

**About this sample Discussion section:** This Discussion section comes from an empirical research paper published in the *International Quarterly of Community Health Education*:

Pasewaldt, S. E., Baller, S. L., Blackstone, S. R., & Bryan Malenke, L. (2019). Impact of a hand hygiene curriculum and group handwashing station at two primary schools in East Africa. *International Quarterly of Community Health Education* 39(3), 175-187. <https://doi.org/10.1177/0272684X18819968>

JMU alumna Stephanie Pasewaldt (class of 2018) conducted the research described in this Discussion section as part of her [Honors capstone project](#) in Health Sciences. After graduating, she revised and published her manuscript with the assistance of her project advisor and readers, whom she listed as co-authors. A Discussion section overview with writing strategies and other resources for writing empirical research papers are available at [this link](#).

## Discussion

This study found the implementation of a hand-hygiene curriculum and group handwashing station increased students' knowledge of illness prevention, the purpose of soap, and critical handwashing times, adjusted their attitudes to be more favorable toward handwashing, and increased their self-reported handwashing behavior. Proper handwashing with soap was enabled and carried out before meals at school due to new infrastructure and a supervised, daily group handwashing schedule. Handwashing became a more frequent topic of discussion for students.

Interestingly, prior to the interventions' implementation more students cited *after eating than before eating* as a critical time to wash hands. This is likely due to the students' cultural norm of eating with their hands. Students typically washed their hands after eating to remove visible food. However, through the curriculum, students learned that it was actually more important to wash their hands before eating to avoid getting

According to the [introduction of this article](#), the purpose of this study was to determine whether an educational intervention would improve students' knowledge, attitudes, and behaviors regarding handwashing. Here, the authors report their key findings, explaining that handwashing knowledge, attitudes, and behaviors indeed improved after the intervention.

Here, the authors begin interpreting their results. A common move in Discussion sections is to answer the question, "Why do you think you got the results you did?" In this case, cultural practices help explain a trend in the data.

sick or spreading disease, even though germs may not be visible at this time. With this improvement in knowledge, students were motivated to start washing their hands before meals. Six months after the interventions' implementation, students were still acting in accordance with this knowledge and washing their hands as a group before meals at school. These results support the association between handwashing knowledge and motivation for behavior change, as discussed by Galiani et al.<sup>17</sup>

Furthermore, as found in other successful handwashing initiatives,<sup>16,21</sup> the strategic implementation of both educational and environmental interventions was effective in promoting and facilitating healthy handwashing behaviors. Educational interventions are not likely to be as effective in achieving behavior change, if they are not simultaneously implemented with a built, environmental intervention,<sup>16,19,21,29</sup> a relationship this study supports. This study's educational intervention, the hand hygiene curriculum, provided students with facts and information necessary for effective handwashing, and subsequently the handwashing station gave them the opportunity to act upon their knowledge in the school setting. The group handwashing stations gave students access to a sanitary place to wash their hands, because without the station, the schools' environments were not physically conducive to the behavior. As mentioned previously, the handwashing stations in this study were strategically located near the schools' latrines and food-serving areas, locations which Asharaf and colleagues suggest

At the end of the second paragraph and throughout the third, the authors make another common move seen in Discussion sections: They connect their results to previous literature. In this case, they demonstrate that their findings support existing knowledge and theory.

This article uses numerical superscripts to reference sources, as prescribed by the *AMA Manual of Style* and the publishing journal. The reference list for this article is not provided here but can be accessed via the link in the citation above.

Much of this paragraph echoes information that appeared in the introduction and Methods sections of this article. The Discussion section should focus on describing the present study's contributions to the state of knowledge on the topic. Lengthy justifications for (or reiterations of) the study's design or methodological choices should be avoided in this section.

increase handwashing frequency during critical times.<sup>42</sup> The public, centralized locations of the stations further serve as a physical reminder for students to wash their hands, a quality Contzen and colleagues conclude is an important contextual factor to promote handwashing behavior.<sup>16</sup> Thus, due to the strategic location of the stations and despite differences in structure design, students at both schools were able to effectively and enjoyably wash their hands individually and as a group.

As the curriculum was implemented, students demonstrated enthusiasm toward handwashing. In addition, since the group handwashing station allowed students to wash their hands together, the behavior became a social activity, which generated more enthusiasm and practice of handwashing. However, this enthusiasm may have faded, never to be translated into action, if students did not have the station to continuously practice their handwashing skills.

Improving and practicing handwashing at school is crucial, since students encounter at least two of the most critical handwashing times, before eating and after using the toilet, while at school. If students are to make a habit of handwashing during these times and sustain the behavior long term, they need access to a handwashing station at their school. At the time of pre-surveys, students did not have access to a handwashing station at school. Consequently, reported handwashing frequency most likely increased on postsurveys due to the new station, since students

The Discussion is the right place for speculations (like this one) about how results might vary under different circumstances.

While the Findings/ Results section should only describe relationships within the data, in the Discussion, it is appropriate to make reasoned inferences or suppositions about the nature of those relationships. However, writers should moderate the strength of their claims with qualifying language, as the authors do here with “most likely.”

washed their hands before eating daily during the program and had the opportunity to do so after using the toilet at school.

In addition, the combination of environmental infrastructure and education about proper handwashing may have impacts extending outside of the school setting. Students washed their hands at the new station only after learning how to properly wash their hands through the curriculum. Students' responses in Figure 3, suggest knowledge learned in school may be applied and can spread to friends and family outside of the school setting. Furthermore, the data in Table 6 suggest additional handwashing behavior changes may have occurred in the home setting, as the largest increases in knowledge were for critical handwashing times occurring outside of the school setting (changing babies and before preparing/cooking food). However, the data in Table 6 only demonstrate knowledge increase and do not provide reliable data about possible infrastructure or behavior changes outside the school context.

Despite students being from schools in different contexts, the interventions yielded similar improvements among students at both schools. Other future handwashing promotion programs implemented at schools should include multiple interventions to motivate and enable proper handwashing behavior among students. Education interventions are important to increase individual knowledge and improve attitudes, but built environment interventions, like handwashing stations, are a necessary resource to empower students to take action to improve their handwashing

Discussion sections follow a narrow-to-broad structure. Notice how the authors move from interpretations of specific results in schools to the broader topic of possible impacts beyond the school setting.

By using the term "suggest," the authors once again qualify or "hedge" their interpretations, ensuring that they present them with a suitable degree of certainty.

The authors further qualify their inferences by clarifying what the data do and do not demonstrate.

The authors could go a step further here and explain what these parallel outcomes suggest: that the interventions employed in this study (and others like it) have the potential to improve handwashing knowledge, attitudes, and behaviors across a variety of contexts.

behaviors. Handwashing stations may vary in design, but stations will likely be effective as long as students have easy access to the facility and are instructed on how and when to use it. Practical issues, such as the ones reported by principals in follow-up, should also be considered when trying to design the most appropriate handwashing station for a school. It may be beneficial to make handwashing a supervised, social activity, as achieved through group handwashing, to generate interest and encourage consistency of the behavior through daily, planned handwashing sessions.

As demonstrated here, limitations are commonly presented in a subsection of the Discussion, usually after the interpretation of results.

Here, the authors make another common move in Discussion sections: They discuss implications for practice. In particular, they highlight lessons learned and make recommendations for others who might implement similar interventions (e.g., public health officials, aid workers, or researchers).

### **Limitations**

A common move when discussing limitations is to consider possible threats to the validity of the findings. In other words, researchers must consider alternative explanations for their results. Here, the authors acknowledge a threat to the internal validity of their experiment: There were differences between groups prior to the implementation of the experiment.

The authors recognize important limitations to this study. Although both schools lacked adequate WASH at baseline, pre-tests comparisons show only one significant difference at baseline between the schools. At baseline, students in Uganda scored slightly higher than students in Kenya on the *Attitudes and Beliefs Regarding Handwashing* subscale, ( $p < .001$ ; Uganda mean 3.74; Kenya mean 3.16). This difference may be attributed to the smaller sample size of the Kenya school. The authors emphasize, despite this baseline difference, significant improvements were found among students at both schools on the *Attitudes and Beliefs Regarding Handwashing* subscale from pre-to-post surveys.

In addition, the study's design did not involve a control. However, since the study involved students from two schools and similar results were found, there is increased evidence for the effectiveness of the interventions on students' knowledge, attitudes, and self-reported

After disclosing a limitation, it may be useful to state why the results still matter or should be taken seriously *despite* that limitation, as the authors do at the end of both of these paragraphs.

behaviors, especially since the program improved these areas at schools with contextual differences.

Researchers must also consider how bias—on the part of the researchers, the participants, and any other actors (such as nurses or teachers)—might have influenced results. Here, the researchers acknowledge the possible presence of *social desirability bias* on the part of participants, and they explain exactly how this might have influenced results.

Furthermore, social desirability bias may have influenced students' responses about handwashing values and beliefs, as students may have responded untruthfully to questions providing answers they thought the researcher desired. For example, students may have declared they felt handwashing was a fun activity (*Attitudes and Beliefs Regarding Handwashing subscale*), but this may not actually be the case. Social desirability bias may have also led to students overreporting their handwashing frequency at baseline and follow-up.<sup>43,44</sup>

In regard to self-reports of handwashing behavior, the authors acknowledge the limitations in measuring handwashing behavior via self-report<sup>45</sup> and recognize many studies have found self-reports to be an unreliable measure of handwashing due to overreporting.<sup>43–45</sup> Despite the limitations, self-report measures remain a frequently relied-upon practical approach for studies of handwashing behaviors.<sup>46–48</sup> Although direct observations, sensor technology, and microbiological measures of hand contamination yield more concrete data, they also demand substantially more resources.<sup>45</sup> In this study, overreporting of handwashing may have occurred at baseline and posttest. Nevertheless, since students postsurvey had access to a handwashing facility and were engaging in scheduled group handwashing daily at school, there is evidence to support the increase in handwashing frequency from pre-to-post surveys.

The design of a study, or the methods it uses, may also have inherent limitations—and those are important to acknowledge as well. Here, the authors concede the limits of self-reported data, but they also offer a justification for choosing this method *despite* its drawbacks.

Finally, this study was small-scale pilot study involving budget and time constraints with a short period of data collection. Students' knowledge, attitudes, and self-reported behaviors improved from pre- to postintervention in 2 weeks, but the researcher did not verify that improvements in knowledge and attitudes were consistently sustained beyond this time. Six-month follow-ups with the principals did not allow for systematic data collection on participants but provided valuable insight about unanticipated practical issues related to the stations. The follow-ups also suggested students were applying the handwashing knowledge and skills the interventions provided them with longer term, since principals reported group handwashing occurred 6 months after initial implementation.

Typically, authors offer suggestions for future research in the concluding paragraph of the Discussion (or in a Conclusion section). Here, those suggestions are offered in a labeled subsection, which may be a convention of the journal that published this article.

### **Suggestions for Further Research**

Future studies are needed to examine the long-term impacts of the hand-hygiene curriculum and group handwashing stations. Galiani et al. found that participants in their study retained the knowledge they gained from school hygiene activities for over 2 years;<sup>17</sup> thus it is possible that students in this study may also retain knowledge for several years after the program's implementation. A similar follow-up with students after a 2-year time period to compare students' knowledge retention with other studies in the literature is an additional research opportunity. Additional long-term studies examining the health outcomes of students exposed to a hand-hygiene curriculum and group handwashing station would be of

Often, suggestions for future research emerge from the limitations of the present study. The recommendation for long-term research here is a direct response to the time constraints discussed in the last paragraph of the Limitations subsection.

great value to provide support for the future interventions. Specifically, long-term research should emphasize if educational and environmental interventions are effective in decreasing incidences of morbidity and mortality.

Implementing this study's interventions at other schools, especially those with larger student populations, could provide increased insight about the effects of education and built, environmental interventions on handwashing, and examine influences of agency on behavior. Since classes of students washed their hands as a group under teacher supervision, students could not easily skip handwashing before meals without being noticed. It would be beneficial to assess the role of peers and teachers on an individual's handwashing behavior, and if peers or teachers are more influential in handwashing behavior to enhance handwashing promotion strategies. Similarly, since responses from students in this study, such as those in Figure 3, suggest that knowledge could spread to friends and family outside of the school setting, it would be advantageous to study the role of students on the handwashing behaviors of their parents, siblings, and even communities.

Other research should explore how to ensure hand hygiene education is integrated into a school's permanent curriculum, as opposed to isolated interventions, which would help ensure future generations of students are educated about handwashing. Interventions directed at

In these sentences, the authors recall the broader problem that inspired their research and that they described in detail in the introduction—that as a result of inadequate WASH, diseases proliferate, causing high morbidity and mortality, especially among children.

The fact that participants' handwashing behavior may have been influenced by the presence of teachers (who acted as enforcers) is a limitation that should have been discussed in the Limitations subsection.

Recommendations for future research may also derive from the results of the study—particularly unexpected or peripheral findings that suggest something but can't be confirmed without more research.



increased training for teachers and establishment of handwashing guidelines at the school would be beneficial for sustainability.

**Conclusion**

The hand hygiene curriculum improved students’ knowledge of handwashing, but the handwashing station was necessary for students to translate their knowledge into action. School-based handwashing promotion programs that include both educational and built environmental interventions can be successful in promoting handwashing behaviors and ensuring handwashing is practiced during important times at schools in both rural and urban contexts lacking proper WASH conditions. The multifaceted approach may also encourage sustainability of handwashing behaviors, which then may lead to reduced incidence of disease in the long term.

Sometimes, conclusions appear as a labeled subsection of the Discussion (as is the case here) or as an entirely separate section. Other times, they simply serve as the concluding paragraph of the Discussion, without any heading. Review examples from sample papers or journal articles in your discipline to determine how to construct and format your conclusion.

The practical or applied aspects of the research may be of interest not only to practitioners and professionals but also to researchers interested in exploring similar topics.



In their conclusion, the authors offer key takeaways from their study. They answer questions commonly answered in the conclusions of empirical research papers: “What do we know now that we didn’t know before?” And “So what?” or “Why does this matter?”