

HAND DRIERS VS PAPER TOWELS



Several academic studies have been carried out regarding this subject and we attempt to summarise their findings below. There is also an abstract of Redway *et al* below. The **emphases** are ours, not the authors'.

We think the Redway paper neatly summarizes the arguments. There are other studies that compare different types of air hand driers (e.g. the Dyson 'Airblade' vs traditional models) but – tellingly – many of them do not compare air driers with paper.

This is classic experimental design in the hands of marketers – design the experiment to answer a very narrow, specific question then phrase the advertising copy such that the casual or lay reader draws a conclusion that is not actually substantiated by the experiment.

Here goes:

HAND DRYING: A STUDY OF BACTERIAL TYPES ASSOCIATED WITH DIFFERENT HAND DRYING METHODS AND WITH HOT AIR DRYERS

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SUMMARY

In a previous study (Knights *et al.*, 1993¹) under naturalistic conditions, towels were found to be more efficient in drying the hands than hot air dryers, many people completing drying on clothes, etc. Microbiological studies revealed that using towels after washing reduced bacterial counts on the hands by an average of 42% (paper) and 10% (cotton). With hot air dryers, however, counts increased by more

than 500%. Bacteria were blown out of dryers whenever they were running.

The present study was carried out, using standard techniques, to identify and count the bacteria associated with hand washing and drying, using the same naturalistic conditions in toilets as before. Average bacterial counts were again reduced by using towels (by about 38%), the most significant decrease (58%) being in bacteria grown on nutrient agar after using paper towels. Hot air dryers again produced significant increases in all bacteria (by more than 260%). Types typical of skin (including staphylococci and micrococci) increased by an average of 169%. **Skin and gut bacterial counts rose by 438%, the largest increases being in enterobacteria and coliforms, including Escherichia coli (395%). Some types and strains of the bacteria found can be pathogenic.** The increases in gut bacteria are indicative of faecal contamination of the hands.

In a further study, bacteria were isolated from swabs taken from the air flow, nozzle and air inlet of 35 hot air dryers in nine types of location (including hospitals, eating places, railway stations, public houses, colleges, shops and sports clubs). Bacteria were relatively numerous in the air flows and on the inlets of 100% of dryers sampled and in 97% of the nozzles. Staphylococci and micrococci (probably from skin and hair) were blown out of 97% of the dryers and 63% showed evidence of the potential pathogen *Staphylococcus aureus*. **At least 6 species of gut bacteria (enterobacteria) were isolated from the air flows of 63% of dryers, indicating faecal contamination.**

It is concluded that hot air dryers have the potential for depositing pathogenic bacteria onto the hands and body. Bacteria could be inhaled and are distributed into the general environment whenever dryers are running. It is recommended that the use of hot air dryers should be carefully considered on health grounds, especially in sensitive locations such as hospitals, catering establishments and food preparation areas.

Chemex Comments:

The appearance of coliforms and enterobacter is extremely worrying when working in food prep. These are the blighters that EHOs specifically swab for and if they find them it often results in an interview under caution. It also appears that this study took into account 'real life' scenarios – studies have shown that people tend to wipe their hands on themselves after using dryers as the water removal is generally incomplete.

The arrival of the Dyson Airblade led to another raft of studies. By far the best is the Westminster one (Redway *et al* 2008² – attached – this is the one to read!!). Redway makes the point:

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However, although damp hands encourage the transmission and survival of bacteria on the hands (Gould, 1994³; Patrick et al., 1997⁴), there are other factors which can affect the hygiene performance of a hand drying method. These factors include: the degree of frictional removal of dirt, grease, bacteria and skin squames from the hands; the absorbance and softness of material used to dry the hands; the emission of bacteria in the air flows of electric hand dryers; the contamination of the surfaces of hand drying devices. **The real test of hygiene performance is not the percentage dryness of the hands alone but the number of bacteria removed from, or remaining on, the hands of users after use.**

Chemex Comments: We suggest reading p18 onwards which deals with the different studies into this and puts them into perspective., then skip to p30. Among the conclusions are:

...although the jet air dryer showed a similar drying efficiency to paper towels, ... its hygiene performance, although better than the warm air dryer, was significantly worse than the two types of paper towel tested in this study. It is possible that paper towels work better because they frictionally remove dirt, grease, bacteria and skin squames from the hands whereas the jet air dryer, like the warm air dryer, does not. The superior performance of paper towels over the two types of electric dryer in reducing the numbers of bacteria was shown with both the fingerpads and the palms of subjects.

Bacteria counts:

In this study both types of **paper towel tested reduced the mean numbers of all types of bacteria** tested on the fingerpads and the palms of subjects. The percentage mean reductions ranged from **-44.6% to -91.5% for fingerpads and from -32.8 to -85.2% for palms.**

The warm air dryer increased the mean numbers of all types of bacteria tested on the fingerpads and the palms of subjects. The percentage mean increases ranged from **+114.1% to +414% for fingerpads and from +230.4% to +478.8% for palms.**

The **jet air dryer increased the mean numbers of most types of bacteria tested on the fingerpads and the palms** of subjects. The percentage mean increases ranged from **+28.0% to +193.3% for fingerpads and from +9.1% to +82.2% for palms.**

Therefore, the manufacturer's claim that the tested JAD is the "most hygienic hand dryer" is **confirmed, especially for fingerpads and assuming that the term "hand dryer" refers to electric devices only because its performance in terms of the numbers of all types of bacteria remaining on the hands of users compared to paper towels was significantly worse.**

Cross-Contamination:

In our opinion, a very clever and elegant protocol was used to test this one. Conclusion:

It is well known to microbiologists that air movements encourage the dispersal and transmission of micro-organisms and increase the chances of the contamination of materials or persons in any situation. This makes paper towels, where little air movement is generated, the most hygienic option tested in this respect followed by the warm air dryer and, lastly, the jet air dryer.

Tests on Dyson dryers for bacterial contamination:

The bacterial counts of the bottoms of jet air dryers were particularly high, probably due to the water from users hands that collects in this area. Counts on the other inner surfaces of the dryers (inner surfaces and slits) were lower, probably due to the fact that these surfaces are generally drier than the bottoms.

The bottom counts showed on average thousands of bacteria per square centimetre and the figure could be even higher due to the upper limit of the counting method used. **These bacterial counts are higher than those found by Mendes & Lynch (1976)⁵ on the average toilet seat.** Their study showed that about 80% of toilet seats in public washrooms had lower mean bacterial counts than the bottoms of the dryers sampled here. However, although any surface in a washroom can become contaminated with bacteria, moist surfaces particularly encourage bacterial colonization and survival and this probably explains the high counts at the bottoms of the jet air dryer chambers which in a busy washroom may be wet much of the time.

Escherichia coli and the other species of Enterobacteriaceae isolated from jet air dryers in this study demonstrate the potential for this type of device to become contaminated with human faecal material. Escherichia coli is a well known marker organism of such contamination. The detection of gut bacteria indicates the potential for this type of dryer to disseminate other more pathogenic types of Enterobacteriaceae (e.g. Salmonella and Shigella species) since the properties of all members of the Enterobacteriaceae are very similar. As with Staphylococcus aureus, these bacteria could be transmitted by touch or dispersed in the air emitted by contaminated dryers.

However, even if the dryer is not touched, **the results of this study show that bacteria are transmitted in the air flow and could contaminate the hands, other parts of the user, their clothes, other washroom users, or be inhaled.**

Overall conclusion:



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The results of all parts of this study suggest that **paper towels should be used in locations where hygiene is paramount, such as hospitals, clinics, schools, nurseries, care homes, kitchens and other food preparation areas.** Warm air dryers and jet air dryers should be carefully considered for these types of location because of their poorer hygiene performance and the increased likelihood of transmission of bacteria, including potentially pathogenic types, via the fingerpads and palms of the hand and their air flows. The performance of both the warm air dryer and the jet air dryer was inferior to paper towels in all respects (drying efficiency, bacterial numbers on the hands, bacterial contamination of the air flow and surfaces of the devices, and transmission of bacteria in the washroom) with the one exception that the jet air dryer is equal in drying efficiency. **The jet air dryer was shown to be superior to the warm air dryer in all respects except for similar bacterial contamination and greater transmission potential. Although representing a considerable improvement over warm air dryers in speed, the jet air dryer's overall performance, with the exception of drying efficiency, was significantly poorer than that of paper towels in all other respects tested in this study**

Chemex Final Comment:

Overall, from a scientific standpoint we find the Redway paper to be authoritative, thorough and the results are pretty clear.

References:

- 1 Knights et al., 1993
<http://www.wmin.ac.uk/~redwayk/research/had2.htm>
Hand drying : A study of bacterial types associated with different hand drying methods and with hot air dryers.
- 2 Redway et al., 2008 A comparative study of three different methods of hand drying methods : paper towel, warm air dryer, jet air dryer. European Tissue Symposium Nov 2008.
- 3 Gould D 1994 The significance of hand drying in the prevention of infection. Nursing times Nov 23-29; 90; (47) ; 33-35
- 4 Patrick DR, Findon G, Miller TE. Residual moisture determines the level of touch-contact-associated bacterial transfer following hand washing. Epidemiology and Infection. 1997; 119; 319-325
- 5 **Mendes, F. & Lynch, J. (1976)** A bacteriological survey of washrooms and toilets. Journal of Hygiene, 76, 183-190.



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