Claudia Sample
COUR 123-Term (ie, HLTH 698-A)

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1. Biran A, White S, Awe B, et al. A cluster-randomised trial to evaluate an intervention to promote handwashing in rural Nigeria. *Int J Environ Health Res*. 2020;1-16. doi:10.1080/09603123.2020.1788712

2. Darvesh N, Das JK, Vaivada T, et al. Water, sanitation and hygiene interventions for acute childhood diarrhea: a systematic review to provide estimates for the Lives Saved Tool. *BMC Public Health*. 2017;17(S4):101-111. doi:10.1186/s12889-017-4746-1

3. Denbæk AM, Andersen A, Bonnesen CT, et al. Effect evaluation of a randomized trial to reduce infectious illness and illness-related absenteeism among schoolchildren: the Hi Five study. *Pediatr Infect Dis J*. 2018;37(1):16-21. doi:10.1097/INF.0000000000001686

4. Dreibelbis R, Kroeger A, Hossain K, Venkatesh M, Ram PK. Behavior change without behavior change communication: nudging handwashing among primary school students in Bangladesh. *Int J Environ Res Public Health*. 2016;13(129):1-7. doi:10.3390/ijerph13010129

5. Ejemot-Nwadiaro RI, Ehiri JE, Arikpo D, Meremikwu MM, Critchley JA. Hand washing promotion for preventing diarrhoea. *Cochrane Database Syst Rev*. 2015;(9):CD004265. doi:10.1002/14651858.CD004265.pub3

6. Ginja S, Gallagher S, Keenan M. Water, sanitation and hygiene (WASH) behaviour change research: why an analysis of contingencies of reinforcement is needed. *Int J Environ Health Res*. 2019;1-14. doi:10.1080/09603123.2019.1682127

7. Kok MC, Dieleman M, Taegtmeyer M, et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? a systematic review. *Health Policy Plan*. 2015;30(9):1207-1227. doi:10.1093/heapol/czu126

8. La Con G, Schilling K, Harris J, et al. Evaluation of student handwashing practices during a school-based hygiene program in rural Western Kenya. *Int Q Community Health Educ*. 2017;37(2):121-128. doi:10.1177/0272684X17701263

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10. Lewis HE, Greenland K, Curtis V, Schmidt WP. Effect of a school-based hygiene behavior change campaign on handwashing with soap in Bihar, India: cluster-randomized trial. *Am J Trop Med Hyg*. 2018;99(4):924–933. doi:10.4269/ajtmh.18-0187

11. Mbakaya BC, Lee PH, Lee RLT. Hand hygiene intervention strategies to reduce diarrhea and respiratory infections among schoolchildren in developing countries: a systematic review. *Int J Environ Res Public Health*. 2017;14(4):371. doi:10.3390/ijerph14040371

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13. McGuinness SL, Barker SF, O'Toole J, et al. Effect of hygiene interventions on acute respiratory infections in childcare, school and domestic settings in low- and middle-income countries: a systematic review. *Trop Med Int Health*. 2018;23(8):816-833. doi:10.1111/tmi.13080

14. McMichael C, Robinson P. Drivers of sustained hygiene behavior change: a case study from mid-western Nepal. *Soc Sci Med*. 2016;163:28-36. doi:10.1016/j.socscimed.2016.06.051

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17. Townsend J, Greenland K, Curtis V. Costs of diarrhoea and acute respiratory infection attributable to not handwashing: the cases of India and China. *Trop Med Int Health*. 2017;22(1):74-81. doi:10.1111/tmi.12808

18. Wang Z, Lapinski M, Quilliam E, Jaykus LA, Fraser A. The effects of hand-hygiene interventions on infectious disease-associated absenteeism in elementary schools: a systematic literature review. *Am J Infect Control*. 2017;45(6):682-689. doi:10.1016/j.ajic.2017.01.018

19. Whinnery J, Penakalapati G, Steinacher R, Wilson N, Null C, Pickering AJ. Handwashing with a water-efficient tap and low-cost foaming soap: the Povu Poa "cool foam" system in Kenya. *Glob Health Sci Pract*. 2016;4(2):336–41. doi:10.9745/GHSP-D-16-00022

20. Wichaidit W, Steinacher R, Okal JA, et al. Effect of an equipment-behavior change intervention on handwashing behavior among primary school children in Kenya: the Povu Poa school pilot study. *BMC Public Health*. 2019;19(1):1-12. doi:10.1186/s12889-019-6902-2

21. Willmott M, Nicholson A, Busse H, et al. Effectiveness of hand hygiene interventions in reducing illness absence among children in educational settings: a systematic review and meta-analysis. *Arch Dis Child*. 2016;101(1):42–50. doi:10.1136/archdischild-2015-308875

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Annotated Bibliography

1. Biran A, White S, Awe B, et al. A cluster-randomised trial to evaluate an intervention to promote handwashing in rural Nigeria. *Int J Environ Health Res*. 2020;1-16. doi:10.1080/09603123.2020.1788712

   Even though past research has demonstrated that handwashing with soap (HWWS) at critical times can reduce incidences of diarrhea, changing hand hygiene behavior continues to be a challenge. A cluster-randomized controlled trial in 14 Nigerian villages sought to change handwashing behavior by using community members to promote HWWS at critical times. The study aimed to change social norms and strengthen an association between performing HWWS and avoiding disgust. Trained community members spent two days in each village teaching non-health messages that utilized disgust-based emotional drivers to change participant perceptions of hand hygiene. Post-intervention, data on handwashing practices was collected through direct, structured observations. The intervention did not produce a significant increase in HWWS at critical times. The study noted that implementing a behavioral intervention without addressing the environmental limitations to HWWS contributed to a poor uptake of the behavior.

2. Darvesh N, Das JK, Vaivada T, et al. Water, sanitation and hygiene interventions for acute childhood diarrhea: a systematic review to provide estimates for the Lives Saved Tool. *BMC Public Health*. 2017; 17(S4):101-111. doi:10.1186/s12889-017-4746-1

   Even though diarrhea-related mortality has reduced in recent years, it continues to be one of the leading causes of morbidity and mortality among children. A systematic review examined the impact of water, sanitation, and hygiene (WASH) interventions on decreasing diarrheal disease. The review included randomized controlled trials (RCTs), cluster-randomized controlled trials (cRCTs), and quasi-experimental trials (QEs) targeting children under age 6. The WASH intervention in each study involved one of three strategies: 1) improving water quality at point-of-use; 2) promoting handwashing with soap (HWWS); and/or 3) safely disposing of excreta. All trials considered how the intervention impacted diarrhea-associated mortality, diarrhea-associated morbidity, or risk of diarrhea. Six studies in low- to middle-income settings examining the effects of HWWS on the risk of diarrhea met inclusion criteria. In each trial, study participants were given soap and received hand hygiene education. The review suggested that proper HWWS decreased the risk of diarrhea by 27%, which was statistically significant. However, the trials were held over a short duration and with a small population. To examine the sustainability of HWWS compliance, more research is needed over a longer period of time and with a larger sample size.

3. Denbæk AM, Andersen A, Bonnesen CT, et al. Effect evaluation of a randomized trial to reduce infectious illness and illness-related absenteeism among schoolchildren: the Hi Five study. *Pediatr Infect Dis J*. 2018;37(1):16-21. doi:10.1097/INF.0000000000001686

   In Denmark, diarrhea and influenza are the leading causes of school absenteeism among children. A 3-armed cluster-randomized controlled trial involving children 6-15 years old at 43 Danish schools implemented a multicomponent intervention to improve hand

hygiene and child wellness. The multicomponent intervention ran for one school year and included 3 parts: 1) hand hygiene curriculum; 2) mandatory handwashing prior to eating lunch; and 3) additional cleaning of school toilets throughout the day. Curriculum was taught over a 2-month period. Topics included: microorganisms, how to avoid spreading infections, proper handwashing technique, and the importance of keeping the toilet clean. The study noted no significant differences in incidences of illness and illness-related absences between the intervention and control groups. Though the curriculum was successfully implemented across all study groups, other interventions were inconsistently followed. Only 1 in 3 teachers implemented mandatory handwashing and the additional cleaning of toilets was erratic. Teachers reported that lack of time and low prioritization affected their willingness to follow the study's intervention, which are important considerations for future programs.

4. Dreibelbis R, Kroeger A, Hossain K, Venkatesh M, Ram PK. Behavior change without behavior change communication: nudging handwashing among primary school students in Bangladesh. *Int J Environ Res Public Health*. 2016;13(129):1-7. doi:10.3390/ijerph13010129

   A proof-of-concept pilot study involving 2 primary schools in Bangladesh studied the impact of infrastructure improvements and visual prompts on hand hygiene after toileting among schoolchildren. The visual cues included a colored footpath and painted footprints leading from latrines to handwashing tanks, and hands painted on tanks. Prior to implementing the prompts, researchers directly observed baseline hand hygiene practices, finding that 3.5% of children (4 out of 114) washed their hands with soap after toileting. Next, they ensured that water and soap were readily available at handwashing stations. As a result, 18% of children (26 out of 145) were directly observed performing handwashing with soap (HWWS) after toileting. The day after building the first nudge (the colored footpath), 58% (69 out of 119) were observed performing HWWS after visiting the latrine. The day after painting footprints on the path and handprints on the water tank, 68% (108 out of 158) demonstrated HWWS. Students were discreetly observed at 2 and 6 weeks post-intervention to monitor behavior changes. At both intervals, 74% of schoolchildren performed HWWS, suggesting that visual cues in combination with the provision of handwashing materials can produce improvements in hand hygiene among schoolchildren.

5. Ejemot-Nwadiaro RI, Ehiri JE, Arikpo D, Meremikwu MM, Critchley JA. Hand washing promotion for preventing diarrhoea. *Cochrane Database Syst Rev*. 2015;(9):CD004265. doi:10.1002/14651858.CD004265.pub3

   A systematic review evaluated the efficacy of handwashing interventions on decreasing diarrheal disease among children and adults. Twenty-two randomized controlled trials met inclusion criteria: 12 daycares and schools in high-income countries; 9 trials in LMIC communities; and one hospital-based trial. Handwashing education and promotional activities in daycares and schools of high-income countries demonstrated a statistically significant 33% reduction in diarrheal episodes among children. The review suggested that a similar response could be seen in daycare and school settings in LMICs. In the review of community-based trials, handwashing education was linked to preventing roughly 25% of diarrheal episodes in children and adults. In trials that

combined handwashing promotional activities with soap distribution, the reduction was 30%. The review surmised that handwashing promotion is an effective approach to reduce diarrheal episodes in the short-term.

6. Ginja S, Gallagher S, Keenan M. Water, sanitation and hygiene (WASH) behaviour change research: why an analysis of contingencies of reinforcement is needed. *Int J Environ Health Res*. 2019;1-14. doi:10.1080/09603123.2019.1682127

   Water, sanitation, and hygiene (WASH) behaviors may significantly reduce morbidity and mortality related to diarrheal disease. However, the success of hygiene behavior change interventions has been minimal. A review of WASH interventions examines the effectiveness of various behavior change models, theories, and frameworks, mainly based in cognitive tradition. The review proposes applying a three-term contingency theory to future interventions seeking to change hand hygiene behaviors. The review indicated that there is a relationship between antecedent events, hand hygiene behavior, and consequences. Therefore, sustainably increasing hand washing with soap (HWWS) involves modifying antecedents and consequences. Antecedent interventions entail modifying the environment or context in order to create a platform for facilitating HWWS. This includes creating a hygiene infrastructure, consistently having handwashing materials available, and educating the target population on proper HWWS. Consequences imply implementing interventions that positively or negatively reinforce the behavior. Consequences include social recognition, material rewards, and performance feedback. Once the desired behavior is established, these contrived reinforcers are gradually removed. The review further suggests that community health groups could be used to facilitate long-term behavior change post-intervention.

7. Kok MC, Dieleman M, Taegtmeyer M, et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? a systematic review. *Health Policy Plan*. 2015;30(9):1207-1227. doi:10.1093/heapol/czu126

   Community Health Workers (CHWs) have become an essential component to public health initiatives in many low- and middle-income countries (LMICs). A systematic review of 140 quantitative and qualitative studies on CHW programs in LMICs examined factors and characteristics influencing CHW performance. The review found that financial and non-financial incentives were the most influential factors. Continuous training and frequent supervisory visits were also associated with improved CHW performance. However, there is little evidence to identify the best methods of training and supervising CHWs. The review noted that clearly defined roles, expectations, and communication processes were associated with improved CHW performance. Finally, linking CHWs to a local health facility improved care coordination and communication, increased access to resources, and enhanced legitimacy within the community. Additional research is required to define evidence-based approaches to training and supervision, as well as to inform health policies in LMICs.

8. La Con G, Schilling K, Harris J, et al. Evaluation of student handwashing practices during a school-based hygiene program in rural western Kenya. *Int Q Community Health Educ*. 2017;37(2):121-128. doi:10.1177/0272684X17701263

An insufficient water, sanitation, and hygiene (WASH) infrastructure in primary schools contributes to increased incidences of infectious diseases resulting in increased absenteeism. In an observational study of 28 schools in rural western Kenya, researchers sought to reduce incidences of infectious disease and school absenteeism by improving WASH facilities. Twenty-eight schools were given soap, 151 tanks for handwashing, and WASH education materials. Four months following the intervention, researchers noted that 59% of handwashing tanks had soap. Researchers also directly observed an increase in student handwashing with soap and cited a statistically significant increase in hand hygiene when the handwashing tank was located within 10 meters of the latrine. In a qualitative survey post-intervention, teachers reported an increase in student handwashing with soap and general cleanliness, as well as decreased illness and absenteeism. The observational study suggests that addressing infrastructure inadequacies, the ease and proximity to accessing facilities, and providing hygiene education can improve handwashing with soap, and thereby decrease the transmission of infectious diseases.

9. Lee RL, Leung C, Tong WK, Chen H, Lee PH. Comparative efficacy of a simplified handwashing program for improvement in hand hygiene and reduction of school absenteeism among children with intellectual disability. *Am J Infect Control*. 2015;43(9):907-912. doi:10.1016/j.ajic.2015.03.023

   As a consequence of poor handwashing, there are high incidences of infectious illnesses among schoolchildren, particularly in students with developmental disabilities. A quasi-experimental study in Hong Kong evaluated the effect of a simple 5-step handwashing technique on illness-related school absenteeism among students with a mild cognitive disability. The study ran over a 12-week period in two special education schools. The 5-step technique was adapted from the World Health Organization's strategy and involved washing between the fingers, on the backs of hands, the backs of fingers, atop the fingertips, and around the thumbs. This technique was taught through demonstration and return demonstration, song, video, a poster for visual cues, and a reward system to reinforce the behavior. Compared to pre-intervention data on hand cleanliness, researchers noted a significant improvement in handwashing practices in the study group. Researchers also noted a significant decrease in school absenteeism versus the control group. The study suggests that the simple 5-step handwashing technique is an effective means to reduce the transmission of infectious illnesses in a school setting among children with special needs.

10. Lewis HE, Greenland K, Curtis V, Schmidt WP. Effect of a school-based hygiene behavior change campaign on handwashing with soap in Bihar, India: cluster-randomized trial. *Am J Trop Med Hyg*. 2018;99(4):924–933. doi:10.4269/ajtmh.18-0187

    Handwashing with soap (HWWS) may decrease the burden of diseases spread by person-to-person contact and fecal-oral routes. For this reason, a cluster-randomized trial in rural India implemented a school-based handwashing campaign to increase HWWS. The campaign sought to change social norms by using educational lessons where schoolchildren and mothers were taught the critical moments to perform hand hygiene. The handwashing intervention consisted of four visits over 21 days to enrolled schools in

32 villages. During visits, promoters taught structured lessons and rewarded participant knowledge and demonstration of handwashing practices. Eight to 10 weeks following the education program, data on handwashing practices was collected through 636 structured, direct observations. When compared to the control group, the handwashing campaign was associated with a 4.4% increase in HWWS, suggesting no significant improvement. The handwashing education failed to engage emotional drivers, in favor of mimicking normal school lesson formats (ie, repetition, memorization). The campaign also failed to address the physical environment, which is the essential platform for launching hand hygiene programs.

11. Mbakaya BC, Lee PH, Lee RLT. Hand hygiene intervention strategies to reduce diarrhea and respiratory infections among schoolchildren in developing countries: a systematic review. *Int J Environ Res Public Health*. 2017;14(4):371. doi:10.3390/ijerph14040371

    Researchers performed a systematic review of 8 randomized controlled trials from developing countries to identify hand hygiene strategies that reduce the transmission of infectious diseases among schoolchildren. The review noted that hand hygiene interventions were associated with a reduction in the transmission of diarrhea and respiratory infections. The 8 reviewed studies implemented multi-level interventions that combined hand hygiene education, policy, and/or funding to address the 3 aspects influencing hygiene behavior: contextual, psychosocial, and technological factors. All 8 trials educated schoolchildren in hand hygiene and highlighted the recommended times to perform handwashing, the correct procedure, and the importance of clean hands. Policy interventions created an institutional school culture that encouraged handwashing with soap, whether through posting signage, employing visual cues, distributing pamphlets, or forming health clubs. Funding interventions focused on providing reliable and consistent access to handwashing materials at appropriate locations and times. The review noted that multi-level interventions to improve handwashing were effective and efficient strategies to reduce school absenteeism, respiratory infections, and diarrheal disease.

12. McCollum R, Otiso L, Mireku M, et al. Exploring perceptions of community health policy in Kenya and identifying implications for policy change. *Health Policy Plan*. 2016; 31(1):10-20. doi:10.1093/heapol/czv007

    Community-based health services are gaining interest and investment from national governments and international partners because they are effective strategies to increase access to health services and improve delivery of these services. A descriptive exploratory survey in 2 Kenyan counties evaluated qualitative data from 40 interviews and 10 focus groups to examine perspectives of the nation's community health strategy (CHS). Even though there is widespread community appreciation for Community Health Workers (CHWs), the present system is limited by poor accountability, funding, and sustainability. CHW attrition is another common problem because the high workload demands are not balanced by incentives. Based on survey findings, a revised strategy must implement a holistic and integrated approach that incorporates vertical programs with the horizontal CHS structure. The study also recommends revising the program to increase funding for the purposes of enlarging the CHW workforce and providing monetary incentives.

13. McGuinness SL, Barker SF, O'Toole J, et al. Effect of hygiene interventions on acute respiratory infections in childcare, school and domestic settings in low- and middle-income countries: a systematic review. *Trop Med Int Health*. 2018;23(8):816-833. doi:10.1111/tmi.13080

Acute respiratory infections (ARIs) are one of the leading causes of morbidity and mortality in low- and middle-income countries (LMICs), especially among children. A systematic review evaluated the effect of hand hygiene interventions on ARI reduction in daycares, schools, and households in LMICs. Fourteen cluster-randomized controlled trials (cRCTs) met inclusion criteria. Most trials involved hygiene education and infrastructure improvements. In daycare settings, reviewers noted a significant reduction in ARI illness and ARI-related absenteeism. In schools, the evidence supported a reduction in ARI-related absenteeism and influenza, but there was insignificant evidence supporting a decrease in ARI illness. In domestic urban settings, there was a significant reduction in ARI illness and pneumonia. The key factors to long-term changes in hygiene behavior included soap accessibility, adjusting social norms, and associating unwashed hands with disgust. The review suggested that hand hygiene interventions in daycares, schools, and domestic settings can decrease morbidity associated with ARIs. Still, the efficacy differs depending on the type of intervention, setting, and long-term compliance.

14. McMichael C, Robinson P. Drivers of sustained hygiene behavior change: a case study from mid-western Nepal. *Soc Sci Med*. 2016;163:28-36. doi:10.1016/j.socscimed.2016.06.051

A qualitative case study of 112 individuals living in a rural Nepalese village examined a water, sanitation, and hygiene (WASH) intervention, particularly factors affecting handwashing with soap (HWWS). The 4-year study employed a variety of theory-based behavioral interventions that addressed contextual, psychosocial, and technological factors affecting hygiene behaviors. Interventions included providing subsidized latrines and handwashing materials, engaging children in participatory exercises, facilitating the community in forming a committee to educate the community as a whole, implementing WASH curriculum in schools, performing street dramas, and training on HWWS. An analysis of the qualitative data showed that accessibility and proximity to water and soap were foundational to changing hygiene behavior. In the post-intervention period, 77% of households surveyed self-reported HWWS at critical times, compared to 8% surveyed pre-intervention. Researchers noted that the majority of households designated a place in the home for handwashing. Moreover, emotional drivers (ie, disgust, perceived threat) and habit formation encouraged sustained changes in hygiene behavior. Barriers to change were water scarcity and low socioeconomic status. The study recommends that future behavioral interventions consider the motivational drivers and contextual barriers when attempting to bring about sustained changes in hygiene behavior.

15. Pellegrino R, Crandall PG, Han-Seok S. Using olfaction and unpleasant reminders to reduce the intention behavior gap in hand washing. *Sci Rep*. 2016;6:18890. doi:10/1038/srep18890

Disgust-induced sensory cues are a method to motivate handwashing. Olfactory senses play a particularly important role in habit formation because smells serve a self-protective

purpose and function in making memories. An experimental prospective memory study evaluated the effects of disgust-associated sensory cues versus a control in eliciting handwashing among 80 adult participants. The study used 4 treatment conditions (visual disgust, auditory disgust, olfactory disgust, and visual control) and recorded handwashing practices prior to handling food. The study noted that there was a higher probability that participants performed handwashing with olfactory disgust-induced reminders (a hidden vaporizer emitting a rotten fish smell), compared to visual or auditory disgust cues. More specifically, olfactory cues increased handwashing compliance by 73% in the study group, compared to the control. Even though disgust-based olfactory cues were the most effective in eliciting handwashing, disgust-based visual and auditory prompts were also associated with a significant increase in probability of handwashing. Still, disgust-based prompts are best used in combination with other interventions to serve as reminders and strengthen the behavior change.

16. Rajasingham A, Leso M, Ombeki S, Ayers T, Quick R. Water treatment and handwashing practices in rural Kenyan health care facilities and households six years after the installation of portable water stations and hygiene training. *J Water Health*. 2018;16(2):263-274. doi:10.2166/wh.2018.149

    An inadequate water, sanitation, and hygiene (WASH) infrastructure contributes to the majority of diarrheal episodes in a low- and middle-income countries. To find short- and mid-term solutions to WASH problems, a non-governmental organization (NGO) facilitated a water and hygiene project in a rural county of Kenya. The NGO installed handwashing and drinking water stations in 53 health care facilities (HCF) specializing in the prevention of mother-to-child-transmission of human immunodeficiency virus, in addition to providing hygiene education to HCF staff, Community Health Workers (CHWs), and patients visiting the clinic. After 6 years, the NGO performed a survey of 299 community members across randomly selected HCFs. Eighty-nine percent of observed clients demonstrated proper handwashing with soap, though only 31% dried their hands properly. However, only 17% of patients reported having a handwashing station in the home. The study indicated that repeat home visits where CHWs reinforce proper HWWS was effective in encouraging the behavior change. In order to succeed, the program must be accepted by the community, be used regularly, and exhibit sustainable improvements.

17. Townsend J, Greenland K, Curtis V. Costs of diarrhoea and acute respiratory infection attributable to not handwashing: the cases of India and China. *Trop Med Int Health*. 2017;22(1):74-81. doi:10.1111/tmi.12808

    Handwashing is a simple and cost-effective behavior to decrease the risk of contracting infectious diseases. A study reviewed primary empirical evidence to examine the economic costs associated with diarrhea and respiratory illnesses related to not washing hands after toileting in India and China. They also performed a cost analysis of handwashing behavior change programs using existing literature. In order to estimate economic losses and returns, the study utilized the World Health Organization's published disability-adjusted life years for diarrhea and respiratory infections in India and China, and also extrapolated results of handwashing behavior change research in low-

and middle-income countries. While the estimated cost for a nationwide handwashing program would be between $0.60 to $1 US dollar (USD) per person in India and China, the potential nationwide savings were an estimated $5.64 billion USD in India and $2.64 billion USD in China, which are both high returns on investment. The study surmised that the cost of not handwashing resulted in preventable losses amounting to billions of USD. Moreover, well-designed handwashing programs could reduce the burden of disease in a cost-effective manner. Therefore, researchers propose that improved handwashing is a cost-effective public health initiative that can be economically beneficial to low- and middle-income countries.

18. Wang Z, Lapinski M, Quilliam E, Jaykus LA, Fraser A. The effects of hand-hygiene interventions on infectious disease-associated absenteeism in elementary schools: a systematic literature review. *Am J Infect Control*. 2017;45(6):682-689. doi:10.1016/j.ajic.2017.01.018

    Research suggests that acute respiratory tract illness (RTI) and gastrointestinal (GI) illness contribute to school absenteeism. Absenteeism can negatively affect academic performance, increase school administrative costs (ie, student tracking), interfere with teaching schedules (ie, educators reteach missed lessons), and burden working caregivers. A systematic review of 19 quantitative experimental studies sought to evaluate the effect of hand hygiene interventions on absenteeism related to RTI and GI illness among schoolchildren. Hand hygiene interventions included the use of alcohol-based hand sanitizer, handwashing with soap, and handwashing education. Handwashing with soap reduced illness-related absenteeism by 22%. When students were paired with a peer mentor who served to remind the student to wash hands and directly observed the technique, illness-related absenteeism was further reduced by 42%, which was statistically significant. Six out of 7 studies showed statistically significant decreases in GI illness-related absenteeism, ranging from 30% to 57%. The evidence supporting a reduction of RTI-related absenteeism due to hand hygiene interventions was equivocal. The review serves as a guide to design, implement, and evaluate future hand hygiene interventions in schools.

19. Whinnery J, Penakalapati G, Steinacher R, Wilson N, Null C, Pickering AJ. Handwashing with a water-efficient tap and low-cost foaming soap: the Povu Poa “cool foam” system in Kenya. *Glob Health Sci Pract*. 2016;4(2):336–41. doi:10.9745/GHSP-D-16-00022

    A high proportion of Kenyans lack access to piped water and soap, which creates barriers to performing handwashing with soap (HWWS) at critical times. Current handwashing systems are also prone to soap theft. The cost of soap in traditional systems is between $0.20 to $0.44 US dollars (USD) per 100 handwashing occurrences. A research team attempted to improve accessibility to handwashing materials in western Kenya by creating the Povu Poa system. The innovative system aimed to make HWWS convenient, adaptable, and cost-effective by using a water-saving swing tap and foaming soap. Compared to traditional handwashing systems, Povu Poa used 30% to 77% less water and 94% to 99% less soap. With this innovation, the study estimated that the cost of soap was reduced to $0.10 USD per 100 occurrences. However, each Povu Poa system costs $12

USD. In addition, the plastic had a low durability to ultraviolet light and 30% of systems had broken pieces after 1-year of use.

20. Wichaidit W, Steinacher R, Okal JA, et al. Effect of an equipment-behavior change intervention on handwashing behavior among primary school children in Kenya: the Povu Poa school pilot study. *BMC Public Health*. 2019;19(1):1-12. doi:10.1186/s12889-019-6902-2

As a result of inadequate access to handwashing materials and poor motivation, Kenyan schoolchildren rarely practice handwashing with soap (HWWS). A cluster-randomized trial among schoolchildren in 20 western Kenyan primary schools examined the effect of providing handwashing stations with soap dispensers in conjunction with behavior change interventions on HWWS after toileting. The behavioral intervention employed educational skits, a handwashing song, and pledge in order to alter social norms and associate unwashed hands with disgust. The behavioral intervention took two-hours to deliver at each school. One-year post-intervention, data on HWWS was collected via surveys and discreet observation of hand hygiene after toileting. The study found that 42% of schools had handwashing points stocked with water and soap post-intervention. Moreover, 32% of schoolchildren performed HWWS after toileting, compared to 0% pre-intervention. Though the results showed a significant increase handwashing materials and the probability of HWWS after toileting, results were far from ideal. Future interventions should explore adding in behavioral intervention strategies, such as visual cues.

21. Willmott M, Nicholson A, Busse H, et al. Effectiveness of hand hygiene interventions in reducing illness absence among children in educational settings: a systematic review and meta-analysis. *Arch Dis Child*. 2016;101(1):42–50. doi:10.1136/archdischild-2015-308875

Respiratory tract (RT) and gastrointestinal (GI) infections are highly infectious illnesses that spread quickly in schools. A systematic review and meta-analysis of 18 cluster-randomized controlled trials evaluated the effectiveness of handwashing among schoolchildren and staff in decreasing the spread of RT and GI infections, and reducing school absenteeism among schoolchildren and staff. The evidence suggests that hand hygiene in the school setting may be effective. Among the 18 studies, hand hygiene interventions correlated with lower incidences of RTIs and school absenteeism. The impact of hand hygiene on GI infections was equivocal. However, there were quality issues in all 18 studies, such as small sample sizes and insufficient randomization. Future studies should consider clear and consistent definitions of RT and GI infections, increased randomization, and increased sample sizes.