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### *Hand hygiene – the primer to good medical education and practice*

The history of hand hygiene dates back to the 19<sup>th</sup> century. The proof that handwashing could stop the spread of infection was shown by doctor Ignaz Semmelweis in 1851. He noticed that the mortality rate on an obstetrical ward where medical students were trained was greater than 10%, whereas on another obstetric ward where midwives were trained the mortality rate was less than 3%. He connected that with the fact that medical students and doctors attended autopsies just before making rounds on the mothers who had just delivered in the obstetric ward. Doctor Semmelweis required the physicians and medical students under his charge to scrub their hands with soap and water and then soak them in a chlorinated lime solution before entering the clinic or ward and between examinations. The obstetric death rate on the ward fell from greater than 10% to less than 1.2% within a few months. Thus it was shown that microorganisms were transmitted between patients on the contaminated hands of health care workers. Since then doctor Semmelweis has been called “the father of asepsis” (10). Today handwashing is considered the major hand-hygiene method recommended all over the world. It is the primer to hospital-acquired infection (HAI) control, especially referring to patients hospitalised in intensive care units exposed to broad-spectrum antibiotics, medical devices and the hands of healthcare personnel. Studies have shown that up to 10% of hospitalised patients suffer from HAI in Britain at any time (2, 3). It attributes to up to 1% of all deaths (5). The Centre for Disease Control estimates that as many as 2 million patients get infections annually in the United States and 90,000 die as a result of HAI (9).

Poor hand hygiene plays an important role in sporadic as well as epidemic foodborne diseases. The hand is a potentially critical point for cross contamination for ill and asymptomatic food workers who may shed high levels of pathogens in their feces (4). Unfortunately, medical literature review indicates that the frequency of handwashing and disinfecting is low (2, 4).

The aim of the study was to collect and analyse data about hand hygiene in dentistry students and food technology students.

#### MATERIAL AND METHODS

Forty-six third-year dentistry and 24 second-year food technology students were asked to fill in a questionnaire consisting of 13 multiple choice questions about their hand hygiene. Participation was voluntary and anonymous. Among dentistry students there were 28 females (60.8%) and 18 males (39.2%) aged 21 to 25 (mean 21.8, median 22). Nine of them (19.6%) came from villages, 11 (23.9%) from small towns and the rest from cities. The food technology students were 24 females aged 20 to 23 (mean 21.1, median 21). Ten (41.7%) of them came from villages, 5 (20.8%) from small towns and 9 (37.5%) from cities. The obtained data were analysed with the use of non paired t-student test.

#### RESULTS

The students counted how many times they washed their hands daily (Tab. 1). They marked occasions on which they washed hands (Tab. 2.). There were no statistically significant differences between these two groups. The dentistry students washed their hands usually with water and soap

– 35 (76.1%), with water and liquid soap – 29 (63.1%), with water and washing gels – 2 (4.3%), and 17 (37%) just with water (more than one option was possible to choose). In case of food technology students the numbers were: 18 (75%), 13 (54.2%), 1 (4.1%), and 19 (79.1%), respectively. They enumerated ways of drying hands after hygienic wash they used (it was possible to mark more than one answer). 100% of dentistry students dried hands with cotton towels, 34.7% (16) with paper towels, and 8.6% (4) with hot air dryers. 91.6% (22) of food technology students dried their hands with a cotton towels, 16.6% (4) with paper towels, and 12.5% (3) with air dryers. The majority of the students examined proved to understand that unwashed hands could be a real nidus of infection.

Tab. 1. Frequency of handwashing in dentistry students and food technology students

Handwashing frequency during a day	Dentistry students n (%)	Food technology students n (%)
Less than 10 times	17 (37)	6 (25)
10-15 times	20 (43.5)	13 (54.1)
16-20 times	7 (15.2)	3 (12.5)
25 times	1 (2)	2 (8.4)
30 times	1 (2)	0

Tab. 2. Situations when students wash their hands

	Dentistry students n (%)	Food technology students n (%)
Before handling food	45 (97.8)	23 (95.8)
After eating	22 (47.8)	15 (62.5)
After using the toilet	45 (97.8)	24 (100)
When soiled	46 (100)	24 (100)
Before contact with an ill person	34 (73.9)	15 (62.5)
After contact with an ill person	41 (89.1)	20 (83.3)
Before handling young babies	16 (34.7)	7 (29.2)
After handling pet animals	36 (78.2)	20 (83.3)

## DISCUSSION

Hand hygiene facilities in hospitals, intensive care units, outpatient clinics should include: liquid soap and hand disinfectant. The recommended by European norms sequence of actions are: wet hands with water, apply soap, rub hands together for at least 10 s, rinse hands with water, dry hands with disposable towel, close water tap with disposable towel, do not touch waste disposal unit throwing the towel away. Hand disinfection is considered adequate if rubbed with disinfectant for at least 30 s. When using an alcohol-based hand rub, apply the product to the palm of one hand and rub hands together, covering all surfaces of hand and fingers, until hands are dry. The above instructions must be placed next to hand hygiene units as prompts for the health care personnel and workers dealing with food (11).

American Centre for Disease Control published its own guidelines for hand washing and disinfection. They recommend the use of alcohol-based hand rubs by health care personnel for patient care before they address some of the obstacles that health care professionals face when taking care of patients. Hand washing with soap and water remains sensible strategy for hand hygiene in non-health care settings and is recommended by the CDC and other experts. When hands of health care personnel are visibly soiled, they should be washed with soap and water. The use of gloves does

not eliminate the need for hand hygiene. Likewise, the use of hand hygiene does not eliminate the need for gloves. Alcohol-based hand rubs significantly reduce the number of microorganisms on the skin, are fast acting, and cause less skin irritation. Health care personnel should avoid wearing artificial nails and keep natural nails less than one quarter of an inch long if they care for patients at high risk for acquiring infections. Operating room personnel should not wear artificial nails and the natural ones should be kept short and clean. Artificial nails only weaken natural nails. Bump or knock to a long artificial nail may cause its separation from the base of the natural nail, allowing a portal for bacterial or fungal entry. Artificial nails are more likely to harbour gram-negative pathogens than natural nails, both before and after hand washing (8).

In Europe there are several norms referring to hand hygiene and medical gloves: EN 420 (General requirements), EN 374 (Medical gloves against chemicals and microorganisms), EN 455 (Medical gloves for single use). A suspension test for the demonstration of bacterial activity (prEN 12054) is obligatory for hand disinfectants in all fields of application. A test to prove activity against yeasts applies only to hygienic hand rub. Claims for virucidal activities can be substantiated by prEN 1476. According to EN 374-1 the penetration of chemicals or microorganisms, on a non-molecular basis, through holes or other defects of the glove must be prevented. This has to be demonstrated by two tests: the air-leakage test where no air bubbles shall escape under water from an inflated glove, and the water-leakage test, where no droplets shall escape from a glove filled with one litre of water within a timespan of 2 minutes. According to EN 455-1 medical disposable gloves are checked in water-leakage test only. According to the norm out of a 10,000 gloves, 80 must be tested and not more than 3 gloves may fail, otherwise the CE-mark cannot be affixed to the batch (7). There are also norms regulating tests for the efficacy of chemical disinfectants and antiseptics use in a step-wise procedure: in phase 1 it should be demonstrated by suspension tests that a product has bactericidal (EN 1040) and /or fungicidal (EN 1275) properties. These norms are, however not required for products to be used in the medical area but are rather meant to constitute standardized methods for assessing the microbial capacity of new chemicals in the the development of disinfectants regardless of the field of application. Phase-2 tests address the field of application. There are tests simulating practical conditions. Norms have been developed for three fields of application: hygienic hand wash, hygienic hand rub, and surgical hand disinfection. In the temperature of 20°C 1 min (for hygienic) and 5 min (for surgical disinfection) contact time should reduce the number of skin microorganisms  $10^5$ -fold for rub and  $10^3$ -fold for wash (7). The EN 1500 describes the norms for alcohol-based hand disinfectants. It states that they should have average standard reduction factor of 4 Log<sub>10</sub>. It is arbitrary, of course. In comparison: in the USA, the Food and Drug Administration requires that effective hand-wash agents for health care staff (including alcohol-based rinses and gels) must lower bacterial counts on hands by 2 Log<sub>10</sub> after one use, and 3 Log<sub>10</sub> after ten applications. The investigators who compare rinses and gels estimate that alcohol application times are 8 – 15 s in daily practice, compared with the 30-s application of the standard test. Therefore, decontamination will be less from both types of preparation than in the studies, with smaller differences between them (1). So, the real difference between the risk for pathogen transmission is still unclear, and awaits further study.

Evaluation of hand hygiene product considers their relative efficacy of antiseptic agents against various pathogens and the acceptability of hand hygiene products by personnel (9).

Tvedt and Bukholm observed hand-hygiene behaviour and evaluated the effect of alcohol-based hand disinfection and handwashing with plain liquid soap on microbial flora in health care personnel. They demonstrated a crude compliance of hand hygiene of 50.4%, which was only performed adequately in 20.8% of cases. Of this group handwashing and hand disinfection procedures were performed properly 34.0% and 71.6% of the time, respectively. They checked also the glove juice and demonstrated that whilst handwashing was sensitive to the way in which hand hygiene was performed, alcohol-based hand disinfection was less sensitive to such performance. They proved that hand disinfection with alcohol-based preparations is a robust hand-hygiene method (11). Montville et al. simulated factors that influenced the levels of bacteria on foodservice workers hands. They found out that hot air drying had the capacity to increase the amount of bacterial contamination on hands, while paper towel drying caused a slight decrease in contamination.

There was little difference in the efficacy of alcohol and alcohol-free sanitizers. Ring wearing caused slight decrease in efficacy of hand washing (4). Naikoba and Hayward reviewed 21 trials dealing with hand hygiene among health care workers. They found low compliance in doctors as well as in nurses. They concluded that in order to keep high level of compliance hospital personnel must get regular reinforcement of hand hygiene through the use of prominently displayed posters, regular performance feedback and provision. The regular use of bedside alcohol-based hand disinfectant produced and sustained effect on levels on hand hygiene and on rates of hospital infection (5).

Hand cleansing is the cheapest, easiest method to reduce significantly cross-contamination between patients. Therefore health care workers need to be repeatedly educated of the positive effects hand washing can give on patient outcome. In order to improve compliance to hand washing it must be a long term change in behaviour. Many health care workers try to excuse themselves with lack of time so the compliance is still too low, but there is a great need for new efforts in this field. It is a teaching job to be launched at the very beginning of medical education remembering that even Semmelweis was greeted with virulent attacks by some outstanding doctors (6).

### CONCLUSIONS

Keeping their hands clean by health care professionals and food delivering services workers is one of the most important ways to protect ourselves and our patients from disease-causing microorganisms. We should wash hands with soap and water and apply alcohol-based hand rubs regularly striving to keep our hands clean.

Dentistry students wash their hands more often than food technology students. They care more about what they wash their hands with and about the way of drying hands properly. But still there is a lot to be done in this field as high percentage of students does not wash hands after contact with patients and pets.

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## SUMMARY

Keeping hands clean by health care professionals and food delivering services workers is the cheapest and one of the most important ways to protect ourselves and our patients from disease-causing microorganisms. We should wash hands with soap and water and apply alcohol-based hand rubs regularly striving to keep our hands clean. Dentistry students wash their hands more often than food technology students (but no statistically significant difference was found). They care more about what they wash their hands with and about the way of drying hands properly. However, there is still a lot to be done in this field.

## Higiena rąk – podstawą dobrej edukacji i praktyki medycznej

Zachowanie higieny rąk przez pracowników służby zdrowia i osób pracujących w kontakcie z żywnością jest najważniejszym i najtańszym sposobem ochrony przed chorobotwórczymi mikroorganizmami ich samych, jak i ich pacjentów. Należy myć starannie ręce wodą z mydłem i stosować środki do dezynfekcji rąk na bazie alkoholu. Studenci stomatologii myją ręce częściej niż studenci technologii żywienia (jednak nie stwierdzono różnic istotnych statystycznie między obiema grupami). Studenci stomatologii bardziej zwracają uwagę na dobór środków myjących oraz sposób suszenia rąk. Wciąż jednak wiele pozostaje do zrobienia w dziedzinie nauczania i utrwalania prawidłowych nawyków higienicznych.