ORIGINAL ARTICLE

Impact of hand hygiene knowledge on the hand hygiene compliance

Martin Novák[1], Jozef Breznický[2,3], Jana Kompaníková[2], Nora Malinovská[4], Henrieta Hudečková[1]

[1]Department of Public Health, [2]Department of Microbiology and Immunology; Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, [3]Orthopaedic Clinic, F.D.Roosevelt Hospital, Banská Bystrica, [4]Department of Foreign Languages, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava; Slovak Republic

ABSTRACT

Aim Hand hygiene practice is still burdened by inadequate compliance, whether in the professional sphere by health professionals or in the non-professional sphere by lay population. Aim of this study was to map the hand hygiene knowledge and its compliance in the monitored group of people.

Methods The research was conducted at the Jessenius Faculty of Medicine in Martin of Comenius University in Bratislava (JFM CU) among seventy 3rd year students of General Medicine (medical study program), and Nursing, Midwifery and Public Health (non-medical study programs). Knowledge of hygienic hand washing according to the WHO guidelines from 2009 was investigated, as well as differences in the level of microbial contamination of hands after routine hand washing between the group that had been acquainted with hand hygiene protocols and the group that had not sufficiently.

Results The results have shown that 32.9% of the students did not perform hygienic hand washing properly. The differences between the groups of students with and without the proper hand hygiene compliance in routine hand washing were not statistically significant.

Conclusion The results of our survey have suggested that the reasons for decreased compliance with hand washing protocols may be related to forgetting to wash the hands or not being acquainted with hand washing protocols at all. The strategies focused only on one aspect of hand hygiene are, according to scientific literature, ineffective in the long term.

Key words: hand washing, education, microbial contamination, prevention

Corresponding author:
Martin Novák
Department of Public Health, Comenius University in Bratislava, Jesenius Faculty of Medicine in Martin
Malá Hora 11149/4B, 036 01 Martin, Slovak Republic
Phone: +421 911 886 256;
Email: martin4novak@gmail.com
ORCID ID: https://orcid.org/0000-0001-9206-0083

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INTRODUCTION

Hand hygiene is considered to be one of the most effective ways to prevent the spread of infectious diseases, both in hospitals and in everyday life (1). In order to make it as effective as possible, it is necessary to be acquainted with the several hand washing methods as well as with the timing in which a particular hand washing method should be performed. In hospital settings, hand washing is regarded as the primary weapon in the infection prevention and control procedures. Here, more than anywhere else, poor hand hygiene increases the risk of nosocomial infections that have a negative impact on the patient treatment, lead to health complications and thus prolong length of hospital stay (LOS) for patients (2). These impacts are notable not only in personal, but also in social and economic areas. As a result, the golden rule for all health professionals must be their perfect compliance in hand hygiene (3). However, high quality education is necessary to achieve this (3). The World Health Organization (WHO) has published WHO Guidelines on Hand Hygiene in Health Care in 2009, which includes a hand hygiene procedure that is a part of health education (3).

Because of that, this research focused on the students of both medical and non-medical study programmes at the Jessenius Faculty of Medicine in Martin of Comenius University in Bratislava (JFM CU).

The aim of this study was to map and assess the abilities of the students to perform hygienic hand washing as recommended by the WHO and to determine whether knowledge on the hand hygiene compliance has an impact on hand washing practise in everyday life.

EXAMINEES AND METHODS

Examinees and study design

The cohort consisted of 70 JFM CU students of General Medicine (24 students; 34.3%), Nursing (24 students; 34.3%), Midwifery (10 students; 14.3%) and Public Health (12 students; 17.1%) study programmes. There were 60 (85.7%) females and 10 (14.3%) males. The research was conducted from September to December 2014.

The students enrolled into the research had been chosen by their willingness to participate. All students were in the 3rd year of their studies, because at the time of data collection they had already had basic knowledge on the hand hygiene compliance. The students' participation in the research was voluntary.

Methods

It was investigated whether the participants were performing the proper hygiene hand washing procedure according to the WHO guidelines from 2009 (3). This procedure includes the following steps: wet hands first, applying of soap, rubbing hands palm to palm (Step 1); right palm over left dorsum with interlaced fingers and vice versa (Step 2); palm to palm with fingers interlaced (Step 3); backs of fingers to opposing palms with fingers interlocked (Step 4); rotational rubbing of left thumb clasped in the right palm and vice versa (Step 5); rotational rubbing, backwards and forwards with clasped fingers of the right hand in the left palm and vice versa (Step 6); rinsing hands with warm water, drying thoroughly with a disposable towel, usage a disposable towel to turn off faucet, hands are clean.

In the course of the observations the focus was on the performance of six steps (Steps 1 to 6). The other steps (wetting hands with water and applying soap, or applying alcohol product on palms; rinsing hands with water; drying hands with single use towel; turning off faucet) were not monitored because our objective was to control and assess the proper hand hygiene compliance and these six steps are included in both techniques included in the WHO Guidelines on Hand Hygiene in Health Care in 2009 for hand washing with a soap, and with an alcohol detergent (3).

The individual steps were monitored, and according to the quality of the hand hygiene compliance, the cohort was divided into two groups: a group with sufficient knowledge (Group 1); and a group with insufficient knowledge of hygienic hand washing (Group 2). A criterion for inclusion in the Group 1 was to handle all six hand washing steps, with a maximum of one error allowed, which was decided by authors (it was not a criterion in the guidelines).

In the next part of the research the hand hygiene practices and compliance of the individual students was investigated. A method published in Mayo Clinic Proceedings (4) was used, which

was based on the procedures listed below. This method represents an effective way to reach goals of this study.

Firstly, the students soaked their hands in a suspension of non-pathogenic bacterium *Micrococcus luteus*. This bacterium was chosen because of its characteristic colour appeared on agar media (bright yellow), which is distinguishable from the physiological microflora. Then the students dried their hands with the electric air dryer and put on sterile gloves containing 30 mL of physiological saline solution in order to wash off the bacteria out of the hands into the solution. Subsequently, the gloves were carefully removed from the hands to avoid spilling of the solution. A sample of 1 ml was taken after thorough mixing from the glove content and inoculated on the agar medium to determine the total colony forming units (cfu). Afterwards, the students were asked to wash their hands in a routine way as they wash them at home. Students then again put on gloves with a saline solution to wash off the bacteria out of the hands and a second sample of 1 mL was taken and inoculated on the agar medium. After 24-hours incubation at 37 °C the percentage of reduction in bacterial cfu between first and second sample (plate) was calculated. During the experiment, the students were not allowed to touch anything, an assistant turned on/off faucet. No soap or disinfectants were used.

Statistical analysis

It was observed whether there was a statistically significant difference in the bacterial count reduction after routine hand washing between the students in Group 1 and Group 2. The differences at the statistical significance of $p<0.05$ were evaluated by calculating and comparing confidence intervals: the difference was statistically significant when there was no overlap of confidence intervals. The results of the microbiological reduction comparisons were expressed in percentage values with 95% confidence intervals.

RESULTS

During the procedure of hygienic hand washing, it was observed how the students followed the hand hygiene protocols according to the WHO guidelines from 2009. They were divided into two groups according to the number of omitted steps. The group of students with sufficient knowledge (Group 1) consisted of those who performed six and five steps correctly (students omitted one or none steps). The total number of the students in Group 1 was 47 (67.1%). The group of students with insufficient knowledge (Group 2) consisted of those who skipped two or more steps. The total number in the Group 2 was 23 (32.9%). Almost a third of the students performed the whole procedure with two or more mistakes (students omitted two or more steps), and as a result they were enrolled into a group with poor compliance in hand hygiene. From the total of 70 participants, 26 (37.1%) students performed all steps; 21 (30.0%), nine (12.9%), 13 (18.6%) and one (1.4%) student omitted one, two, three and four steps, respectively. None of the students omitted steps five or all steps.

From six observed steps, step 4 was omitted most frequently, by 29 (41.4%) participants. Here the students were supposed to wash the backs of fingers in opposing palms. On the other side, step 2, where the students were to put the right palm over left dorsum with interlaced fingers, was omitted least of all, eight (11.4%). Steps 1 and 5 were omitted by 10 (14.3%) students each, step 3 by nine (12.9) and step 6 by 15 (21.4) students.

The students who mastered the hand washing protocols showed a notable reduction in microbial concentration on both hands if compared to the group of students with poor compliance in hand hygiene protocols. However, the difference between the groups was not statistically significant (Table 1).

Table 1. Reduction in the number of bacterial colonies after routine hand washing – division according to hand washing knowledge

Group*	Percentage of microbial reduction (95% CI)	
	Left hand	Right hand
Group 1	78.5% (84.8 – 72.2)	76.2% (82.2 – 70.2)
Group 2	69.5% (78.3 – 60.8)	68.12% (77.8 – 58.5)

*Group 1, all six hand washing steps handling with a maximum of one error allowed; Group 2, with insufficient knowledge of hygienic hand washing; CI, confidence interval;

DISCUSSION

Hand hygiene is widely recognized as the primary measure in preventing the spread of microorganisms. It is also proven to be effective in reducing the incidence of nosocomial infections (5,6). Despite the relative simplicity of hand hygiene protocols,

the hand hygiene compliance among healthcare providers is uneven, and can be as low as 40% (7). Boyce and Pittet have reported that the average hand hygiene compliance rates among doctors and nurses at the University Hospital in Geneva were approximately 30-50% (6). Other studies are more optimistic and show hand hygiene compliance rate between 50-89% (8-10).

Continuous efforts are being made to find effective and sustainable strategies to address this problem. One such strategy is the programme called "My 5 Moments in Hand Hygiene", which has been outlined by the World Health Organization including hand hygiene compliance before patient contact, before aseptic tasks, after bodily fluids exposure, after patient contact, and after contact with patient surroundings. This programme has been designed to improve education in the hand hygiene compliance and to help monitor and guide hand hygiene habits among health professionals (11,12).

Hand washing plays a significant role in the reduction of the transmission of infections such as diarrhoea, pneumonia, influenza, helminthiasis, neonatal infections, and others (3, 13-16). Hand hygiene is also essential for disease control in both commercial and domestic food preparation, as well as in healthcare and education settings (15). Studies have shown that hand hygiene support can be the single most effective way in the reduction of costs and the global burden of diseases transmitted by contaminated hands (17,18).

Hand hygiene is the most effective measure in preventing the transmission of pathogenic microorganisms during medical treatments (1,19,20). In 2006, the WHO issued draft guidelines in order to provide evidence on hand hygiene and specific recommendations to improve practices. These guidelines have been successful in reducing nosocomial infections at institutional and regional level (5,21,22).

Pessoa-Silva et al. (23) implemented a series of interventions to improve the hand hygiene compliance in neonatal departments. The hand hygiene compliance significantly improved from 42% to 55% during the research period (it was accompanied by increased use of hand disinfectants) resulting in 60% reduction in nosocomial infections in the children with very low birth weight (24).

It would be expected that in routine hand washing there would be a greater reduction in microorganisms on hands of the students who were familiar with hand hygiene protocols than in the students with insufficient knowledge. However, the results surprisingly showed that this is not the case. The sample group was made up of the students studying medical disciplines and the differences were not significant. It can therefore be assumed that one-time (laymen) training during global hand washing day and other occasions may not be effective enough to remember the procedures.

The results of this study also showed the reason for the differences in extracurricular factors, because when the students demonstrated proper hand hygiene procedure (as they had learned), they all showed similar results. Additionally, even though the students should have been educated in hand hygiene, many of them either did not follow or forgot to follow protocols in practice. This can, however, have a major impact on their professional and personal lives. Such approach may pose threats to their health or to the health of the patients with whom they come into contact. Therefore, we would recommend them to repeat their practical skills and theoretical knowledge in hand hygiene more frequently.

If health professionals and students of health care have low compliance with hand hygiene – based on our results, one third does not know how to properly hand hygiene according to the WHO guidelines – it can be assumed that the lay population would have even worse results. Non-compliance with hand hygiene practices can be caused by a variety of reasons: lack of time, cold water, which may shorten hand washing procedure, underestimating the severity of the direct contact diseases (3). Our research has suggested that one reason may be forgetfulness of the right habits.

The assessment of hand hygiene support programmes usually focuses on individual, specific interventions and monitors their impact on hand hygiene. Although they have an initial positive benefit, most of the individual interventions do not show long-term maintenance of proper hand hygiene (5). At the same time, the studies have shown that no individual intervention brings long-term behavioural changes (5,6,19, 25-27). In the course of a 14-month study research in two hospitals in Washington DC in the United States

a narrowly focused cultural change and other interventions had to be implemented to bring improvement into hand hygiene practice (27). From the above mentioned it can be concluded that students should be in constant touch with proper hand hygiene education and practice at lectures and practical lessons. Simultaneously, they should also be regularly guided and checked to attain the proper hand hygiene behavioural patterns.

However, research outcomes show that basic health education does not always achieve the expected level in the hand hygiene compliance as necessary for the clinical practice (19,28,29). A contribution of the more experienced health professionals into the improvement of the students' hand hygiene is not negligible. To make hand hygiene programmes work, it is inevitable to make the hand washing facilities, such as water, soap, disposable towels and hand sanitizers, freely available. The principles of hand hygiene should regularly be repeated and stressed to address not only those in the professional sphere, but also lay population. Distribution of the promotional materials (bags, pens, mouse pads, etc.) with the slogans and hand hygiene images. At the same time, advantage should be taken from the electronic and mass media such as television and radio commercials, or social media posts (19, 30-32).

In concussion, despite the attained hand hygiene education, many students in our research group failed to carry out the hand hygiene procedure according to the WHO guidelines successfully. It is important to repeat the practice of proper hand hygiene procedures regularly. Although students have shown knowledge of hand hygiene, they do not consider hand washing as an essential part of daily routines.

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REFERENCES

1. Allegranzi B, Pittet D. Role of hand hygiene in healthcare-associated infection prevention. J Hosp Infect 2009; 73:305-15.
2. Fox C, Wavra T, Drake DA, Mulligan D, Bennett YP, Nelson C, Bader MK. Use of a patient hand hygiene protocol to reduce hospital-acquired infections and improve nurses' hand washing. Am J Crit Care 2015; 24:216-24.
3. WHO. WHO guidelines on hand hygiene in healthcare. [Online] http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf . (20 June 2019)
4. Gustafson DR, Vetter EA, Larson DR, Ilstrup DM, Maker MD, Thompson RL, Cockerill III FR. Effects of 4 hand-drying methods for removing bacteria from washed hands: a randomized trial. Mayo Clin Proc 2000; 75:705-8.
5. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, Perneger TV. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Lancet 2000; 356:1307-12.
6. Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Infect Control Hosp Epidemiol 2002; 23:3-40.
7. Longtin Y, Sax H, Allegranzi B, Schneider F, & Pittet D. Hand hygiene. N Engl J Med 2001; 364:24.
8. Azim S, Juergens, C, McLaws, ML. An average hand hygiene day for nurses and physicians: the burden is not equal. Am J Infect Control 2016; 44:777-81.
9. Hagel S, Reischke J, Kesselmeier M, Winnin, J, Gastmeier P, Brunkhorst FM, Scherag A, Pletz MW. Quantifying the Hawthorne effect in hand hygiene compliance through comparing direct observation with automated hand hygiene monitoring. Infect Control Hosp Epidemiol 2015; 36:957-62.
10. Wetzker W, Bunte-Schönberger K, Walter J, Pilarski G, Gastmeier P, Reichardt C. Compliance with hand hygiene: reference data from the national hand hygiene campaign in Germany. J Hosp Infect 2016; 92:328-31.
11. Shinde MB, Mohite VR. A study to assess knowledge, attitude and practices of five moments of hand hygiene among nursing staff and students at a tertiary care hospital at Karad. IJSR 2014; 3:311-21.
12. Basurrah MM, Madani TA. Handwashing and gloving practice among health care workers in medical and surgical wards in a tertiary care centre in Riyadh, Saudi Arabia. Scand J Infect Dis 2006; 38:620-4.
13. Blencowe H, Cousens S, Mullany LC, Lee AC, Kerber K, Wall S, Lawn, J. E. Clean birth and postnatal care practices to reduce neonatal deaths from sepsis and tetanus: a systematic review and Delphi estimation of mortality effect. BMC Public Health 2011; 11:11.
14. Curtis V, Schmidt W, Luby S, Florez R, Touré O, Biran A. Hygiene: new hopes, new horizons. Lancet Infect Dis 2011; 11:312-21.
15. Ejemot-Nwadiaro RI, Ehiri JE, Arikpo D, Meremikwu MM, Critchley JA. Hand washing promotion for preventing diarrhoea. Cochrane Database Syst Rev 2015; 9: CD004265.

16. Freeman MC, Clasen T, Brooker SJ, Akoko DO, Rheingans R. The impact of a school-based hygiene, water quality and sanitation intervention on soil-transmitted helminth reinfection: a cluster-randomized trial. Am J Trop Med Hyg 2013; 89:875-83.
17. Freeman MC, Stocks ME, Cumming O, Jeandron A, Higgins JP, Wolf J. Curtis V. Systematic review: hygiene and health: systematic review of handwashing practices worldwide and update of health effects. Trop Med Int Health 2014; 19:906-16.
18. Cairncross S, Valdmanis V. Water supply, sanitation and hygiene promotion In: Jamison DT, Breman JG, Measham AR, Evans DB, Jha P, Mills A, Musgrove P, editors. Disease Control Priorities in Developing Countries. 2nd ed. Chapter 41. Washington (DC): The International Bank for Reconstruction and Development / The World Bank, 2006.
19. Pincock T, Bernstein P, Warthman S, Holst E. Bundling hand hygiene interventions and measurement to decrease health care–associated infections. Am J Infect Control 2012; 40:18-27.
20. Pittet D, Allegranzi B, Sax H, Dharan S, Pessoa-Silva CL, Donaldson L, Boyce JM. Evidence-based model for hand transmission during patient care and the role of improved practices. Lancet Infect Dis 2016; 6:641-52.
21. Grayson ML, Jarvie LJ, Martin R, Johnson PD, Jodoin ME, McMullan C, Quin D. Significant reductions in methicillin-resistant Staphylococcus aureus bacteraemia and clinical isolates associated with a multisite, hand hygiene culture-change program and subsequent successful statewide roll-out. Med J Aust 2008; 188:633-40.
22. Allegranzi B, Gayet-Ageron A, Damani N, Bengaly L, McLaws M., Moro ML, Donaldson L. Global implementation of WHO's multimodal strategy for improvement of hand hygiene: a quasi-experimental study. Lancet Infect Dis 2013, 13:843-51.
23. Pessoa-Silva CL, Hugonnet S, Pfister R, Touveneau S, Dharan S, Posfay-Barbe K, Pittet D. Reduction of health care–associated infection risk in neonates by successful hand hygiene promotion. Pediatrics 2007; 12:382-90.
24. Van De Mortel TF, Kermode S, Progano T, Sansoni,J. A comparison of the hand hygiene knowledge, beliefs and practices of Italian nursing and medical students. J Adv Nurs 2012; 68:569-79.
25. Whitby M, Pessoa-Silva CL, McLaws ML, Allegranzi B, Sax H, Larson E, Pittet D. Behavioural considerations for hand hygiene practices: the basic building blocks. J Hosp Infect 2007; 65:1-8.
26. O'boyle CA, Henly SJ, Larson E. Understanding adherence to hand hygiene recommendations: the theory of planned behavior. Am J Infect Control 2001; 29:352-60
27. Larson EL, Early E, Cloonan P, Sugrue S, Parides M. An organizational climate intervention associated with increased handwashing and decreased nosocomial infections. Behav Med 2000; 26:14-22.
28. Kelcíkova S, Skodova Z, Straka S. Effectiveness of hand hygiene education in a basic nursing school curricula. Public Health Nurs 2012; 29:152-9.
29. Kelcikova S, Mazuchova L, Bielena L, Filova L. Flawed self-assessment in hand-hygiene: a major contributor to infections in clinical practice?. J Clin Nurs 2019; 28:2265-75.
30. Forrester LA, Bryce EA, Mediaa AK. Clean Hands for Life™: results of a large, multicentre, multifaceted, social marketing hand-hygiene campaign. J Hosp Infect 2010; 74:225-31.
31. Nevo I, Fitzpatrick M, Thomas RE, Gluck PA, Lenchus JD, Arheart KL, Birnbach DJ. The efficacy of visual cues to improve hand hygiene compliance. Simul Healthc 2010; 5:325-31.
32. Thomas M, Gillespie W, Krauss J, Harrison S, Medeiros R, Hawkins M, Woeltje KF. Focus group data as a tool in assessing effectiveness of a hand hygiene campaign. Am J Infect Control 2005; 33:368-73.