

# OBSERVANCE OF HAND WASHING PROCEDURES PERFORMED BY THE MEDICAL PERSONNEL BEFORE PATIENT CONTACT. PART I

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## Abstract

**Introduction:** According to the Centers for Disease Control and Prevention (CDC) as well as the World Health Organization (WHO) recommendations, medical staff are obliged to decontaminate the skin of the hands before every single patient contact. **Materials and Methods:** The study was performed by quasi-observation among the group of 188 medical staff (nurses and physicians) working in three selected hospitals of the Łódź province. The procedure of hand washing and disinfection performed directly before the patient contact according to the CDC and WHO recommendations were observed. The results was subject to statistical analysis ( $p < 0.05$ ). **Results:** During 1544 hours of observation 4101 activities requiring hand washing were recorded. The medical staff obeyed the hand washing procedure before the patient contact only in 5.2% of the situations. There was no activity observed before which hand hygiene was maintained in 100% of cases. Observance of hand hygiene depended significantly on the type of the performed activity, the professional group, and the workload index. A decrease in percentage observance of hand hygiene according to the time of the day was found to be of statistical significance. The mean time of hand washing was 8.5 s for physicians and 6.6 s for nurses. **Conclusion:** The level of observance of hand washing procedures among the medical staff prior to the patient contact appears to be alarmingly below the expectations.

## Key words:

Hygiene, Compliance with procedures, Hand washing, Medical personnel

## INTRODUCTION

Requirements of the Centers for Disease Control and Prevention (CDC) constitute generally accepted recommendations for hand hygiene among health workers [1]. In May 2009, the World Health Organization (WHO) published guidelines on hand hygiene, in order to raise the level of adherence to these recommendations, and thereby reduce the transmission of microorganisms to patients and medical personnel. In most points, recommendations of

these two institutions are similar, although WHO in their guidelines take into account the differing cultural and economic settings in various countries in an attempt to provide the link between the developed and developing countries [2].

The medical community makes use of various methods of cleaning and disinfecting hands. These methods include: social hand washing, hygienic hand washing, hygienic hand disinfection by hand rub, and surgical

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hand washing. In the daily work of nurses and doctors involving regular contacts with patients during minor activities (blood collection and exchange of drains), there is no need for surgical hand washing. The most commonly used are, therefore, the first three of these methods [1,2].

Social (normal) hand washing is simple hand washing with soap and water, cosmetics, performed in everyday conditions. Its aim is to get rid of visible dirt and mechanically remove microorganisms present on the skin surface. Running lukewarm water should be used. Frequent exposure to hot water may increase the risk of dermatitis. The procedure of hand washing should last at least 15 s, covering all surfaces of the hands and fingers [1]. If elbow taps are not provided, towels should be used to open/close the taps [3,4]. In accordance with the guidelines, social hand washing is required before starting work [1,2].

For hygienic hand washing, washing or disinfecting or both preparations are used that contain bactericidal chemical compounds. The procedure for hygienic hand disinfection that makes use of the “rubbing-in” method is applicable for non-contaminated hands or hands previously washed with ordinary soap and water. This method uses antiseptic preparations, directly poured or otherwise applied to the hands and then rubbed into the skin until the hands are dry. The recommended duration of the procedure is at least 30 s. Indications for hygienic hand washing or hygienic hand disinfection by rubbing include the following circumstances:

- prior to direct contact with the patient;
- prior to invasive or nursing activities, regardless of whether gloves are used or not;
- prior to contact with blood, body fluids, mucous membranes, broken skin, before wound dressing, prior to contact with burns and bedsores;
- prior to contact with catheters, drains and equipment parts directly in contact with the patient’s tissues;

- in case of contact with the patient, between the examinations of different parts of the body characterized by different microbial contamination.

The World Health Organization (WHO) adds that in the situations when disinfectants are not available, simple washing hands with soap and water is sufficient.

Prior to administration of medicines, before preparing food for eating, and before patient feeding, hand disinfection using alcohol rub or washing hands with ordinary or antibacterial soap and water is required.

All of the recommendations emphasize the necessity to decontaminate the skin of the hands before any contact with the patient, but also before protective gloves are to be put on the hands [1,2,5].

The aim of the work was to assess the compliance with the requirement of cleaning/disinfecting hands before each contact with the patient.

## MATERIALS AND METHODS

The study group comprised 188 participants (79% women and 21% men; 66.5% nurses and 33.5% doctors) working in six selected departments of three hospitals in the Łódź province. Two departments were selected in each of the hospitals: one – “increased risk” (operative) department, and the other – conservative care department. The “increased risk” departments employed 80 people (25 doctors and 55 nurses). The other departments employed 108 people (38 doctors and 70 nurses). All employees of the departments specified above participated in the study.

Data collection was performed by direct quasi-participatory observation that involved accompanying each member of the medical personnel (nurses, doctors) and recording all tasks performed by the personnel during the observation unit. One clock hour was selected to be the observation unit, during which all procedures performed by the personnel were recorded. If, in the 60th minute of

the observation unit, a participating doctor or nurse performed a hand hygiene-related procedure, the observation was continued until the procedure was completed. For each employee, a series of (random) observations within three time periods was assigned: 3 independent observation units in the morning (7–12 a.m.), 3 units in the afternoon (1–6 p.m.) and 3 units in the evening (7–11 p.m.). Random selection in this case was achieved by starting observation of the first person encountered in the department during the observation unit.

Continuity and repeatability of observation was ensured by several-month stay of the investigator in the hospital department, during day and night shifts, and during busy and relatively quiet hours. The results of the observations of individual hygiene procedures were recorded on specially designed observation sheets.

The observed medical personnel was not informed about the main purpose of the study to minimize the Hawthorne effect – their behavior was therefore unaffected and natural [6].

Compliance with hygiene procedures was defined as washing hands at any time interval with soap and water or an antiseptic, or rubbing a sanitizer into the hands immediately before contact with the patient, as specified in the recommendations of the Centers for Disease Control and Prevention in Atlanta and the guidelines of the World Health Organization:

- before preparing and serving food,
- before eating,
- prior to patient care (bathing, making bed, dressing),
- before invasive activities,
- before wound dressing,
- before touching catheters and medical equipment parts directly in contact with the patient's tissues,
- before putting on gloves.

The duration of the hygiene procedures was measured using an electronic stop-watch Magma 10 (Hanhart GmbH&Co. KG, Germany).

The Research Ethics Committee approved the study protocol (Resolution RNN/113/06/KE).

Statistical inference was conducted at the significance level  $p < 0.05$ . Two-sided tests were used for the verification of statistical hypotheses. A logistic regression model with random effects for the analysis of hygiene procedures for hand washing was also used. In the random effect model, a person was used as the grouping variable. The random effect model was used to account for the within person correlation.

All statistical analyses were conducted using the R Statistical Package (<http://www.r-project.org>).

## RESULTS

During the entire study, the total number of observation units was 1544. Out of these, 97 hours were observation units during which there were no activities requiring hand hygiene observed. During the remaining 1447 units, there were reported, in total, 4101 activities that required hygiene procedures before contact with patients. For statistical analysis, 3498 operations were selected which, in accordance with the recommendations of the CDC and WHO, require observing the full hygienic procedure (washing or disinfection or both of hands and wearing protective gloves).

The recorded average compliance of the medical personnel to the hand-washing procedures required before contact with patients was as low as 5.2%.

A dependence was found at the significance level of  $p < 0.001$  between the compliance with the “BEFORE” hand hygiene requirements on the type of activity to be performed (Table 1). The hand-washing rule was adhered to most frequently before performing medical activities (biopsy and endoscopy). The medical personnel washed their hands twice less frequently (13.1%) before feeding the patients. This frequency, twice as high as the average, can probably be explained by the fact that while

feeding the patients, the medical personnel did not use protective gloves. It seems that the medical personnel use protective gloves as a substitute for hand washing, hence hand hygiene rules were adhered to considerably less frequently before such activities as changing wound dressing (9.6%), blood sampling (7.6%) or insertion of vascular catheter (5.6%). Considering that urinary catheterization is a known risk factor for urinary infections, and that this fact has been stressed by many authors in the relevant literature, during performing that activity it is absolutely necessary to obey the principles of good sanitary practice. Of the 65 cases of catheterization inspected during this study, less than a negligible (1.5%) proportion was preceded by hand washing (hand washing “before” the activity).

Compliance with the hand washing requirements before the activity differed significantly in both observed professional groups. Nurses used to neglect hand hygiene more

**Table 2.** Compliance with hand washing procedures before activities requiring hygiene, depending on the profession

Profession	Hand washing before the activity			
	yes		no	
	n	%	n	%
Doctor	24	16.8	119	83.2
Nurse	157	4.7	3 198	95.3

$p < 0.001$ .

often (the percentage of compliance: 4.7% vs. 16.8%,  $p < 0.001$ ) (Table 2).

The impact of the workload on adherence to hygiene requirements was also examined. Two indicators were defined for that purpose: the activity index and the index of effective workload. The activity index (the number of activities requiring hand hygiene per time unit) did not significantly affect the compliance to hand hygiene (Table 3). The workload index defined in this way does not reflect

**Table 1.** Compliance with hand washing procedure before activities requiring hygiene, depending on the activity type

Activity	Activities that require hand washing (total) (n)	Hand washing before the activity (%)	
		yes	no
Collect blood	304	7.6	92.4
Insert/remove venflon	144	5.6	94.4
Install/remove drip	1 035	3.2	96.8
Inject	627	3.7	96.3
Perform biopsy/endoscopy	70	31.4	68.6
Change wound dressing	239	9.6	90.4
Insert urinary catheter	65	1.5	98.5
Touch equipment that comes in direct contact with mucous membranes	82	8.5	91.5
Perform per rectum examination/enema	8	12.5	87.5
Contact with the patient's excrements (pampers change)	183	1.6	98.4
Patient nursing (washing)	576	2.8	97.2
Record arterial blood pressure	167	4.8	95.2
Physical examination of the patient	441	2.5	97.5
Feed the patient	160	13.1	86.9

$p < 0.001$ .

**Table 3.** Compliance with hand washing procedure before activities requiring hygiene, depending on the activity index

Activity index*	Hand washing before the activity			
	yes		no	
	n	%	n	%
1-3	82	6.1	1 272	93.9
4-6	56	4.7	1 125	95.3
> 6	43	4.5	920	95.5

\* The number of activities requiring hand hygiene during an observation unit.  
p = 0.86.

**Table 4.** Compliance with hand washing procedure before activities requiring hygiene, depending on the index of effective workload

Index of effective workload (min)*	Hand washing before the activity			
	yes		no	
	n	%	n	%
1-15	17	3.1	535	96.9
16-45	109	5.2	1 978	94.8
≥ 46	55	6.4	804	93.6

\* The total working time in an observation unit.  
p = 0.016.

**Table 5.** Compliance with hand washing procedure before activities requiring hygiene, depending on the type of department

Department	Hand washing before the activity			
	yes		no	
	n	%	n	%
Hospital 1				
surgery department	29	5.2	526	94.8
medical care department	44	5.1	817	94.9
Hospital 2				
surgery department	42	6.8	577	93.2
medical care department	8	4.1	185	95.9
Hospital 3				
surgery department	18	4.7	362	95.3
medical care department	40	4.5	850	95.5

p = 0.60.

the actual workload of the employee. The administrative work in its broad sense affects personnel-workload and -overload, so it can also affect the compliance with hygiene procedures. In this study, we developed a different type of indicator, which reflected the true workload in terms of the time spent on work in general during the observation unit. The index defined in that way – the index of effective workload (the total time devoted to work during the observation unit including cleaning work, administrative work, etc.) – had a significant effect on the compliance with hand-hygiene procedures practiced before contact with the patients (Table 4).

There was no statistically significant dependence on the type of department (Table 5), or its character (Table 6). The recommendations on hand hygiene before contact with the patients or potentially infectious material were equally neglected in all departments.

The compliance with the hygiene requirements was noted to be slightly lower, on the border of statistical significance (p = 0.12), during the evening shifts (Table 7).

In addition, hospital infection control teams were asked to assess the compliance with the recommendations on hygiene and respecting the guidelines developed by these

**Table 6.** Compliance with hand washing procedure before activities requiring hygiene, depending on the character of the department

Character of the department	Hand washing before the activity			
	yes		no	
	n	%	n	%
Medical care	92	4.7	1 852	95.3
Increased risk	89	5.7	1 465	94.3

$p = 0.35$ .

**Table 7.** Compliance with hand washing procedure before activities requiring hygiene, depending on the time of day

Time of day	Hand washing before the activity			
	yes		no	
	n	%	n	%
7–12 a.m.	117	6.1	1 806	93.9
1–6 p.m.	37	5.0	699	95.0
7–11 p.m.	27	3.2	812	96.8

$p = 0.12$ .

teams by the personnel of individual investigated departments. The compliance was rated as good in case of two departments, as average in case of other two departments, and as poor in case of the remaining two departments.

**Table 8.** Time devoted to washing/disinfecting hands before the activities

Department	Hand washing time before the activity (s)					
	doctors			nurses		
	mean	median	range	mean	median	range
Hospital 1						
surgery department	10.1	11.0	6.4–11.3	7.2	6.0	1.00–18.3
medical care department	8.2	7.7	4.2–15.12	6.0	5.3	1.15–13.2
Hospital 2						
surgery department	9.5	8.0	3.22–19.48	8.0	7.1	2.07–35.49
medical care department	3.1	3.1	3.12–3.12	8.0	7.4	3.04–13.86
Hospital 3						
surgery department	4.1	4.1	4.14–4.14	5.5	6.1	1.43–11.26
medical care department	5.4	5.0	4.52–7.14	5.9	5.2	1.42–14.92
Total	8.5	7.6	3.12–19.48	6.6	6.0	1.00–35.49

No relationship was noted between those ratings and the compliance with the hygiene requirements before contact with the patients or potentially infectious material in the departments ( $p = 0.5$ ).

The mean duration of hand washing prior to activities, which require it was 8.5 s in doctors and 6.6 s in nurses. In the “increased risk” departments, hand-washing time before service was longer (7.4 s) than in other departments (6.1 s) (Table 8).

## DISCUSSION

The problem of nosocomial infections is not only the dilemma of services responsible for dealing with them, but it is also important for people working in the hospital. The organization of hospital work should be designed in a way that most efficiently eliminates such infections; the hands of medical personnel are the major vectors of transmitting them. In the historical sources there is evidence of a correlation between the transmission of nosocomial infections and hand hygiene. Ignaz Phillip Semmelweis was the first to note this relationship and recommended that doctors and students wash their hands after each visit in

the dissecting room and before contact with a pregnant woman. This made it possible to reduce the rate of puerperal septicemia [7].

Although observing the rules of hand hygiene is the cheapest way to interrupt the routes of transmission of microorganisms in the hospital, the problem of non-compliance with the rules of asepsis and antisepsis still exists. Numerous references to that problem may be found in relevant literature. The study involving the observation technique, conducted in 1998 in the U.S., that evaluated the use of hand-washing techniques by medical personnel during their work for 6 weeks, showed that the frequency of hand washing was dependent on factors such as occupation (doctors – 37.4%, nurses – 32.6%) and the nature of the activities (bathing a patient – 83.3%, collecting blood samples – 77.6%, changing wound dressing – 64.7%, examining a patient – 47.5%, emptying a bedpan – 44.1%) [8].

A relationship between hand washing/disinfecting and the type of activity was found in this study. Similarly, no activity was noted before which medical personnel would totally (100%) adhere to the rules of good hygiene. Tvedt et al. confirmed the above results, since in their study only 50.4% of the investigated medical personnel performed the recommended hand hygiene procedure, and only 20% performed it correctly [9]. Like in our study, there were doubts concerning the fact whether the hygiene procedures were performed properly. This is evidenced by too short time devoted to hand washing (8.5 s in doctors and 6.6 s in nurses). The Boston questionnaire study showed, among the medical personnel of two hospitals, that 87% of the respondents felt that hand hygiene was a very important element in preventing infections and that 70% of them claimed that they complied with the requirements of hand hygiene. Unfortunately, it was not confirmed in practice, because only 14% of the respondents washed their hands before contact with the patients [10].

Results of other publications also point to a lower level of compliance with hygiene procedures than the one

indicated by subjective responses. Similar conclusions were obtained in a study conducted at the University Hospital in Geneva in 1994, focusing on 307 observation sessions lasting 20 minutes each. The study subjects were 1043 medical workers (520 nurses, 158 doctors, 166 auxiliary personnel, 199 other medical personnel) working in 48 departments. Compliance with the hand-washing procedures was recorded only in 48% of the participants and it varied depending on the category (nurses 52%, doctors 30%). Hand hygiene rules were least adhered to in intensive care units (36%) and surgical departments (47%) and were most adhered to in the pediatric departments (59%). Despite such a low rate of compliance with hospital hand hygiene rules, the authors suggest that the results may still be overestimated. The observers tried to work as discretely as possible, but the medical personnel were likely to change their behavior due to the awareness of being watched; therefore, the actual situation in regards to observing the guidelines of hygiene could be even poorer [11].

The statistical analysis of the results of this study showed no correlation between the compliance with the hand hygiene procedures and the type of department. The hygiene recommendations were equally ignored in all departments. In 2002, observational studies were conducted in a city hospital in Ireland on a group of 73 medical workers. The average level of compliance with the hygiene procedures was 51%, and varied depending on the category of the personnel (nurses 56%, doctors 31%) [12]. Another study reports the average hand hygiene adherence rate of 50% and – similarly to the previously described studies – points to a difference between the health professional categories (nurses 52%, doctors only 23%) [13]. Polish reports indicate that the poorest levels of compliance with proper hand hygiene rules were recorded in physicians [4]. The present study also showed profession-dependent differences in the adherence to hygiene procedures. It was shown, however, that it is the nurses that apply suitable

hygiene procedures less frequently, perhaps because of higher workload and considerably more frequent direct contacts with the patients.

The results of the univariate analysis indicate that the medical personnel adhered to the hand washing procedures before contact with the patient only in 5.2% of the cases. This is a much lower proportion than the one reported by other authors [11,14–18]. According to the best knowledge of the authors, this is the only study using participatory observation, in which the subjects, in addition to being ignorant of the true aim of the study, were intentionally diverted to the issues remote from the compliance with the principles of hygiene. This study managed to eliminate the Hawthorne effect [6], and therefore it may be hoped that the behaviors of nurses and doctors were natural and not modified by the presence of the researcher. Perhaps this is the reason for a far lower level of compliance with the hygiene procedures compared to the results of the previously reported research, which could be somewhat overestimated, as noted by the authors themselves.

Pittet et al. found that hygiene adherence was higher at weekends (59%) and night-time work (55%) than on weekdays (46%) [11]. This is explainable by lesser workload in those periods. The present study indicates that medical personnel during night hours of their duty comply with the hand hygiene requirements less frequently than during the afternoon and early morning duty hours. With similar structure of their activities, and with a similar difference in the workload, the day/night difference in complying to the hand hygiene rules may be attributable to more strict supervision exercised during morning and afternoon hours by the head of the hospital departments or the head nurse. Workload expressed in terms of the fraction of time devoted to work in general during one observation unit (work at the bedside, administrative work, cleaning, etc.) significantly affected the level of compliance with the hygiene procedures before contact with the patient. Interestingly, the greater was the index of effective workload, the more often the hand washing procedure before contact

with the patient was obeyed. This aspect of the work requires further analysis.

## CONCLUSION

The level of compliance with hand washing procedures among the medical personnel prior to contact with the patient is drastically below the expectations.

The compliance with the procedures occurred less frequently as the day went on. Inadequate compliance with the hygiene procedures as well as too short hand washing time point to the need to take action to increase the level of knowledge of hospital hygiene and encourage proper behavior.

## REFERENCES

1. Boyce J, Pittet D. *Guideline for hand hygiene in healthcare settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force*. Am J Infect Control 2002;30:S1–46.
2. Pittet D, Allegranzi B, Boyce J. *The World Health Organization Guidelines on hand hygiene in health care and their consensus recommendations*. Infect Control Hosp Epidemiol 2009;30(7):611–22. DOI: 10.1086/600379.
3. Bannister B, Begg N, Gillespie S. *Infectious disease*. Oxford: Blackwell Science; 2000.
4. Mamos E. *Physicians scored the worst*. Zakazenia 2003;2: 69–71.
5. Heczko P, Wójkowska-Mach J. *Nosocomial infections. Handbook for infection control teams*. Warszawa: Wydawnictwo Lekarskie PZWL; 2009.
6. Babbie E. *The practice of social research*. 9th ed. Belmont: Wadsworth/Thomson Learning; 2001.
7. Grant G, Grant A, Lockwood C. *Simpson, Semmelweis, and transformational change*. Obstet Gynecol 2005;106(2):384–7. DOI: 10.1097/01.AOG.0000168452.10067.27.

8. Laskowska A, Krajewska-Kułak E, Łukaszuk C, Sobolewski M, Rolka H, Jankowiak B, et al. *Analysis of nurses knowledge of healthcare acquired infections*. *Probl Hig Epidemiol* 2007;88(3):348–53.
9. Tvedt C, Bukholm G. *Alcohol-based hand disinfection: A more robust hand-hygiene method in an intensive care unit*. *J Hosp Infect* 2005;59(3):229–34.
10. Harris A, Samore M, Nafziger R, DiRosario K, Roghmann M, Carmeli Y. *A survey on handwashing practices and opinions of healthcare workers*. *J Hosp Infect* 2000;45(4): 318–21.
11. Pittet D, Mourouga P, Perneger T, the Members of the Infection Control Program. *Compliance with handwashing in a teaching hospital*. *Ann Intern Med* 1999;130(2):126–30.
12. Creedon S. *Healthcare workers' hand decontamination practices: compliance with recommended guidelines*. *J Adv Nurs* 2005;51:208–16.
13. Lankford M, Zembower T, Trick W, Hacek D, Noskin G, Peterson L. *Influence of role models and hospital design on hand hygiene of health care workers*. *Emerg Infect Dis* 2003;9(2):217–23. DOI: 10.3201/eid0902.020249.
14. Kuzu N, Özer 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. DOI: 10.1086/502545.
15. Lam B, Lee J, Lau Y. *Hand hygiene practices in a neonatal intensive care unit: A multimodal intervention and impact on nosocomial infection*. *Pediatrics* 2004;114(5):565–71.
16. Larson E, Albrecht S, O'Keefe M. *Hand hygiene behavior in a pediatric emergency department and a pediatric intensive care unit: comparison of use of 2 dispenser systems*. *Am J Crit Care* 2005;14(4):304–12.
17. Wendt C, Knautz D, Baum H. *Differences in hand hygiene behavior related to the contamination risk of healthcare activities in different groups of healthcare workers*. *Infect Control Hosp Epidemiol* 2004;25(3):203–6. DOI: 10.1086/502378.
18. Won S-P, Chou H-C, Hsieh W-S, Chen C-Y, Huang S-M, Tsou K-I, et al. *Handwashing program for the prevention of nosocomial infections in a neonatal intensive care unit*. *Infect Control Hosp Epidemiol* 2004;25(9):742–6. DOI: 10.1086/502470.