Spillover Effects of Handwashing Behavior in Children: Pre-Analysis Plan

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Abstract

Programs in early education are often intended to teach basic skills that should be adopted not only within schools but more broadly in daily life. The process of information transfer from the institution to the home, however, is both poorly understood and often unsuccessful. This study examines (1) the impact of introducing a handwashing campaign and handsoap dispensers into primary schools in rural Bangladesh on hygiene practice and child health; and (2) the precise process of information transfer of such practices within and across institutions. Using time-stamped sensors in handsoap dispensers distributed both at schools and at households to a random subset of primary school attendees, paired with a hygiene curriculum randomized at the classroom level, the process of information and behavioral spillovers are tracked along two key dimensions: (1) school-to-home spillovers, as some children will come from treated classes while others will not, and (2) home-to-school spillovers, as some classes will have a higher concentration of children treated at home than other classes.

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1 Experimental Design

This study employs a randomized field experiment in 26 primary schools and 858 households in rural Bangladesh over a five month period. In order to track the institutional spillovers of handwashing behavior between school and home, the design must first generate exogenous variation in handwashing behavior. At the school level, this is done by randomizing the administration of a simple media information campaign across classrooms. The campaign involves a series of children's cartoons revolving around hand hygiene, the entirety of which takes approximately fifteen minutes to air (aired via a projector in the classroom) and is done twice per week for the duration of the experiment. At the home level, the exogenous variation is generated by randomizing the saturation of distribution of soap dispensers across classrooms.

To address the school to home spillover effect, sample is stratified by schools and the educational campaign exposure is randomized at the classroom level. For each school, one half of classes are randomly assigned to the handwashing educational campaign (T) and the remaining half to no campaign (C). To measure changes in handwashing behavior, all classrooms receive a liquid handsoap dispenser with a sensor (which records second-level presses to release soap) as well as a free weekly refill of soap for the duration of the experiment. A subset of students are randomly chosen from each classroom to also receive dispensers in their home, through which the effectiveness of the school program is tracked: if the households of students from treated classrooms wash more at home than the households of students from control classrooms, then cross-institutional information transfer from school to home is established. Enumerators will visit each household once per month to refill the soap and to collect handwashing and child health data.

To trace the home to school spillover effect, we exploit the student-level randomization of home dispensers: in a simple saturation design with student-level randomization stratified at the classroom level, either two or 25% of students are randomly identified to receive the dispenser at home. Specifically,

classes in T will be further randomized into two groups: (T0) low saturation and (T1) high saturation, where T0 classes will randomly select two students from each class to receive the soap dispenser at the student's home and T1 classes will randomly select 25% of the students from each class to receive the dispenser at their homes. Classes in C will likewise be randomized into two groups: (C0) low saturation and (C1) high saturation. Enumerators will visit each school once per week to refill the soap and collect handwashing and attendance data.

Estimated effects:

1. **Information treatment effect: Classroom dispenser use data for (T) v. (C)**

2. **School to home spillover effect: Household dispenser use data and child health data for students and siblings from treated classrooms (T) v. students and siblings from control classrooms (C):**By installing the soap dispensers at the households, the extent to which the treatment received in classrooms is transferred to and manifested within students' homes can be estimated.

3. **3. Home to school spillover effect: Classroom dispenser use data for classrooms with high saturation (T1 + C1) vs. classrooms with low saturation (T0 + C0):** By comparing the handwashing rates of the low-saturation classes to those of the high-saturation classes, whether students who cultivate a behavior at home are more likely to perform it at school can be tracked. Because the handsoap dispenser is at the classroom level, the effect picked up (T1+C1 vs. T0+C0) will be the combined effect of behavior brought to school by students with a dispenser at home and subsequent peer effects at school (the more peers one has washing their hands, the more likely one is to wash). While this design does not allow to disentangle the two, it is important to note that peer effects cannot take place unless there first exists a home to school spillover.

We also try to minimize the peer effects by making the dispenser allocation blind to all the students, such that the household participant children will learn about the dispenser at home first and the children in school will not know who does or does not have a dispenser at home unless the child chooses to reveal and shift behavior at school accordingly.

a. Household spillovers:

i. Because handsoap dispensers are attached to households, not household members, it is impossible to determine precisely who is using the dispenser at home. However, Hussam et al. (2019b) find that self-reported rates of handwashing are correlated with child health improvements from handsoap dispensers, suggesting that we may be able to rely on self-reports to track this process of transfer. Monthly reports from all household members of how often they washed their hands with soap at dinnertime in the three prior evenings are gathered. If within-household spillovers exist, then family members of treated classroom children will report higher likelihood of washing than family members of control classroom children.

ii. Variation in the number of Control (C) classroom siblings of children in Treated (T) classrooms: if there exists higher handwashing rates among Control classrooms that have a higher concentration of siblings of Treated classroom children, the study has traced the process of information transfer from school to home, sibling to sibling, then home to school. With only 78 classrooms, the experiment is unlikely to be powered to do this, but this exploratory analysis will be run nonetheless.

2 Outcomes of Interest

The primary outcome variables are the daily handwashing rates at each classroom at the school level and the daily handwashing rates and the child health measures collected at each household at the household level.

2.1 School Level

A. Classroom Handwashing Rate

Daily handwashing rates are precisely measured by and extracted from the time stamped sensor embedded in each of the liquid soap dispensers installed inside the classrooms. At each press of the dispenser, a sensor records the exact time when the button is pressed. We normalize the number of presses by the attendance data and the hours each class spend inside the classroom. For classes that share the same classroom and thus share the same dispenser, we also collect data on the exact timing of the classroom change and match the dispenser usage data to the class occupying the classroom at the time. The identity of the user is unknown, but we proxy for distinct users by collapsing presses that occur two or fewer seconds apart into a single press. Furthermore, since the exact time the dispenser was pressed is known, meal-time specific handwashing rates (the time most advocated by the public health campaigns) can be calculated, by asking the schools their reported lunch time.

2.2 Household Level

A. Unconditional Household Handwasing Rate

Daily handwashing rates are precisely measured by and extracted from the time stamped sensor embedded in each of the liquid soap dispensers installed at each selected households. The enumerators were instructed to install the dispensers near the water source inside the household or the veranda where families typically eat meals together. At each press of the dispenser, a sensor records the exact time when the button is pressed. We normalize the number

of presses by the number of household members. The identity of the user is unknown, but we proxy for distinct users by collapsing presses that occur two or fewer seconds apart into a single press. Furthermore, since the exact time the dispenser was pressed is known, meal-time specific handwashing rates can be calculated, by asking the households their reported meal time.

B. Conditional Household Handwasing Rate

We also measure the conditional daily handwashing rates at the household, taking into consideration the number of adults and the number of children at the household. This will help us see if there exists any information transfer or spillover within the household members.

C. Child Health

Child health measures on the selected subset of students and their siblings who receive liquid soap dispensers at the households will be collected.

Incidence of child diarrhea and respiratory illness is collected at the baseline and every month by enumerators, and consist of self reports in which mothers are asked how many days each child had experienced diarrhea in the past two weeks, and likewise for respiratory illness (cough, cold).

Anthropometric measures of height, weight, and mid-arm circumference of the children were collected at baseline, and will be collected again at the five month mark during endline.

3 Specification

3.1 School to Home effect

Our preferred specification for the primary household outcomes is as follows:

$$Y_{ht} = \alpha_{ht} + \beta Campaign_h + \gamma_t + \theta_v + \lambda_s + \delta_c + \epsilon_{ht} \tag{1}$$

where Y_{ht} represents the household outcomes specified in Section 2, on day t from the household h. $Campaign_h$ is an indicator variable for the treatment assignment that equals 1 if the child from the household h is in a treated class and watches the handwashing campaign videos at school. γ_t is a time fixed effect, θ_v is a village fixed effect, λ_s is a school fixed effect, and δ_c is a class fixed effect.

3.2 Home to School effect + Peer effect

$$Y_{ct} = \alpha_{ct} + \beta Highsat_c + \gamma_t + \lambda_s + \delta_c + \epsilon_{ct} \tag{2}$$

For the home to school effect, we compare the handwashing rates at the classrooms with different saturations of students with dispenser at home. Y_{ct} represents the class outcomes specified in Section 2 and $Highsat_c$ is an indicator variable for the saturation treatment asssignment that equals 1 if the classroom c had at least 25% students who were selected to receive the soap dispenser at their home and equals 0 if the classroom only has 2 selected students. γ_t is a time fixed effect, λ_s is a school fixed effect, and δ_c is a class fixed effect.

4 Heterogeneity

Home to School effect

- **Student Characteristics:** Do certain student characteristics influence the magnitude of home to school spillovers? For example, do popular students or academically talented students affect the behaviors of their peers more than bullies or troublesome students do?
- **Teacher Characteristics:** Do teachers' gender, experience, or relationship with the students affect the students' home to school spillover effect?
- **Gender Composition:** Does the knowledge and behavior spread quicker at classes where the female to male ratio is higher?

School to Home effect

- **Child's Gender:** Are female students who watch the campaign videos more likely to spread that information to her mother and her siblings?
- **Child's Birth Order:** Are firstborn students more likely to spread the information and induce behavioral changes in her siblings?

References

Hussam R., Rabbani A., Rigol N., and Roth B., 2019. "Habit Formation and Rational Addiction: A Field Experiment in Handwashing" Working paper.