
# Can Automatic Hand Dryers Serve as a Microbial Reservoir for Contamination?


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## INTRODUCTION / PURPOSE

Hand dryers are considered a more environmentally friendly alternative to using paper towels as they reduce paper waste. They also are advertised to be more sanitary than the paper towel dispensers since they eliminate direct contact with the dispenser and towels. With the widespread use of hand dryers, often the only option in restrooms are these hand dryers, and their antimicrobial nature has been put into question.

Our purpose for doing this research was to determine if the hand dryers in public restrooms are antiseptic, or if they are a source of contamination to your hands during drying.

## PROBLEM

Recent studies have suggested they can be a reservoir for bacteria waiting to be cycled through the air (1,2).

Our objective in this experiment was to see if there were bacteria on these hand dryers and if hand dryers serve as a reservoir for bacteria that can be reinoculated on a person's hands during drying.

As we conducted this experiment, we also decided to compare the number of microorganisms between two different types of hand dryers, and compare men's and women's restrooms.

## INTERVENTIONS / METHODS

***Testing Locations***

Commercial hand dryers were tested on the campus of Weber State University, located in Ogden, Utah. Three buildings were tested, with four bathrooms selected in each building. The buildings were Tracy Hall, Shepherd Union, and the Stewart Library. The Shepherd Union and the Stewart Library restrooms use Dyson Airblade hand dryers, while Tracy Hall restrooms contain Mediclinics Dualflow Plus hand dryers. Restrooms selected at locations based on foot traffic were in various locations throughout these buildings.

***Sampling and Media***

Commercial sterile 3M Quickswabs used for collecting bacteria samples from the hand dryers. These swabs contain 1 mL of letheen broth which was then used for the pour plates. Pour plates, used to enumerate the bacteria contained Tryptic Soy Agar (TSA). TSA was utilized because it contains nutrients allowing for propagation of a large variety of bacteria, including organisms that are components of the human microbiota.

***Experimental Protocol***

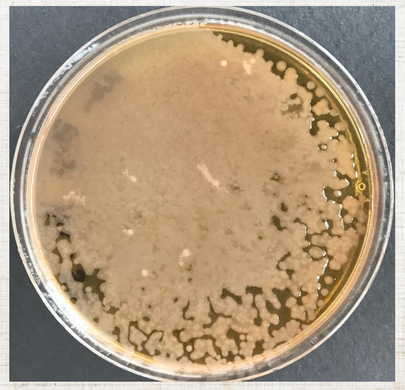
Samples were collected using the 3M Quickswabs from three different locations in each hand dryer. One location was at the top of the dryer above the air vents, one location was in the middle beneath the air vents on the internal part of the dryer where hands are moved through following the manufacturers sampling, flowing heated air to facilitate drying, and one location was at the bottom of the dryer. With each swab, a 5 $cm^2$ area was swabbed by carefully rolling the moistened swab over the surface. The swab was then placed in the 1mL of letheen broth of the Quickswab container, which was vortexed prior to plating to get all bacteria off of the swab. This 1mL was transferred to a sterile petri dish along with approximately 20 mL of sterile molten TSA (50°C). Once poured, the dish was swirled 10 times to dispense the sample. Pour plates were held at room temperature for 3 hours and then placed in a 37°C incubation chamber. Observations of the plates were made after incubating for 48 hours. Each plate was then counted for cfu/5$cm^2$ and results recorded.

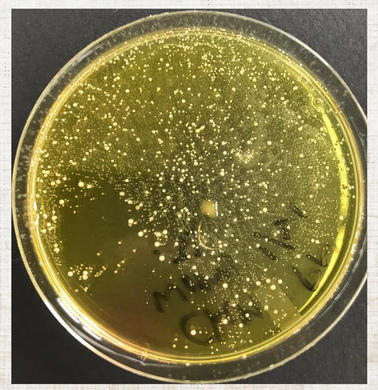
***DNA Sequencing***

16s rRNA sequencing was done to the isolated growth. This was done by breaking apart the cells, extracting the DNA, doing polymerase chain reaction, testing with a nanodrop, cleaning, and sending it out to for 16s rRNA sequencing.

| Men's vs. Women's Hand Dryers | | Dyson Airblade vs. Mediclinics Dualflow Plus | |
|---|---|---|---|
| **Men's Total Average** | **Women's Total Average** | **Dyson Total Average** | **Mediclinics Total Average** |
| Top – 107* | Top – 51 | Top – 58 | Top - 120 |
| Middle – 144 | Middle – 145 | Middle – 16 | Middle - 114 |
| Bottom - >311 | Bottom - >299 | Bottom - 287 | Bottom - 340 |

*CFU/5 $cm^2$





## RESULTS

- *Sample Location in the Dryer*

The average growth of for the Dyson Airblade was 58 cfu/5$cm^2$ on the top section, 16 cfu/5$cm^2$ in the middle section, and 287 cfu/5$cm^2$ on the bottom section. The average growth of the Mediclinics Dualflow Plus was 120 cfu/5$cm^2$ on the top section, 114 cfu/5$cm^2$ on the middle section, and 340 cfu/5$cm^2$ on the bottom section.

- *Men's vs. Women's Restrooms Based on Location*

The average growth of the men's restrooms in all three buildings were 107 cfu/5$cm^2$ on the top section, 144 cfu/5 $cm^2$ on the middle section, and greater than 311 cfu/5$cm^2$ on the bottom section. The average growth of the women's restrooms in all three buildings were 51 cfu/5$cm^2$ on the top section, 145 cfu/5$cm^2$ on the middle section, and greater than 299 cfu/5$cm^2$ on the bottom section

## SUMMARY

These results showed that both types of dryers served as a microbial reservoir containing a high number of bacteria inside the drying chamber. A high microbial load was found in every dryer, both men's and women's, and in every building location, except for two, on all the dryers. Those two locations where no microbial load was found was the top location in the women's Tracy Hall testing center restroom, and the middle location in the women's Tracy Hall fourth floor restroom. This shows that on every dryer, bacterial cells are residing on the surface and that viable bacteria are being cycled through the air contaminating your hands. The bottom of the dryers had the highest levels of contamination, and the top sections have the lowest levels of contamination for both men's and women's restrooms.

**<u>Suggested Intervention</u>**

To counteract the large amounts of contamination in these hand dryers, our recommendation would be that they should be cleaned with anti-microbial cleanser once per day as part of the routine restroom cleaning protocol. This would greatly limit the number of bacteria on the inner surface of these dryers, lessening bacterial contamination on washed hands by the air when hand dryers are used.

## References


1. Gerba, C. P., J. L. Melnick, C. Wallis. 1975. Microbiological hazards of household toilets: Droplet production and the fate of residual organisms. Applied Microbiology. 30(2): 229-237.
2. Gerba, Charles and Maxwell, S. (2012). Bacterial contamination of shopping carts and approaches to control. Food Protection Trends. 32. 747-749.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