A Study of Long-term Performance of the Sawyer PointONE™ Filter as Household Point of Use Water Treatment

Thomas Soerens¹, Erik Lindquist¹, Lawrence Mylin¹,², Jose Sanchez³, David Reddy⁴, Holly Ross¹, Andrew Nevin¹, Daniel Yeisley¹

¹The Collaboratory for Strategic Partnerships and Applied Research at Messiah College, ²Hershey Medical Center, ³Food for the Hungry, Bolivia, ⁴Give Clean Water, Fiji
Outline

• Background
• Field sampling
• Lab bacterial challenge
  – Results
• Further work
Sawyer PointONE™ filters

- Hollow Fiber Membrane:
  - PointONE™ = 0.1 µm pore size
  - 7 log bacteria removal
- POU bucket filter system

Images source: sawyer.com
Lindquist et al.¹: Sawyer PointONE bucket filters distributed to 952 households in Cochabamba, Bolivia

- Followed for 12 weeks after distribution and monitored for diarrheal disease in children under 5 years of age
- Diarrheal disease was reduced significantly in the households given filters: 78% reduction.

### Diarrheal disease prevalence and intervention effect estimates

<table>
<thead>
<tr>
<th>Study arm</th>
<th>May 2010 diarrhea period prevalence (%)</th>
<th>June 2010 diarrhea period prevalence (%)</th>
<th>July 2010 diarrhea period prevalence (%)</th>
<th>Diarrhea prevalence over 12-week period (%)</th>
<th>Diarrhea prevalence ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (N = 220)</td>
<td>49</td>
<td>39</td>
<td>42</td>
<td>43</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>WASH BCC (N = 246)</td>
<td>61</td>
<td>20</td>
<td>14</td>
<td>30</td>
<td>0.71 (0.59–0.86)</td>
<td>0.0857</td>
</tr>
<tr>
<td>Filter (N = 235)</td>
<td>10</td>
<td>10</td>
<td>6</td>
<td>9</td>
<td>0.21 (0.15–0.30)</td>
<td>0.0286</td>
</tr>
<tr>
<td>Filter and WASH BCC (N = 203)</td>
<td>11</td>
<td>9</td>
<td>12</td>
<td></td>
<td>0.27 (0.22–0.34)</td>
<td>0.0286</td>
</tr>
</tbody>
</table>

Methods

• Summer 2015: Filters in use for 5 or 6 years were sampled in Cochabamba, Bolivia and Ba, Fiji

• Field Samples
  – Source water
  – Filtered water
  – After backflush
  – After backflush with bleach

• Field lab analysis (same day)
  – IDEXX Colilert® Quantitray®/2000 MPN
  – Membrane filtration: total Coliform
    • m-ColiBlue24®, 3 dilutions
Methods

• Lab in PA
  – Filters sampled in field were collected
    • Ends sealed for transport. Hand carried to PA.
  – Disinfect with bleach in lab
  – Bacterial challenge with $10^6$-$10^8$ e. coli/100mL
    • IDEXX Quantitray/2000 MPN
    • Membrane filtration count
Results – lab breakthrough

- Bolivia 5 yr filters (preliminary)
Results – lab breakthrough
• Fiji 6 yr filters

[Graph showing log removal for WHO Protective, WHO Highly Protective, and EPA standards, with bars for each year from 1 to 24.]
Observations

• Filters can last at least 6 years if taken care of
  – *But some fail*
  – *Training, practice, culture make a difference*
• Weak links
  – *Losing, not using filter*
  – *cleaning system (e.g., lost syringe) note: new design*
  – *Housing, o-ring (to a lesser degree)*
• Filters can host bacteria on effluent end
• Some filters had very low flow
  – *Filters that were not used for awhile and/or not cleaned*
    • *Chicken vs egg*
Additional and future work

- Testing of filters taken from field by Sawyer.
  - Preliminary results similar to Bolivia, Fiji
- 1 million gallons put through 24 filters in lab.
Acknowledgements

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• Additional support by The Collaboratory for Strategic Partnerships and Applied Research
  – *Increasing hope and transforming lives through education, collaboration, innovation and service.*
  – *Over 200 students working on 40 projects with partners in 14 countries.*

• announcement: currently searching for Dean of School of Science, Engineering, and Health.