

2020 Handwashing Research Summary



About the Research Summary

Since 2012, the Global Handwashing Partnership has synthesized the latest handwashing research, highlighting key findings, and providing guidance on handwashing best practices for academics and implementers. In 2020, handwashing with soap was spotlighted as an important measure to prevent the spread of COVID-19. The research covered in this summary reflects this heightened interest in handwashing, both as a response to the COVID-19 pandemic and as a sustainable public health measure as the pandemic passes.

The Global Handwashing Partnership searched NCBI and Global Health databases to identify peer-reviewed articles for inclusion in the 2020 research summary. Articles were filtered by publication dates between January 1, 2020 and December 31, 2020. Search terms included: handwashing, hand hygiene, hand disinfection and other variations. We also included terms for specific settings and integrated issues, such as nutrition, education, healthcare facilities, and COVID-19.

We included a series of criteria to manage the scope of this research summary. Only articles published in peer-reviewed journals in 2020 were included in our analysis. We placed no limitations on geographic location, setting, or language. In total, there were 133 articles that fit these criteria. Articles were categorized based on a study's primary outcome. Additional tags were used to identify studies that fit into multiple categories. Articles were reviewed to identify key takeaways.

Research Highlights for 2020

In this section, we summarize research highlights from 2020. We identified key themes within the handwashing research and summarized findings as such:

- Handwashing Benefits
- Handwashing Access and Supplies
- Handwashing Behavior
- Handwashing Programs in Specific Contexts
- Handwashing and COVID-19

Handwashing Benefits

Research published in 2020 reinforces what was already known – handwashing has cross-cutting benefits. Studies in 2020 focused on handwashing benefits related to nutrition and early childhood development, diarrheal disease, and neglected tropical diseases. Beyond the research highlighted, we know that handwashing has a positive effect on other education, health, and economic outcomes.

The latest research confirms that poor access to water, sanitation, and hygiene (WASH) facilities can negatively affect child growth and development. A cross-sectional study in rural North Central Ethiopia found that the prevalence of diarrheal disease among children under five in non-open defecation-free areas was 41% compared to 19% in open-defecation-free zones ([Tafere et al., 2020](#)). Ethiopia's community-led total sanitation and hygiene strategy targets ending open defecation, hygienic use of toilets, and handwashing at critical times. In this case, the lack of functional handwashing facilities and improper excreta disposal were significantly associated with diarrheal diseases among children under 5. Another cross-sectional study examined the association of nutrition and WASH practices on children's nutritional status, intestinal parasitic infections, and diarrhea in rural Nepal ([A. Shrestha et al., 2020](#)). Handwashing, nutrition, and health interventions included in the study resulted in lower stunting (20% to 18%), decreased anemia (33% to 32%), decreased intestinal parasitic infections and improved hygiene behaviors.

Proper and consistent hand hygiene practices can also be protective against neglected tropical diseases. Handwashing with soap was found to be a key factor in preventing soil-transmitted helminth (STH) infections among children. One study explored the prevalence and risk factors associated with STH infections among children from Bhubaneswar, Odisha in India ([Mahapatra et al., 2020](#)). The study found STH infections were 12% less likely in those children practicing handwashing with soap. Another study investigated the prevalence of *Toxocara canis* (dog roundworm) or *T. canis* infection and its associated risk factors among primary school-aged children in rural Thailand ([Phasuk & Punsawad, 2020](#)). Lack of handwashing before meals was revealed as a significant risk factor. Children who did not practice proper handwashing before meals had more than 2 times greater odds of acquiring *T. canis* infection.

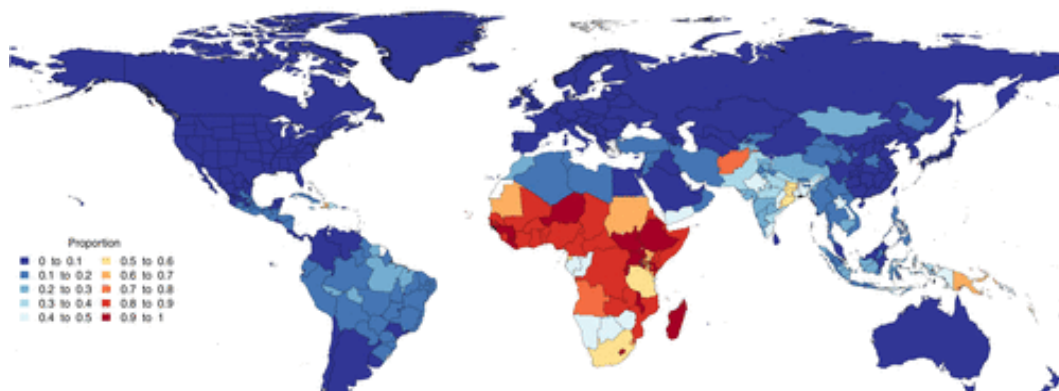
WASH in combination with other interventions proved beneficial for early childhood development. The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) trial in Zimbabwe found that compared to the arm with standard care, children in the infant and young child feeding (IYCF) plus WASH arm had higher total child development scores as measured by the Malawi Developmental Assessment Tool (mean difference +4.6) as well as higher MacArthur Bates vocabulary scores (+8.5 words) ([Chandna et al., 2020](#)).

What does this mean? Overall, studies published in 2020 substantiated the role hand hygiene plays in preventing diseases and ensuring improved nutrition and early childhood development. Further research should be conducted to showcase the economic benefits of handwashing, as this is fundamental to ensure adequate investment for hand hygiene within programs and policies.

Access and Supplies

Research continues to suggest that inequalities in access to handwashing facilities or supplies disproportionately affect low- and middle- income countries. Recent reports indicate over 40% of the global population lack a basic handwashing facility in their home with over 50% of the population in sub-Saharan Africa and Oceania lacking access to a facility with soap and water ([Brauer, Zhao, Bennitt, & Stanaway, 2020](#)). A review from the Demographic and Health Surveys (DHS) of 16 countries in sub-Saharan Africa found in-country disparities, with inequalities in access to water and soap among the poorest households and rural residents who represent the majority of the population in most countries examined in this study ([Jiwani & Antiporta, 2020](#)). In a refugee setting in Uganda, only 30% of households had access to a handwashing facility with soap and water ([Namara, Mendoza, Tumukunde & Tsebeni Wafula, 2020](#)).

Proportion of population with no access to handwashing station with soap and water in 2019



Estimated proportion of population with no access to a handwashing station with soap and water. Source: [Brauer et al., 2020](#).

Studies examined solutions that can be used for handwashing in settings with limited water, soap, or alcohol-based handrubs. A systematic review by [Mbakaya, Kalembo and Zgambo \(2020\)](#) assessed the use, benefits, adoption and effectiveness of the tippy tap, a common do-it-yourself solution. The authors found that the availability of tippy taps can increase handwashing initially and may be useful in promoting handwashing practice in resource-constrained settings. However, while tippy taps provide a ubiquitous solution, they are often not maintained, and practitioners should consider the potential deleterious effect they have on handwashing practices in the long-term. Several studies compared alternative materials to soap and water such as the use of sand, soil, ash, seawater, or alkaline materials ([Kivuti-Bitok, Chepchirchir, Waitthaka & Ngune, 2020](#); [Paludan-Müller, Boesen, Klerings, Jørgensen & Munkholm, 2020](#)). The studies highlighted several methods for decontaminating hands, either physically or chemically damaging microbes through alkaline products (ash), increased temperature, and reduced humidity (drying). While these alternative materials can be used as stop-gap options in the absence of soap and water or alcohol-based handrub, there is still some uncertainty around the adverse effects of these alternative measures on the people that use these methods.

Other studies focused on the efficacy of commercial products used for hand hygiene. With focus around COVID-19, several studies evaluated a range of commercially available products including soaps and alcohol-based handrubs for antiviral efficacy against SARS-CoV-2. Results from these studies re-affirmed the recommendations that proper hand hygiene can significantly reduce SARS-CoV-2 viral load on hands ([Mukherjee, Vincent, Jayasekera & Yekhe, 2020](#); [Berardi et al., 2020](#); [Kratzel et al., 2020](#)). Beyond COVID-19, one study by [Khairnar et al. \(2020\)](#) compared the efficacy of hand sanitizer, liquid soap, and the combination of both for reducing microbial colonies on the hands among dental students. Using a single-blinded randomized controlled trial, the study found that all three interventions were equally effective with the reduction of total bacterial contamination on the hands of participants, suggesting sanitizers can be used effectively in the absence of soap and water. Furthermore, studies tested the efficacy of WHO-recommended modified handrub formulations compared to the original formulations, with results showing improved product efficacy among modified formulations with higher alcohol concentration for the hygienic preparation of hands for surgery and other clinical interactions ([Suchomel, Steinmann & Kampf, 2020](#); [Suchomel et al., 2020](#)).

What does this mean? Over 40% of the global population lack a basic handwashing facility in their home. Disparities in access can be seen both between and within countries. For those that lack access to soap and water, there are alternatives to ensure proper hand hygiene. The use of alcohol-based handrubs have been proven to reduce contamination on hands. Likewise, alternative solutions can be used as stop-gap efforts in resource-constrained settings.

Handwashing Behavior

Despite the act's simplicity, improving handwashing practice must be supported, reinforced, and mainstreamed as a critical behavior that should be practiced multiple times a day. Academics and practitioners have increasingly recognized the need to address a range of behavioral determinants that go beyond knowledge to address handwashing behavior.

Behavioral Determinants

The latest research examined the association between behavioral determinants, such as social norms, affiliation, and enabling infrastructure, and handwashing behavior within different contexts, highlighted below.

Households - An integrative systematic review by [White, Hasund Thorseth, Dreibelbis, & Curtis \(2020\)](#) was the first of its kind to systematically map and appraise the strength and quality of evidence for handwashing determinants in domestic settings. In total, 50 meta-associations of determinants (determinants that were mentioned in more than 3 studies) were included in the analysis. There were 6 positive meta-associations deemed to be supported by good evidence related to handwashing infrastructure, stage and props (handwashing facility with soap and water present, handwashing facility near toilet and/or close to kitchen, having handwashing facilities that are desirable and user friendly, and having piped water close to the household). Other positive meta-associations that were considered to have good evidence included feeling that your handwashing was being observed due to the presence of others in the bathroom, living in certain geographic environments and having a young child in the family.

Healthcare Facilities - Studies identifying behavioral determinants within healthcare settings found that enabling technologies, social norms, and increased interactions with patients and other staff increased hand hygiene rates among health care staff in the United States and Tanzania ([Sands & Aunger, 2020](#); [Gon et al., 2020](#)). An institution-based cross-sectional study conducted at the University of Gondar Hospital in

What is a Behavioral Determinant?

Behavioral determinants are factors which can be modified to prompt changes in behavior.

Below is a list of key determinants from the studies in this summary:

- **Social norms** – Beliefs and understandings among a certain group
- **Affiliation** – A person's connections or relationships
- **Enabling Infrastructure or Technologies** – Access and placement of a handwashing facility
- **Disgust** – A person's desire to avoid feces and germs on hands
- **Nurture** – Parents care for and attentiveness to their children
- **Perceived susceptibility** – A person's feelings of personal vulnerability to a disease
- **Perceived severity** – A person's perception of the seriousness of a disease

Northwest Ethiopia assessed handwashing practices among mothers ([Taddese et al., 2020](#)). The study determined that factors such as marital status (odds of handwashing increased by almost 3 times for married mothers) and level of education (literate mothers were over 2 times more likely to practice proper handwashing compared to illiterate mothers) were important determinants of handwashing behavior.

Schools - Several studies explored factors for handwashing among school-aged children. One study found that despite high levels of handwashing knowledge (72%), only 18% of students reported washing their hands after defecation in Ghana ([Fianko & Gawu, 2020](#)). This study suggests that determinants, such as perceived susceptibility and perceived severity of disease must be considered when designing handwashing programs in this particular setting. Another study showcased the importance of enabling infrastructure in schools in Australia ([Ofori et al., 2020](#)). The study deployed a smart handwashing station that provides personalized feedback to nudge school-aged children to practice better hand hygiene.

Humanitarian Settings - One study explored motivational drivers and other determinants for child handwashing within an internally displaced persons camp in Northern Iraq ([Watson et al., 2020](#)). The study reported that children, caregivers, and hygiene promoters associate child handwashing practices with a familial role, environmental factors pertaining to location and quality of handwashing facilities and materials, level of exposure to hygiene promotion, and social norms. Children were also motivated most by play and nurture. Motive-centered interventions targeting play or nurture and addressing familial motivational drivers, such as affiliation and love, may be an effective approach in this context. Another study focused on handwashing determinants among women in internally displaced persons camps and found that perceived susceptibility to disease and perceived severity of disease were important factors of handwashing behavior ([Zangana, Shabila, Heath & White, 2020](#)).

Overall, while our understanding of behavioral determinants remains sub-optimal, handwashing programs will be most successful when using approaches that address a range of key determinants rather than having a sole focus on education about disease transmission.

Monitoring behavior

Monitoring handwashing practice is critical in understanding overall behavior to better design programs; however, handwashing can be challenging to monitor. The latest research focuses on the use of electronic monitoring systems to measure hand hygiene compliance in healthcare settings. Recent studies examined various forms of electronic monitoring, including covert close-circuit television (CCTV) monitoring as well as specific sensor-based monitoring technologies such as SaniNudge ([Livshiz-Reven et al., 2020](#); [Iversen et al., 2020](#)). A study by [Gould, Lindström, Purssell & Wigglesworth \(2020\)](#) evaluated five electronic monitoring systems for hand hygiene adherence with respect to data accuracy and their ability to avoid the Hawthorne effect (change in behavior in response to observational awareness). Findings suggest there was concordance

between hand hygiene adherence assessed by manual observers (direct observation) and the electronic monitoring systems during 84% of the occasions. As participants became more aware of being observed through manual observation, hand hygiene performance increased 3-fold. Electronic monitoring systems were able to avoid this effect. A metric that generates a quantitative measure of hand cleanliness by comparing the dirt wiped from a hand to a color chart was developed and tested by [Delea et al. \(2020\)](#). The metric produces more nuanced data than conventional qualitative metrics, such as proxy indicators or observations, and could provide a reliable tool to collect more quantifiable data moving forward.

What does this mean? Despite being a simple act, handwashing behavior is notoriously difficult to measure and sustain. More research is needed to better identify and define handwashing determinants which will lead to habit formation. Likewise, accurate measurement of handwashing behavior will be critical to understand true handwashing practice rates.

Handwashing Programs in Specific Contexts

There is no single best practice to motivate improved handwashing, as determinants range by setting. Thus, designing and implementing handwashing programs can and should be adapted to the different contexts, including community settings, healthcare facilities, households, schools, and workplaces, as highlighted below.

Community - The use of community engagement activities is critical to improve hand hygiene in community or public settings. For example, one study explored the use of community engagement activities to improve hand hygiene and other preventive practices for COVID-19 in the Kilimanjaro region of Tanzania ([Mboya et al., 2020](#)). Suggested interventions include targeted and mass promotion campaigns through community leaders, public announcements, and radio shows. Likewise, the use of nudges such as visual aids and access to foot-pedaled handwashing facilities were found to improve the practice of hand hygiene and social distancing in a community setting. While mass media campaigns were critical in addressing misinformation, it is most important to develop context-specific prevention strategies in the community.

Healthcare Facilities - Multimodal strategies have proven to be most effective in addressing hand hygiene compliance in healthcare settings. These strategies use a variety of tactics, including improving access to hand hygiene supplies, training and education, observation and feedback, reminders in the facility, and creating a culture of hand hygiene among healthcare staff. [Teasing et al. \(2020\)](#) produced promising results using a multimodal intervention which increased hand hygiene compliance from 12% for the control group to 36% among the intervention group. [Yousef et al. \(2020\)](#) also used the modified WHO multimodal strategy, with focus on frequent training and follow up, to address hand hygiene compliance which started at

28% and increased to 58% in a hospital in Cairo. Another multimodal intervention implemented in a gynecology and obstetrics center in Vietnam resulted in hand hygiene compliance moving from 21% up significantly to 75% ([Phan et al., 2020](#)).

Households - In a home setting, influencing determinants could include access to enabling technologies (access and placement of a handwashing facility) or emotional drivers, such as affiliation or nurture. One study indicated the need for an improved value chain to ensure safely managed sanitation services and hygiene behavior change in Tanzanian households ([Mshida et al., 2020](#)). This would involve integrating hygiene behavior change promotion into ongoing WASH programs and planning safely managed sanitation services for households in Babati, Tanzania.

Schools - Several studies showcase interventions to improve handwashing knowledge and practice in school settings. One study found the use of digital technologies, including computer games and videos, to be effective in improving knowledge and practice of proper handwashing among school-aged children ([Ofori et al., 2020](#)). Several programs used educational resources, such as books, websites, songs, and Glo Germ (a visual tool to demonstrate the effectiveness of a person's handwashing technique) to yield significant improvements in handwashing behavior among preschool-aged children ([Younie et al., 2020](#); [Dingman et al., 2020](#)). Also, the use of Persuasive Space Graphics (images and messages integrated within an architectural environment that encourage specific actions) proved to be an efficient, low-cost means of promoting hand hygiene. In a study conducted in the United Kingdom, persuasive space graphics increased quality and frequency of handwashing in the primary school setting ([Rutter et al., 2020](#)). Teacher-led handwashing promotion can also be an effective way to achieve behavior change. A 4-week "School of Five" program promoting handwashing with soap led to an overall 15% improvement in handwashing in the treatment group vs. the control group ([Tidwell et al., 2020](#)).

Workplaces - The workplace is an often-neglected setting for handwashing interventions, yet both formal and informal workspaces can provide settings for a high transmission of disease. A review by [Gravina et al. \(2020\)](#) suggests that workplaces would be more effective at reducing the transmission of illnesses by improving hand hygiene protocols, cleaning and disinfection procedures, sick leave and attendance policies, and personal protective equipment (PPE) protocols. Two other studies published in 2020 measured hand hygiene compliance in two separate work settings (a factory and food manufacturing environment) ([Pan et al., 2020](#); [Evans, Samuel & Redmond, 2020](#)). Pan et al. (2020) conclude that 71% of factory workers adhere to consistent hand hygiene within one Chinese factory. Evans, Samuel & Redmond (2020) found that only 3% of workers in high-care areas of a food manufacturing facility complied with proper hygiene practices. These studies suggest the need to develop a better culture of hand hygiene in all work settings, and there is a particularly acute need in some workplaces.

What does this mean? Because behavioral determinants vary by target audience and setting, it is important to understand how programs should vary by setting based on key motivating factors. When designing and implementing a handwashing program, it is important to design interventions that are context-specific to trigger and maintain handwashing practice.

COVID-19

The importance of hand hygiene has become more recognized over the last year, as the spread of COVID-19 rapidly emerged into a pandemic. Some studies assessed how the COVID-19 pandemic has impacted hand hygiene behavior. According to [Zakout et al. \(2020\)](#), COVID-19 has increased hand hygiene rates upon arrival at home, using soap and sanitizer, and wearing face masks in Saudi Arabia. Some studies found positive associations between hand hygiene behavior and a person's gender, education level, and occupation type ([Guzek et al, 2020](#); [Huong et al., 2020](#); [Chen et al., 2020](#)). Hand hygiene in public settings remains a challenge. A study by [Bonful et al. \(2020\)](#) suggests that hand hygiene compliance in public transportation stations in the Greater Accra region remains poor and that enforcement is needed to maintain handwashing and social distancing practices. A study by [Mboya et al. \(2020\)](#) suggests mass public health campaigns are critical to inform and update the public to ensure handwashing compliance both during COVID-19 and beyond.



Community social mobilizers wash their hands before a vaccination campaign. Photo Credit: UNICEF

Research Analysis

We appraised the overall quality and relevance of research published in 2020 by calculating a composite score ranging from 0 to 5. Scores were calculated using the following criteria to assess study quality: articulated research question and study design (0-2) and valid and reliable results (0-1). We also scored each study on whether it had practical and/or novel findings (0-2), which assessed study relevance. Criteria definitions are included in the table below.

Criteria	Definition
Study Design	The study has a clearly focused research question and an appropriate study design to answer that research question. Total score between 0 and 2.
Valid and Reliable Results	The study presented valid and reliable results for the primary outcome. This requires a study to examine handwashing behavior beyond self-reported data. We also examined sample size and follow-up methodology to appraise the research. Total score between 0 and 1.
Practical Findings	The study presented useful findings for non-academic practitioners. An additional point was added if the study showcased a novel tool or approach. Total score between 0 and 2.

Out of 133 studies, 23 studies (17.3%) scored a 3 or below, with many of these studies using self-reported data alone to measure handwashing practices. While this research can be useful, self-reported data does not provide an accurate measure of handwashing rates. Most studies in this summary (n=84; 63.2%) scored a 4, indicating they are of good quality and provide practical findings that may be useful for non-academic practitioners. Studies that scored a 5 were our top research picks for 2020. In total, 24 (18.0%) studies included in this summary scored a 5. Some of these studies were considered pioneering efforts and either included a new tool, such as a novel metric to measure handwashing, or an innovative approach or technology. As a notoriously difficult behavior to study, we felt that studies scoring a 5 brought new insights to the sector.

Key research themes were similar to research from prior years. Studies measuring handwashing behavior focused on a range of determinants, including knowledge, emotional drivers, and enabling technologies. Out of the 81 studies examining handwashing behavior, only 11.1% of those studies addressed multiple behavioral determinants. This suggests that our understanding of behavioral determinants for handwashing remains sub-optimal and further research should be done to strengthen the evidence base.

Studies were conducted in a range of contexts, including households, healthcare facilities, schools, workplaces, humanitarian settings and communities. Some studies addressed multiple

settings. In total, 5% of studies were conducted in households, 39% in healthcare settings, 19% in schools, 2% in workplaces, 3% in humanitarian settings, and 33% in community settings. Studies published in 2020 had an increased focus on hand hygiene programming in healthcare facilities and community settings as part of the COVID-19 response. While many studies addressed COVID-19 in 2020, it will be more critical to assess the impact of COVID-19 for the ongoing practice of hand hygiene and build on the lessons learned for hand hygiene in the future.

Overall, research published in 2020 reinforced previous themes in hand hygiene and highlighted evidence gaps for further research.



Photo Credit: United Purpose

Conclusion and Practical Recommendations

This research summary is reflective of the emerging interest of hand hygiene as a preventive measure. While 2020 catapulted handwashing into the spotlight, it will be important to maintain this momentum moving forward. As previously seen with other disease outbreaks, the rates of handwashing may reduce as risk perception decreases around COVID-19, and it will be important to implement efforts that address disparities in access and induce hand hygiene habits. We have included a set of practical recommendations that build on the evidence pulled for this summary below.

Identify behavioral determinants for handwashing.	<p>This summary suggests that further research should be done to strengthen the evidence base around handwashing determinants. When designing handwashing behavior change programs, it is important to identify key behavioral determinants and design your activities to address these. There are many tools and frameworks, such as COM-B, Behaviour Centred Design, Designing for Behavior Change, IBM-WASH and RANAS, to help identify and conceptualize the range of behavioral determinants which programs should target.</p>
Ensure access to a desirable and conveniently located handwashing facility with soap and water.	<p>Evidence suggests that one of the greatest opportunities to improve handwashing with soap includes the establishment of handwashing facilities and supplies, as these can act as a cue or reminder for handwashing and can work to overcome some of the perceived effort and other psychological trade-offs that may prevent handwashing.</p>
Build on what is known.	<p>Assessing the global evidence for handwashing can ensure you apply best practices through your efforts. Consult and confirm with available data, while also noting where gaps remain in the evidence base.</p>
Focus future research efforts on neglected contexts.	<p>In this summary, there was limited focus on hand hygiene in the workplace and humanitarian settings, yet both of these settings are critical for universal improved hand hygiene and require further research.</p>
Visit the Handwashing Handbook landing page.	<p>In 2020, the Global Handwashing Partnership published a comprehensive guide to handwashing and hand hygiene programming that is built on similar evidence presented in this summary. The handbook proposes ways to drive hand hygiene advocacy, reflects on the psychological research for habit formation, and provides tips for using a systems approach to scale up handwashing.</p>

View all of the studies pulled for this summary [here](#). Visit the Global Handwashing Partnership website for additional handwashing resources [here](#).

Acknowledgements

This research summary was prepared by Aarin Palomares (Global Handwashing Partnership), Ezlie Perez (Global Handwashing Partnership), and Kelly Sholz (Pfizer). Technical reviews were conducted by Aeorangajeb Al Hossain (FHI 360/Global Handwashing Partnership), Ron Clemmer (FHI 360/Global Handwashing Partnership), and Alexandra Czerniewska (London School of Hygiene and Tropical Medicine/COVID-19 Hygiene Hub).