

# “Clean care is safer care”: correct handwashing in the prevention of healthcare associated infections

R. Squeri<sup>1</sup>, C. Genovese<sup>2</sup>, M.A.R. Palamara<sup>2</sup>, G. Trimarchi<sup>3</sup>, V. La Fauci<sup>1</sup>

*Key words: Handwashing, prevention, healthcare associated infections*

*Parole chiave: Igiene mani, prevenzione, infezioni correlate all'assistenza*

## Abstract

**Background.** In 2005, WHO developed the campaign “Clean care is safer care”, aiming at the reduction of Healthcare Associated Infections (HCAI) through the worldwide promotion of appropriate hand hygiene practices. Adherence to these practices presently ranges from 5 to 81% (average 40%).

**Methods.** Aim of the study was the evaluation of healthcare workers (HCWs) adherence to the application of WHO guidelines on the hand hygiene and the possible impact on HCAI reduction. First, some wards at highest HCAI risk were identified. Then, direct observational survey was conducted to evaluate the behaviour of the different HCW categories.

**Results.** Six-hundred-twenty-eight HCWs were observed: 519 nurses (68 in training), 109 physicians (63 in training). Survey analysis highlighted that compliance with handwashing was higher in post care practices (59.6%) than before (55.1%). Some HCWs performed handwashing in both cases. Only in 30.6% of cases HCWs observed the handwashing technique suggested by the guidelines. In 70.4% they wore gloves during procedures in which it was possible to have contact with potentially infectious material, but they did not change them before caring for a new patient in 64% of cases.

**Conclusions.** The survey confirms the international data, showing a low compliance with hand hygiene practices by the HCWs and the need to promote a correct handwashing based on respect of the international guidelines.

## Introduction

Patient safety, i.e. the set of actions aimed at preventing the avoidable risks arising from healthcare practices, has become in recent years an absolute priority for healthcare settings. Among the most frequently avoidable risks there are the healthcare-associated infections (HCAI/HCAIs), which represent a double public health problem, associated with the humanization of care and economic management (1, 2).

In addition to the damaging effects on patients' health, HCAIs will involve additional therapies, increase assistance costs and lead to defensive medicine.

In Italy the estimated costs for a single case range widely, as in United States and in England (3).

According to a study conducted in 29 European countries by the European Centre for Disease Prevention and Control (ECDC), in 2011-2012, HCAI rate in Europe was 6% of all hospital admissions. In Italy, where

<sup>1</sup> Department of Biomedical Sciences and Morphological and Functional Images, University of Messina, Italy

<sup>2</sup> Postgraduate Medical School in Hygiene and Preventive Medicine, University of Messina, Italy

<sup>3</sup> Department of Economics, University of Messina, Italy

49 hospitals had been involved, the most frequent HCAI were found to be those of the respiratory tract (24% of the total), followed by urinary tract infections (21%), surgical site infections (16%) and blood infections (16%) (4). In Italy HCAs amount to about 450,000-700,000 per year, causing patients' death in over 1 percent of cases (5).

The cost, mainly resulting from the increase in days of hospitalization, can range from € 4,000 for a patient hospitalized in a medical ward to € 28,000 for a patient in an intensive care unit (6).

About 30% of HCAs are potentially preventable by adopting effective measures (1, 7).

The association between hand hygiene and HCAI onset has been widely demonstrated. Thanks to the classical studies of Semmelweis and Holmes (8), this procedure was accepted as one of the most important measures for preventing transmission of pathogens in hospitals and is currently promoted by the WHO guidelines. Since 2005 the First Global Patient Safety Challenge is the reduction of the HCAs, through hand hygiene promotion with the campaign *Clean Care is Safer Care*.

In 1995 and 1996, in the USA, the CDC/Healthcare Infection Control Practices Advisory Committee (HICPAC) recommended that either antimicrobial soap or a waterless antiseptic agent be used for cleansing hands upon leaving the rooms of patients with multidrug-resistant pathogens, such as vancomycin-resistant Enterococci and methicillin-resistant *Staphylococcus aureus* (2, 9).

More recently, the HICPAC guidelines issued in 2002 defined alcohol-based handrubbing, where available, as the gold standard for hand hygiene practices in healthcare settings, whereas handwashing is reserved for particular situations only (2).

WHO recommends the assessment of HCWs' compliance with this practice through the use of direct and/or indirect

methods. The *direct* method, essential to define precisely the level of hand hygiene compliance, provides for (a) the observation of HCWs behaviours by the patients and the consequent assessment (patients might feel uncomfortable in having to check the HCWs' hygiene compliance) or (b) the self-assessment by the HCWs. The *indirect* methods require to monitor the electronic control of basins for handwashing and the cleaning product consumption. The observational survey collects data on HCWs anonymously, considering the types of procedures performed on the patient, the running time and practice before and after the use of gloves. Moreover, it was observed that the awareness of being evaluated can improve the adherence of the HCWs ("Hawthorne effect"), although this effect can still be reduced (10).

## Materials and Methods

The objective of the study, from March 2015 to March 2016, was the evaluation of HCWs' adherence to the application of the WHO guidelines on hands hygiene and the possible impact on HCAI reduction. We performed direct observational surveys in certain departments at risk, represented by adult and pediatric intensive care, general surgery, orthopedics, neurosurgery, maxillofacial surgery, otorhinolaryngology and haematology, that were divided into three areas: surgical, medical and intensive care. Therefore, we considered the behaviour of different categories of HCWs with observation sessions of two hours in each department at certain times. In each session, we observed at least 10 opportunities for handwashing by the operators of each professional category. 628 HCWs were observed: 519 nurses (68 in training), 109 physicians (63 in training) belonging to surgical, clinical and intensive care areas (Table 1). Looking at the distribution by

Table 1 - Distribution of the subjects by areas

Areas	Frequency	Percent
Surgical	368	58.6%
Intensive care	154	24.5%
Clinic	106	16.9%

gender, 42.5% were males and 57.5% females.

### Statistic analysis

All statistical variables detected in 628 HCWs have been subjected to synthesis by frequency distributions. For the verification of statistically significant differences between the four HCWs categories (doctors, nurses, doctors in training and nurses in training) and all other variables detected in the sample was used the chi-square test for k independent samples with their partition model in the case of rejection of “zero hypothesis” (11).

The significance of changes in variables in which each subject is a control of himself (for example: hands washing pre- vs post-procedure; use of gloves vs change of gloves) was tested using the McNemar test (11). For the purposes of statistical significance, p values <0.05 were used. All summary and inferential analyses were performed using R software (The R Project for Statistical Computing).

## Results

The overall adhesion to the handwashing before and after contact with the patient or the surrounding environment was found to be 57%. Overall handwashing adherence was greater after practicing care (59.6%) than before contact with the patient (55.1%). In 30.6% of cases HCWs respected the handwashing technique envisaged by the guidelines, while in the remaining cases (69.4%), they did not follow neither the timing nor the mode suggested by the

guidelines (Table 2). 70.4% of HCWs wore gloves during manoeuvres in which it was possible to contact potentially infectious material, but 64% did not change them during the switch from one patient to the next (Table 3). Adherence - with regard to handwashing before contact with the patient - was 57.2% for nurses, 56.5% for doctors and 57.1% for doctors in training (Table 2), while the lowest adhesion was observed for nurses in training (38.2%), with statistically significant differences between this category and the previous three ( $\chi^2 = 8.77$ ;  $p < 0.033$ ). Similarly for washing after contact with the patient, the latter category is the one with the worse adhesion (equal to 44.1%), while the best adhesion was found for doctors (82.6%) followed by nurses (60.8%) and doctors in training (50.8%), with highly significant differences between categories ( $\chi^2 = 19.15$ ;  $p < 0.001$ ). An appropriate handwashing was performed according to current indications mostly by nurses in training (35.3%: Table 2), followed by nurses, with significant differences ( $\chi^2 = 12.43$ ;  $p < 0.006$ ).

The test on the significance of changes in variables linked to handwashing before and after patient approach, showed that 282 (44.9%) operators did not wash hands before treatment and just 72 operators changed their attitude (25.5% washed their hands in the post treatment). By contrast, 346 (51.1%) workers washed hands before treatment and 44 (12.7%) changed their attitudes, not washing them in the post treatment. This change of attitude has some statistically significant differences ( $p < 0.012$ ).

As regards the use of gloves by nurses in training, this is the category with greater compliance (91.2%), with highly significant differences from the other groups ( $p < 0.001$ ), followed by nurses ( $p < 0.05$ ) and doctors ( $p = 0.997$ ); this practice is not, however, currently used by doctors in training, who show adherence equal to 63.5%, with highly significant differences ( $p < 0.001$ ) with the other categories. The change of gloves from

Table 2 - Summary table of actions carried out by the four categories

Arms	Hand hygiene compliance		
	Handwashing in pre procedure	Handwashing in post procedure	Right washing method
Doctors	56.5%	82.6%	17.4%
Nurses	57.2%	60.8%	33.3%
Doctors in training	57.1%	50.8%	15.9%
Nurses in training	38.2%	44.1%	35.3%
Total	55.1%	59.6%	30.6%

one patient to another is performed by doctors in most of the cases (82.6%;  $p = 0.997$ ), but only in 41.3% of cases by doctors in training, with highly significant differences from the other groups ( $p < 0.001$ ) (Table 3).

In the intensive care area there was a greater adhesion to handwashing before the patient approach than in surgical and clinical wards, with highly significant differences ( $\chi^2 = 115.59$ ,  $p < 0.001$ ). The same considerations apply for washing hands after contact with the patient ( $\chi^2 = 100.38$ ,  $p < 0.001$ ) and for the adhesion to handwashing method suggested by the WHO guidelines ( $\chi^2 = 45.21$ ,  $p < 0.001$ ).

Gloves wearing was carried out in 92.2% of cases by the intensive care operators, while only 35.8% by clinical area operators ( $\chi^2 = 95.95$ ;  $p < 0.001$ ). Gloves change was performed in the intensive care units by 89.6% and only by 34 % in the clinical area ( $\chi^2 = 86.03$ ,  $p < 0.001$ ).

In summary, we can say that in 7% of cases HCWs wore gloves but neither performed handwashing (both before or

after contact with the patient), nor the clutch with hydro-alcoholic gels, and also in 14% of cases did not adopt any of the actions required (Fig. 1).

Our study did not suggest greater adherence of female gender with respect to male except for changing gloves, which is carried out mostly by women (69% versus 31%), with statistically significant differences ( $\chi^2 = 5.47$ ;  $p < 0.02$ ), resulting from surgical area ( $\chi^2 = 5.90$ ;  $p < 0.015$ ) and ICU ( $\chi^2 = 4.63$ ;  $p < 0.031$ ). Sex in the various categories is evenly distributed.

## Discussion and Conclusions

Despite the well established knowledge of the role of hand hygiene in HCAI prevention, many HCWs disregarded handwashing in varying degrees. International literature reports variable compliance levels, from 5% to 81%, with a mean value of 40% (12-14). Our study shows insufficient adhesion with a higher compliance in the ICUs than in surgery and internal medicine wards, compared to what has been observed in other national and in international studies (15, 16), which report, on the contrary, more compliance in the surgical and internal medicine wars than in the ICUs (14, 17). Overall, the adhesion is lower before the contact with the patient rather than after the contact: this involves the need of further training HCWs; in fact, several studies

Table 3 - Use and change gloves in the four categories

Arms	Gloves worn	Change gloves
Doctors	82.6%	82.6%
Nurses	67%	64.3%
Doctors in training	63.5%	41.3%
Nurses in training	91.2%	70.6%
Total	70.4%	64%

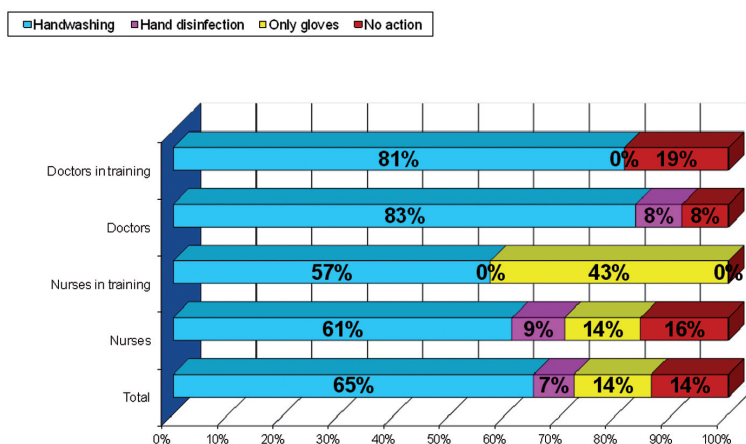


Fig. 1 - Type of hygiene by healthcare workers

show an increase in adhesion thanks to multimodal educational programs (14, 18-22). The use of gloves was higher than the national average, even if 31% of HCWs did not perform handwashing (23). The WHO guidelines define such action as incorrect, since the only presence of the gloves acting as a barrier may not protect from the transmission of pathogens (24). The category with the lower adhesion resulted that of the nurses in training, both before and after contact with the patient. Low compliance to hand hygiene is associated to male sex, to HCWs categories, to use of gloves, to high workload of the HCWs and, as previously stated, to work in ICUs (17).

In conclusion, our study revealed a worrying negligence by HCWs in the application of the WHO guidelines and the need for urgent informative and formative actions. The correct implementation of the analyzed procedures might bring, in fact, substantial sanitary, economic and ethical benefits.

#### Acknowledgements

**Funding:** This study did not receive any funding

**Competing interest:** The authors declare that there are no conflicts of interest

**Ethical approval:** Not required.

#### Riassunto

*“Cure pulite sono cure più sicure”: il corretto lavaggio delle mani nella prevenzione delle infezioni correlate all’assistenza*

**Introduzione.** Nel 2005 l’OMS ha sviluppato la campagna “Clean care is safer care”, mirando alla riduzione delle ICA attraverso la promozione di adeguate pratiche di igiene delle mani a livello mondiale. L’adesione a tale pratica varia dal 5% all’81% (valore medio 40%).

**Metodi.** L’obiettivo dello studio è stata la valutazione dell’aderenza del personale sanitario all’applicazione delle linee guida dell’OMS sull’igiene delle mani e il possibile impatto sulla riduzione delle ICA. Nella prima fase sono state individuate alcune degenze a maggior rischio di ICA. Nella seconda fase, è stata realizzata un’indagine osservazionale diretta per valutare il comportamento delle diverse categorie di operatori sanitari.

**Risultati.** Sono stati osservati 628 operatori sanitari (o.s.): 519 infermieri (68 in formazione), 109 medici (63 in formazione). Dall’analisi dell’indagine è stata evidenziata un’aderenza complessiva al lavaggio delle mani maggiore dopo le pratiche assistenziali pari al 59.6% mentre prima del 55.1%. Alcuni operatori sanitari eseguivano il lavaggio delle mani in entrambi i casi. Solo nel 30,6% dei casi gli operatori sanitari hanno rispettato la tecnica di lavaggio delle mani prevista dalle linee guida. Nel 70,4% indossavano i guanti durante le procedure in cui era possibile il contatto con materiale potenzialmente infetto, ma non li cambiavano tra un paziente e il successivo nel 64% dei casi.

**Conclusioni.** Lo studio conferma i dati internazionali, evidenziando una bassa compliance alle pratiche di igiene delle mani da parte degli operatori sanitari e la necessità

di promuovere un corretto lavaggio delle mani basato sul rispetto delle linee guida internazionali.

## References

1. Sax H, Allegranzi B, Uçkay I, Larson E, Boyce J, Pittet D. My five moments for hand hygiene: a user-centred design approach to understand, train, monitor and report hand hygiene. *J Hosp Infect* 2007; (1): 9-21. Epub 2007 Aug 27.
2. World Health Organization (WHO). World alliance for patient safety. WHO guidelines on hand hygiene in health care (advanced draft). Global patient safety challenge 2005-2006: Clean care is safer care. Available from: [http://www.who.int/patientsafety/events/05/en/GPSC\\_Exec\\_Summary\\_04052005\\_DEF.pdf](http://www.who.int/patientsafety/events/05/en/GPSC_Exec_Summary_04052005_DEF.pdf) [Last accessed 2016, September 15].
3. Agozzino E, Di Palma MA, Gimigliano A, Piro A. Economic impact of healthcare-associated infections. *Ig Sanita Pubbl* 2008; 64(5): 655-70.
4. European Centre for Disease Prevention and Control (ECDC). Surveillance Report. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals, 2011-2012. Available from: <http://ecdc.europa.eu/en/publications/publications/healthcare-associated-infections-antimicrobial-use-pps.pdf> [Last accessed 2016, September 15].
5. Epicentro. Infezioni correlate all'assistenza. Available from: [http://www.epicentro.iss.it/problemi/infezioni\\_correlate/epid.asp](http://www.epicentro.iss.it/problemi/infezioni_correlate/epid.asp) [Last accessed 2016, September 15].
6. ASSOBIOMEDICA Federazione nazionale per le tecnologie biomediche, diagnostiche, apparecchiature medicali, dispositivi medici borderline, servizi e telemedicina La posizione associativa in tema di: infezioni ospedaliere. Giugno 2011. Available from: <http://www.assobiomedica.it/static/upload/con/controllo-delle-infezioni-ospedaliere.pdf> [Last accessed 2016, September 15].
7. Harbarth S, Sax H, Gastmeier P. The preventable proportion of nosocomial infections: an overview of published reports. *J Hosp Infect* 2003; 54(4): 258-66.
8. Lane HJ, Blum N, Fee E. Oliver Wendell Holmes (1809-1894) and Ignaz Philipp Semmelweis (1818-1865): Preventing the Transmission of Puerperal Fever. *Am J Public Health* 2010; 100(6): 1008-9.
9. Squeri R, Grillo OC, La Fauci V. Surveillance and evidence of contamination in hospital environment from meticillin and vancomycin-resistant microbial agents. *J Prev Med Hyg* 2012; 53(3): 143-5.
10. Hagel S, Reischke J, Kesselmeier M, et al. Quantifying the Hawthorne effect in hand hygiene compliance through comparing direct observation with automated hand hygiene monitoring. *Infect Control Hosp Epidemiol* 2015; 36(8): 957-62.
11. Siegel S, Castellan NJ. Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill, 1992.
12. Picheansathian W, Pearson A, Suchaxaya P. The effectiveness of a promotion programme on hand hygiene compliance and nosocomial infections in a neonatal intensive care unit. *Int J Nurs Pract* 2008; 14(4): 315-21.
13. Marra AR, D'Arco C, de Arruda Bravima B, et al. Controlled trial measuring the effect of a feedback intervention on hand hygiene compliance in a step-down unit. *Infect Control Hosp Epidemiol* 2008; 29(8): 730-5.
14. Erasmus V, Daha TJ, Brug H, et al. Systematic review of studies on compliance with hand hygiene guidelines in hospital care. *Infect Control Hosp Epidemiol* 2010; 31(3): 283-94.
15. Chittaro M, Coiz F, Faruzzo A. Compliance with handwashing in health care settings. *Ann Ig* 2006; 18(2): 109-15.
16. Novoa AM, Pi-Sunyer T, Sala M, Molins E, Castells X. Evaluation of hand hygiene adherence in a tertiary hospital. *Am J Infect Control* 2007; 35(10): 676-83.
17. 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. *MMWR Recomm Rep* 2002; 51(RR-16): 1-45, quiz CE 1-4.
18. Maury E, Moussa N, Lakermi C, et al. Compliance of health care workers to hand hygiene: awareness of being observed is important. *Intensive Care Med* 2006; 32(12): 2088-9.
19. Hayden MK, Bonten MJ, Blom DW, Lyle EA, van de Vijver DA, Weinstein RA. Reduction in acquisition of vancomycin-resistant enterococcus after enforcement of routine environmental

- cleaning measures. *Clin Infect Dis* 2006; **42**(11): 1552-60.
20. Berhe M, Edmond MB, Bearman G. Measurement and feedback of infection control process measures in the intensive care unit: Impact on compliance. *Am J Infect Control* 2006; **34**(8): 53-9.
  21. Santana SL, Furtado GHC, Coutinho AP, Medeiros EAS. Assessment of healthcare professionals' adherence to hand hygiene after alcohol-based hand rub introduction at an intensive care unit in Sao Paulo, Brazil. *Infect Control Hosp Epidemiol* 2007; **28**(3): 365-7.
  22. Swoboda SM, Earsing K, Strauss K, Lane S, Lipsett PA. Isolation status and voice prompts improve hand hygiene. *Am J Infect Control* 2007; **35**(7): 470-6.
  23. Kuzu N, Ozer F, Aydemir S, Yalcin AN, Zencir M. Compliance with hand hygiene and glove use in a university-affiliated hospital. *Infect Control Hosp Epidemiol* 2005; **26**(3): 312-5.
  24. Tenorio AR, Badri SM, Sahgal NB, et al. Effectiveness of gloves in the prevention of hand carriage of vancomycin-resistant *Enterococcus* species by health care workers after patient care. *Clin Infect Dis* 2001; **32**(5): 826-9.

Corresponding Author: Raffaele Squeri, PhD, Department of Biomedical Sciences and Morphological and Functional Images, University of Messina, Via Consolare Valeria, 98125 Messina, Italy  
e-mail: squeri@unime.it