

# To Dry or Not to Dry

## Do Air Dryers Spread Bacteria in Public Restrooms?

### Hypothesis

If hands are dried in a public restroom with a Dyson Airblade, Xlerator, paper towels, or naturally dried, there will be more bacteria on hands dried with a Dyson Airblade than hands dried with the Xlerator, paper towels, or naturally dried because the Dyson Airblade disperses the bacteria from the unlidged toilets at a faster rate. Also, there will be more bacteria on the surface of the Airblade than the other air-drying methods.

### Introduction

When washing your hands in a public restroom, chances are you will have two options to dry your hands. You will either dry your hands with a paper towel or with an air dryer. Both options are questionable. Many studies claim air dryers spread bacteria onto your hands. At the same time, paper towels are wasteful and hurt the environment. My question is: "Is using an air dryer really less sanitary than using a paper towel?"

First, we need to understand why air dryers were invented. In order to be conservative and make an environmental change, air dryers were introduced into the market. Paper towels require a lot of energy and materials to make. According to Durafresh, "a lot of resources, including 110 million trees per year, and 130 billion gallons of water are used. Comparably huge amounts of energy are required to manufacture and deliver paper towels from the factory to the store." On the other hand, only one air dryer will be needed compared to the innumerable paper towels that will be used.

Air dryers might seem to be the better choice however they might not be as sanitary. A Harvard University study showed that hot air dryers suck up bacteria from the bathroom and distribute it onto people's hands. When toilets are flushed, they splatter a fine mist of microbes. So when air dryers are used, they take in that bacteria from the toilets.

I decided to do this project because my father, an infectious disease doctor, is always insisting that my siblings and I wash our hands whenever we are in public places. I notice every time I go to wash my hands, there is always a different method to use when drying. Whether it is a Dyson AirBlade, paper towels, or a normal hot air dryer or if there is nothing at all. I wanted to determine if any method is more sanitary than others.

My independent variable is the type of drying method used. My dependent variable is the number of bacteria colonies that grow. My control variable is the number of bacteria on unwashed hands. I measured the bacteria by swabbing hands after each drying method and culturing the bacteria on sheep blood agar dishes and counting how many bacteria colonies grew after one week. I also swabbed inside the Dyson AirBlade and Xlerator Air Dryer and swabbed the surface of the paper towel dispenser to determine how much bacteria were on the devices.

### Hand Drying Methods



Dyson AirBlade



Xlerator



Paper Towel



Naturally Dry

### Procedure

#### Prior to Experiment:

1. Locate each type of the hand dryers in a public restroom.
2. Recruit 10 subjects to participate in experiment.
3. Use marker to label sterile swab tubes with designated subject and drying method or unwashed hands.

#### Testing unwashed hands:

4. Each subject's hands will be swabbed before washing.
5. Open sterile swab tube.
6. Swab subject's unwashed dry hands in a zig zag pattern.
7. Return swab to labeled tube.

#### Testing Drying Methods

8. At each location, wash hands for 20 seconds without soap.
9. Dry hands until dry with designated drying method.
10. Open sterile swab tube.
11. Swab subject's dry hands in a zig-zag pattern.
12. Return swab to labeled tube.
13. All subjects repeat this procedure with this drying method.
14. Repeat steps 8-12 at each location.

#### Prepping Sheep Blood Agar Plates

15. Label sheep blood agar plates with drying method, subject number, and date.
16. Lift the lid of the sheep blood agar plate.
17. Take swab and roll it lightly in a zig-zag pattern onto sheep blood agar plate.
18. Put the lid back onto the sheep blood agar plate making sure the tube and plate labels match.
19. Repeat steps 15-18 for each swab.
20. Incubate sheep blood agar plates in a dark warm location.
21. After 7 days: Inspect the plates and count the colonies of each bacteria on each plate and record it accordingly.
22. Determine which air-drying method had the most bacteria.

#### Swabbing Air Dryers and Surfaces

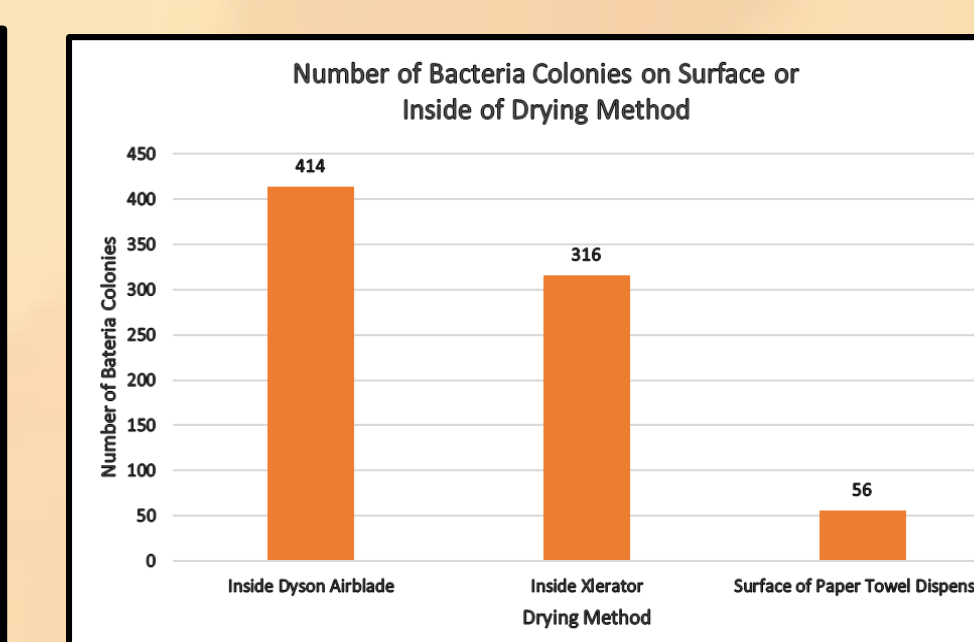
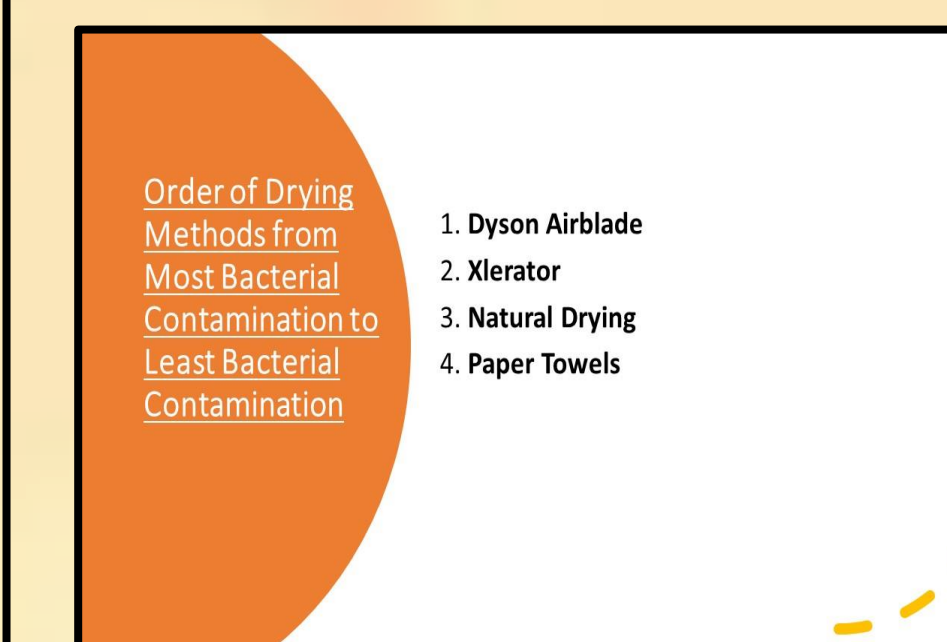
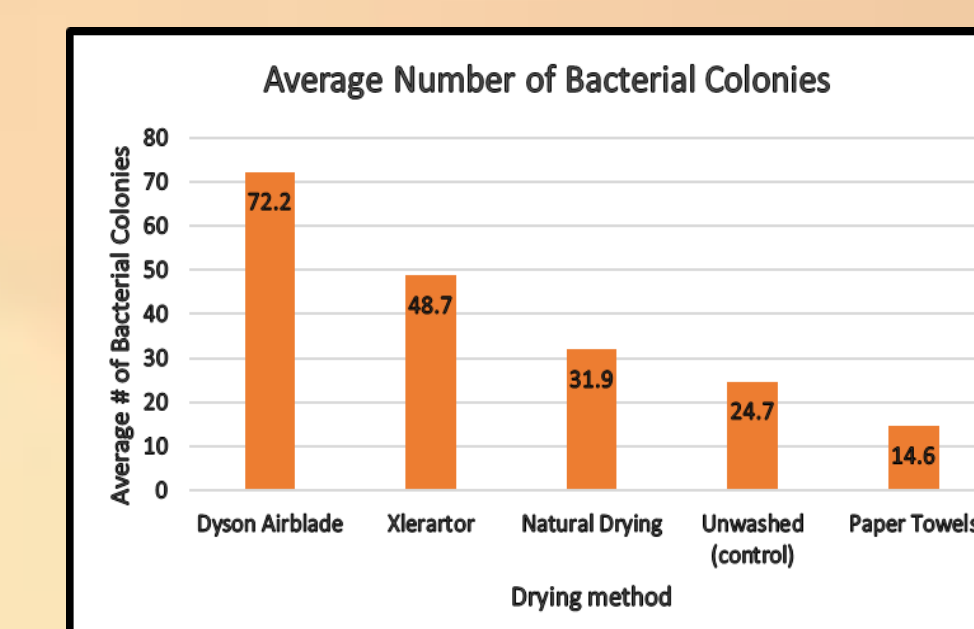
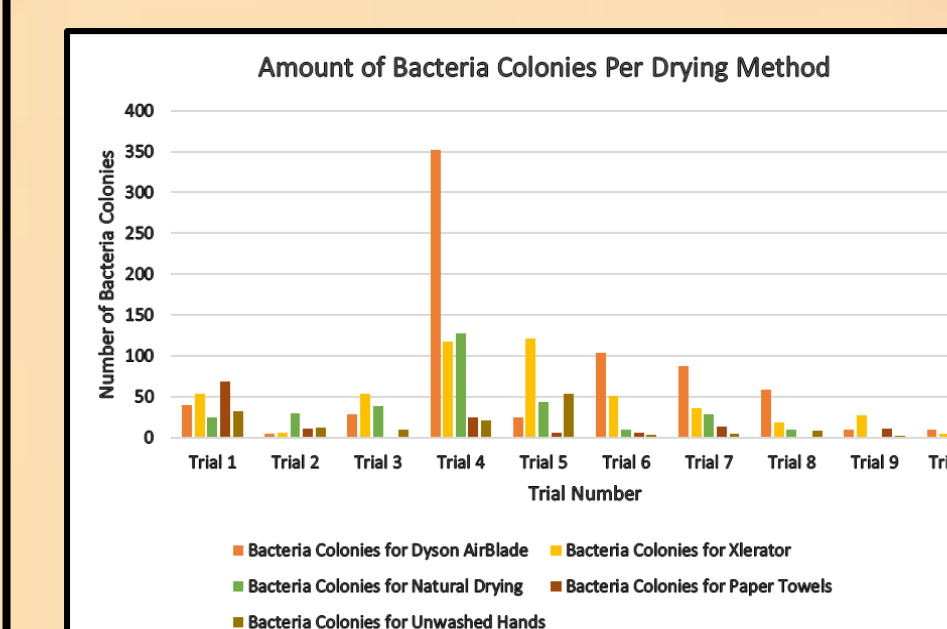
23. Swab surface of paper towel dispenser
24. Swab inside Dyson Airblade
25. Swab inside Xlerator Hand Dryer
26. Prep and incubate sheep blood agar dishes similar to steps 15-22

### Results

#### Trial #4



#### Surfaces of Air Dryers



### Conclusion

My hypothesis was that drying hands with the Dyson AirBlade hand dryer would spread more bacteria than other hand drying methods. I also hypothesized that drying hands with a paper towel would have the least bacteria. After testing ten trials with each hand drying method, my hypothesis was correct. I believe that this is the case because the Dyson AirBlade is circulating the public restroom air more than the other drying methods and the bacteria contaminated air is being deposited back on to the washed hands.

Drying hands with a paper towel resulted in the least bacteria count. The average number of bacteria colonies with paper towels was 14.6. The average number of colonies with the Dyson AirBlade was 72.2. Hands dried with the Dyson AirBlade had 394% more bacteria than hands dried with a paper towel. Drying with a paper towel decreased the bacteria by 40%. Drying hands with the Dyson AirBlade increased bacteria by 197% compared to unwashed hands.

The Xlerator hand dryer increased the bacteria colonies amount by 97% compared to unwashed hands. Drying the subjects' hands by natural air increased the bacteria colony count by 29%. The unwashed hands were the control for the experiment to compare the other drying hand methods.

I also swabbed inside the air dryers and the area around the paper towel dispenser. There were 414 bacteria colonies inside the Dyson AirBlade, 316 bacteria colonies inside the Xlerator, and 56 bacterial colonies on the surface of the paper towel dispenser. There was 23% more bacteria on the Dyson compared to the Xlerator and 86% more bacteria on the Dyson compared to the paper towel dispenser.

In order to reduce bacteria in general, the design of public restrooms should be changed. Lids should be added to toilets. Also, all water faucets should be touchless. Also, there should be no doors to exit the restroom or the door should be able to push.

If I did this experiment again, I would test each location with ten subjects three times each to get more accurate results. I would also test all the locations on the same day so that no other factors would interfere with the results. Ideally, the drying methods should be done in the same building to reduce the differences between the maintenance and cleanliness of the facilities. I would also swab the hands immediately before every hand washing to get more accurate comparisons.

I believe my experiment is important because everyone uses public restrooms. Although the bacteria are most likely harmless, they may affect people with weakened immune systems such as the elderly and sick. Also, currently with COVID-19, it is important to practice the best hygiene to prevent the spread of the virus. Further research should be done to redesign public restroom layouts and create decomposable and economical paper towels.

In conclusion, I have shown that the Dyson AirBlade Hand Dryer spreads more bacteria than any other drying method and the AirBlade also contaminates hands more than if they were not even washed. Paper towels are the best method to be used to dry hands. However, due to their environmental impact alternative methods should be found. Also, public restrooms should be redesigned so that the bacteria-rich air does not circulate.