Disease Transmission and Control in the Home Setting

Teleclass Presented by Dr. Charles Gerba, University of Arizona
March 20, 2003

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Disease Transmission and Control in the Home Setting
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Slide 2

“Water disinfection and personal hygiene ended the age of epidemics.”

“The development of antibiotics and vaccines have had only a small impact on mortality.”

V. Greene

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The Home is a Multifunctional Setting

• A residence
• restaurant
• day care setting
• a hospital
• and animal shelter

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Significance of Hygiene in the Home
• Most foodborne infections occur in the home
• Cross contamination is the cause of 30% of the Salmonella outbreaks
• 2/3 of all colds originate in the home setting

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Sources of Pathogens Within the Home
• People
• Pets
• Food
• Water
• Air
• Fomites (Inanimate Objects)

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The Germest Areas in the Home
• Kitchen
  – cleaning tools (sponge or dishcloth)
  – sink
  – cutting board
• Bathroom
  – sink
• Washing machine
• Playroom or child’s bedroom

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Ranking of Sites by Coliform Densities. The Four Most and Four Least Contaminated Sites Are Shown.

- Geometric mean per cm² or per mL

Sponge/dishcloth
Bath sink drain
Kitchen sink drain
Cutting board
Kitchen floor
Bath countertop
Bath floor
Toilet seat

__________________________________________________________________________

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Importance of Hands in Disease Transmission

- A small child will bring their hands to their nose or mouth once every three minutes
- A child will swallow the amount of household dust found on six kitchen floor tiles per day
- A working adult will touch as many as 30 objects in one minute
- The hands are the major route of transmission for colds and many enteric diseases

__________________________________________________________________________

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Risk Model for Hard Surfaces

Number of organisms per square centimeter

% transferred to hand

Contamination of food

Growth in the food

Probability of becoming ill

% transferred to mouth

__________________________________________________________________________

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Bugs in Your Underwear

The Hidden Secrets of Enteric Bacteria

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Occurrence of Coliforms and Fecal Coliforms in Wash Water After Laundering

<table>
<thead>
<tr>
<th>Type of Clothing</th>
<th>Coliform Arithmetic Average</th>
<th>Fecal Coliform Arithmetic Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Washer Load</td>
<td>Per Item</td>
</tr>
<tr>
<td>Underwear</td>
<td>5.2 x 10^6</td>
<td>4.5 x 10^6</td>
</tr>
<tr>
<td>Jeans</td>
<td>7.2 x 10^6</td>
<td>1.07 x 10^3</td>
</tr>
<tr>
<td>Bath Towels</td>
<td>1.2 x 10^6</td>
<td>1.77 x 10^3</td>
</tr>
</tbody>
</table>

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Occurrence (%) of Coliforms and E. coli in Washing Machines and Laundered Clothes*

<table>
<thead>
<tr>
<th>Sample</th>
<th>Coliforms</th>
<th>E. coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface of Drum†</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Cloth swatch</td>
<td>44</td>
<td>16</td>
</tr>
<tr>
<td>Final Rinse Water‡</td>
<td>25</td>
<td>1.5</td>
</tr>
</tbody>
</table>

*Results from 140 samples collected from households
†10 ml samples
‡100 ml samples
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Transfer of Bacteria between Fabrics

<table>
<thead>
<tr>
<th>Organism</th>
<th>Inoculated CFU log10 Recovered After Laundering</th>
<th>Sterile CFU log10 Recovered After Drying</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inoculated Swatches</td>
<td>Sterile Swatches</td>
</tr>
<tr>
<td>S. aureus</td>
<td>5.3</td>
<td>4.8</td>
</tr>
<tr>
<td>E. coli</td>
<td>6.0</td>
<td>5.2</td>
</tr>
<tr>
<td>S. typhimurium</td>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>M. fortuitum</td>
<td>5.9</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Swatches contained 5.1 to 5.5 CFU log10 of organisms recovered before washing.

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Risk of Rotavirus Infection from Laundering

<table>
<thead>
<tr>
<th>Concentration of Virus</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 10^7</td>
<td>The amount in 0.001 g of feces</td>
</tr>
<tr>
<td>2 x 10^5</td>
<td>After washing 99% reduction sq. cm clothing</td>
</tr>
<tr>
<td>2 x 10^4</td>
<td>After 28 min. drying</td>
</tr>
<tr>
<td>2 x 10^3</td>
<td>After washing 99% reduction sq. cm clothing</td>
</tr>
<tr>
<td>2 x 10^2</td>
<td>After 28 min. drying</td>
</tr>
<tr>
<td>2 x 10^1</td>
<td>After 28 min. drying</td>
</tr>
<tr>
<td>2 x 10^0</td>
<td>After 28 min. drying</td>
</tr>
<tr>
<td>2</td>
<td>1% transferred to hands</td>
</tr>
<tr>
<td>2</td>
<td>10% transferred to mouth</td>
</tr>
<tr>
<td>Risk of infection</td>
<td>1:10</td>
</tr>
</tbody>
</table>

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Environments Most Contaminated with Bodily Fluids (saliva, urine, blood)

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Occurrence of fecal bacteria on the hand (United States)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Greatest</th>
<th>Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparing a meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children after playing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doing the laundry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person exiting a toilet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Most Contaminated Sites in Offices (Total Bacteria)

- Desk Tops
- Phone (mouth piece and handle)
- Fax Keys
- Computer Mouse
- Computer Keyboard
- 60% of coffee cups contain coliform bacteria

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Public Toilets

- Diseases shown to be transmitted by public toilets: Hepatitis A, Norwalk, Salmonella, Shigella
- Pathogens are most likely found in the sink, faucet, and bottom of toilet seat. Least likely on door knob and stall latch
- Women’s restrooms contain more coliform on all surfaces than men’s restroom, except the floor

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Public Toilets

- Institutional restrooms are the most contaminated, while fast food restaurants and hospitals are the cleanest
- *E. coli* and *Salmonella* most commonly isolated from the restroom sink
- *Salmonella* found in 3% of the sinks tested

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Goals of Home Hygiene

- Identify those places where you are most likely to come into contact with pathogens
- It is not to kill all microorganisms, but to target the reduction and killing of pathogenic microorganisms to levels that present no significant risk of infection
- To accomplish this goal is not by more cleaning, but by the development of better cleaning tools and products

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Types of Products that Aid Hygiene in the Home

- Disposable cleaning tools (e.g. paper towels, disinfecting wipes)
- Cleaning tools which prevent the growth of bacteria (e.g. antimicrobial sponges)
- Self disinfecting or antimicrobial surfaces (e.g. cutting boards)
- Products which both clean and disinfect
- Hand sanitizers (alcohol gels)
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Ranking of Sites by Coliform Densities. The Four Most and Four Least Contaminated Sites Are Shown for Each Period.

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Cleaning Protocols for Phase 3 of the Study

<table>
<thead>
<tr>
<th>Kitchen Surface</th>
<th>Cleaning and Disinfecting Method</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponge or dishcloth</td>
<td>Soak in bleach 5 - 10 min.</td>
<td>3/ week</td>
</tr>
<tr>
<td>Countertop, cutting board, handles</td>
<td>Spray with disinfectant cleaner, wipe clean after 30 sec.</td>
<td>daily</td>
</tr>
<tr>
<td>Floor around kitchen sink</td>
<td>Spot clean with disinfectant cleaner, wipe clean after 30 sec.</td>
<td>daily</td>
</tr>
<tr>
<td></td>
<td>Mop with disinfectant, let stand 5 min., rinse</td>
<td>3/ week</td>
</tr>
</tbody>
</table>