Social influence on handwashing with soap: results from a cluster randomized-controlled trial in Bangladesh

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Abstract.

We analyzed data from a cluster randomized-controlled trial (cRCT) conducted among 20 schools in Rajshahi, Bangladesh to explore the role of social influence on handwashing with soap (HWWS) in a primary school setting. Using data collected through covert video cameras outside of school latrines, we used robust-poisson regression analysis to assess the impact of social influence – defined as the presence of another person near the handwashing location - on HWWS after a toileting event. In adjusted analyses, we found a 30% increase in HWWS when someone was present, as compared to when a child was alone (PR 1.30 CI 1.14 – 1.47, p<0.001). The highest prevalence of HWWS was found when both child(ren) and adult(s) were present or when just children were present (64%). Our study supports the conclusion that the presence of another individual after a toileting event can positively impact HWWS in a primary school setting.

Washing hands with soap (HWWS) has long been recognized as important in reducing infectious disease transmission (1), particularly among those most susceptible to such infections. However, triggering and sustaining improved hand hygiene behaviors remains difficult (2, 3). That behaviors change when others are present is a basic tenet of behavioral research, yet the role of social influence on handwashing has been largely unexplored in the literature. Primarily, social influence has been treated as a source of bias – reactivity, courtesy bias, observation bias, and the Hawthorne effect are all concepts used in epidemiology to account for the potential social influence introduced through the act of observation or data collection (Table 1). In hygiene research, social influence is primarily operationalized positively in psychosocial terms – social norms, peer pressure, and social desirability all focus on the psychological processes related to how individuals alter behaviors in a manner that adheres to the expectations of those around them (Table 1). Social influence on handwashing has been examined in health care settings (4-6), with higher rates of handwashing associated with the presence of an observer or colleague at critical moments. Outside of the healthcare setting, few studies have aimed to measure effects of social norms and peer influence on handwashing behavior (7-10) . Pickering and colleagues found HWWS among Kenyan primary school students to increase by 23% when at least one other student is present (11). While studies are encouraging with respect to peer influence as a tool for handwashing promotion, further study is needed.

To explore the role of social influence on HWWS in a primary school setting, we completed a secondary analysis of data from a cluster randomized-controlled trial (cRCT) conducted among 20 schools in Rajshahi, Bangladesh. Eligibility, site selection, and data collection and analysis for the main trial have been previously reported (12) (Trial Registration: NCT02703974). In brief, 20 schools were randomly selected and assigned to receive either a nudge-based handwashing intervention or an intensive hand hygiene education intervention. This analysis examines four post-intervention follow-ups at weeks 6-7, 12-13, 18-19 and 24-25. To allow for an in-depth analysis of social influence beyond the boundaries of intervention designation, we combined data from control and intervention groups, though intervention group was still controlled for in analyses. Details of each intervention group can be found in previous publication (12).

Data were collected through video cameras (Super Circuits Covert Hidden Outdoor Electrical Box Spy Camera with Built-in DVR Recorder) disguised as electrical boxes and mounted outside of each school latrine area after approval was granted by the local education office and the school principals. Cameras captured children's behaviors in the public space entering and exiting the latrines and approaching the handwashing station (HWS). Data were recorded in Excel, noting the time, gender of the child, whether one or both hands were washed, the use of soap and water, if the HWS facility had both soap and water available, and whether another child, teacher or other adult (such as a neighbor or groundskeeper) was present when the child returned from the toileting event. At times, children urinated and/or defecated outside of the latrine facility and in view of the camera. These were recorded as toileting events and included in our analysis, though the video footage was promptly deleted by the data reviewer. To ensure consistent results, two schools from each follow-up round were randomly selected for re-review with an agreement greater than 95% between the first and second review.

Our dependent outcome variable was washing both hands with soap following a known toileting event. Our primary independent variable was social influence, defined as the presence of another person near the HWS following a toileting event. Due to the limited peripheral range of the cameras, we could only record whether someone was in view of the camera, and not necessarily in view of the child.

Social influence was first analyzed as a binary variable, comparing one or more persons present when a student returned from a toileting event to no one present or in view of the camera when returning from the toileting event. In the second analysis, social influence was defined as a categorical variable based on the type of person – no one in view of the camera as the reference group and 1) other child(ren), 2) teacher or other adult, or 3) both child and adult present as comparision groups. Data are presented as the Prevalence Ratio (PR) calculated using robust-poisson regression, adjusted for gender, school size, intervention group, and school-level clustering. A robust-poisson model was chosen as a more stable alternative to a log-binomial model for calculating changes in the probability or incidence of a binary outcome associated with the independent variable of interest.

HWWS prevalence after toileting events was 63% (990/1561) when others were present at the time of handwashing compared to 48% (384/799) when the child was alone. This translates to a 30% increase in

HWWS in our adjusted model (PR 1.30 CI 1.14 – 1.47, p<0.001) (Table 2). When social influence is defined as a categorical variable, the presence of other children (64%, 932/1467), or the presence of both children and adults (64% 33/55) was associated with the highest handwashing prevalence, while presence of an adult(s) - such as a teacher, groundskeeper, or community-member - was associated with a smaller increase in HWWS (59%, 23/39). In our adjusted model, this translates to a 30% increase in HWWS when one or more child is at the handwashing station (PR 1.30 CI 1.14 – 1.49, p<0.001), a 24% increase when both a child and an adult were present (PR 1.24 CI 1.01 – 1.52, p=0.043), and a 23% increase when one or more adult was present (PR 1.23 CI 1.03 – 1.47, p=0.024) compared to when the child was alone (Table 3).

Social influence was positively and significantly associated with handwashing in our cluster-randomized trial. Similar to the findings of Pickering and colleagues (2013), our study found that HWWS after a toileting event was 30% higher when another person was present. In reviewing camera footage, we noted several instances in which modeling appeared to be an important mechanism by which social influence influenced handwashing behavior, similar to other studies (11). Examples included students reminding others of handwashing by pointing to or leading another student to the HWS, students demonstrating proper handwashing techniques to other students, and older students assisting younger students with handwashing. Instances of modeling were observed at both nudge and hygiene education schools. The effects of role-modelling have also been documented in other settings such as healthcare facilities, noting that if the attending physician failed to wash their hands, the other physicians on the team were likely to forgo handwashing as well (6).

Even in our limited sample, we found significant differences in handwashing based on the type of person present, with a smaller increase in handwashing observed when an adult was present after a toileting event.. Our camera footage suggests that students were at times wary of approaching the HWS if teachers or adults were using it or nearby, possibly out of respect or in an effort to promptly return to class. This highlights the important role adults and teachers can play in influencing handwashing behaviours. A student's respect for teachers and adults may be a powerful motive for behavior change among school-aged children.

While the use of cameras may have helped reduce reactivity to the presence of an observer, the camera itself is likely to have engendered reactivity, the independent effect of which is difficult to measure. Additionally, our assessment of social influence was based on the cameras' field of view rather than student's own field of view. In order to address this issue and increase our confidence in our measure of social influence, we conducted a sensitivity anaylsis in which we isolated the two schools where the handwashing infrastructure was in an enclosed space. The results indicated a similar impact on HWWS, although handwashing rates without another person present were much lower (data not shown).

Social influence could be a powerful tool in promoting handwashing in a primary school setting. Our findings suggest that a hygiene promotion intervention that incorporates social norms as a cue to action could have significant potential to encourage behavior change among primary school students. Fostering positive peer pressure and peer support for improved handwashing should become central to efforts to improve handwashing among school-aged children and the impact on behaviours rigorously documented. The positive potential of social influence could also be considered in the design of school sanitation facilities, ensuring that handwashing facilities are placed in spaces visible to other students. However, caution should be exercised in re-designing facilities, as gender-separated latrines and privacy for girls must be maintained. We therefore recommend exploration of a user-centered design for both the handwashing facility and the latrine area that enables social forces to act on the handwashing facility while maintaining gender and privacy needs within the latrine area.

Table 1: Common terms used to describe how social influence alters behaviors	
Term	**Definition**
Reactivity	Modifying one's behavior as a reaction to being observed (13)
The Hawthorne effect	Describes a specific form of reactivity in which an individual changes their behavior due to the awareness of an experiment, study or the presence of a researcher (14)
Observation bias	Bias in an observer's measurement or interpretation of their observation that results in misclassification or other error (15)
Experimenter bias	Bias in the observer's results due to preconceived expectations influencing the experimental design or interpretation (16) (also known as "expectancy bias" or "observer-expectancy effect")
Courtesy bias	Modifying behaviors or responses to better fit social norms and/or avoid offending others (17)
Social norms	societal rules dictating acceptable behavior (18)
Peer pressure	Influence exerted by a peer group that compels someone to conform or act in a certain way (19)
Social desirability	Behaving in a manner that is perceived as desirable or acceptable (20)

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Table 2: Washing both hands with soap comparing social influence to no social influence after known toileting events for the four combined follow-up collections

Social influence	% (N)	Adjusted PR*	Confidence Interval	P-value
Total	58% (1374/2360)			
No one present or in view of the camera	48% (384/799)	Ref		
At least one person present	63% (990/1561)	1.3	1.14 - 1.47	<0.001

**adjusted for gender, school size and intervention group*

Table 3: Washing both hands with soap by type of social influence after known toileting events for the four combined follow-up collections

Type of social influence	% (N)	Adjusted PR	Confidence Interval	P-value
Total	**58% (1374/2360)**			**Wald Test: <0.001**
No one present	48% (384/799)	Ref		
Children	64% (932/1467)	1.30	1.14 – 1.49	<0.001
Adult	59% (23/39)	1.23	1.03 – 1.47	0.024
Both child & adult	64% (35/55)	1.24	1.01 – 1.52	0.043

**Adjusted for gender, school size and intervention group*

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