

THE WORLD OF TISSUE

Paper towels or hand dryers? That is the question!

If we asked ourselves what the greatest medical advance of the last 150 years has been, what would we answer? Most of us would automatically think about the discovery of penicillin, antibiotics, or the invention of X-rays, the discovery of the structure of the DNA molecule or still other important medical milestones that have allowed saving so many people's lives. But the actual answer to this question would surprise you. The British Medical Journal conducted a survey, and it was: sanitation.

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A country's level of sanitation is the best way to measure its medical progress. And it is not the complexity of the discoveries made but rather the actions performed to improve the quality of life and the longevity of people's lives. According to the British Medical Journal, from 1840 to the present, the main progress in the realm of medicine has been the development of sanitation measures that have reduced the diffusion of cholera, malnutrition and infections that cause or have in the past caused the death of millions of people. Unfortunately, however, still today about 2.6 billion people live in difficult sanitary conditions. The sanitary and hygienic level of a country is presently the focus of many projects developed by the United Nations. And to this end, the year 2008 was designated as the International Year of Sanitation, an event aimed at making the world more aware of the need to improve the hygienic and sanitary conditions of all poor countries. The main purpose of the International Year of Sanitation was to enhance awareness of the benefits of good hygiene by breaking the taboos related to changes in behavior and habits. The sanitation development program also includes all those activities aimed at improving hygienic conditions.

LET'S TAKE FOR EXAMPLE HAND HYGIENE, something that plays a fundamental role in keeping in check the diffusion of infectious diseases, bacteria, viruses and parasites resistant to antibiotics. These microorganisms and bacteria nest on the surface of the skin and then disappear after just a few minutes. Some of them cause diseases or can be harmful to the body, above all if they come into contact with foodstuffs, the mouth or the nose. By simply washing one's hands with soap and water, the spread of disease and bacteria can be reduced while at the same time increasing the hygienic and sanitary aspect. Let's take developed countries as an example, where we find that 95% of people interviewed states that they wash their hands after having been to the bathroom. Considering that "Men come from Mars and women from Venus," (as John Gray, psychologist and marriage counselor stated in his famous book) in this case, too, the habits of women are different from those of men. Women wash their hands more often: 64% of women wash their hands more than 6 times a day, against 48% of men. "Clean hands are safe hands" is one of the messages of the WHO (World Health Organization) that counts among its guidelines "wash your hands with soap and water, rinse them carefully and dry them with a disposable towel to reduce contamination".

Hand hygiene assumes an important role also for the control and reduction of infections associated with health care assistance that have an important impact on human health and affect millions of people in the world each year. According to a study conducted by the WHO, "Global Patient Safety Challenge - Clean Care is Safer Care", over 1,400,000 people worldwide are affected by these types of infections (in developed countries, about 5-10% of all persons hospitalized; in developing countries, about 25%). Surely, aerial spread remains the primary source of diffusion of the viruses, but also diffusion through contaminated hands plays an important role. For this reason, according to the WHO, hand hygiene associated also with other means of control of infection diffusion is to be counted among the principal and essential measures of control and response to this pandemic.

BUT WHAT HAPPENS INSTEAD WHEN WE WASH OUR HANDS AND DRY THEM WITH A PAPER TOWEL OR AN ELECTRIC HAND DRYER? From a study conducted by the ETS (European Tissue and Paper Association) in collaboration with the University of Westminster, it has come to light that the use of paper hand towels reduces on the average 42% of bacteria, while the use of electric dryers increases them by 50%. In these last few years, numerous studies have been conducted aimed at analyzing the benefits deriving from hand hygiene and the efficacy of the different detergents, but in-depth studies about the different contribution brought to hand hygiene by a correct drying process

are few and far between. However, there is increasing awareness of the importance of this phase in the complex debate related to hand hygiene.

And from a survey conducted by SCA, too, it has emerged that what worries 47% of the world's population regarding risks linked to hygiene is insufficient hand hygiene in public washrooms. The study conducted by the ETS analyzes the difference between paper hand towels and air dryers used in public washrooms. The air can constitute a vehicle of bacteria transmission. A good example is a hospital environment where avoiding contamination means not sharing one's "personal belongings" and there is also a strong preoccupation for bacteria diffusion through the air conditioning system.

Today, the three main methods of hand drying used in public washrooms and analyzed in the study are:

1. Paper towels (PT); 2. Warm air dryers (WAD); 3. Jet air dryers (JAD);

The latter (JAD) were introduced on the market recently by producers such as Dyson, Mitsubishi and Veltia and for the first time analyzed and compared to other drying systems by the University of Westminster. The study compares the different drying methods and their contribution to correct hand hygiene by analyzing the following factors: A. Drying efficiency; B. Changes in the number of different types of bacteria on the palms and fingertips before and after washing and drying the hands; C. Assessment of the potential contamination of other users and the washroom environment resulting from the use of each of the three methods; D. Bacterial sampling of any eventual contamination of the jet air dryer;

A. DRYING EFFICIENCY OF THE DIFFERENT DRYING METHODS. It has been generally demonstrated that the transmission of bacteria and other micro-organisms takes place more readily on wet skin than on dry (Gould 1994). This effect is determined partially by the ease with which water is transferred from one surface to another and partially by the greater propensity of micro-organisms to colonize damp environments. Hence, the quantity of residual water on the hands after drying is directly proportional to the number of bacteria transferred through contact. The greater the amount of residual water, the greater will be the quantity of bacteria (Patrick et al., 1997). The research conducted by the ETS compared the efficiency of drying of five different types of paper towels, with warm air dryers and jet air dryers:

1. Paper towel (PT 1): 2-ply, 100% recycled (Wepa);
2. Paper towel (PT 2): 2-ply, 100% virgin (Sofidel);
3. Paper towel (PT 3): 2-ply, through-air dryer (TAD), 50% virgin-50% recycled (Kimberly-Clark);
4. Paper towel (PT 4): 1-ply, 100% recycled (Kimberly-Clark);
5. Paper towel (PT 5): 1-ply, 100% recycled (Sofidel);
6. Warm Air Dryer: Electric-Aire™ (World Dryer Corporation);
7. Jet air dryer (JAD): Airblade™ (Dyson).

Drying performance assessment of the seven methods of analysis was made thanks to the collaboration of two volunteers who washed and dried their hands according to a pre-established procedure and for different 10-second intervals of time: 10-20-30-40-50-60 seconds.

The weight of the quantity of water present on washed and unwashed hands was measured, and then the weight of quantity of residual water on the hands following drying through each of the 7 methods; the average drying percentage was calculated as follows:

Average drying percentage:

$$\frac{(\text{Weight of water on wet hands} - \text{weight of the water on dried hands}) \times 100}{\text{Weight of the water on wet hands}}$$

RESULTS SHOW THAT THE 5 TYPES OF PAPER TOWELS AND THE JAD HAVE THE SAME DRYING CAPACITY

(90% drying in 10 seconds) and negligible differences in the respective performances for the subsequent time intervals. Air dryers are significantly less efficient (slower) with respect to the other 6 methods, 90% drying is obtained in over 4 times the drying time (47 seconds).

However, despite the fact that it has been demonstrated that wet hands increase the probability of transmission of bacteria present on them (Gould, 1994 - Patrick et al., 1997), other factors come into play in the hygienic performance of hand drying methods, such as: the degree removal of dirt, bacteria and skin particles through rubbing, the absorption and softness of the material used to dry the hands, the emission of bacteria from the flow of air in the electrical apparatus, the contamination of the electrical drying apparatus.

To evaluate the actual hygienic performance, it is not sufficient to analyze the drying percentage, but we must also consider the number of bacteria present on the hands before and after the use of the different drying methods.

B. NUMBER OF DIFFERENT TYPES OF BACTERIA PRESENT ON HANDS BEFORE AND AFTER DRYING WITH THREE

DIFFERENT METHODS: PAPER TOWELS, WARM AIR DRYERS, JET AIR DRYERS. In this survey, the drying times are based on the observation of the average hand drying time spent by users in public washrooms: paper towel (10 sec), electric dryers (20 sec) - (Redway et al., 1997) - for the jet air dryers, the time suggested by the producer was used (10 sec), and since these have only recently been introduced on the market, field observations are not yet available.

20 test subjects (10 men and 10 women) of 18 to 60 years of age were asked to visit a public washroom according to their respective habits, to return to the laboratory without washing their hands and then again after having washed their hands using the following methods:

1. Paper towel (PT 1): 2-ply, 100% recycled (Wepa);
2. Paper towel (PT 3): 2-ply, through-air dried (TAD), 50% virgin - 50% recycled (Kimberly-Clark);
3. Warm air dryer (WAD): Elettric-Aire™ (World Dryer Corporation);
4. Jet air dryer (JAD): Airblade™ (Dyson).

The results obtained from the analysis before drying (BD) and after (AD) were collected and the percent variation in the number of bacteria was calculated (meant as the units comprising the bacterial colonies) as follows:

Percentage variation in the number of bacteria AD and BD:

$$\frac{(\text{Number after drying} - \text{number before drying}) \times 100}{\text{Number before drying}}$$

THE RESULTS OF THIS STUDY highlight that the two types of paper towels (PT 1 and PT 3) tested reduce the number of all types of bacteria on fingertips and palms of the subjects examined. Warm air dryers increase the average numbers of all types of bacteria tested both on fingertips and on palms.

In conclusion, based on the recent study, the JAD producer's claim that it is "the most hygienic hand dryer" is confirmed only if the JAD is compared with other electrical hand drying devices because, if compared to paper towels, its performance in terms of average number of residual bacteria on hands after drying is significantly higher.

C. POTENTIAL CROSS-CONTAMINATION OF WASHROOM USERS AND WASHROOM ENVIRONMENT RESULTING FROM THE USE OF EACH OF THE THREE METHODS: PAPER TOWELS, ELECTRICAL HAND DRYERS AND JET AIR DRYERS.

The hands of two volunteer subjects were artificially contaminated with a solution of yeasts in order to ascertain and compare the potential capacity for contamination of people and the surrounding washroom environment of three different hand drying methods.

From the data collected, it emerges that paper towels tend to contaminate people present in the washroom and the washroom environment in a considerably lower degree with respect to JAD. Paper towels are better than warm air dryers at zero meters, without substantial differences at greater distances. However, the performance of warm air dryers is better than JAD at every distance tested.

It is a well-known fact that air movements encourage the dispersion and transmission of microorganisms, increasing the possibility of contamination of materials and people. Hence, paper towels - that practically do not generate significant air movements, can well be considered the most hygienic of the three drying methods.

D. SAMPLING OF ANY POSSIBLE CONTAMINATION BY JET AIR DRYERS.

Previous studies (Blackmore, 1989. Knights et al., 1993; Redway et al., 1994) have demonstrated that also the internal surfaces of the warm air dryers can be the object of bacterial contamination. Bacteria can be transferred through air flows emitted and can deposit on the hands of people using them or transmitted through the air to all washroom users.

From the analysis conducted on the air slots, it has emerged that the JAD in public washrooms may be contaminated with large numbers of bacteria: particularly exposed to contamination is the lower portion of the drying chamber. It was observed that water coming from the hands of the JAD users collects in this area, that it is often damp and this encourages the colonization and survival of bacteria.

In conclusion, the study conducted by the ETS highlights how the paper towel is more hygienic with respect to the other two types of electrical hand dryers (warm air dryers and JAD). Hence, it is clear that, in order to ensure an appropriately hygienic environment in public places such as hospitals, clinics, nurseries, care homes, kitchens and other food preparation areas where hygiene is of primary and fundamental importance, the preference to install paper towel distributors instead of air dryers is surely a winning choice in order to ensure an appropriate level of hygiene.