



## ORIGINAL ARTICLE

### **The significance of proper hand hygiene and awareness of contaminated objects in a healthcare setting.**

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#### **Introduction**

In the EU alone, the ECDC states that there are up to 4.1 million overall hospital-acquired infections (HAI) annually and 30 % could be limited by proper hand hygiene [1]. Other ECDC publication lists that on any given day in an acute care-hospital, about 80 000 patients have at least one healthcare-associated infection [2]. In order to emphasize the importance of hand hygiene in clinical settings, the students of the Jagiellonian University Medical School class of 2022 performed a hand washing microbiological experiment.

The experiment was done in order to visualize the difference between poor and proper hand hygiene as well as possible contamination of the hospital environment from commonly used objects.

#### **Materials and Methods**

The medical students first sampled their unwashed hands for cultivation. Then another sample was taken after following the WHO guidelines for proper hand washing. Finally, a

sample was taken for culture after the hands had been properly washed and alcohol-disinfected.

The samples were cultivated on general purpose Trypticase soy agar. The Petri dishes were distributed amongst the students, who were asked to divide the surface into three equal areas with a marker. The medical students were then instructed to firmly place an unwashed digit onto the agar surface for 10 seconds. The pressure of the digit was hard enough to leave a fingerprint on the agar, but soft enough as to not displace or destroy the agar.

The students then proceeded to wash their hands according to the WHO guidelines for proper hand washing and then pressed the same digit as before on the second demarcated area [3].

Lastly, the students used Skinman Soft Hand Disinfectant with a high alcohol content (Ecolab, Poland) and then proceeded to press the same digit on the third area demarcated on the agar.

This was done to show the effectiveness of different methods of hand sanitization and the importance of combining proper hand washing with soap and the use of alcohol disinfectants in order to reach the maximum level of microbiological cleanliness in their future practice as medical doctors.

The agar plates were then incubated at aerobic conditions in 37°C for 24 hours. After incubation, the plates were examined. The three zones on each agar plate were compared to one another. Students also made comparisons between each agar plate.

Having in mind another common source of microorganisms in hospital settings, surplus agar plates were used to sample objects, such as smartphones, jewellery, keys and wrist watches onto the same agar. Also, materials from several other locations of the body were collected for cultivation and those included: scrotal, perineal and glans penis samples.

All results were evaluated and then documented with a camera (Nikon Coolpix A10, Japan).

## Images

The following photographs were taken and a film recorded when the culture results became available after 24 h (Figures 1-8).



Figure 1. Agar plate with visible division into three fields, namely: dirty (hands); washed and washed & disinfected (WD). One may see different looking microbial colonies on the dirty and washed area. WD is free of such colonies.



Figure 2. Similar Petri dishes with the division into three fields, as above, showing similar results as in Figure 1. Albeit not done according to a quantitative model for testing disinfectants, the figure illustrates the differences between dirty hands and proper hand hygiene around medical settings very well. The medical students can see how much difference it makes to use disinfectant fluids in medical practice.



Figure 3. Not only dirty hands may be dangerous to the patients. Here the agar surface illustrates a print made with a small key and the microbial growth after 24 h. The microbes were not speciated as this was beyond this short observational study.



Figure 4. Doctors should also be careful about jewellery. Here a nice round microbial growth from an imprinted earring.



Figure 5. Another earring, this time much larger with a more visible bacterial growth.

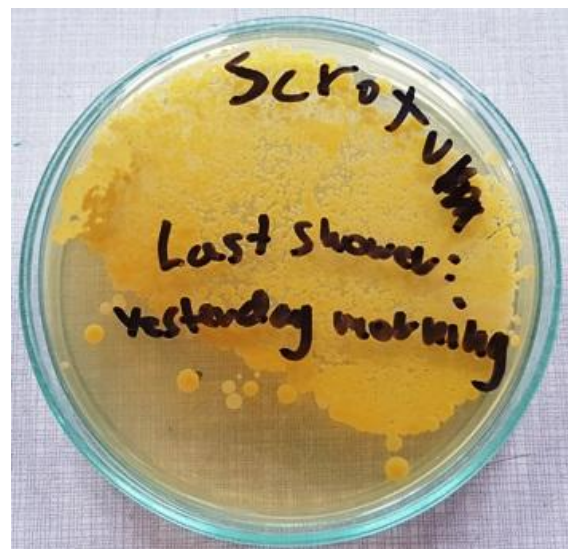


Figure 6. An interesting print which was made in the toilet. An imprint of the scrotum, showing abundant microbial growth in the area. The student made the print and indicated that the last shower he took was the day before. This may very well illustrate the need for extra special disinfection care that needs to be taken when inserting medical devices in the vicinity.



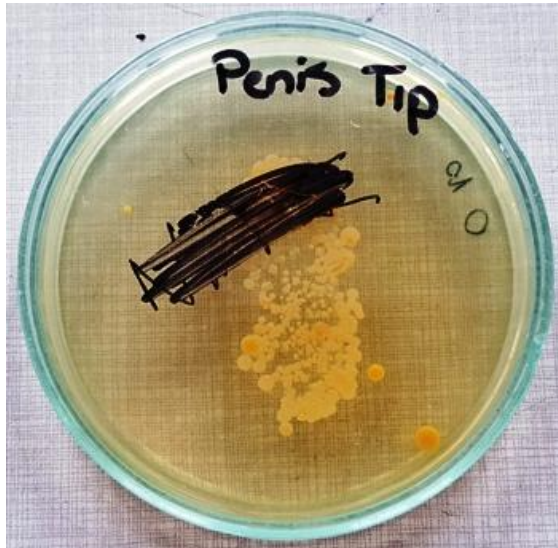


Figure 7. Another interesting print which was made in the toilet. Here the student pressed the glans penis to the agar. The result shows abundant microbial growth and should also emphasize the need for proper hygiene when inserting the Foley catheter.



Figure 8. Film photograph showing the results of cellphone imprints with abundant growth of microbes. The entire film may be seen on the official WJOMI YouTube channel by clicking

the link: <https://www.youtube.com/channel/UCv78AAmi2wvjdglHVHwIXog>

## Discussion with conclusions

Proper hand hygiene is the simplest and least expensive means of reducing the prevalence of nosocomial infections. When properly applied, hand washing followed by alcohol application can lower infection rates caused by nosocomial infections by even 30% [1]. Training and education of medical students in proper hand hygiene early and throughout the course of their medical studies may prove beneficial on lowering rates of nosocomial infections [3].

Furthermore, this study demonstrates the importance of not bringing highly contaminated objects, such as cellphones, into the rooms of e.g. immunocompromised patients, which unfortunately is a frequent occurrence in many hospitals.

Lastly, the samples from the scrotum, penis and perineum indicate the flourishing microbial life which exists in these areas, and emphasizes risks posed by bacteria that may enter the urinary tract or circulatory system through the femoral vessels, which is commonplace in procedures such as heart catheterization and angiography. The rich flora found in the perineal, penile and inguinal region shows the importance of proper hygiene and careful preparation before performing procedures such as catheterization of the bladder or percutaneous coronary intervention via the femoral or iliac arteries.

To conclude – hand hygiene remains the cheapest but most important form of HAI prevention. It also prevents the transmission of resistant microorganisms. It's also vital to clean everyday-use objects regularly.



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