Handwashing Research Summary

What we learned about handwashing in the first half of 2016

Between January and June 2016, 32 relevant peer-reviewed studies on handwashing were identified.

Behavior Change

Evidence increasingly demonstrates that cues and emotional drivers can impact handwashing behavior change.

Handwashing Hardware

In Kenya, a new handwashing system was field-tested and found to improve water and soap efficiency. Researchers developed Povu Poa ("Cool Foam" in Swahili) that included a wooden frame, a rinse water container with water-frugal tap, a container of soapy water (a 50:1 water-to-powdered-soap mixture) with foaming soap dispenser ("soap foamer"), and a runoff collection bucket at the bottom of the frame. Povu Poa only used 357 mL of water and $0.10 of soap per wash, compared to 513 mL of water and $0.20 of soap per wash for conventional jug and basin with bar soap and 1429 mL of water and $0.47 of soap per wash for conventional sink and metal tap with bar soap. The cost for mass production of the Povu Poa system is estimated at $12 per unit, and can pay for itself in 1 year based on savings on the costs of water and soap.[1]

Cues

Disgust-based cues, particularly olfactory cues, were more effective at increasing handwashing behavior than conventional reminder posters.[4] An experiment on handwashing in a food service setting involved 80 Hispanic/Latino participants performing prospective memory while one of the four following handwashing cues was present: 1) disgusting image (visual cues); 2) disgusting sound (auditory cues); 3) disgusting odor (olfactory cues); 4) regular handwashing posters/controls. The probability of handwashing during the experiment was lowest in control (18%), followed by visual cues (40%), auditory cues (40%), and odor (73%).[4]

Non-verbal environmental cues are effective at changing behavior without using traditional methods of behavior change communication.[5] An intervention study in two primary schools in rural Bangladesh showed that the proportion of handwashing after latrine use among students increased from 4% at baseline (no intervention), to 18% after adding handwashing infrastructure, then to 58% after adding the footpaths, and then to 68% after adding the footpath and handprints. The proportion remained at 74% at 2 and 6 weeks post-completion follow-up visits.[5] *This study was presented at the PPPHW's 2016 Handwashing Think Tank. Find more information on the Handwashing Think Tank here.*

The Knowledge-Practice Gap

Improving handwashing knowledge alone is typically insufficient to change handwashing behavior.[6] In India, a handwashing awareness-raising campaign, the Great WASH Yatra, increased knowledge about the benefits of handwashing, but had little effect on changing intention to wash hands with soap.[6]

The knowledge-practice gap is more narrow for handwashing than for treatment of drinking water and sanitation.[7] In Kenya, evaluation of a water, sanitation, and hygiene (WASH) program showed that the knowledge-behavior gap (the percent of respondents who were aware of the importance of the behavior practiced the behavior) in the communities with regard to personal hygiene was smaller (85%) than the gap in treatment of drinking water (49%) and sanitation (37%). The program significantly improved the proportion of handwashing after defecation, but there was a decrease in the proportion of respondents who washed their hands after attending to a child who had defecated.[7]

Hospitalization for cholera can serve as a teachable moment for behavior change in WASH, including handwashing.[8] In Bangladesh, researchers developed and assessed the week-long Cholera Hospital-Based Information for 7 Days (CHoBI7) intervention program. Household members in the intervention arm had significantly higher odds than households in the control arms of handwashing with soap at key times (50% vs. 18%; OR = 4.71; 95% CI = 2.61,8.49) and preparing and using soapy water (71% vs. 9%, respectively).[8]

Implementing and sustaining large-scale hygiene promotion programs is still a challenge.[9,10] For instance, evaluation of UNICEF's assisted WASH program showed that the coverage rate of handwashing places in schools remained inadequate after the end of the program period.[9]

Data collected in response to the Global Analysis and Assessment of Sanitation and Drinking Water 2013/2014 Survey showed large variations by country with regard to the definitions of hygiene and hygiene-related activities. Challenges in hygiene promotion included poor implementation of policies, weak coordination mechanisms, human resources limitations, and lack of available hygiene promotion budget data.[10]

Food Hygiene

A qualitative study in Bangladesh described the food preparation process and handwashing opportunities during food preparation among 24 caregivers in three rural villages. Community members typically ate curry and rice at meals, accompanied by uncooked mashed food and salad that were mixed by hand. Food preparation was interrupted by tasks that could contaminate hands and the preparers would then continue the food preparation process without washing their hands; not all components needed for handwashing were within easy reach.[31]

Benefits of Handwashing

Handwashing halts the spread of infection and is effective in preventing the spread of some diseases, including:

Cholera

In Bangladesh, researchers developed and assessed the efficacy of the week-long Cholera Hospital-Based Intervention for 7 Days using a randomized trial design. The intervention included teaching household members of cholera patients about handwashing with soap and water treatment to initiate standard of care and reduce their risk of contracting cholera. During the intervention period, prevalence of *V. cholerae* infection was 7% in the intervention arm compared to 14% in the control arm. Prevalence of symptomatic *V. cholerae* infection was 0% in the intervention arm vs. 5% in the control arm.[11]

Diarrhea

Studies in Mozambique and India found that self-reported handwashing may have a protective effect against moderate to severe diarrhea (MSD). A comprehensive school-based WASH intervention was associated with lower absenteeism due to diarrhea in Mali.

The Global Enteric Multicenter Study, a multi-country case-control study, assessed the association between shared sanitation facility and MSD in children under the age of five. At five sites in The Gambia, Kenya, Mali, Bangladesh, and Pakistan, this study found that association between self-reported handwashing with soap or ash and MSD was not significant. However, the association was significant at the study sites in Mozambique and India (adjusted matched OR=0.65, 95% CI = 0.45, 0.92 and OR = 0.73, 95% CI = 0.61, 0.88, respectively).[12] As the data is self-reported, interpretation should be made with caution.[13]

In Mali, a WASH intervention was delivered to 100 beneficiary schools that were matched with 100 comparison schools.[14] Pupils in the beneficiary schools had lower odds of self-reported absence due to diarrhea than those in the comparison schools (OR = 0.73; 95% CI = 0.56,0.94). But, the odds of being absent at roll call was higher in the beneficiary schools than in the comparison schools (OR = 1.23; 95% CI = 1.06, 1.42). School-wide WASH interventions resulted in reduced absenteeism due to diarrhea, but not the overall absenteeism rate.[14]

Healthcare-Associated Infections (HAIs)

In the Guizhou Province of China and Kampong Cham Province of Cambodia, improved handwashing compliance is associated with a decrease in prevalence of HAIs. In China, researchers assessed an intervention designed to improve hand hygiene compliance among healthcare workers in a hospital setting; prevalence of HAIs decreased from 3.56% at baseline to 2.25% after the intervention.[15]

In Cambodia, a hand hygiene education program was provided for all healthcare workers in January 2012. After the program, hand hygiene promotional posters were provided and alcohol gel was placed at the sinks of each ward. The surgical site infection incidence at the study hospital decreased from 32.3% in the final quarter of 2011 to 1.0% in the final quarter of 2014.[16]

Helminthic Infections

In Ethiopia, better quality of sanitation and hygiene was associated with lower levels of hookworm infections.[17] In the 2013-2014 Ethiopian national parasitic mapping program, schools with higher sanitation and hygiene scores (i.e., distinguished as those with better availability of latrines with soap or ash, basins, and water for handwashing) had significantly fewer pupils with hookworm infections compared to schools with lower sanitation and hygiene scores (Kendall's tau = -0.08; 95% CI = -0.13, -0.02). Schools with higher sanitation and hygiene scores also had lower infection intensities of certain types of worms (*A. lumbricoides* and *T. trichiura*), but the differences were not statistically significant.[17]

In western Kenya, handwashing at school was associated with lower odds of *A. lumbricoides* in children who attended schools with an improved water source, but was non-significant in schools without improved water sources. The association was stronger among those who washed hands at both school and home in schools with improved water source, but the association was non-significant among students in schools without an improved water source.[19] The benefit of handwashing in preventing *A. lumbricoides* infection varies by whether the school has continuous access to an improved water source.

A cross-sectional study on factors associated with soil-transmitted helminth (STH) infection among preschool-aged children and school-aged children in Kibera Slum, Nairobi, Kenya, showed that drying hands with a clean towel after handwashing was associated with significantly lower odds of STH infection, (adjusted PR = 0.60; 95% CI = 0.40,0.92), while handwashing and other methods of hands-drying did not have significant associations.[18]

Influenza

Self-reported hand hygiene was found to be associated with lower odds of seasonal influenza and influenza-like illness in China. In Fujian Province, southeastern China, 100 laboratory-confirmed cases of seasonal influenza were recruited for a case-control study. Self-reported handwashing practice was measured by a "handwashing score" ranging from 0 to 9. Progressively more frequent handwashing habits were associated with progressively lower odds of seasonal influenza (per unit of handwashing score OR = 0.58; 95% CI = 0.47, 0.72re).[20] A cross-sectional study conducted among 13,003 Beijing residents showed that those who reported practicing optimal hand hygiene had lower prevalence of influenza-like illness (ILI) than those who did not report practicing optimal hand hygiene (44.2% vs. 49.5%, OR = 0.87; 95% CI = 0.80, 0.94). The association was the third-strongest, after associations between ILI and not sharing towels and handkerchiefs, and ILI and regular physical exercise.[21]

Stunting

Children of mothers who wash their hands with soap or ash have higher mean height-for-age than children of mothers who do not. In 2010, a cross-sectional study was conducted amongst 1,227 children aged 6-23.99 months and their mothers from 18 clusters of villages in rural Jharkhand and Odisha in India to identify individual determinants associated with the children's height-for-age z-score (HAZ). Handwashing with a cleansing agent (e.g. soap or ash) was the third-strongest protective factor (HAZ adjusted beta = +0.32; 95% CI = +0.11, +0.53), after cooking outdoors rather than in the main living area (HAZ adjusted beta = +0.66; 95% CI = +0.35, +0.98) and birth spacing (HAZ beta = +0.40; 95% CI = +0.09, +0.71).[22]

Viruses

In Guangdong Province, China, children 10 years old and younger who "often" washed their hands after using the toilet had lower odds of hand, foot, and mouth disease, but the association was not statistically significant (age-adjusted OR = 0.79; 95% CI = 0.35,1.75). However, those who "often" washed their hands before meals had significantly lower odds of hand, foot, and mouth disease (adjusted OR = 0.41, 95% CI = 0.19, 0.89). Unfortunately, the study did not distinguish between handwashing with water alone and handwashing with a cleansing agent.[23]

Determinants of Handwashing

Successful handwashing behavior change requires both the availability of facilities (e.g. a handwashing station with soap and water) and adoption of a good handwashing habit. Among mothers, the availability of handwashing facilities may influence handwashing with soap after defecation. Other determinants of handwashing may also depend on the activities around the behavior. For instance, the frequency of handwashing before eating may vary depending upon the type of food to be eaten or handwashing before cooking food may be influenced by the perceived threat of germs.

In Zimbabwe's Mawabeni commune, a mixed-methods cross-sectional study among mothers of children under the age of five showed that all mothers reported handwashing after defecation, but only about one-fourth washed their hands with soap (23%). Mothers who practiced open defecation reported that they tended to forget to wash their hands after returning home from defecating in the bush due to the long time interval. Mothers with latrines at home identified not having a handwashing facility at home as a limiting factor. All mothers reported handwashing before eating main meals (i.e., breakfast, lunch, and supper) and cooked foods, but only 63% said that they washed their hands before eating fruits, nuts, and maize. Only 23% of mothers washed their hands before preparing food, with some mothers highlighting that they did not wash their hands because the food would go through a cooking process which would kill germs. Focus group discussions showed that unavailability or a limited supply of water for handwashing was a barrier to handwashing at critical moments.[24]

Household handwashing behavior was associated with having both an improved sanitation facility and improved water sources, even after adjusting for socioeconomic status indicators. The Vietnam Multiple Indicator Cluster Survey, a large-scale nationally-representative survey, showed that household-level "handwashing behavior" (i.e., defined as having a specific place for handwashing and having cleansing materials and water available at that specific place) was positively associated with the education level and ethnicity of the household head, the household wealth index, having an improved sanitation facility (adjusted OR = 1.69; 95% CI = 1.37,2.09), and having improved water sources (adjusted OR = 1.74; 95% CI = 1.37,2.21). The investigators adjusted all independent variables for one another in the final multivariate regression model.[28]

A study in Uganda found that the perceived risk of infection amongst healthcare workers may influence their decision to practice proper hand hygiene. This study, which was conducted among healthcare workers at two hospitals, showed that handwashing did not happen at 80% of all handwashing opportunities. Many sinks were non-functioning and lacked clean towels for hand drying. Staff reported washing hands between patient contact and felt that the current facilities were adequate. However, the staff also indicated selective hand hygiene practice. For instance, the staff used alcohol-based hand rub only when dealing with a patient who appeared to be infective.[25]

Action Control

Action control is the continuous evaluation of one's own handwashing behavior. This was found to be the bridge in the planning-behavior gap for handwashing in among students in Costa Rica.

In this longitudinal study conducted among 440 undergraduate students, self-efficacy—the belief in one's capacity to wash one's hands whenever required, e.g., "I am confident that I can clean my hands regularly, even when I am in a hurry"—and outcome expectancies—the expected benefits of handwashing, e.g., "If I wash my hands frequently every day, then I'll stay healthy"—predicted the students' intention for handwashing. Planning and action control were mediated between intention and changes in handwashing frequency. **Action control was the most proximal factor in handwashing behavior and was determined to be the bridge of the planning-behavior gap.**[26]

Psychosocial and Contextual Factors

Alternatively, **psychosocial and contextual factors together explained nearly half of the variation in handwashing frequency among caregivers of schoolchildren in Burundi.** In rural Burundi, a cross-sectional study among 660 caregivers of schoolchildren showed that contextual factors (e.g., household wealth, amount of water per person, and having a designated place for handwashing) accounted for 13% of the variation in handwashing frequency. The addition of psychosocial factors to the model then explained 41% of the variation in handwashing frequency. In the final model, amount of water per person was the only significant contextual factor. Self-efficacy, planning, and remembering to wash hands were significant psychosocial factors.[27]

In Bangladesh, a cross-sectional study among 200 undergraduate students of a private university using a semi-structured questionnaire showed that a handwashing behavior score (i.e., calculated from self-reported handwashing practice) was significantly associated with age group, marital status, educational status, and mother's education when each association was adjusted for all other covariables.[29]

Inclusive WASH

For disabled persons in Malawi, disability affected handwashing primarily due to physical barriers. In 10 traditional authorities and townships, investigators purposively selected and interviewed 36 disabled persons and 15 caregivers. Water access was the most commonly reported challenge among disabled respondents in rural areas, as piped water is not available and disabled individuals cannot readily take a container to buy water from the kiosks. As such, they must pay for both the water and for another person to carry water for them. None of the participants reported soap availability as a challenge. Physical barriers makes handwashing problematic for disabled individuals because clean hands often have to be placed back on crutches, wheelchairs, or other surfaces that are unclean.[30]

Measurement of Handwashing Efficacy

Measurement of handwashing behavior and efficacy across studies remains a challenge. A review of methods for evaluating the efficacy of handwashing in preventing transmission of harmful pathogens showed a large variation with regard to: how the hands are inoculated with the study microorganisms; the methods used to recover microorganisms from the hands; and the indicator organisms tested. These variations can make it difficult to compare studies. As such, there is a need to both develop more standardized handwashing test methods and form guidelines on minimal information required before handwashing experiment results can be published.[32]

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