HW behavior through the introduction of enabling technologies or altering the choice architecture of an environment (GHP 2021). Others focus on psychosocial motivations, seeking to tap into the emotional drivers of behavior change, such as disgust, affiliation, nurture, aspiration, and self-efficacy (Biran et al. 2022; Briceño et al. 2017; Greenland et al. 2016; Swarthout et al. 2020).

SBC programs targeting psychosocial motivators of HW incorporated a learning phase prior to program design (often described as formative research and/or user-centered design) to gain a better understanding of the barriers to and enablers of behaviors within a specific context (Biran et al. 2005; Scott et al. 2007; Curtis, Danquah, and Aunger 2009; Greenland et al. 2013; Xuan et al. 2013; Parvez et al. 2017). This shift has led to HW program designs that address a range of behavioral determinants (for example, the emotional drivers listed in the previous paragraph) through multiple interactions with communities and a variety of delivery channels to change behaviors (Greenland et al. 2017; White et al. 2020). Much of the previous research did not specify a particular context when identifying determinants, and it remains unclear if the behavioral determinants and motivators that drive HW behaviors after latrine use are the same determinants that would encourage HW prior to food preparation. Some studies also successfully increased HW behaviors using norms change interventions (Chidziwisano et al. 2019; Chidziwisano et al. 2020), while other studies failed to demonstrate the impact of norms change on HW behaviors (Biran et al. 2020; Greenland et al. 2017)). More research is needed to fully understand these drivers and social norms of FH-related HW to better inform the design of SBC interventions that can elicit HW behavior adoption and use within the home setting and caregiving context.

There is evidence supporting the effectiveness of HW interventions in blocking the fecal-oral pathway, often measured through diarrhea incidence, although the findings are mixed, with effect sizes ranging across studies and contexts. A recent meta-analysis including eight RCTs from LMICs estimated that HW promotion results in a 17 percent reduction in diarrhea morbidity among children under five

(Walker, Walker, and Black 2022). Another review concluded that HW promotion in LMIC communities can prevent about 28 percent of diarrhea episodes, based on eight trials with a total of roughly 14,000 participants (Ejemot-Nwadiaro et al. 2015). Notably, however, six of the eight trials were from Asia, with evidence from one study in South America and another in Africa categorized as being of "moderate quality" (meaning that further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate) (Ejemot-Nwadiaro et al. 2015; Ejemot-Nwadiaro et al. 2021). The variability and quality of findings indicate the need for more evidence to inform the understanding of the health impacts of interventions promoting HW.

FH interventions include SBC communication targeting individual and social norms, education, and hands-on practice of behaviors (Manaseki-Holland et al. 2021; Woldt and Moy 2015). SBC FH interventions are grounded in health behavior theories to address the psychosocial factors, social norms, and emotional motivators to support a range of recommended behaviors, such as hygienic food storage, reheating food, proper feeding practices, and hygienic cooking practices, including HW at critical food preparation junctures and the use of clean utensils (Chidziwisano et al. 2020; Freeman et al. 2020; Manaseki-Holland et al. 2021; Simiyu et al. 2020).

Recent evidence suggests that SBC FH interventions provide some protection against diarrhea, especially when combined with other WASH interventions. In Gambia, an intervention used community-wide campaigns and home visits to promote five key hygiene behaviors for complementary feeding and one for drinking water among mothers of children 6–24 months old. The promoted behaviors were: (1) HW with soap before cooking, (2) washing pots and utensils before preparation and drying on a clean (and cleanable) surface, (3) HW with clean water and soap when contaminated during cooking, (4) reheating pre-made food after storage before feeding, (5) HW with clean water and soap before feeding child (mother) and eating (child), and (6) boiling drinking water for the child(ren). The intervention significantly reduced self-reported diarrhea, diarrhea hospitalization, and acute respiratory infections at 6- and 32-month follow-ups (Manaseki-Holland et al. 2021). Interestingly, the selected villages received no interventions and were not visited by the study team between months six and 32, suggesting that the intervention was self-sustaining and highly accepted by recipients. The intervention effectiveness and sustainability were credited to a robust theoretical base to the intervention (hazard analysis critical control points [HACCP] and motivational drivers), involvement of whole communities including fathers and community leaders, and peer support and education, and the use of culturally embedded performing arts, among other factors (Manaseki-Holland et al., 2021). However, the results have limited generalizability because the program was delivered exclusively in villages participating in the national Primary Health Care Program (which entailed having a male village health worker and a traditional birth attendant), and most villages were relatively small (Manaseki-Holland et al., 2021).

3.3 SYNERGIES AMONG HANDWASHING, FOOD HYGIENE, AND OTHER WASH INTERVENTIONS

Researchers have tested HW and FH interventions alone, together, and combined with other WASH interventions. Some have hypothesized that combining several intervention types into a multicomponent strategy could lead to synergistic effects with greater benefits than each intervention alone, given the possibility to target multiple pathways simultaneously (Briceño et al., 2017; Prochaska et al., 2008). In practice, such an intervention would address aspects of food preparation, food handling, HW, and utensil washing, jointly expected to lower the total exposure to fecal contamination by IYC (Chidziwisano et al., 2019; Manaseki-Holland et al., 2021; Wang et al., 2017) by providing continuous protection against pathogen exposure from food preparation to consumption.

The body of evidence is mixed on the combined effects of HW and FH interventions with other WASH components. In rural Malawi, the Hygienic Family Program tested the effectiveness of an intervention of HW with soap and FH (Arm 1) and HW with soap and FH combined with IYC and animal feces

management and water management (Arm 2) on self-reported diarrhea. Arm 1 did not have any water supply and sanitation facilities. Arm 1 resulted in a significant 13-percentage point reduction of diarrhea incidence compared to the control group, while Arm 2 reduced diarrhea by 13.5 percentage points (Morse et al., 2020). Despite the marginal incremental effect from adding more components to the intervention package, this study provides some evidence supporting that layering WASH interventions, including combining FH and HW interventions (as done in Arm 1), could yield additional health benefits. In contrast, other studies on combined WASH interventions included in this review failed to reduce fecal contamination on hands and household objects, rates of diarrhea, acute respiratory infections, or other health outcomes among IYC, likely related to implementation fidelity and complexity as explained below (Ercumen et al., 2018; Greenland et al., 2016; Null et al., 2018; Swarthout et al., 2020; Aluri et al., 2022). This evidence suggests that integrated programming of WASH interventions may be beneficial, but more research is needed to understand how interventions can be combined and delivered to lead to greater health benefits.

Programs also need to address implementation challenges that may considerably impact their effectiveness. Low uptake of the intervention limits its ability to achieve the dose threshold needed to lead to behavior change and health benefits (Briceño et al., 2017; Greenland et al., 2016; Null et al., 2018; Pickering et al., 2015). Low design fidelity also appeared to affect program effectiveness. A Tanzania RCT reported that implementers adapted SBC messages for clarity, which caused a loss of fidelity to the original content (Greenland et al. 2017). Another study reported that sub-optimal service delivery due to higher workloads than usual among community health workers coupled with low incentives negatively impacted the potential intervention outcomes (Aluri et al. 2022). These important gaps in intervention delivery limit the current understanding of the dose and response relationship of HW and FH SBC interventions, a critical aspect to inform intervention design and scale-up (Pickering et al. 2019). HW and FH interventions, combined with other WASH interventions or not, need to balance feasibility considerations with practical implementation factors to improve fidelity of implementation and intervention effectiveness (Greenland et al. 2016).

3.4 HW AND FH HARDWARE AS BEHAVIORAL DRIVERS

Researchers have also explored the role of access to necessary supplies, such as water and soap. Evidence on HW and FH hardware, including characteristics and desirable attributes that will facilitate adoption and ongoing use in low resource environments, is promising (Simiyu et al. 2020). Studies suggest that HW and FH hardware are essential to creating sustainable routines to support behavioral performance and habit formation (Biran et al. 2022; Neal et al. 2015; Simiyu et al. 2020). For HW stations, attributes such as user friendliness, water and soap availability, and the location of the washing station have been linked to performance of HW behaviors at critical times, including but not specifically focusing on times related to food preparation and feeding. (White et al. 2020). These attributes of HW facilities likewise play a critical role in nudging desirable HW behaviors at both the conscious and subconscious levels (Grover, Hossain, Uddin, Venkatesh et al. 2018). However, these studies did not seek to understand in detail how determinants might differ across the various critical times. Little is known about the relevant attributes of HW stations that support HW before and during food preparation/eating/feeding, and the relevant type and attributes of cooking and feeding utensils to support caregivers' hygienic behaviors related to complementary food preparation and IYC feeding. Moreover, the physical attributes of the HW stations and the FH hardware may carry different importance based on caregiving contexts, and, therefore, require an understanding of their relevance before their implementation (Simiyu et al. 2020). Potential attributes to consider include user friendliness; water and soap availability; the location of the washing station, as well as cost, size, and device stability on existing surfaces within the household; water reservoir size; hands-free on/off valve; and other characteristics, as identified by end-users.

A cross-sectional study in Peshawar, Pakistan found that when BCC programs are implemented with individual and community needs, levels of understanding, beliefs, and sociocultural norms in mind, all the domains of hand hygiene showed statistical improvement (e.g., HW before meals, before cooking, before feeding a child, after defecation) (Qazi and Anwar 2021). However, designing programs based on extensive formative research regarding needs, levels of understanding, beliefs, and norms is complex and resource intensive, as are the BCC and individual-level interpersonal communication approaches commonly used in SBC programming (Avenir Health 2021). Recent cost-effectiveness studies for SBC contain mixed findings, providing no clear path on what level of SBC interventions yield desired and sensible results (Avenir Health 2021).

Because on-premises piped water is often not available or easily accessed in many resource-poor settings, innovators have developed do-it-yourself, low-cost HW facilities. The limited data available on the effectiveness of such technologies indicates that they may initially improve HW behavior (Zhang et al. 2013; Biran 2011; Husain et al. 2015). However, many programs later discover that communities often end up with a "graveyard" of dysfunctional do-it-yourself HW stations or no hardware at all, hindering the sustainability of HW practices (Biran et al. 2022; Briceño et al. 2017). This happens because the products lack many of the features considered desirable in an HW station, and because of a lack of focus on providing aspirational programming for sustainable behavior change (Biran et al. 2022). However, evidence on market-based, aspirational HW stations, such as Happy Tap and SATO Tap, on improving hand hygiene within the household setting is limited.

Limited evidence suggests that feeding and storage hardware (such as storage containers, cups, and spoons) may be instrumental in the adoption of FH practices (Simiyu et al. 2020). In Kenya, there was high adoption of feeding hardware and an increased performance of recommended food storage practices by caregivers in a study that aimed to co-design and pilot an FH and HW intervention package. Adoption was particularly high for items with very specific purposes (e.g., baby bowl and spoon or liquid hand soap), also referred by authors as "props 'disrupting' the child feeding setting" so that new behaviors can be adopted and sustained, compared to general purpose items (e.g., HW station or bar soap), which tended to be used for multiple purposes (Simiyu et al. 2020). Additional studies are needed to understand how these items would impact behaviors in different contexts, as evidence around the provision of hardware for FH practices is scarce.

3.5 INSIGHTS FROM STAKEHOLDER INTERVIEWS AND IPS ON HW AND FH BEHAVIORS

3.5.1 HW BEHAVIORS IN THE HOME

Stakeholders interviewed indicated that HW with soap remains an often-intractable behavior, and that water access is paramount in the adoption of this behavior. Importantly, WASH researchers pointed out the need to understand HW behaviors within local caregiving contexts and indicated that HW behaviors surrounding latrine use may be quite different than HW behaviors associated with food preparation and eating or feeding. As such, studies on HW, including those seeking to nudge HW in the home setting, should take these differences into account. In addition, stakeholders pointed out that while institutional settings (specifically schools) showed a good degree of success in using nudges and cues, these successes would not likely translate directly to the home setting; therefore, participatory input is vital to innovate in this area. Lastly, since the stated focus of this desk review is on improving IYC health, it is noted that SMEs engaged during the review indicated that infant HW is not a viable intervention, given how quickly their hands become contaminated again, and the recontamination speed, frequency, and degree is worsened if the infant's hands are not properly dried. Stakeholders felt that caregiver HW, particularly around food preparation and feeding, was a more important practice for further study, where

appropriately supported by, or combined with, broader HW behavior change programming targeting other critical times and/or other household members/the broader community.

3.5.2 FH BEHAVIORS

FH garnered considerable interest across SME groups, with many stakeholders considering it a priority and suggesting an integration with HW, particularly when examining HW behaviors around food preparation and feeding. Technical SMEs with USAID and IPs, along with global WASH researchers, indicated the need for FH studies situated within caregiving contexts. Global WASH researchers also pointed out that studies have been conducted using a HACCP approach (Ayelign, Alemu, and De Saeger 2022; Bick et al. 2020; Islam et al. 2012; Jaffee et al. 2018); given robust evidence on contamination in complementary foods, stakeholders suggested that future research focus on identifying ways to improve FH within caregiving contexts. Additionally, programmatic SMEs and IPs pointed to the value of identifying and piloting small, doable actions based on the science and local cultural context. These then could be scaled up based on research findings and impacts measured.

Nearly every IP with whom the review team spoke expressed interest in the FH research topic, and many noted it is critically understudied. In the context of Ethiopia, Malawi, and Rwanda, there was interest in understanding FH and hygienic behaviors within the programmatic context of introducing complementary foods to children 6–24 months old. These programs use care group models to implement their activities and focus on promoting behavior changes that will improve FH, including HW practices and food storage (with a lesser focus on the latter). Among global WASH researchers, there is considerable interest in looking at food storage hardware, including simple covers, which can prevent contamination by fomites and flies. All stakeholders recognized that refrigeration and electrification are vital factors that influence the capacity for storing food safely, as well as fuel access/improved cookstoves for reheating stored foods; however, these areas are beyond the scope of the proposed research.

3.6 KEY EVIDENCE GAPS AND RESEARCH QUESTIONS ON HW AND FH

The literature review and stakeholder consultation highlighted several gaps in evidence on how best to improve HW at critical times by caregivers of IYC, particularly before food preparation and feeding, as well as FH practices:

- **HW determinants:** Significant gaps remain in identifying what behavioral determinants drive HW behaviors, including different emotional and psychosocial drivers for HW at various critical times, particularly those associated with HW with soap prior to preparing food, before feeding children, and after handling IYC feces (GHP 2021).
- **HW stations:** Gaps remain in understanding the characteristics of HW stations, including the required number of HW stations and their location within the household, which will motivate the adoption and consistent practice of HW behaviors at critical times, particularly linked with FH. There are still many unknowns about the affordability, feasibility, and sustainability of (marketing of) commercially available HW stations among rural populations (Amon-Tanoh et al. 2021; Biran et al. 2022; Hulland et al. 2013; White et al. 2020).
- **FH packages:** Additional research is needed to tailor and ensure relevance of FH hardware packages and interventions to the local caregiving contexts, and to understand which of these FH hardware packages most effectively stimulate adoption and consistent practice of behaviors. This includes identifying what hardware is needed to reduce contamination and improve FH at the most critical points, including the likelihood of small, doable actions to yield results (e.g., the introduction of utensils, bowls, containers, drying racks, and cutting boards) (Simiyu et al. 2020).

- **IYC HW:** The feasibility and "biological plausibility" of IYC HW is a notable gap, with little evidence to resolve if inclusion of infant HW would reduce or perhaps increase fecal contamination of infant hands, given that newly cleaned wet hands can easily pick up more potentially contaminated soil that might then be mouthed by the infant; and materials available to dry infant hands would likely be contaminated (towels, rags or caregivers' clothing).
- **Combined HW and FH interventions:** More evidence is needed to understand how HW and FH interventions can be combined and delivered effectively to lead to greater health benefits.
- **SBC approaches:** An increased understanding is needed regarding the role of SBC in situations where program recipients have access to HW stations that are desirable and adequate for their context. Specifically, the research team can consider effective strategies to sustain behavior adoption, including broader norm change.

Based on the evidence and the input from stakeholders and IPs, WASHPaLS #2 proposes to combine HW and FH research questions into one study to identify drivers that will initiate and sustain the adoption of HW and FH behaviors within the caregiving context, specific to the introduction of complementary foods, when infant growth and nutrition most often begin to falter. WASHPaLS #2 will pursue the following research questions on HW and FH:

- What is a feasible and desirable intervention package to support caregivers' improved performance of HW and FH behaviors around complementary food preparation and consumption by IYC?
- What is the effect of the HW and FH hardware and relative role of SBC messaging within the broader intervention package on caregivers' performance of HW and FH behaviors around complementary food preparation and consumption by IYC?
- What is the effect of the HW and FH hardware and relative role of SBC messaging within the broader intervention package on complementary food contamination and IYC health outcomes?[2]

WASHPaLS #2 will explore these questions through implementation research with a local IP, using a context-appropriate research design to be finalized in collaboration with them. The research team will explore the last question listed above using the most rigorous outcome measures possible within study resource and timeline constraints.

[2] WASHPaLS #2 notes that although not as accurate as biological data to measure pathogen presence in foods or IYC stools, diarrhea incidence, as measured through caregivers' self-reports, has been used as an outcome in several studies in Malawi (Chidziwisano et al. 2020; Morse et al. 2020) and similar settings (Biran et al. 2020; Null et al. 2018). The research team will aim to use the most rigorous outcome indicator possible within study resources, and as part of this will also explore using diarrhea incidence as a secondary outcome to replicate previous relevant studies.

4.0 CONCLUSIONS AND NEXT STEPS

This desk review set out to better understand critical areas that interrupt contamination and transmission pathways that specifically threaten IYC health and growth, with a focus on intervention areas related to addressing IYC HEs, promoting HW behaviors in the home setting, and improving overall FH.

The reviewed literature strongly supports the notion that achievement of a safer and cleaner environment and safer practices for IYC will require a combination of interventions, as no one intervention alone is biologically plausible to sufficiently reduce IYC exposure. Such intervention packages will need to be contextually appropriate and relevant to caregivers, households, and broader communities, and effective in inspiring and/or supporting the multiple behaviors associated with them. While the introduction of strategically placed/designed hardware can potentially reduce the need for high-intensity BCC, studies can help elucidate the processes by which this is achieved.

Studies are also needed on the fidelity of implementation and factors that influence the ability to take programs to scale, as well as to identify causal mechanisms within programmatic interventions, including the relative contributions of multiple HE interventions in facilitating the adoption and sustainment of key behaviors and the improvement of IYC-specific HEs and practices. Such research should consider a range of potential interventions for evaluation, ideally targeting behaviors and enabling technologies to manage IYC and animal feces, at a minimum. More comprehensive approaches may include "transformative WASH" interventions that engage householders to address multiple pathways simultaneously through the use of simple hardware that facilitates improved practices. These interventions are transformative because of their potential to sufficiently impact household hygiene to improve IYC health and growth.

In addition to research examining HE in resource-limited settings, complementary food is a major source of pathogen exposure and contamination of IYCs through multiple pathways. While previous interventions have concentrated on enhancing caregivers' hygienic behavior, more evidence is needed on interventions supporting HW with soap for complementary food preparation and child feeding, as those likely differ from HW practices for other needs. HW stations near the latrine do little to facilitate HW before food prep and feeding, but little to no data exists to tease out how to facilitate HW at multiple junctions. Moreover, studies on hygienic behaviors tend to examine food and hand hygiene separately. This approach does not fully address the interconnected ways leading to food contamination. To address this issue, a more comprehensive approach is required that combines hardware and behavior change messaging targeting the caregiving context. However, there is still uncertainty regarding the most effective hardware attributes, including the desirable features of FH hardware and the placement of HW stations and their physical and functional features. Moreover, while ample evidence supports the role of behavior change messaging in improving hygiene practices, it is crucial to understand the enhanced impact of combining *and streamlining* SBC messages and desirable hardware on caregivers' uptake of hygienic behaviors and children's health.

The combined research questions proposed in this review aim to generate actionable evidence on interventions to improve IYC health outcomes from two perspectives or angles:

- Through interventions that target pathways outside the body, primarily focusing on environmental conditions and behaviors that influence fecal contamination in IYC HEs; and
- Through interventions that target behaviors affecting exposure pathways tied to FH and consumption.

WASHPaLS #2 will design and implement studies to answer the proposed research questions in collaboration with implementers. This entails continuing discussions on partnership with the projects

and teams listed in Annex C. As next steps, the team will continue to flesh out research activities, including study design, methods, and data analysis plans. Based on the questions developed thus far, WASHPaLS #2 anticipates contributing to the literature and research uptake as follows:

IYC HEs:

- By delivering a validated theory of change for a tested combination of interventions to improve HEs for IYC;
- By advancing understanding of and evidence on the effectiveness of hardware-based SBC interventions likely to support and sustain improved HE behaviors at the individual and community level, as well as generate positive health outcomes;
- By contributing evidence on the effects of enabling technologies and other behavioral determinants (knowledge, skills, self-efficacy) on outcome measures, disaggregated across indicators to allow for comparison of effectiveness; and
- By informing current and future USAID and national funding of WASH interventions in the research country and similar settings, as well as providing a solid framework to confirm findings in other global settings.

HW and FH:

- By providing evidence on HW and FH packages necessary to change feeding behaviors, including the promises and/or limitations of hardware-focused SBC;
- By advancing understanding of the hardware and devices likely to support and sustain FH and HW behaviors and generate positive health outcomes; and
- By contributing to the evidence base on hygienic behavior interventions to inform WASH policy and programming globally.

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ANNEX A. LIBRARY SEARCH TEMPLATES

Key words (include any "and" "or" commands):

TABLE 2. WASHPALS #2 LITERATURE REVIEW REQUEST TEMPLATE: RQ 3.1, OPTION A	
	SEARCH TERMS
WATER, SANITATION, AND HYGIENE (WASH)	(sanitation OR hygien* OR sanits* or sanitz*)
	AND
LAYERED INTERVENTIONS	Layered intervention* OR Integrated* OR System*
	AND
FLOORING	(floor* OR courtyard* OR environment* OR outdoor safe zone)
	OR
SOCIAL AND BEHAVIOR CHANGE (SBC)	(behavior change OR changing behavior OR "trials of improved practice" OR SBC OR BCC OR SBCC OR TIPS)
	OR
INFANTS AND YOUNG CHILDREN (IYC)	((Infant* OR child*) AND (stunt* OR growth OR health OR feces OR fecal disposal OR feces disposal OR latrine))
	OR
CONTAMINATION	(fecal OR contaminat* OR sludge OR helminth OR E. coli OR infection*)
	OR
ANIMALS	(poultry OR ruminant OR livestock OR animal*) AND (pen* OR coop*)

Terms to exclude: None

Time frame: 2017 to present

Geography: East Africa, West Africa, Central Africa, South Africa (If we need to narrow this down, focus on East and South Africa first, specifically Ethiopia and Malawi.)

Language(s): English

Journals/databases of interest: PubMed, Global Health, Academic Search Premier

Search fields: Title/abstract only

Key words (include any "and" "or" commands):

TABLE 3. WASHPALS #2 LITERATURE REVIEW REQUEST TEMPLATE: RQ 3.2	
	SEARCH TERMS
WASH	(handwash* OR hand wash* OR hand hygiene OR "washing your hands" OR hand disinfect* OR hand rub OR handrub OR hand sanitizer OR hand sanitiser)
	AND
SBC	(behavior change OR behaviour change OR changing behavior OR changing behaviour OR SBC OR BCC OR SBCC OR nudg* OR (environmental AND (nudg* OR cues)) OR habit formation)
	AND
CONTAMINATION	(fecal OR contaminat* OR sludge OR helminth OR E. coli OR Escherichia coli OR infection*)
	OR
IMPLEMENTATION SETTINGS	(school* OR clinic* OR hospital* OR household* OR restroom* OR washroom* OR bathroom*)
	OR
POULTRY	poultry

Terms to exclude: None

Time frame: 2017 to present

Geography: East Africa, West Africa, Southern Africa (focusing primarily on urban regions in Africa); South Asia, Southeast Asia

Language(s): English

Journals/databases of Interest: PubMed, Web of Science, Global Health, Academic Search Premier

Search fields: Title/abstract only

Key words (include any "and" "or" commands):

TABLE 4. WASHPALS #2 LITERATURE REVIEW REQUEST TEMPLATE: RQ 3.3	
	SEARCH TERMS
WASH	(sanitation OR hygien* OR sanitis* OR sanitiz*)
	AND
SBC	(behavior change OR behaviour change OR changing behavior OR changing behaviour OR "trials of improved practice" OR SBC OR BCC OR SBCC OR TIPS)
	AND
CONTAMINATION AND FOOD SAFETY	(contaminat* OR contaminat* (utensil* OR surface* OR hand*) OR raw food OR (food AND (storage OR preparation OR safety OR hygiene OR pathogen*)) OR hazard analysis OR critical control point OR HACCP)
	AND
IYC	((Infant OR child*) AND (stunt* OR growth OR health))

Terms to exclude:

Time frame: 2017 to present

Geography: East Africa, West Africa, Southern Africa

Language(s): English

Journals/databases of Interest: PubMed, Web of Science, Global Health, Academic Search

Search fields: Title/abstract only

ANNEX B. STAKEHOLDER ENGAGEMENT

During the first nine months of the project, WASHPaLS #2 conducted key informant interviews (KIIs) with WASH subject matter experts (SMEs) and potential implementing partners (IPs) on global and programmatic research priorities for the sector specific to SBC. WASHPaLS #2 conducted the following stakeholder engagement activities:

- Developed a KII interview guide and built and maintained stakeholder engagement roster (see below);
- Conducted meetings with the Advisory Board points of contact, United States Agency for International Development (USAID) and other Global WASH and SBC experts, and potential IPs for input on the SBC Research Agenda and proposed studies; and
- Performed a rapid qualitative analysis of interview notes and feedback from stakeholders to inform final SBC research agenda and design of selected studies.

While building out the stakeholder engagement roster and identifying SMEs with whom the review team would consult, four groupings of stakeholders were identified: USAID technical SMEs (WASH, SBC, and Nutrition), academic WASH researchers, international nongovernmental organizations (NGOs) and programmatic SMEs (technical SMEs on program design and implementation), and country-level stakeholders (USAID mission field staff, potential IPs). During stakeholder engagement, WASHPaLS #2 identified potential partnering programs for studies and worked to solidify collaboration across organizations.

Table 5 presents the overview of stakeholders engaged in this review, followed by the Stakeholder Interview Guide that facilitated semi-structured interviews with the informants. In Annex C, Table 6 summarizes consultation findings by stakeholder group and topic area and Table 7 summarizes the discussions with potential IPs leading WASH or WASH-related projects in Ethiopia, Ghana, Malawi, Rwanda, and Zimbabwe. This includes an assessment of partnering opportunities linked to WASHPaLS #2's proposed SBC research questions.

TABLE 5. STAKEHOLDER ENGAGEMENT ROSTER				
NAME	**COMPANY**	**TITLE**	**GEOGRAPHIES**	**DESCRIPTION**
USAID Technical SMEs				
James Winter	USAID	WASH Technical Specialist	United States	James Winter is a WASH Technical Specialist at USAID. His research focuses on the impact of providing WASH education and infrastructure on health, economic, and hygiene outcomes.
Rebeccah Pinto	USAID	Deputy Chief, Nutrition and Environmental Health	United States	Rebeccah Pinto is a Deputy Chief in the Nutrition and Environmental Health Division at USAID. Rebeccah's expertise lies in implementing sustainable strategies to build capacity for WASH initiatives.
Nga Nguyen	USAID	Senior WASH and SBC Adviser	Malawi	Nga Nguyen is a Senior WASH and SBC Adviser at USAID. Nga provides technical expertise in designing and facilitating hygiene promotion programs.
Lucy Mungoni	USAID/Malawi	WASH Senior Technical Advisor	Malawi	Lucy Mungoni works in WASH sector as a Senior Technical Advisor at the USAID Mission, Malawi.
Violet Orchardson	USAID/Malawi	Nutrition Advisor	Malawi	Violet Orchardson is a Nutrition Advisor at the USAID Mission, Malawi.
Academic WASH Researchers				
Robert Dreibelbis	London School of Hygiene & Tropical Medicine (LSHTM)	Deputy Director LSHTM's Environmental Health	Africa and Asia	Robert Dreibelbis serves as a Deputy Director for LSHTM's Environmental Health Group, a research group focusing on the links between WASH and health. Robert's research focuses on understanding the determinants of WASH and WASH-related behaviors and developing and evaluating WASH/WASH behavior change interventions in households, communities, and institutions.
Sarah McKune	University of Florida	Research Associate Professor	Global/Ethiopia	Sarah McKune is a Research Associate Professor in the Department of Environmental and Global Health and the Center for African Studies at the University of Florida. Her research seeks to explain the complex, system dynamics that affect child growth and nutritional outcomes, including factors such as household hygiene and sanitation, livestock ownership, climate change, and gender dynamics within the household.
Arie Havelaar	University of Florida	Professor	Global/Ethiopia	Arie Havelaar is a Preeminent Professor of Global Food Safety and Zoonoses in the Animal Sciences department, the Global Food Systems Institute, and the Emerging Pathogens Institute of the University of Florida. His research focuses on epidemiology and risk assessment of foodborne and zoonotic diseases and their prevention. He has published extensively on the global burden of foodborne disease. He contributes to the Feed the Future Innovation Lab for Livestock Systems, leads the "Campylobacter Genetics and Environmental Enteric Dysfunction (CAGED)" project, and participates in several other projects focusing on food safety in low- and middle-income countries.
Kondwani Chidziwisano	Malawi University of Business & Applied Sciences	Professor	Malawi	Kondwani Chidziwisano has over eight years of experience working in the WASH sector with the government and NGOs. For the past five years, Kondwani has conducted several WASH research consultancies in Malawi.

TABLE 5. STAKEHOLDER ENGAGEMENT ROSTER				
NAME	**COMPANY**	**TITLE**	**GEOGRAPHIES**	**DESCRIPTION**
Tracy Morse	University of Strathclyde	Professor	Malawi	Tracy Morse is an Environmental Health Specialist. She has led collaborative research projects in Malawi and across the region focused on preventive community health with a particular emphasis on WASH, food safety, air quality, maternal and reproductive health, and community development models.
Sheillah Simiyu	Africa Population Health Research Center	Fellow, WASH, and SBC Research Lead	Africa	Sheillah Simiyu is a fellow at Urbanization and Wellbeing Unit at Africa Population and Health Research Center. She is currently involved in studies aimed at understanding enteric disease transmission among children, developing a research agenda on hand hygiene in public settings, evaluating hygiene interventions among persons with disabilities and older persons, evaluating water and sanitation supply in low-income settlements, and hand hygiene interventions in low-income settings.
Layla Kwong	University of California Berkeley	Assistant Professor	Africa and Asia	Laura (Layla) Kwong is an Assistant Professor in Environmental Health Sciences at the University of Berkeley who focuses on exposure to environmental contaminants and infectious disease, impacts on child and maternal health and development, and interventions to reduce adverse impacts.
International NGO Programmatic SMEs				
James B. (Ben) Tidwell	World Vision	WASH Research Lead	Global	James B. (Ben) Tidwell is the WASH Research Lead for World Vision and his work focuses on the application of econometric methods and behavioral science to understand consumer demand and institutional behavior to facilitate scale-up of sustainable WASH service delivery through private sector and government-led approaches.
Miles Kirby	World Vision	Head of Research, SPIR II (Ethiopia)	Ethiopia	Miles Kirby is the Head of Research, SPIR II at World Vision with a particular focus on sustainable water and sanitation practices.
Thaddeus Pennas	FHI 360	Technical Advisor, SBC	Global	Thaddeus Pennas is the Technical Advisor, SBC at FHI 360. He is an experienced environmental and sustainability professional with over 20 years of experience in the industry, including a strong background in sustainability strategy development, energy management, and environmental compliance.
Sandy Remancus	FHI Solutions	Director, Alive & Thrive (A&T)	Global	Sandy Remancus is the Director of A&T at FHI Solutions. Sandy has 30 years of experience in nutrition, food security, public health, and program management. She also served as A&Ts Regional Director for Africa.
Nadra Franklin	FHI Solutions	Managing Director of FHI Solutions	Global	Nadra Franklin serves as the Managing Director of FHI Solutions, FHI 360's nonprofit subsidiary focusing on programs not funded by the United States government that promote healthy growth and development through nutrition. Franklin's extensive experience in health research and implementation strongly positions her to lead this game-changing initiative.
Tobias Stillman	FHI 360	Director of Nutrition	Global	Tobias Stillman is the Senior Technical Advisor and Lead for the Nutrition and Food Security Division.

TABLE 5. STAKEHOLDER ENGAGEMENT ROSTER				
NAME	**COMPANY**	**TITLE**	**GEOGRAPHIES**	**DESCRIPTION**
Om Prasad Gautam	WaterAid	Senior WASH Manager, Hygiene	Global	Om Prasad Gautam is the Senior WASH Manager at WaterAid. Om Prasad is a public health expert and behavior change scientist with more than 22 years of work and research experiences in WASH, public health, behavior change, food hygiene (FH)/safety, and child health research.
Stephen Sara	Save the Children	WASH Lead Advisor	Global	Stephen Sara is the WASH Lead Advisor at Save the Children. Stephen is a global health professional with interests in WASH as it relates to maternal, newborn, child health, and nutrition.
Nicole Weber	Save the Children	WASH Lead Advisor	Global	Nicole Weber is the Lead Advisor, WASH, at Save the Children. Nicole serves as the technical director for the WASH component of the PRO-WASH & SCALE projects.
Mary DeCoster	Food for the Hungry, Inc.	Director of SBC Programs	Ethiopia	Mary DeCoster is the Director of Social and Behavioral Change Programs at Food for the Hungry, Inc. Mary is a recognized expert on the Care Groups approach and has provided technical support, training, and coaching to staff from many organizations on the use of Care Groups to promote behavior change in vulnerable communities.
Steward Goodwin	Food for the Hungry, Inc.	WASH Manager	Ethiopia	Steward Goodwin is the WASH Manager at Food for the Hungry, Inc.
Phil Moses	Food for the Hungry, Inc.	Director of Health Programs	US HQ/Ethiopia	Phil Moses is the Director of Health Programs at Food for the Hungry, Inc.
Chris Prottas	Water Trust	Executive Director	Uganda	Chris Prottas is an Executive Director at the Water Trust. Chris specializes in evidence-based programs to sustainably improve water and sanitation.
Country-Level Stakeholders				
Walter Mwasaa	CARE	Takunda Chief of Party	Zimbabwe	Walter Mwasaa is the Chief of Party of Takunda program implemented by CARE Zimbabwe. His work includes guiding the implementation of livelihood, food security development, and recovery programs.
Delilah Takawira	FHI 360	SBC Technical Advisor, Takunda	Zimbabwe	Delilah Takawira is the SBC Advisor for Takunda, a USAID program implemented by CARE Zimbabwe.
Michael Ghebrab	Feed the Children	Chief of Party	Malawi	Michael Ghebrab is the Chief of Party for the USAID Akule ndi Thanzi, and nutrition program implemented by Feed the Children.
McHenry Makwelero	Feed the Children	Country Representative	Malawi	McHenry Makwelero is the Country Representative for Feed the Children in Malawi.
Aulive Msoma	Feed the Children	Monitoring and Evaluation Director	Malawi	Aulive Msoma is the Monitoring and Evaluation Director for USAID Akule ndi Thanzi.
Bruce Uwonkunda	Water for People	Deputy Chief of Party	Rwanda	Bruce Uwonkunda is the Deputy Chief of Party for THRIVE WASH Activity.

TABLE 5. STAKEHOLDER ENGAGEMENT ROSTER				
NAME	**COMPANY**	**TITLE**	**GEOGRAPHIES**	**DESCRIPTION**
Uwineza Liliane	CARE	WASH Technical Advisor	Rwanda	Uwineza Liliane is the WASH and SBC Technical Advisor for CARE in Rwanda.
Nicaise Ugabinema	CARE	Project Manager	Rwanda	Nicaise Ugabinema is the Health and WASH Technical Program Manager for CARE in Rwanda.

STAKEHOLDER INTERVIEW GUIDE

Note: We used this interview guide to conduct stakeholder interviews. However, these were conducted as unstructured interviews, and, in accordance with qualitative research and interviewing best practices (Tolley et al. 2016), interviewers explored topics that extended beyond these questions where necessary and may not have covered all questions stated in the guide in every interview.

Purpose:

We are working to learn more about your background and identify WASH and social and behavior change (SBC) research priorities to inform USAID WASHPaLS #2 SBC research agenda and approach in our own research going forward. We are particularly interested in global WASH and some of its subcategories, such as domestic hygiene.

We are conducting interviews with experts in WASH like yourself. Your feedback and recommendations will be shared internally at FHI 360 to help guide our work and externally as part of reports and presentations for our IPs, USAID, and other WASH stakeholders. We will not directly attribute your answers without permission.

Interview Questions:

BACKGROUND

1. Can you tell me a little about your most recent work in WASH?
    a. Can you tell me about any background you have in SBC or SBC research for WASH?
2. Were you involved in WASHPaLS 1?
    a. If so, what was the extent of your involvement?
    b. If not, are you familiar with the activities from WASHPaLS 1?
    c. What do you think would be a relevant research follow-on from WASHPaLS 1?

RESEARCH PRIORITIES

3. What are your top priorities in global WASH research as it relates to SBC?
    a. What would you consider to be a research priority in terms of SBC and hygienic environments (HEs)?

        [Probe: focus on flooring, effects of HEs on infants and young children (IYC)]

    b. What would your priorities be regarding SBC and handwashing (HW) research?

        [Probe: environmental nudging with HW, domestic HW]

    c. What do you consider to be the most important research priority for FH?

        [Probe: FH in households, effect of low FH on IYC]
4. Which countries would you prioritize for SBC and global WASH research?

5. How do these priorities intersect with or differ from USAID's WASH priority countries and these countries' SBC research needs?

   [remind them of priority countries if necessary: DRC, Nigeria, Ethiopia, Nepal, Afghanistan, Ghana, Haiti, India, Indonesia, Kenya, Liberia, Madagascar, Mali, Mozambique, Senegal, South Sudan, Uganda, and Tanzania]

COLLABORATIVE OPPORTUNITIES

6. Are there any current projects or organizations that you are aware of that are implementing WASH SBC programming relevant to hygienic environments, handwashing, and/or food hygiene(?) with whom FHI 360 could partner to conduct research?

CLOSING

Before we end our interview, do you have any final thoughts or comments that you would like to share? Thank you for taking the time out of your schedule to speak with me about WASH research and SBC.

ANNEX C. STAKEHOLDER INPUT AND PARTNERING OPPORTUNITIES SUMMARY TABLES

TABLE 6. SUMMARY OF STAKEHOLDER INPUT

STAKEHOLDER GROUP	HES: FLOORING	HES: IYC FECES DISPOSAL	HES: ANIMAL MANAGEMENT	HW	FH
USAID/Washington, DC Technical SMEs (WASH, SBC, Nutrition)	• Indoor and outdoor flooring is a costly investment. • The team needs more evidence for indoor flooring and outdoor flooring at the feasibility stage. • Desirable interventions require very little behavior change communication (BCC) for uptake and sustainability.	• There is a high priority for HE interventions and WASHPaLS I gives promising evidence. • The team needs to better understand/ gather better data on latrine use among young children (YC). • Adaptation across contexts is key.	• One Health approaches to HEs necessitate looking at fecal contamination from animals. • This can be combined with livelihood interventions/ activities. • There is relatively less interest on the productive use of animal manure; this is something to explore with IPs contingent on potential complementary program activities.	• HW has a relatively lower priority, given the desire to minimize intensive BCC. • There is interest in identifying nudges. The team recognizes that evidence in this area is scant. • Behaviors around latrine use and food preparation/consumption need to be considered separately	• FH spans WASH and nutrition sectors and must keep WASH lens. • There is a high potential to integrate FH with HW study. • FH is related to food preparation and storage. • The team needs to account for infrastructure for refrigeration and identify small, doable actions that can be implemented in rural settings without electricity.
Global WASH Researchers (University of Florida, LSTHM, UC Berkely, World Vision)	• Indoor and outdoor flooring is a costly investment. • The team needs more evidence for indoor flooring and outdoor flooring at the feasibility stage. • Layering flooring interventions with other HE interventions has very little evidence.	• Latrine use among young children is a changeable behavior, with promising evidence from WASHPaLS I that can be adapted to other contexts. • Proper IYC feces disposal is critical behavior for improving HE broadly. • IYC feces disposal does not offset exposure to animal	• There is a need to move beyond reducing/eliminating animal feces in the home to play spaces where IYC may be exposed. • Campylobacter is a particularly important pathogen, primarily from chickens. • Nighttime cooping/penning may be more feasible and still effective.	• Water access is critical. • A HW station near the latrine is the nudge. • There is promising research on how to nudge HW behaviors associated with food preparation and feeding. • There needs to be a focus on caregiving socioeconomic context, structure, and environment. • There is a strong potential to integrate HW with FH research.	• FH needs to be understood within the caregiving context. • Hazard analysis data is extensive, but observational data is needed to understand how sociocultural factors influence key hygienic behaviors and contamination points. • The team must consider the constraints of refrigeration and electricity and explore

TABLE 6. SUMMARY OF STAKEHOLDER INPUT					
STAKEHOLDER GROUP	**HES: FLOORING**	**HES: IYC FECES DISPOSAL**	**HES: ANIMAL MANAGEMENT**	**HW**	**FH**
		feces among IYC; this can be included in multicomponent interventions.		• Behaviors around latrine use and food preparation/consumption need to be considered separately.	cheap options for cooling and storage.
Programmatic SMEs (SBC, WASH, Nutrition)	• Health and behavior change programs do not typically include flooring as part of their interventions/activities. • Nutrition programming is moving away from WASH interventions generally, given the findings of SHINE randomized controlled trial (RCT).	• Health and behavior change programs often address latrine use and could incorporate use/adaptation for IYC. • A nutrition and maternal health program intervention platform using a care group could be ideal for promoting safe disposal of IYC feces.	• Animal penning/cooping can be costly because of feeding requirements—free-range grazing and scavenging. • Although nutrition programming is moving away from WASH interventions generally, this intervention is often included in livelihood interventions and can be viable.	• Health and behavior change programs often address HW at critical times, and more evidence is needed on how to move this intractable behavior. • There is a strong potential to integrate HW behavior interventions with FH. There is a particular need to understand HW behaviors associated with food preparation and feeding.	• Health and behavior change programs often address latrine use and could incorporate use/adaptation for IYC. • There is increased attention on food safety issues in the nutrition sector, especially absorption of pathogens in the gut.
Country-Level Stakeholders (USAID Mission Field Staff, Potential IPs	• This is an expensive intervention; there are no program funds to support this intervention. • Market infrastructure may not be present. • Global inflation will influence the ability of participants to purchase flooring. • Participants might consider lower-cost alternatives, such as playmats, fenced-in play areas, and/or playpens.	• Proper IYC feces disposal is a relevant activity for Rwanda and Malawi. • This topic is part of a care group model to promote behavior change. • The team can include exploratory research to adapt enabling technologies to local context.	• Ethiopia Resilience and Food Security Activity (RFSA) is the only project doing this intervention.	• There is interest in combining this with FH studies, especially to look at HW behaviors at critical times related to food preparation and consumption.	• Nutrition programs are particularly interested in understanding FH as it relates to complementary feeding and dietary diversity interventions.

TABLE 7. MATRIX OF OPPORTUNITIES				
COUNTRY	**PROJECT(S)/ PRIME AND KEY PARTNERS**	**ALIGNED WASHPALS #2 SBC RESEARCH QUESTIONS**	**KEY PROJECT INFORMATION PERTAINING TO RESEARCH OVERLAP**	**COLLABORATION PROGRESS, POINT OF CONTACT ROLES ENGAGED (STATUS AS OF JUNE 2022)**
Ethiopia	Project name: SPIR II Project type: RFSA Prime implementer: World Vision Research partner (RP): International Food Policy Research Institute	HEs Safe disposal of IYC feces Animal penning/cooping	• Baseline data is being collected in July for a RCT evaluation focusing on nurturing care groups (NCGs) that could incorporate a WASH component. • There is potential to add a complementary stand-alone study for HEs. • The most feasible interventions are animal penning, IYC safe feces disposal, and hygienic behavior promotion through NCGs. • Flooring intervention is possible, but it is complicated by being a market-based service and Earth Enable is just starting up in the country. • There have been extensive conversations with headquarters (HQ) and project staff; Nga has had minimal email communication with the mission. • Note: Ethiopia requires Congressional approval, which may significantly delay a study in this country.	Conducted several conversations with the prime implementer and one including the RP. IP HQ staff are fully engaged and supportive, Project Chief of Party is supportive, and the RP is supportive. Discussed with: • Prime implementer: Yes • Research/SBC/other pertinent subcontractor: Yes • USAID Mission field staff: No
Ghana	Project name: E-WASH Project type: WASH Prime implementer: Global Communities Research partner: Aquaya	Safe disposal of IYC feces	• The project just began start-up in 2022. • There is a primary emphasis on latrine construction and use; overlap with young children latrine use. • The program has a community engagement approach, working to create community health plans centered on latrine construction, use, accessibility, and sustainability. • Will collaborate with USAID Accelerating Social and Behavior Change project to promote latrine use and open-defecation-free zones. • There is a partnering project within a concentrated zone of influence in Northern Ghana: seven total USAID IPs working in the zone.	Conducted initial discussion with prime implementer, but this was not pursued further given extensive presence of other activities in the same program area. Discussed with: • Prime implementer: Yes • Research/SBC/other pertinent subcontractor: No • USAID Mission field staff: No
Malawi	Project name: Tiwalere 3 Prime implementer: Feed the Children	Safe disposal of IYC feces HW nudges FH	• This project is using a care group model to deliver nutrition/WASH interventions including SBC at various times (before feeding baby, before cooking, and after using toilet). • Water technology new to Tiwalere that can engage more with communities and facilitators can take group input.	Conducted conversations with USAID field staff, including nutrition and SBC leads. There is strong Mission and HQ support within USAID. Discussed with: • Prime implementer: No

TABLE 7. MATRIX OF OPPORTUNITIES				
COUNTRY	**PROJECT(S)/ PRIME AND KEY PARTNERS**	**ALIGNED WASHPALS #2 SBC RESEARCH QUESTIONS**	**KEY PROJECT INFORMATION PERTAINING TO RESEARCH OVERLAP**	**COLLABORATION PROGRESS, POINT OF CONTACT ROLES ENGAGED (STATUS AS OF JUNE 2022)**
	Subs include: Total LandCare		• Note: There is potential overlap/integration with World Vision project with the Government of Malawi implementing nationwide care group model.	• Research/SBC/other pertinent subcontractor: No • USAID Mission field staff: Yes
Rwanda	Project name: Isoko y'Ubuzima (Thrive WASH) Prime implementer: Water for People Subs include: CARE, IRC	Safe disposal of IYC feces HW nudges FH	• Although the focus is more on market-based demand creation for sanitation productions rather than individual behaviors, there is potential to include relevant, complementary studies related to WASHPaLS #2 focal area 3. • The project is in discussion with Earth Enable. • Working in concert with Ministry of Health Community-Based Environmental Health Promotion Program • The team could look at outcomes that measure adoption rates of enabling technologies, such as floors or coops, including predictors of early adopters. • The program area overlaps in five districts with USAID Early Childhood Development (ECD) project where the team could look at impacts of interventions at the intersection of WASH and nutrition. • There was an initial meeting with Water for People country staff and USAID/Rwanda. • There is high interest but competitive field; two other WASHPaLS studies also vying for partnership.	Conducted conversations with USAID field staff, including nutrition and WASH leads. There is strong Mission and HQ support within USAID. Also met with the program team, who is supportive. Discussed with: • Prime implementer: Yes • Research/SBC/other pertinent subcontractor: N/A • USAID Mission field staff: Yes
Rwanda	Project name: Improved Nutrition and Early Child Development Gikuriro Kuri Bose Prime implementer: Catholic Relief Services Research partner: Data for Impact	HW nudges FH	• The project has high research needs but lacks research partners and staff. • There are FH research needs that overlap with interventions targeted at addressing stunting—complementary food and hand hygiene behaviors for children under six months need to be studied. • The program areas overlap with WASH project in five districts.	Conducted conversations with USAID field staff, including nutrition and WASH leads. There is strong Mission and HQ support within USAID. Discussed with: • Prime implementer: No • Research/SBC/other pertinent subcontractor: No • USAID Mission field staff: Yes

TABLE 7. MATRIX OF OPPORTUNITIES				
COUNTRY	**PROJECT(S)/ PRIME AND KEY PARTNERS**	**ALIGNED WASHPALS #2 SBC RESEARCH QUESTIONS**	**KEY PROJECT INFORMATION PERTAINING TO RESEARCH OVERLAP**	**COLLABORATION PROGRESS, POINT OF CONTACT ROLES ENGAGED (STATUS AS OF JUNE 2022)**
Zimbabwe	Project name: Takunda Prime implementer: CARE SBC partner: FHI 360 RFSA	HW nudges	• Previous studies showed a lack of HW after changing a child's diaper and before cooking due to forgetting, so a nudging study would be a valid follow-on. • The study would follow and complement an in-progress PRO-WASH Human Centered Design study to improve latrine design, construction, and maintenance. • There was an initial meeting with the Chief of Party, SBC lead, and USAID. • There were significant concerns about water scarcity, abject poverty, other research priorities, and demands on the team. • This is likely to be a very small, focused study.	Conducted conversations with USAID field staff, including nutrition and WASH leads. There is strong Mission and HQ support within USAID. Discussed with: • Prime implementer: Yes • Research/SBC/other pertinent subcontractor: Yes • USAID Mission field staff: Yes

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