CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

S1507

Project Title

Potential Pathogens: A Surface Comparison of the Occurrence of Gram-positive and Gram-negative Bacteria

Abstract

Objectives/Goals

25 million people in the United States and Canada have a phobia of using public toilets. The objective is to identify the bacteria in public restrooms to show what the common person may be exposed to. The hypothesis is stated as, if the toilet seats and faucet knobs are swabbed from public restrooms, then the toilet seats will contain the most bacterial organisms that provide the greatest opportunity for gram-positive and gram-negative pathogenic infections.

Methods/Materials

Based on last year's project, all toilet seats contain gram-positive Staphylococcus when grown nutrient agar. This year, MacConkey agar was used to find gram-negative growth. 50 toilet seats were swabbed, placed on MacConkey agar, and were incubated for 48 hours at 98ºF. Growth was Gram stained and viewed under a microscope. 50 faucet knobs were swabbed for comparison. Faucet knobs were swabbed onto nutrient agar, incubated for 48 hours, and transferred onto MacConkey and Mannitol Salt agar. These were grown for 48 hours and growth was Gram stained and viewed under a microscope. Additional tests on the bacteria, including catalase and oxidase tests, were performed.

Results

100 total surfaces were swabbed during this project.

50 of 50 toilet seats contained Staphylococcus (Staph), 4 of 50 contained Escherichia coli, and 1 of 50 contained Klebsiella pneumoniae.

50 of 50 faucet knobs contained Staph, with 34 of 50 containing Staph aureus, and 23 of 50 containing Staph epidermidis. 2 of 50 faucet knobs contained Haemophilus influenzae, 2 of 50 contained Escherichia coli, 1 of 50 contained Proteus, and 1 of 50 contained Pseudomonas.

Conclusions/Discussion

This data refuted the hypothesis. Faucet knobs contained the most variety of bacterial growth. Faucet knobs are touched by hands, which touch the eyes, nose, and mouth. These areas are optimal for bacterial transfer, which poses a higher potential for infection. Bacterial spread can be prevented by turning off knobs with a paper towel. In an additional study, bacteria was placed onto nutrient agar that contained hand sanitizer. Bacterial growth was completely inhibited, so hand sanitizer reduces possible infection. Unless one has an open sore on the buttocks or thighs, toilet seat bacteria cannot enter the body to cause infection. This data suggests that toilet seat covers are unnecessary and are not protecting the body.

Summary Statement

When toilet seats and faucet knobs are swabbed from public restrooms, faucet knobs grow the most variety of bacterial organisms.

Help Received

Parents purchased materials and drove to obtain samples; The Edwards AFB Medical Clinic technicians allowed the use of their materials and aided in research and the conduction of the project.