Handwashing and Habit Formation: A Test of Rational Addiction

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ASSA 2018: AEDB Session
Handwashing with soap

- High rates of child stunting and mortality worldwide due to bacterial and viral transmission
  - Diarrhea, ARI
  - 2 million child deaths yearly (WHO 2013)

- Handwashing with soap
  - “the most effective vaccine against childhood infections” (World Bank 2005)

- But handwashing rates abysmally low (3-35%) worldwide, especially during critical times. Why?
Why don’t people wash their hands?

1. Scarcity of information
   - Information interventions have not worked. (WSP 2015, Galiani et al. 2015)
   - People believe washing is important.

2. Scarcity of resources
   - Resource interventions, including our own, have not worked. (WSP 2013, Ejemot et al. 2015, SHDS 2015)
   - People have soap and water.

3. No health returns in high-disease environments
   - Not true in our setting: handwashing reduces acute respiratory infection and loose stool incidence
   - Translates into significant improvements in weight and height

People still don’t wash.
Key features of handwashing with soap

1. Preventive activity.
   - Returns are not salient.

2. Not a social norm.
   - No persistent social costs to shirking.

3. Repetitive activity.
   - Repeated engagement is costly...unless it becomes a habit.

These features apply to many important health activities: water treatment, latrine use, clean cookstove use, etc.
Conceptual framework: habits and rational addiction


1. Habit formation: intertemporal complementarities in the utility from consumption

2. Rational habit formation: Agents are aware of complementarities, so changes in future consumption affect current consumption
What we do in practice

We implement an RCT among 2900 rural households with young children in West Bengal.

1. Our experimental design randomizes:
   - whether agents receive monetary incentives, social incentives, only a soap dispenser, or no intervention for daily handwashing
     ⇒ habit formation
   - whether agents anticipate monetary incentives, social incentives, or neither
     ⇒ rational habit formation

2. We observe:
   - precise measure of handwashing behavior before, during, and after withdrawal of the interventions
   - willingness-to-pay for soap
   - child health: diarrhea, ARI, weight, height
Measurement technology: from the Media Lab
Measurement technology: to the field
Handwashing outcome measure

Primary outcome: binary measure of dispenser use during the family’s self-reported evening mealtime.

Maximize $\sigma$ by making handwashing amenable to habituation:

$\Rightarrow$ **habit loop:** trigger, routine, feedback (Neal et al. 2015)
Households are visited once every two weeks.
Incentives intervention

Incentivized households receive:

1. calendar
2. dispenser to keep
3. soap for one year
4. tracking of behavior on calendar
5. tickets (one or three) per night dispenser active
   - redeemed for child and household prizes (on day of receipt or later)
   - 1 ticket = Rs. 3 = USD 0.05

**Note:** tracking measured and incentives earned daily, but recorded and received every two weeks
Incentives

Incentive villages

- **pure control**
  - 1 ticket (2 mo)
  - 1 ticket (2 mo)

- 1 ticket (2 mo)
  - 3 tickets (2 mo)
  - **ANTICIPATE**

- 1 ticket (2 mo)
  - 3 tickets (2 mo)
  - **SURPRISE**
Parallel monitoring experiment

Disentangling incentives from feedback alone:

- Full sample
- Monitoring villages (MV)
- Incentive villages (IV)
## Monitoring intervention

<table>
<thead>
<tr>
<th>Household Receives</th>
<th>Incentive</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>calendar</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>dispenser to keep</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>soap for one year</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>feedback on calendar</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>tickets</td>
<td>×</td>
<td></td>
</tr>
</tbody>
</table>
Monitoring

Monitoring villages

- pure control
  - dispenser (2 mo)
    - dispenser (2 mo)
  - monitoring (2 mo)
    - ANTICIPATE
      - dispenser (2 mo)
      - monitoring (2 mo)
        - SURPRISE
Roadmap

1. Introduction
2. Conceptual framework
3. Experimental design
4. Habit formation results
   - Contemporaneous effects
   - Persistence effects
   - Anticipatory effects
5. Child health results
6. Conclusion
Contemporaneous effects
Contemporaneous effects: receiving any tickets increases handwashing at dinnertime.

![Graph showing the likelihood of washing during reported dinner time](image-url)
**Contemporaneous effects**: tripling tickets has little effect on handwashing

Fraction of households who used at dinner time

- Day
- Standard incentive
- 3x incentive

![Graph showing fraction of households who used at dinner time](image-url)
Contemporaneous effects: monitoring increases handwashing

Fraction of households who used at dinner time

Day

Dispenser control
Monitoring
Persistence effects
**Habit formation**: previously receiving incentives makes you wash more on extensive margin.

![Graph showing habit formation results](image-url)

- Fraction of households who used at dinner time

<table>
<thead>
<tr>
<th>Day</th>
<th>Dispenser control</th>
<th>Former standard incentive</th>
<th>Former triple incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>80</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>110</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>140</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Habit formation: previously receiving triple vs. single tickets does not persist.
**Habit formation**: previously being monitored makes you wash more.

![Graph showing habit formation results](image-url)
Rational habit formation effects
Rational habit formation: no evidence in households anticipating triple tickets

Dinnertime dispenser use: incentives

- Unanticipated 3X tickets
- Anticipated 3X tickets
Rational habit formation: strong evidence in households anticipating being monitored.
Child health effects
Handwashing decreases loose stool and ARI incidence

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any loose stool</td>
<td>-0.0315***</td>
<td>-0.0817***</td>
<td>-0.0393**</td>
<td>-0.204**</td>
</tr>
<tr>
<td></td>
<td>[0.00975]</td>
<td>[0.0236]</td>
<td>[0.0154]</td>
<td>[0.0884]</td>
</tr>
<tr>
<td>Total days of loose stool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any ARI symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total days of ARI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Received dispenser</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of pure control</td>
<td>0.100</td>
<td>0.209</td>
<td>0.270</td>
<td>1.247</td>
</tr>
<tr>
<td></td>
<td>[0.00572]</td>
<td>[0.0151]</td>
<td>[0.00886]</td>
<td>[0.0504]</td>
</tr>
<tr>
<td>Observations</td>
<td>3,820</td>
<td>3,830</td>
<td>3,830</td>
<td>3,830</td>
</tr>
</tbody>
</table>

Notes: Observations are at the child level. "Received dispenser" is any household that received a dispenser, pooled over treatment arms. p-values adjusted for multiple hypothesis testing using Anderson (2008). *** p<0.01, ** p<0.05, * p<0.1.
Handwashing improves child anthropometric outcomes

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received dispenser</td>
<td>0.135*</td>
<td>0.227*</td>
<td>0.0752*</td>
</tr>
<tr>
<td></td>
<td>[0.0640]</td>
<td>[0.0902]</td>
<td>[0.0518]</td>
</tr>
<tr>
<td>Mean of pure control</td>
<td>-2.167</td>
<td>-1.866</td>
<td>-1.365</td>
</tr>
<tr>
<td></td>
<td>[0.0459]</td>
<td>[0.0666]</td>
<td>[0.0432]</td>
</tr>
<tr>
<td>Observations</td>
<td>863</td>
<td>862</td>
<td>858</td>
</tr>
</tbody>
</table>

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To summarize:

1. Handwashing alone has **substantial impacts on child health**
2. Financial incentives and monitoring without incentives increases handwashing
3. **Handwashing is habitual**: effects persist after incentives or monitoring are removed
   ⇒ optimal scheme: frontload incentives
4. **Agents are rational habit formers**: anticipation of a rise in the future likelihood of handwashing increases current handwashing
   ⇒ optimal scheme: delay and announce incentives
A model of habit formation for good behaviors

Discrete time model with periods 1, ..., T.

Agent chooses to:
- wash hands: \( w_t = 1 \)
- not wash: \( w_t = 0 \)

Habit stock of activity:
- \( k_t = \gamma k_{t-1} + w_{t-1}, \gamma \in [0, 1) \)
  where \( \gamma \) is the level of decay
A model of habit formation for good behaviors

Define the agent’s instantaneous utility from washing in period $t$ as

$$u_t(w_t, k_t) = \begin{cases} 
\alpha - [x_t - \sigma k_t] & \text{if } w_t = 1 \\
0 & \text{if } w_t = 0 
\end{cases}$$

(1)

where

- $\alpha$ is the health benefit from washing
- $x_t$ is the cost of washing (in time, effort, attention)
- $\sigma$ is ease in washing due to habituation

Behavior is **habit forming**: $\frac{\partial u_t}{\partial k_t} > 0 \Rightarrow \sigma > 0$
Levers to increase handwashing

We want to maximize the net instantaneous utility of handwashing:

\[
    u_t(k) = u_t(1, k) - u_t(0, k) = \alpha - x_t + \sigma k_t
\]  

When consumption stock is zero, we can only shift:

- \(x_t\): subsidize cost of washing

Once \(k_t\) is positive, \(\sigma\) kicks in \(\Rightarrow\) subsidy can be temporary.
Testable predictions

\[ u_t(k) = \alpha - x_t + \sigma k_t \]

1. **Incentives:** \( \frac{\partial u_t}{\partial x_t} \leq 0 \). Reducing the cost of handwashing (by increasing the value of handwashing) raises handwashing rates.

2. **Habit formation:** \( \frac{\partial u_t}{\partial k_t} \geq 0 \). A rise in past handwashing rates increases current handwashing rates.
Testable predictions

\[ u_t(k) = \alpha - x_t \left( \frac{\partial}{\partial x_t} \right) + \sigma k_t \]

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Rational habit formation

In a world where agents are forward looking, their long run utility is:

$$U_t(k_t) = \max_{w_t} \begin{cases} 
[\alpha - x_t + \sigma k_t] + \delta U_{t+1}(\gamma k_t + 1) & \text{if } w_t = 1 \\
\delta U_{t+1}(\gamma k_t) & \text{if } w_t = 0 
\end{cases}$$

Additional testable prediction:

Rational habit formation: $\frac{\partial^2 U_t}{\partial k_{t+1}} \geq 0$. An anticipated [and actual] rise in future handwashing rates is associated with an increase in current handwashing rates.

Consistency check:

Health: $\alpha \geq 0$. Handwashing generates positive health internalities.
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