



CHANGES IN PRE- AND POST-INTERVENTION HAND HYGIENE COMPLIANCE IN ICU ON WHO HANDWASHING POSTERS

Lada Lijović^{1,2}, Josip Jaman³, Yannick Mudrovčić⁴, Dominik Ivanković⁵, Katarina Jelić⁶, Lana Videc Penavić², Tomislav Radočaj² and Hrvoje Silovski⁷

¹Department of Intensive Care Medicine, Laboratory for Critical Care Computational Intelligence, Amsterdam Medical Data Science, Amsterdam Public Health, Amsterdam Cardiovascular Science, Amsterdam Institute for Infection and Immunity, Amsterdam UMC, Vrije Universiteit, Amsterdam, The Netherlands;

²Department of Anesthesiology, Intensive Medicine and Pain Management, Sestre milosrdnice University Hospital Center, Zagreb, Croatia;

³Department of Surgery, Sestre milosrdnice University Hospital Center, Zagreb, Croatia;

⁴Department of Surgery, Sveti Duh University Hospital, Zagreb, Croatia;

⁵Department of Surgery, Merkur University Hospital, Zagreb, Croatia;

⁶Department of Emergency Medicine of Sisak County, Sisak, Croatia;

⁷Department of Surgery, Zagreb University Hospital Center, Zagreb, Croatia

SUMMARY – Healthcare-associated infections (HAI) cause more deaths in the European Union than all other infectious diseases. Hand hygiene (HH) has been considered the most important means of preventing HAIs but HH compliance is generally less than 50%. One of the five steps that the World Health Organization (WHO) guidelines identify to be specifically implemented are poster reminders. The aim of this study was to evaluate compliance with HH by healthcare workers before and after an intervention on standardized WHO HH poster reminders. An observational one-month study was conducted in a university hospital center surgical intensive care unit. HH compliance was measured through direct observation using WHO observation tool. Intervention was done on day 15 by replacement of standard WHO posters with posters containing a message aimed to call for personal responsibility in patient outcome. A total of 1113 HH opportunities were observed. Overall, HH was performed in 15.4% of cases pre-intervention and 28.3% of cases post-intervention ($p < 0.001$). The preferred method of HH was soap and water. Healthcare workers mostly chose to perform HH after exposure to body fluids, where compliance was 35.1% pre-intervention and 58.7% post-intervention. Gloves were used in 98% of cases of clean/aseptic procedures where HH was not performed. In conclusion, using standard posters to convey additional messages of awareness of consequences and personal responsibility may improve HH and should be considered in multimodal approaches to improve HH compliance.

Keywords: *Hand hygiene compliance; Intensive care unit; World Health Organization; Interrater reliability; Posters*

Correspondence to: *Lada Lijović, MD*, Department of Anesthesiology, Sestre milosrdnice University Hospital Center, Vinogradska c. 29, HR-10000 Zagreb, Croatia
E-mail: l.lijovic@amsterdamumc.nl

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Introduction

It is estimated that 6.5% of patients in acute care hospitals had at least one healthcare-associated infection (HAI) in the European Union and European Economic Area (EU/EEA)¹. HAIs in acute care hospitals are responsible for more deaths in the EU/EEA than all other infectious diseases under surveillance at the European level². Most HAIs are spread by direct contact, especially by the hands of healthcare workers, and hand hygiene (HH) has traditionally been considered the simplest, cheapest and most important means of preventing HAIs³. Many studies have shown that HH compliance is generally less than 50% of all opportunities⁴.

The World Health Organization (WHO) recommendations on HH best practices and improvement strategies within its Clean Care is Safer Care campaign are considered the gold standard for healthcare worldwide, with direct unobtrusive observation as the most reliable method for measuring HH compliance rates^{5,6}. WHO guidelines identify the following five components to be specifically implemented: alcohol-based hand rubs (ABHR) at point of care, training and education, observation and performance feedback, reminders, and administrative support.

The aim of this study was to evaluate compliance with HH by healthcare workers using WHO Patient Safety Observation Form before and after an intervention on standardized WHO HH poster reminders.

Methods

Venues

Observations were conducted in surgical Intensive Care Units (ICU) at the Zagreb University Hospital Center (ZUHC) and Sveti Duh University Hospital (SDUH) during five weeks in May and June 2020. Approvals of Ethics Committees of both hospitals and verbal consent by management staff were obtained. The ZUHC ICU has 20 beds in two wings of identical design. Four isolation units were excluded from the research. Each bed has alcohol-based hand rub dispenser, and two handwashing units are placed at each entrance and in the middle of each wing.

Instruments

Forms and definitions were used according to the WHO hand hygiene observation method. The WHO observation form was used for data collection. HH opportunity was defined as a time span between departure and arrival of hand-to-surface exposure of a risk-prone hand transition that requires HH by indications. Indications are defined as follows: (1) before touching a patient, (2) before aseptic/clean procedure, (3) after body fluid exposure risk, (4) after touching a patient, and (5) after touching patient surroundings. It was noted if HH was (I) performed with alcohol-based hand rub, (II) soap/H₂O, (III) was not performed, and (IV) healthcare workers wore gloves. Sex and order of observed person was also noted, as was date and shift (06-14 h daily, 14-22 h afternoon, and 22-06 h night shift).

Study design

We developed a two-phase study. In phase 1, a one-week interrater reliability mock trial at SDUH ICU was performed. Phase 2 was a one-month trial at ZUHC divided in the pre- and post-intervention phases for statistical comparison of HH performance in the pre- and post-intervention phases.

Our observational team was formed three months before the beginning of the trial and it included four observers who were not employed in institutions where the trials were done, and one infection-control trained nurse. Observers were handed WHO educational materials and were additionally trained in one/day course with a trained nurse. During phase 1, interrater reliability was run for each observer with a trained nurse, 275 observations were made with agreement of 90.2% and Cohen's kappa of 0.87.

Before the beginning of phase 2, a one-month period was divided in two-hour periods and random number generator chose a two-hour period of each day in which the team would observe healthcare workers. Weekends, holidays, and all three shifts were included. All healthcare workers that had patient contact were observed (physicians, nurses, other healthcare workers, and auxiliary staff). Observations were made using direct observation, although healthcare workers were informed that the observers were present for a study on different aspects of care rather than specifically monitoring hand hygiene practices.

Intervention

Intervention was done on day 15 by replacement of the standard WHO posters with our posters of the same size, designed by a professional graphic designer and containing a message with emotional subtext aimed to call for personal responsibility of healthcare workers in patient outcome, while retaining all the information on handwashing as the original. A message was chosen by agreement of three psychologists among five different suggestions. ‘Before’ and ‘after’ posters are shown in Figure 1.

Statistical analysis

Statistical analysis was performed using SPSS version 26. Categorical variables were expressed as number of cases (n) and percentage (%). Categorical variables were analyzed using χ^2 -test or Fisher exact test, as appropriate. Mann Whitney test was used for analysis of continuous variables and these values were expressed as median and interquartile range. All tests were two-sided. Agreement was calculated using

Cohen’s kappa with quadratic weights. The value of $p < 0.05$ was considered statistically significant. Power analysis indicated that for the medium size effect of 0.21, power of our research would be 0.99.

Results

In the period from May 31 to June 30, 2020 we observed 1113 handwashing opportunities, 552 (49.6%) pre-intervention and 561 (50.4%) post-intervention. Female healthcare workers were more frequently observed, 65.2% pre-intervention and 69.9% post-intervention, without statistically significant difference between phases. Most frequently observed were nurses (70.3% pre-intervention and 78.3% post-intervention) and physicians (24.5% pre-intervention and 16.2% post-intervention). There were no observations regarding auxiliary healthcare workers.

Overall, HH was performed in 85 (15.4%) cases pre-intervention and 159 (28.3%) cases

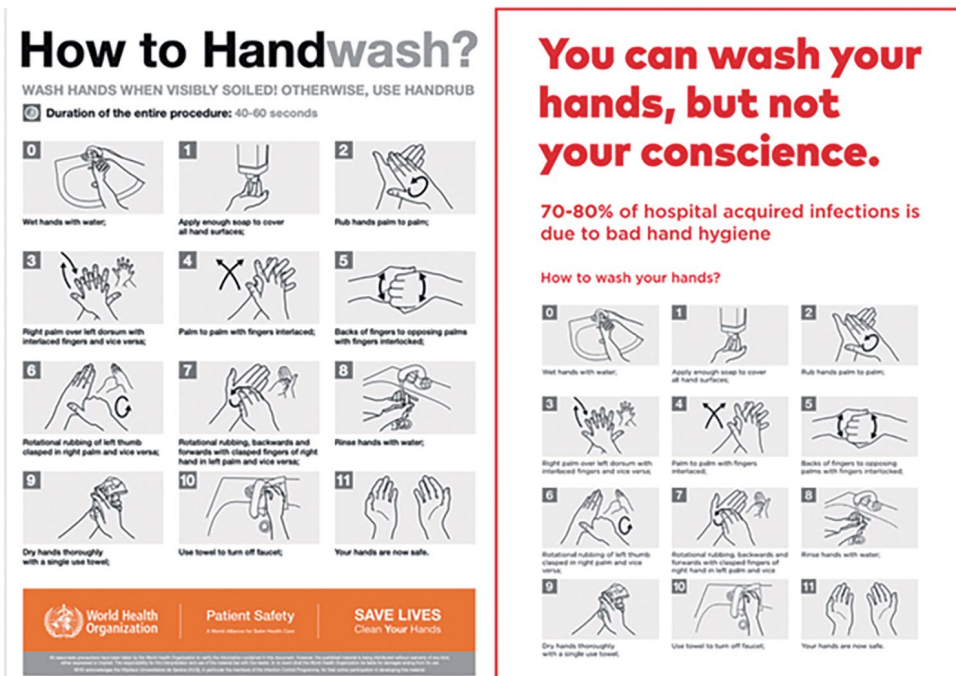


Fig. 1. Original WHO handwashing poster (left) and poster after intervention (right).

post-intervention ($\chi^2(1)=27.2$, $p<0.001$). Pre-intervention, nurses performed HH in 65 (16.8%) cases, and post-intervention in 135 (30.8%) cases ($\chi^2(1)=22.0$, $p<0.001$). For physicians and other healthcare workers, there was no statistically significant difference in HH performed pre-intervention and post-intervention. The preferred method of HH was soap and water (62.3% pre-intervention and 73.6% post-intervention). Results are summarized in Table 1.

Healthcare workers mostly performed HH after exposure to body fluids, where compliance was 35.1% of cases pre-intervention and 58.7% post-intervention ($\chi^2(1)=8.3$, $p=0.004$); the difference was due to improvement in nurses' HH performed. Similar results were

recorded for the indication after touching a patient, where HH was performed in 33.3% of observations pre-intervention and 53.4% of observations post-intervention ($\chi^2(2)=5.4$, $p=0.020$). Results *per* indication are shown in Table 2.

Gloves were used in 25.3% of cases pre-intervention and 22.3% post-intervention, without a statistically significant difference. Gloves were used in 98% of cases of clean/aseptic procedures where HH was not performed. There was no statistically significant difference in the duration of alcohol based hand rubbing or soap/water washing and in performance in the morning, afternoon and night shifts pre-intervention and post-intervention.

Table 1. Overall HH compliance of healthcare workers according to profession

Healthcare worker	Pre-intervention		Post-intervention		P
	Performance of recommended HH/ opportunities, n	Compliance, %	Performance of recommended HH/ opportunities, n	Compliance, %	
Physician	17/135	12.6	19/91	20.9	0.095
Nurse	65/388	16.8	135/439	30.8	<0.001 ^a
Other HW	3/29	10.3	5/31	16.1	0.708 ^b

HW = healthcare worker; HH = hand hygiene; ^a $\chi^2(1)=22.0$; ^bFisher exact test

Table 2 Overall hand hygiene compliance of healthcare workers according to 5 WHO moments

WHO 5 moments	Pre-intervention		Post-intervention		P
	Performance of recommended HH/ opportunities, n	Compliance, %	Performance of recommended HH/ opportunities, n	Compliance, %	
Before touching a patient (moment 1)	14/228	6.1	35/228	15.4	0.001 ^a
Before clean/aseptic procedure (moment 2)	4/61	6.6	3/43	7.0	0.933 ^b
After body fluid exposure risk (moment 3)	26/74	35.1	44/75	58.7	0.004 ^c
After touching a patient (moment 4)	18/54	33.3	48/90	53.3	0.020 ^d
After touching patient surroundings (moment 5)	23/135	17.0	29/125	23.2	0.215

WHO = World Health Organization; HH = hand hygiene; HW = healthcare worker; ^a $\chi^2(1)=10.0$; ^bFisher exact test; ^c $\chi^2(1)=8.3$; ^d $\chi^2(1)=5.4$

Discussion

The aim of this study was to evaluate compliance with HH by healthcare workers before and after an intervention presented on standardized WHO HH poster reminders in a university hospital surgical ICU. In the pre-intervention period, based on 552 observations, overall compliance was 15.4%, with nurses performing slightly better (16.8%). That kind of adherence is considerably lower than that recently suggested by systematic reviews; a mean compliance of 59.6% has been reported for 61 international ICUs⁷. Post-intervention, overall compliance was improved to 28.3%, with statistically significant improvement only in nurses' performance. Such findings are in concordance with previous studies where the influence of professional group is important; physicians are often excluded from HH compliance studies since they intend to underperform compared to nurses and respond differently to interventions⁸.

Most effective strategies in improving HH compliance are multimodal strategies, summarized in the WHO Multimodal Hand Hygiene Improvement strategy⁹. Part of the strategy are promotional tools, which include How to Handwash posters, widely implemented in hospitals in Croatia with national guidelines on HH in healthcare workers¹⁰.

We hypothesized that by an intervention on posters including a message with emotional subtext to call for personal responsibility of healthcare workers in patient outcome while retaining all the original information on handwashing, might improve HH compliance. To the best of our knowledge, this type of intervention was the first of this kind.

Immense efforts have been taken to reduce the possible bias expected to raise during observation. To control for information bias, random short daily 2-hour periods were chosen, where four external observers, doctors, not the authors of the study, were trained in a pilot study in another clinical center ICU until they achieved agreement above 90%. Interrater reliability was also followed on 10% of the study sample and remained above 90%. To control for Hawthorne effect, healthcare workers were told that another type of study was performed. We tried to avoid selection bias by including all shifts, weekends and holidays into

observation periods, and by observing all healthcare workers.

World Health Organization recommends performing HH with soap and water when visibly dirty or visibly soiled with blood or other body fluids, or if exposure to potential spore-forming pathogens is strongly suspected or proven, and allows alcohol-based handrub as the preferred means for routine in all other clinical situations⁵. Standardized form does not differentiate between indications for the means used but, in our research, there was no difference in the duration of performed HH between alcohol-based handrub and soap and water use. There were remarkable differences in the results for "my five moments for hand hygiene" indications. Pre-intervention best compliance was after body fluid exposure (35.1%), with best compliance improvement after intervention (58.7%). Similar results were seen with the indication after touching a patient.

Low compliance with guidelines did not improve significantly with this intervention in clean/aseptic procedures as an indication for HH. Since sterile gloves are worn, one suggested explanation is because gloves can be falsely perceived as an alternative for HH¹¹. Glove use may undermine HH by decreasing motivation of healthcare workers to perform HH by shifting the motivation of self-protection to gloves. If wearing gloves satisfies self-protection motivation (fear, disgust), the motivation of healthcare workers to sanitize their hands can diminish and then largely depend on the motivation to reduce cross-contamination and to protect patients^{12,13}.

The indication "before touching a patient" showed statistically significant improvement with poster replacement. Indications "after" a contact with patient clearly outperformed "before" indications. While the lack of improvement in HH in clean/aseptic procedures and "before" moments together might indicate that motivational change with this intervention is based on the self-protection instinct, improvement in "before touching a patient" moment suggests that motivation of protecting a patient is also present.

The idea of implementing methods targeting motivational, emotional or ethical dimension of HH behaviors is not a new concept⁷. The instinctive tendency to perform HH to protect oneself from infection has been identified repeatedly¹⁴. However, interventions

focused on HH moments that protect patients are needed. We showed that a simple intervention on standard promotional posters with a motivational message to protect a patient could improve HH compliance, and should be considered in multimodal approaches to improve HH compliance.

Limitations of this study include the inability to perform multicenter observation and follow-up due to the SARS-COVID-19 pandemic.

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Sažetak

PROMJENE U PRIDRŽAVANJU SMJERNICA HIGIJENE RUKU NAKON UVOĐENJA PERSONALIZIRANIH PLAKATA SZO U JEDINICAMA INTENZIVNOG LIJEČENJA

L. Lijović, J. Jaman, Y. Mudrović, D. Ivanković, K. Jelić, L. Videc Penavić, T. Radočaj i H. Silovski

Bolničke infekcije uzrokuju više smrti u Europskoj Uniji nego sve druge infektivne bolesti. Higijena ruku smatra se najvažnijom mjerom u prevenciji bolničkih infekcija, no poštivanje mjera higijene ruku općenito je ispod 50%. Jedan od pet koraka za koje smjernice Svjetske zdravstvene organizacije (SZO) smatraju da se specifično moraju primjenjivati su podsjetnici u obliku postera. Cilj ovog istraživanja bio je procijeniti poštivanje mjera higijene ruku zdravstvenih radnika prije i poslije intervencije prikazanih na standardiziranim posterima o pranju ruku SZO. Provedena je jednomjesečna opservacijska studija u kirurškoj jedinici intenzivnog liječenja sveučilišne bolnice. Poštivanje higijene ruku praćeno je izravnom opservacijom uporabom opservacijskog alata SZO. Intervencija je napravljena 15. dana zamjenom standardnih postera SZO našim posterima koji sadrže poruke usmjerene na podizanje svijesti o osobnoj odgovornosti osoblja u ishodu liječenja bolesnika. Zabilježeno je 1113 prilika za higijenu ruku. Ukupno je higijena izvedena u 15,4% slučajeva prije intervencije i 28,3% slučajeva poslije intervencije ($p < 0,001$). Najčešća metoda higijene ruku bila je pranje sapunom i vodom. Osoblje preferira izvoditi higijenu ruku nakon izlaganja tjelesnoj tekućini bolesnika, tj. 35,1% prije intervencije i 58,7% poslije intervencije. Rukavice su upotrebene u 98% slučajeva čistih/aseptičnih postupaka kada higijena ruku nije izvedena. U zaključku, uporaba standardnih postera SZO o pranju ruku za slanje dodatnih poruka za podizanje svijesti o posljedicama i osobne odgovornosti može poboljšati izvođenje higijene ruku i trebala bi se razmotriti kao dio multimodalnih pristupa za povećanje izvođenja higijene ruku u zdravstvenim ustanovama.

Ključne riječi: *Higijena ruku; Jedinica intenzivnog liječenja; Poster; Svjetska zdravstvena organizacija; Pouzdanost među istraživačima*