Preventing Waterborne Disease

Professor Kristen Jellison
BioS 10
November 1, 2013
Waterborne Disease – Global Statistics

- 1.1 billion people lack access to improved water supply
- 2.6 billion people lack access to improved sanitation
- Between 1.085 to 2.187 million deaths each year due to diarrheal diseases can be attributed to the ‘water, sanitation, and hygiene’ risk factor
  - 90% of these deaths are among children under age 5
Proportion of the population using improved drinking water sources, total

LEGEND

- 100%
- 90% - 99%
- 70% - 89%
- 50% - 69%
- Less than 50%
- No data

* disclaimer
Burden of Waterborne Disease

- Water-related disease is the 2\textsuperscript{nd} biggest killer of children worldwide (1\textsuperscript{st} = acute respiratory infections)
- At any one time:
  - half of the world’s hospital beds are occupied by patients suffering from water-related diseases (WaterAid, 2008)
  - half of the population of the developing world is suffering from one or more diseases associated with inadequate water and sanitation (WaterAid, 2008)
Burden of Waterborne Disease

- 443 million school days lost annually to water-related diseases

  - to reduce by half the proportion of people without access to safe water and sanitation by 2015
  - An extra $10 billion needed each year to reach the goal (this is about half of what rich countries spend on mineral water)
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*Ultimate goal*: Prevention of waterborne disease

- Water treatment technologies
  (emphasis on developing countries)
  - *Biosand filtration*

- Watershed management
  - *Parasite fate and transport*
Biosand Filtration

- 0.3m x 0.3m x 0.9m
- Weight: 170 lbs.
- Costs: $10-45 USD
Biosand Filtration

From spiked water tank

2 concrete BSFs
2 concrete BSFs modified with rusty nails
2 bucket (5-gal) BSFs
2 bucket (5-gal) BSFs modified with rusty nails
2 bucket (2-gal) BSFs
2 bucket (2-gal) BSFs modified with rusty nails
Biosand Filtration
Biosand Filtration

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Avg</th>
<th>Std Dev</th>
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<tbody>
<tr>
<td>Influent</td>
<td>4.82</td>
<td>61.37</td>
<td>30.17</td>
<td>18.40</td>
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<td>Concrete</td>
<td>0.15</td>
<td>1.61</td>
<td>0.43</td>
<td>0.29</td>
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<tr>
<td>5gal buckets</td>
<td>0.15</td>
<td>1.60</td>
<td>0.46</td>
<td>0.31</td>
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<td>2gal buckets</td>
<td>0.23</td>
<td>1.41</td>
<td>0.53</td>
<td>0.28</td>
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</tbody>
</table>
Biosand Filtration

**Total Coliforms Removal**

**E. coli Removal**
Biosand Filtration

**Cryptosporidium Removal**

**MS2 Virus Removal**
Conclusions:

- Biosand filtration can be effective with smaller units
  - The addition of nails to the diffuser basin enhanced virus removal
  - No appreciable correlation between bacterial and *C. parvum* removal and pause period was identified
  - Increasing the pause period increased virus removal for all filter sizes (this relationship was stronger for filters without nails)
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**Ultimate goal**: Prevention of waterborne disease

- Water treatment technologies (emphasis on developing countries)
  - Biosand filtration
- Watershed management
  - Parasite fate and transport
Cryptosporidium
Cryptosporidiosis

(Adapted from Current & Blagburn, 1990)
Summary

Ultimate goal: reduce prevalence of waterborne disease

- Optimize household water treatment options in developing countries and develop standard operating procedures for their use
- Understand parasite fate and transport in the environment
- Identify public health risk associated with parasites in drinking water supplies
- Improve methods for watershed monitoring of parasites
Acknowledgements

**Graduate Students**
- Elizabeth Wolyniak
- Julie Napotnik
- Xia Luo
- Kyle Doup
- Robin Barnes-Pohjonen
- Colin McCleod
- Sandra Connelly
- Amy Lynch
- Joseph Ziemann
- Ryan Smith

**Undergraduate Students**
- Tom Jawin
- Annie Cornell
- Jennifer Markham
- Natalie Tacka
- Natalie Smith
- Kyle Doup
- Sara Zientarski
- Margo Wilson
- Nadine Kotlarz
- Kelsey Preston
- Ally Mayer
- Kevin Myers

**Funding Agencies**
- National Science Foundation
- U.S. Environmental Protection Agency
- Lindbergh Foundation
- PA Department of Community and Economic Development
- Pennsylvania State University

**Collaborators**
- Philadelphia Water Department
- U.S. Centers for Disease Control
- Centre for Affordable Water and Sanitation Technology (CAWST)
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