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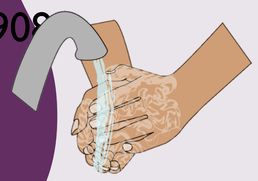

ISOLATING RESISTANT STAPHYLOCOCCUS FROM HAND DRYERS IN AN URBAN COLLEGE

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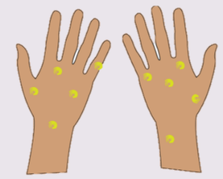

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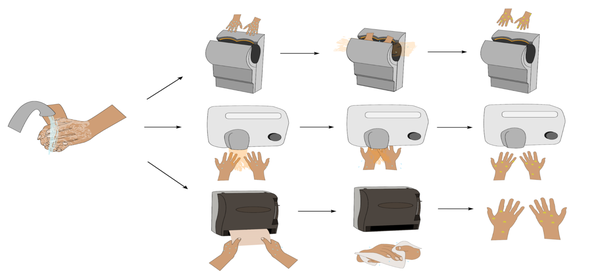
Abstract

Much emphasis is being placed on hand washing as a preventive measure to avoid spreading bacteria. However, recent studies have implied that methods used to dry your hands can contribute to bacterial spread. This is alarming due to the presence of antibiotic resistant bacteria in the environment such as MRSA. We examined three different types of devices people commonly use to dry their hands. Drying option A, was a hand towel dispenser. Drying option B, was a vertical air dryer that dries the front and back of each hand simultaneously as they are drawn slowly out of the machine. Drying option C, was a downward pointing dryer. We hypothesized that Drying Option B would be the best reservoir for resistant Staphylococci due to it's design. Using HardyChrom contact agar plates, selective for Staphylococci, our initial study indicated that Drying option B overall had higher colony numbers of Staphylococcal bacteria (We repeated this experiment twice). On the first round, we found that the average number of bacterial colonies per site identified on drying option B (13.6 colonies per sampling site) were higher than option A (11 per site) or C (7 colonies colonies per site). Similar results were found one week later (A had 4.5 per site, B had 13.6 per site and C had 2 per site). In order to determine if campuses might be playing a role in this and whether or not cleaning could reduce the bacterial burden, we expanded our survey to include all three campuses of our college and we collected samples both before and after we after we cleaned the dryer sampling surfaces using clinical grade antimicrobial soap (commonly used at our institution). We took samples at time 0, 20 mins after cleaning and 7 days later. Though not all campuses had examples of all three dryer types, similar trends were observed where we could find them. The vertical dryers (Option B) had the greatest numbers of colonies at time point zero, cleaning reduced bacterial burden but it recovered to pre-cleaning numbers 7 days later. Dryer options A and C were found at all three campuses and exhibited similarly low numbers of bacteria before and after cleaning. Our work though preliminary demonstrates that the type of dryer used could serve as an important reservoir for resistant bacteria in the college environment and that the cleaning strategy may not be effective in reducing the problem. We are currently typing the bacteria isolated to determine their genetic relatedness and survival capabilities and characteristics.

Introduction/ Hypotheses



We wanted to determine what bacteria might be found on the surfaces of different types of handdryers in our campus. This led to several hypotheses.

Hypothesis 1: Hand dryers are reservoirs for presumptive antibiotic resistant Staphylococcal (ARS) bacteria

Hypothesis 2: Cleaning the handdryers will remove the presence of presumptive antibiotic resistant Staphylococcal (ARS) bacteria

Hypothesis 3: Hand dryer devices aerosolise presumptive antibiotic resistant Staphylococcal (ARS) bacteria

Acknowledgments

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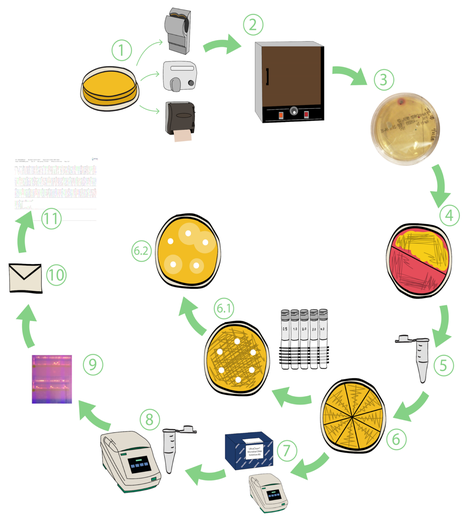
Methods



Process 1 Using Hardy-Chrom contact agar plates, selective for presumptive antibiotic resistant Staphylococcus bacteria (ARS), we took 10 samples of different hand drying mechanisms (Drying option A, was a hand towel dispensers. Drying option B, was a vertical air dryer that dries the front and back of each hand simultaneously as they are drawn slowly out of the machine. Drying option C, was a downward pointing dryer). Plates were Incubated at 37°C and up to 16 colonies were isolated from each plate

Process 2 16 strains were isolated and purified by streaking for single colonies using Mannitol Salt Plates. Growth and fermentation pattern was recorded. Purified strains were stored at -80°C..

Process 3 Stocked purified strains were streaked onto TSA, incubated at 37°C for a minimum of 2 days. DNA was isolated using the Ultra Clean DNA isolation kit. PCR was conducted using isolated DNA or a boil prep and gel to reveal the presence of tuf (for species), *mecA* (methicillin resistance) and *qacAB* (quaternary ammonium compound resistance). In addition, antibiograms were generated for each strain using Mueller-Hinton agar and a 0.5 McFarland Standard.

Process 4 PCRs for those strains that were positive for *tuf* and *mecA, tuf* and *qacAB* and tuf, *mecA* and *qacAB* were sent for sequencing.

Results of plating

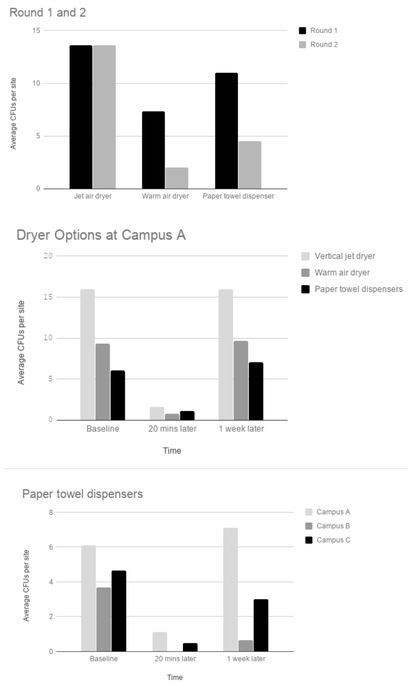


Chart 1 reveals that vertical air jet dryers, had the greatest bacterial load (Option B). We found that the average number of bacterial colonies per site identified on drying option B (13.6 colonies per sampling site) were higher than option A (11 per site) or C (7 colonies colonies per site). We reproduced the experiment one week later (A had 4.5 per site, B had 13.6 per site and C had 2 per site) and found similar results. Thus we proved hypothesis 1 to be true.

In round 3, we included a cleaning step using the cleaning agent employed by our facilities personnel as well as expanding our study to include all three of our campuses. Only campus A had all three drying options. The second chart reveals drying option B had the greatest numbers of bacteria and that despite cleaning, these numbers returned to baseline one week later.

In the third chart we studied paper towel dispensers at all three campuses. Campus A had the greatest bacterial burden of all three campuses. Again cleaning reduced the numbers but they increased one week later. Hypothesis 2 was thus not proven.

Sequencing Results

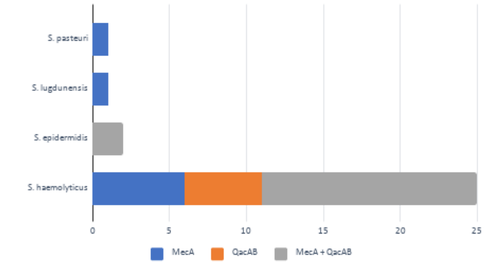
Table 1. Sequencing results for Round 1

Preliminary Findings for Round 1					
	Number Sequenced (Total isolated)	*S. haemolyticus*	*S. epidermidis*	*S. lugdunensis*	*S. pasteuri*
Dryer Option A	9(20)	6	2	0	1
Dryer Option B	6(20)	6	0	0	0
Dryer Option C	4(20)	3	0	1	0

Table 2. Sequencing results for Round 2

Preliminary Findings for Round 2					
	Number Sequenced (Total isolated)	*S. haemolyticus*	*S. epidermidis*	*S. lugdunensis*	*S. pasteuri*
Dryer Option A	4(10)	4	0	0	0
Dryer Option B	4(10)	4	0	0	0
Dryer Option C	2(10)	2	0	0	0

Chart 4. Presence of resistance genes in Staphylococci



Discussion

Our study has provided further evidence that hand dryers and vertical jet hand dryers in particular are reservoirs for bacteria, in our case, antibiotic resistant Staphylococci. We note that we have several key experiments left to complete, the sequencing of all bacteria we isolated and determining if they are clonally related. Nevertheless, our findings of such high numbers of bacteria and our results with the cleaning pose many new questions for further study. We intend to use Box fingerprinting to determine the genetic relatedness of the Staphylococci we isolated, and potentially multi-locus sequence typing for the *Staphylococcus hemolyticus* strains that we isolated. We have found *Staphylococcus hemolyticus* at several sites at our campus, implying that these bacteria are the most common Staphylococci in our environment. Our data gathered from our dispersal and aerosolization experiments are currently being analysed. The reasons for finding these species and not others remain to be elucidated but may be influenced by methicillin or QacAB resistance.

Citations

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