

## Patient Safety through Hand Hygiene Risk Management

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### Abstract

**Background:** Patient safety is the responsibility of all participants in healthcare and health services. In clinical hospitals and other healthcare facilities, it is necessary to create conditions in which healthcare is delivered according to a model in which patient safety is the central priority, not only from a medical but also from a socio-economic perspective.

**Objective:** This study aimed to identify differences in equipment between high- and low-risk clinics and to assess staff hand hygiene practices, including the most common indications and the frequency of antiseptic handwashing, by profession, profile, and clinic risk level.

**Materials and Methods:** The study included 100 randomly selected participants from healthcare and non-healthcare professions, with 50 from low-risk clinics and 50 from high-risk clinics. The study was conducted anonymously. A modified WHO questionnaire, the Hand Hygiene Knowledge Questionnaire for Health-Care Workers, was used. Descriptive statistics were used in the analysis.

**Results:** The study partially confirmed the working hypothesis, with the first and second research statements showing statistically significant differences in clinic equipment and staff practices related to hand hygiene. The third statement, which found no statistically significant differences in the frequency of antiseptic handwashing, supports the null hypothesis.

**Conclusion:** While knowledge of hand hygiene doesn't always translate into proper practice, ongoing education for healthcare workers and promotion of hand hygiene significantly influence their attitudes and actions. Following established hand hygiene procedures and applying them carefully in daily practice can produce lasting results.

**Keywords:** risk management, healthcare-associated infections, hand hygiene

### Introduction

Patient safety is the responsibility of all participants in healthcare. In clinical and hospital settings and other healthcare facilities, it is necessary to create conditions that ensure healthcare is delivered according to a model that

prioritizes patient safety. Healthcare-acquired infections (HAIs) pose a significant risk to the quality and safety of healthcare services.

Hospitals must develop risk management strategies focused on quality of work and prevention. Hospital-acquired infections are the most common complication of hospital treatment and a significant threat to patient safety, with mortality ranging from 5–35% [1–4].

Promoting proper hand hygiene among nurses significantly reduces HAIs, underscoring the importance of continuous education [5]. Risk factors for infection include iatrogenic (procedures, staff experience, hand contamination, non-compliance with asepsis), organizational (staffing ratios, room arrangements, overcrowding, equipment contamination), and patient-related factors (severity of illness, prolonged hospitalization) [6, 7].

Hand hygiene is the most effective and simplest infection control measure. Its implementation is essential for preventing infections at specific sites, including urinary

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tract infections, surgical wound infections, ventilator-associated pneumonia, and bloodstream infections. Proper hand hygiene in healthcare settings is critical [8, 9].

Healthcare institutions must continuously implement infection prevention measures and use collected data to identify trends, patterns, and priorities to improve patient safety [10–13]. Guidelines for infection control include protocols for hand hygiene, patient isolation, disinfection, sterilization, environmental hygiene, and the management of biological waste.

The “*My Five Moments for Hand Hygiene*” concept defines critical points for hand hygiene: before patient contact, before aseptic procedures, after exposure to body fluids, after patient contact, and after contact with the patient environment [14]. Protective gloves should be used appropriately; misuse increases the risk of microorganism transmission [15].

Despite the effectiveness of hand hygiene, adherence remains low due to skin irritation, inadequate sink placement, lack of soap or paper towels, high workload, insufficient staffing, prioritization of patient needs, improper glove use, forgetfulness, lack of knowledge, and lack of awareness of protocols [16].

## Objective

The aim of the study was threefold

1. To determine differences in equipment between high-risk and low-risk clinics.
2. To assess staff practices regarding hand hygiene and the most common indications for hand hygiene in relation to occupation, profile, and clinic risk level.
3. To determine the frequency of performing antiseptic hand hygiene in relation to occupation, profile, and clinic risk level.

## Hypothesis

### Working Hypothesis

1. There are statistically significant differences in equipment between high-risk and low-risk clinics.
2. There are statistically significant differences in staff practices regarding hand hygiene, and the most common indications for hand hygiene vary by occupation, profile, and clinic risk level.
3. There are statistically significant differences in the frequency of antiseptic hand hygiene by occupation, profile, and clinic risk level.

## Materials and Methods

The study involved 100 randomly selected participants from both healthcare and non-healthcare professions, with 50 participants from low-risk clinics and 50 from clinics with an increased risk of healthcare-associated infections (HAIs). The participants were employees of four clinics at the University Clinical Center Tuzla: the Clinic for Anesthesiology and ICU, the Clinic for Hematology and Bone Marrow Transplantation, the Clinic for Internal

Medicine, and the Clinic for Psychiatry. The first two clinics were classified as high-risk for HAIs, whereas the latter two were classified as low-risk.

The research employed a survey, and all participants remained anonymous. The questionnaire was adapted from the WHO *Hand Hygiene Knowledge Questionnaire for Health-Care Workers* [17]. Participants were presented with two or more answer options and required to select the correct one. The survey questions were divided into demographic data, information about workplace characteristics and workload, and data regarding staff practices and attitudes.

## Statistical analysis

Descriptive statistical methods were applied in the study. Results were presented as absolute numbers, percentages, statistical rates, and measures of central tendency. The Chi-square ( $\chi^2$ ) test was used to assess the significance of differences for non-parametric data, while Student's t-test was applied for parametric data. A p-value of  $< 0.05$  was considered statistically significant. The results are presented in tables and graphs.

## Results

The study included 100 randomly selected employees from the University Clinical Center Tuzla, with 50 participants from low-risk clinics and 50 from clinics with an increased risk of HAIs. Regarding gender distribution, there were 60 females and 40 males, evenly split between low- and high-risk clinics.

Testing for gender differences across clinics using the  $\chi^2$  test indicated no statistically significant difference, suggesting that gender will not significantly affect the study results.

The mean age of participants was compared using Student's t-test; no statistically significant difference was observed between the clinic groups ( $t = -0.514$ ;  $p > 0.05$ ), suggesting that age is unlikely to significantly affect the research outcomes. (Tab. 1, 2)

Clinic Risk	No	Mean	SD
High-risk clinics	50	43.66	10.050
Low-risk clinics	50	44.72	10.556
Total	100	44.19	10.268

Table 1. Mean age of participants grouped by clinic risk

Clinic Risk	No.	Mean	SD
High-risk clinics	50	17.76	10.716
Low-risk clinics	50	20.54	10.622
Total	100	19.15	10.707

Table 2. Mean length of work experience of participants grouped by clinic risk

Clinic	Cleaner	Non-healthcare secondary staff	Nurse/ Technician	Bachelor of Health Sciences	Medical Doctor	Total
High-risk clinics	2	5	19	6	18	50
Low-risk clinics	4	3	21	7	15	50
Total	6	8	40	13	33	100

Table 3. Distribution of participants by occupation among high- and low-risk clinics

The difference in the representation of various occupations between high-risk and low-risk clinics for healthcare-associated infections (HAIs) was tested using the  $\chi^2$  test and was not statistically significant ( $\chi^2 = 1.661$ ,  $p > 0.05$ ). This indicates that occupational distribution will not significantly affect the research results. (Tab. 3)

The difference in the representation of healthcare versus non-healthcare staff between high- and low-risk HAIs clinics was tested using the  $\chi^2$  test and was not statistically significant ( $\chi^2=0$ ,  $p>0.05$ ), indicating that the proportion of non-healthcare staff does not significantly affect research results.

#### Workplace Characteristics and Workload

Analysis of participants' responses revealed a statistically significant difference in the presence of sinks ( $\chi^2 = 9.846$ ,  $p < 0.05$ ), with sinks more frequently present in high-risk clinic rooms. (Tab. 4)

Clinic Risk	Every room	Some rooms	No rooms	Total
High-risk clinics	38	12	0	50
Low-risk clinics	23	26	1	50
Total	61	38	1	100

Table 4. Availability of sinks in patient rooms according to participants' responses

#### Staff Practice

There is a statistically significant difference in the number of hand washes by occupation ( $\chi^2 = 39.489$ ,  $p < 0.05$ ). (Tab. 5)

There is a statistically significant difference in handwashing practices by staff distribution ( $\chi^2 = 33.448$ ,  $p < 0.05$ ). (Tab. 6)

There is a statistically significant difference in hand-disinfection practices by staff category ( $\chi^2 = 30.1$ ,  $p < 0.05$ ). (Tab. 7)

How many times do you wash your hands during working hours	5-10	10-20	20-30	>30	Total
Cleaner	0	3	0	3	6
Non-healthcare secondary staff	0	2	0	6	8
Nurse/Technician (secondary education)	0	7	4	29	40
Bachelor of Health Sciences (BHS)	0	0	4	9	13
Medical Doctor	10	9	5	9	33
Total	10	21	13	56	100

Table 5. Analysis of handwashing frequency by occupation

When do you wash your hands	Before pat. contact	After patient contact	Before meals	After meals	Unknown	Total
Non-healthcare staff	0	0	5	1	8	14
Healthcare professional	6	9	1	0	70	86
Total	6	9	6	1	78	100

Table 6. Analysis of when hands are washed by healthcare vs. non-healthcare staff

In which situations do you perform hand disinfection?	Before patient contact	After patient contact	After glove removal	After contact with body fluids	After contact with pat. surroundings	Unknown	Total
Non-healthcare staff	0	1	1	1	5	6	14
Healthcare professional	5	10	1	2	1	67	86
Total	5	11	2	3	6	73	100

Table 7. Hand disinfection practices by healthcare vs. non-healthcare staff

There is a statistically significant difference in antiseptic handwashing by staff category ( $\chi^2 = 6.348$ ,  $p < 0.05$ ). (Tab. 8)

Do you perform antiseptic hand washing?	Always	Some-times	Never	Total
Non-healthcare staff	5	8	1	14
Healthcare professional	38	48	0	86
Total	43	56	1	100

Table 8. Frequency of antiseptic hand washing by healthcare vs. non-healthcare staff

## Discussion

Quality standards require that each patient room have a sink with appropriate equipment and a box of paper towels. Analysis of staff responses regarding room equipment showed a statistically significant difference, indicating that many rooms remain inadequately equipped and not aligned with WHO recommendations. To improve hand hygiene practices, facilities must ensure sufficient, properly located sinks, liquid soap/lotions, alcohol-based hand rubs, quality paper towels, wall-mounted dispensers, and paper towel boxes [18].

In addition to inadequate equipment, factors such as lack of time, heavy workload, insufficient knowledge, inconvenient sink locations, and low motivation also reduce compliance with hand hygiene [19]. The daily patient average across all four clinics was 15.4. Due to limited staffing, one doctor and one nurse often care for multiple patients or work across multiple rooms, increasing the likelihood of lapses despite existing SOPs and hand hygiene principles.

Studies consistently show a link between higher infection rates and low staffing levels or overcrowded wards, confirming inadequate hand hygiene. Compliance varies with workload intensity, department type, occupation, and time of day, and is typically lower in high-intensity care settings and among doctors than among nurses [20]. Increased patient-to-nurse ratios significantly raise the risk of hospital-acquired infections, with each additional patient per nurse increasing risk by up to 42% [21–24].

Recent studies indicate that compliance remains suboptimal, particularly among physicians, whereas nurses exhibit higher adherence [25–28]. Time limitations often prevent proper handwashing or adequate use of alcohol-based disinfectants. Adequate staffing, monitoring, and administrative support are essential for maintaining safe hand hygiene practices.

A statistically significant difference in handwashing practices and indications was observed across occupation, profile, and clinic risk. Differences can be partially explained by variations in patient contact time, but this does not justify deviations from protocols. Nurses have more opportunities for handwashing than doctors, as supported by Azim S. et al. [28].

Organizational conditions and task characteristics also influence adherence [29]. Although healthcare professionals possess the necessary knowledge, it is not consistently applied. Continuing education and promotion can improve attitudes and behaviors. Significant differences in antiseptic handwashing across professional groups align with the literature, which reports lower compliance among doctors and various occupational barriers [28, 30].

## Conclusions

Clean hands are the single most important factor in reducing hospital-acquired infections. Problems with handwashing among healthcare professionals, beyond insufficient staffing, are often overlooked because attention is focused on other aspects of patient care.

The study confirmed the working hypothesis, showing statistically significant differences in clinic equipment, staff hand hygiene practices, and frequency of antiseptic handwashing.

Although knowledge of hand hygiene does not automatically translate into practice, continuing education for healthcare professionals and the promotion of hand hygiene significantly influence attitudes and behaviors. By following defined hand hygiene procedures conscientiously every day, long-term results can be achieved. Professional and responsible staff consistently and correctly perform hand disinfection.

Healthcare professionals must have adequate knowledge and professional experience in preventing and controlling healthcare-associated infections (HAIs), although this is not.

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