Eurofins-Inlab study results: microbial contamination of washroom surfaces with different hand drier devices.

Sources:
• Eurofins-Inlab study
• Extracts from comments by Prof. Mark Wilcox about the study (Professor of Medical Microbiology, University of Leeds & Leeds Teaching Hospitals, Leeds, UK)
Institut for Microbiology of food, analyses, hygiene of companies and environmental hygiene

Inlab was founded in 1992 as a microbiology laboratory of food. Inlab is member of the Eurofins Group since December 1st, 2007.

Microbiological testing, expert advice & sample drawing in the following areas:

- Food (final-, intermediate products and raw materials), feeding stuff, articles of daily use including passing of rapid analyses
- Drinks and dispensing equipment
- Sanitary products, cosmetics and commercially available drugs
- Drinking- and mineral water, bath water
- Medical water like flushing water
- Hygiene of companies
- Compost
- Training courses, inspections, hygiene advice

Accreditation:
Accredited according to DIN/EN ISO/IEC 17025 (DAR and DAkkS for second governmental samples), § 43 IfSG (permission for working with pathogens - according to NRW-governmental permission) drinking water laboratory and admitted laboratory of the “compost quality control association” for analysis of salmonella." DIN EN ISO/IEC 17025:2005; Authorised experts for double and cross checks according to § 43 LFGB (German Food and Feed Code) cosmetics excluded - authorised for drinking water analysis by German authorities

For further informations about Eurofins and Inlab look up: [www.eurofins.de](http://www.eurofins.de)  [www.eurofins.com](http://www.eurofins.com)  [www.inlab-dortmund.de](http://www.inlab-dortmund.de)
Basics on the need of Hands Drying
Extracts from comments by Prof. Mark Wilcox about the study

• Hand washing helps to prevent the cross-contamination of microbes from one person or surface to another.

• It prevents infection and can sometimes even save lives, by reducing the numbers of pathogens on hands.

• A fundamental aspect to hand washing is the drying of hands.

• Hands can be dried with …:
  • the use of single use paper hand towels,
  • reusable cotton/textile towels,
  • traditional warm air driers,
  • high velocity jet air driers.

• The first two methods absorb water on the hands; the other types disperse water into the air, via a variety of mechanisms.

• Micro-organisms, especially Staphylococci, Coliforms and Yeasts may contaminate hands during toileting.

• Hands may already be contaminated with bacteria, viruses or yeasts before washing and could be transferred during the drying process or afterwards.
The Eurofins-Inlab study measured the **microbial contamination** of **three types of drier devices** in the washrooms. Commissioned by ETS, it was carried out in various settings in the **Ruhr region, West Germany** (Feb-May 2012).

- **150 washrooms** were selected by Eurofins –Inlab (ETS doesn’t know their location) and contained **jet air driers, warm air driers, or hand towel dispensers** (50 of each). They were **balanced** to represent high versus low use settings.

- Specialised sponges were used to swab the surfaces of hand drying devices.

- The sampled surfaces were those **most likely touched** during hand drying, i.e. the **inside surface of jet air driers**, the **inside or outside surfaces** of the **outlet tube** of **warm air driers**, and the **outlet** (bottom) of **paper towel dispensers**. Also a **surface area** (100 cm$^2$) of the **floors** below was sampled.

- The sponges were processed to **determine the total number of microorganisms** and numbers of **potential pathogens** (e.g. Staphylococci including *Staphylococcus aureus*, and coliforms including *Escherichia coli*).

- As the sampled drier device surfaces differed in size, measured microbial counts were **reanalysed** according to counts per unit surface area.
The **total microbe counts** (aerobic bacteria) were significantly higher both on the surfaces of **Jet Air Driers** (approximately 1000 times higher) and on the **floors** beneath these devices (approximately 20 times higher), in comparison with **Paper Hand Towel Dispensers**.
There were also a similar significant difference in total Staphylococcal counts on and beneath these two hand dryer device types. **Jet Air Dryers** and **Paper Hand Towels Dispenser**.
Contamination from Coliforms, E. Coli, and coagulase positive Staphylococci

<table>
<thead>
<tr>
<th>Device</th>
<th>Jet air dryer</th>
<th>Warm air dryer</th>
<th>Paper dispenser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet Air Driers</td>
<td>52%</td>
<td>14%</td>
<td>0%</td>
</tr>
<tr>
<td>Warm Air Driers</td>
<td>46%</td>
<td>16%</td>
<td>10%</td>
</tr>
<tr>
<td>Paper Towel Dispensers</td>
<td>52%</td>
<td>14%</td>
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The proportion of Jet Air Driers, Warm Air Driers and Paper Towel Dispensers on which Coliforms were found was 52%, 14% and 0%, respectively; the corresponding proportions of floors beneath devices positive for Coliforms were 46%, 16% and 10%, respectively.
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• Approximately **1 in 8** of the **floors** below Jet Air Driers had **staphylococcal counts > 10 million** (per 100 cm²); **none** of the counts on the **floors** below Paper Hand Towels Dispensers exceeded this level. 4% of floors beneath Warm Air Dryers had counts above this level.

• There was **consistency of results**: higher drier surface microbe counts were usually accompanied by higher counts on the floors beneath the devices.

• The surfaces that were tested were those **most likely to be touched**. As a result, the actual surfaces that were examined differed in terms of size (surface area); the jet air driers had the largest potential touch areas.

• In a recent observational study (commissioned by the Kimberly-Clark Corporation), one or both hands of all subjects (n=120) touched the blades of a Dyson Jet Air Drier during hand drying; the avg. number of **observed device touches** by hands per drying was **13**.

• The **microbe counts** were **adjusted** to take account of the **differences in surface areas** that were sampled. Having made this adjustment, the microbe counts were still significantly higher (i.e. **over 300 times higher** per unit area sampled) on the **inner surfaces of Jet Air Drier** in comparison with those found on **bottom surface of Hand Towel Dispensers**.
Why microbes dispersal must be avoided

• But how may micro-organisms contaminate the hand driers?
  • direct transfer by **hands touching** a device (direct touch transfer),
  • transfer by the **air during hand drying** (direct air transfer),
  • transfer by the **air after hand drying** (indirect air transfer).

• Procedures should **minimise the risk of microbes dispersal**.

• **Avoidance** of **touching contaminated surfaces** and **prevention of airborne spread** of microbes **are key ways of minimising the transmission of infection**.

• In cases of increased dispersal of microbes during hand drying, hands are more likely to be **re-contaminated** during the drying process, and this could lead to **increased spread** of potential pathogens.

• In some cases this could affect the person who acquires the microbes **during hand drying**, or a **subsequent person** using the same washroom.

• Microbes could be acquired either by **touching** a contaminated surface (e.g. the hand drier device), from microbe-containing **droplets/particles** present in the **air that land** on a person, or by **breathing** **microbe-containing particles** or **droplets**.
### Examples of risks associated with microbes dispersal: Staphylococcus aureus and flu virus

**Staphylococcus aureus** is carried in the nose and some skin sites of about 1 in 5 people.  
- It can cause a wide range of disease if the bacteria gain access to certain sites e.g. a skin wound; some types of *Staphylococcus aureus* can also cause food poisoning.  
- **The most common way that *Staphylococcus aureus* is transferred is on hands.**  
- Therefore, the contaminated surface of some hand driers (*particularly, according to this study, Jet Air Driers*) may pose a greater risk of the transfer of such potential pathogens.

<table>
<thead>
<tr>
<th><strong>The influenza (flu) virus</strong> is highly contagious.</th>
</tr>
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<tbody>
<tr>
<td>- Influenza can spread so easily because of the large amounts of virus that an infected person can spread into the environment, plus the low number of virus cells needed to set up a new infection, and the time that the viruses can survive (in the air / on surfaces).</td>
</tr>
<tr>
<td>- Acquisition of the influenza virus occurs when an infected person coughs or sneezes and small droplets/particles (each one can contain &gt; 100 virus cells) are breathed in by another individual. <strong>One or a few droplets/particles can be enough to initiate infection.</strong></td>
</tr>
<tr>
<td>- Transmission may also occur by touching a surface that is contaminated with the virus/respiratory secretions. Influenza virus can live on a hard surface for several hours.</td>
</tr>
<tr>
<td>- Floors in particular reflect the potential for airborne transmission, including from droplets emitted during hand drying. <strong>Droplets/particles released during hand drying could transmit respiratory viruses such as influenza from contaminated hands,</strong>; alternatively, viruses could be acquired by touching Hand Dryer surfaces. <strong>Both possibilities would appear to be more likely with Jet Air Driers.</strong></td>
</tr>
</tbody>
</table>

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Conclusions drawn by Prof. Mark Wilcox

- **Good hand washing** followed by **careful hand drying** are **key** ways to **prevent microbe spread**.

- A **hand drying method** should be chosen that **minimises** the risk of **re-contaminating** the hands.

- From the results of the current study, it appears that there may be a **greater risk of exposure to microbes** associated with some types of hand driers.

- There was an increased level of microbial contamination on and beneath **air driers, particularly Jet Air Driers**, in comparison with **Hand Towel Driers**.

- These findings have **implications** for the **prevention** of spread of microbes and infection, that should be explored further.
For more information about the studies and the activities of the European Tissue Symposium, please look at:

http://www.europeantissue.com/

In particular to have access to the summary and the dataset of the Eurofins-Inlab study, please look at:

http://www.europeantissue.com/hygiene/NewStudy/

The Mayo Clinic Proceedings article can also be read at: