Wet Lab Activity – Hand Hygiene and Infection Control

In this activity, you will use your wet lab resources to test the effectiveness of hand hygiene methods for the removal of bacteria from your skin. You establish a subjective baseline for the skin microbiota of your fingertips and then determine through subjective means the impact made on the microbiota by some process used to remove microbes from the skin.

The means for removal of microbes from the skin are not surprising. We either wash our hands, use hand sanitizers, or do both. Many variable can be considered – type of soap used, length of washing process, inclusion of abrasives or use of a fingernail brush, the hand sanitizer formulation, as examples. Or you might want to try testing freshly donned nitrile examination gloves vs. gloves worn through an entire lab period. These are some of the hand hygiene and infection control processes that can be studied.

We have been told to wash our hands with warm water and soap for 30 seconds. How does this change if we use cold water, or no soap, or wash for 3 minutes? By carefully designing your project, it would be possible to find answers for these questions.

Oftentimes, the approach taken is to do one treatment on Day 1, and then to do a modification of that treatment on Day 2. So Day 1 might start with conducting a baseline test and then involve washing with warm water and standard soap for 30 seconds. Day 2 might involve conducting a baseline test and then changing one of those variables: cold vs. warm water, or antibacterial soap vs. standard soap, or 30 seconds vs 3 minutes, etc. Changes from the baseline to the post-treatment results would indicate the impact of the treatment. Comparison of Day 1 to Day 2 would give us qualitative information about the differences in microbe populations due to changes in washing methods.

In my labs, some students would work in groups of four investigate one variable (this gives four replicas for the variable to judge consistency of results). Another group would look at a second variable, and so on. Because the skin microbiota grows to reestablish its equilibrium each day, we can work on this assumption that repeating this process day after day would give somewhat consistent results, and that

For these experiments, the basic protocol is kept standard:

1. Control Plate – Day 1. Before handwashing, students press fingertips onto the surface of two plates – one of nutrient agar (total bacteria) and one of Mannitol Salt Agar (Staphylococci). We mark the plates into two halves and put left fingers onto one side and right fingers onto the other.
2. Treatment Plate – Day 1. After handwashing, students dry their hands and then repeat the steps for pressing fingertips onto a second set of plates. This gives "before-and-after" for the handwashing treatment.
3. All four plates are sealed with Parafilm® and incubated at 35 C for 24-48 hr.
4. Reading Results – Day 2. Plates must remain sealed with Parafilm® unless your instructor says it should be removed. Results on the plates are compared, looking for the following:
    a. Total amount of growth. Did handwashing reduce the amount of growth found on the plate?
    b. Types of growth. Did handwashing reduce the variety of colonies found on the plate? This would be judged on variety in sizes, colors, and other colony characteristics.
    c. Did the Mannitol Salt Agar change color under colonies? The medium begins red, but if mannitol-fermenting *Staphylococci* like *Staphylococcus aureus* are present, the acids from fermentation change the pH indicator Phenol Red from red to yellow. This is a reason not to open the plates when reading results.
    d. Compare the Before (baseline) plates with those from After Treatment (washing). What impact did washing have on the reduction in the numbers and types of bacteria present on the skin?
    e. Make notes to review the results of your hand hygiene base experiment. Provide explanations for what you found that was expected, and what was found that was not expected.
    f. We always recommend students take photos of their plates to have a record of their appearances for adding to their lab reports or research posters. Once this is done, the plates should be placed in biohazardous waste containers for autoclaving and disposal. Then, disinfect your work area and wash your hands prior to leaving.
5. This is the basic experiment, which can be followed up on Day 2 by making a new set of plates using a modification in the treatment used to answer questions raised by the Day 1 results. Those would be Day 2 Control Plates and Day 2 Treatment Plates to be read on Day 3. Some ideas for modifying a variable that you might use are described above.

We hope this or a similar activity for demonstrating the value of hand hygiene and use of nitrile examination gloves in controlling contamination and infections in healthcare settings.