Assessing Microbial Contamination on Computer Keyboards at CCSU
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Introduction and Background
Bacteria are found on keyboards in computer labs at Central Connecticut State University. Bacteria are a part of normal life; some may end up causing disease but other bacteria, a person’s normal flora, are benign or beneficial. People pick up bacteria from environmental sources, including inanimate surfaces (fomites). There has been much research on bacterial contamination of computer keyboards, particularly in health care settings. These studies usually demonstrate the presence of significant levels of contamination including pathogens.

This study examines levels and types of bacterial contamination on computer keyboards in open access student computer labs in Copernicus Hall at Central Connecticut State University. Hypothesis: Keyboards that are commonly used harbor more bacteria than keyboards that are not used often. Computer keyboards have the ability to “self-clean” overnight.

Methods:

Locations Tested
Several computer labs were chosen to collect samples from. The keyboards closest to an exit or entrance of the labs were chosen because of the likeliness of that computer being the most used of all in the room.

Microbial Plate Media Used
Five different media plates are used to identify specific organisms. These plates include EMB, MSA, NA, SAB and BAP. SAB plates were incubated at room temperature about 25° C. The other four plates were incubated at 37° C. All the plates were incubated for 48 hours.

- **SAB**: Sabouraud plates are media plates used for growth of fungi. This media contains an antibiotic that is used to inhibit growth of bacteria. (1)
- **MSA**: Mannitol Salt Agar plates contain 7.5% NaCl, selective for halophiles. They also contain mannitol and phenol red, a pH indicator. Mannitol ferments saccharose acid which creates a yellow zone around the colony. NA, Nutrient agar plates, a non-selective media allow the growth of many organisms. The other media used contain chemicals that cause differences in the way bacteria grow. (2)
- **BAP**: Blood agar plates contains blood cells from sheep. This allows organisms to be distinguished because of their ability to either grow or produce alpha, beta or gamma hemolysis. Beta hemolysis is usually associated with pathogenic bacteria which lyse intact red blood cells. This is characterized by a clear or white zone around a colony. Partial hemolysis is alpha hemolysis which turns blood around the colony to a green color. Gamma hemolysis is when the area around a colony is unchanged. (4)

Sampling Protocol
The keys tested on each keyboard were the home row (asdf jkl;) both shift keys and the Enter key. Specific keys on a computer keys were chosen to help identify a cleansing method was determined. The keys row, ENTER and Shift keys were used because this is the standard position when typing. Therefore these keys should contain even if not most of the bacteria on the keyboard.

A method of cleaning keyboards was determined without destroying the keyboards in computer labs. Two methods of disinfecting keyboards were used. The results of these trials are described in the Results. Sterile NaCl (0.85 % w/v) was used to house bacteria taken from the keyboards. 1 ml of saline was used for each keyboard, and 100 μl of this liquid solution was transferred with a pipette onto the desired plate. The liquid was spread around the entire plate using a sterile cell spreader. For every plate, the same amount of liquid was used.

Determination of Effective Keyboard Decontamination Procedure
If a keyboard was rendered useless after disinfectant was applied, the method could not be used to clean keyboards. Both disinfectants were applied to the keyboard in a form that did not require dumping a keyboard into liquid. Instead cotton swabs were used to apply disinfectant to keys on the keyboards. For the first disinfectant alcohol was used to clean the keyboards. For the second disinfectant, the keyboards were disinfected with a solution containing a [1 to 10 dilution] 1 ml of Vesphene II SE and 10 ml of distilled water. After five minutes, a cotton swab was dipped in water and the keys were swabbed. After this was done three times, no bacteria were recovered (data not shown) the keyboard was finally disinfected.

Determination of Microbial Contamination in One Day of Use
Several keyboards were sampled, one in each of the heavily used computer labs in Copernicus Hall. Samples were collected before the labs opened in the morning (“Before”), following which the keyboards were disinfected using the Vesphene method described above. These samples were plated according to the methods described on five different plate media. A second sample was collected from each test keyboard at the end of a full day’s student use, and those samples plated as above. Following incubation, colonies were counted on the various media.

Micr. plate media were used

<table>
<thead>
<tr>
<th>Room</th>
<th>Classes per testing day</th>
<th>Open Lab hours per testing day</th>
<th>Work Stations Sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>5</td>
<td>5</td>
<td>station closest to the room exit</td>
</tr>
<tr>
<td>133</td>
<td>2</td>
<td>6</td>
<td>first station in front near the entrance of the room</td>
</tr>
<tr>
<td>134</td>
<td>4</td>
<td>6</td>
<td>first station in front near the entrance of the room</td>
</tr>
<tr>
<td>150</td>
<td>2</td>
<td>10</td>
<td>station closest to exit of the room</td>
</tr>
<tr>
<td>161</td>
<td>3</td>
<td>6</td>
<td>last station toward center of the room on the left side</td>
</tr>
</tbody>
</table>

Conclusions/Future Directions

**Conclusions:**

- BAP is a better recovery medium than NA for the bacteria collected from keyboards, suggesting that fastidious organisms are common
- There is no detectable significant difference in the numbers of recovered bacteria and the degree of observed student use of computers in the labs
- The few colonies recovered on MSA plates were likely growing halophilic bacteria
- There is no detectable significant difference in the numbers of recovered bacteria and the degree of observed student use of computers in the labs

**References:**