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**Basic Science**



# Implementation of Proper Hand Hygiene among Microbiological Laboratory Workers Respectively to WHO Guidelines

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## Abstract

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**Key words:** WHO; guidelines; education; hands; hygiene.

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**Background:** Hand hygiene has a fundamental role in the prevention of one of the most challenging problems in the management of modern hospitals: nosocomial infections and occupational diseases.

**Aim:** This survey presents the experience of laboratorians in the Microbiology Department in the Clinical Center in Skopje in promoting proper hand hygiene by participating in a training course and implementation of WHO guidelines among laboratory staff.

**Material and Methods:** The group of 36 Health Care Workers (HCW) has been divided in to seven different groups, based on their specific work in the Institute of Microbiology. The investigation was conducted in two phases: phase-1 was before the training course and phase-2 immediately after taking the training course. During phase-2, hand samples were taken with the technique of the moist swab on the left hand and the fingertips touch method on the right hand.

**Results:** It was found that 17% of the cultures from the left hand detected pathogenic bacteria and 39% on the samples taken from the right one (there is significant difference ( $p = 0.041$ )).

**Conclusion:** The Touch Method appears to be the more sensitive method than swabbing the critical areas of the palms. It is also evident (significant) that awareness of the problem of the staff, obtain some changes in their attitude and practice.

## Introduction

The spread of nosocomial infections, among immunocompromised patients is connected with Health Care Workers (HCW) hand contamination in almost 40% of cases and it is a challenging problem in modern hospitals. The best way for HCW s to overcome this problem is implementing by correct hand hygiene procedures [1, 2]. For this reason the World Health Organization (WHO) launched in 2005 the GLOBAL Patient Safety Challenge [3].

Two categories of microorganisms can be present on HCW s hands: transient flora and resident flora. The first one is represented by the microorganisms taken by HCW s from the environment. These microorganisms are capable of surviving on the human skin and sometimes to reproduce themselves. The second group on the other hand, is represented by the permanent micro organisms that lived on the skin surface (on the stratum corneum or immediately under it). They are capable of surviving on human skin and grow freely on it. They have low pathogenicity and

infection rate, and they create a kind of protection from the colonization of other more pathogenic bacteria. The skin of HCW s are colonized by  $3.9 \times 10^4 - 4.6 \times 10^6$  cfu /cm<sup>2</sup> (3). The micro organisms creating the resident flora are: *Staphylococcus epidermidis*, *Staphylococcus hominis*, *Micrococcoci*, *Propionibacterium*, *Corynebacterium*, *Dermobacterium*, *Pitosporum*, while in the transitional could be found *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter spp*, *Enterobacter spp* and *Candida spp*. [3].

The goal of hand hygiene is to eliminate the transient flora with careful and proper performance of hand washing, using different kind of soap, such as an one which is antiseptic, and by using an alcohol based gel. The main problems found in the practice of hand hygiene is connected with the lack of available sinks and time consuming performance of hand washing [4, 5]. An easy way to resolve this problem could be the use of alcohol based hand rub, because of its faster application compared to correct hand washing [6].

Proper hand washing should be connected with the knowledge that generally bacteria can be found in higher quantities on fingertips and in places not easily reachable with a fast and inaccurate wash, like inter digital spaces or under the nails [3, 7, 8].

A very important issue is prevention of damages on the skin. Intensive use of soaps and alcohol hand rubs could damage the skin surface too. This could be painful and it could reduce the compliance of HCW s to use these hygienic measures. To overcome this problem, it would be useful to use soaps or alcohol hand rubs with emollients.

It's also useful to perform a monitoring of the behaviour of HCW's [9-11] and in the consumption of hand hygiene products. These data would be helpful to realize whether additional measures have to be taken in the future period [12-15].

Good education and training for HCW's is supposed to teach them that they need to pay attention on careful and permanent hand hygiene as a measure in prevention of nosocomial infections caused mostly by multidrug-resistant bacteria such as [16] *Pseudomonas aeruginosa*, *Acinetobacter spp.*, *Klebsiella spp.*, methicillin resistant *Staphylococcus aureus* (MRSA) or *vancomycin resistant Enterococci (VRE)*[3] Good hygiene procedure and disinfection can decrease the biomass of those bacteria in the health care facilities [16, 17].

The goal of this survey was to demonstrate the

importance of education and implementation of WHO hand hygiene guidelines over the attitude for hand hygiene among the laboratory staff, as well as choice of the proper method for collecting specimens for microbiological control.

## Material and Methods

The survey was undertaken based on the experience of the Infection Control Program from the University of Geneva [18] and a few other training programs [19, 20]. Our survey was conducted in two phases: Phase 1 - collecting samples before the educational course and Phase 2 – collecting samples from the staff after they have finished the 6 months (every Monday morning) educational course about hand hygiene according to the WHO guidelines [3].

We collected samples of the bacterial flora present over the left hand surface of 72 HCW's in the department from both palms, using different methods for each. These 72 samples were taken with the moist swab method as a technique for the left hand and for the right hand we used the touch method. Staff persons have been divided in 7 groups according the educational background and place where each person works in the institute (Table 1) to see whether these factors influence significantly the level of contamination of hands.

First, we put the swab in a solution with glucose and then we scoured it on the surface of the left hand, especially on the most critical areas which are the palmar creases, the inter digital spaces, the fingertips, and on the dorsal part of the hand. After that we put the



Figure 1: Touch method.

swab again in glucose solution and we took a few drops of the liquid and scoured it on a blood agar Petri dishes. For the right hand, we used the fingertips touch method, asking the HCW's to put their fingertips directly on the blood agar Petri dishes. Then, both the Petri dishes and test – tubes were incubated for 24 hours at 37° C. The day after, we carried out an identification based on the morphological aspect of the colonies and took samples from them for more specific biochemical tests, like the DNase and the methicillin resistance in *Staphylococcus aureus* colonies, or the IMViC test and the culture on UTI chromogenic agar, completing in this way the



Figure 2: Taking sample with moist swab.

identification of the bacteria after a successive incubation for 24/48 hours at 37° C. Bacterial isolates have been confirmed by automatic VITEK 2 identification system.

### Training

The survey includes persons with completely different educational backgrounds - from high academic levels to primary education, among cleaning persons. The training course lasted 6 months. The course was given every Monday morning before starting the laboratory work. The course It included theoretical lectures as well as practical exercises. Mainly the education was focused on increasing the level of awareness among the staff, of proper hand hygiene as an important factor in transmitting micro organisms that they come in contact with during their professional activities. To achieve better motivation and acceptance of the recommendations, the main attention was put on the possibility for self infections as well as the possibility of carrying the pathogens via hands over their personal properties.

Over one week practical training for proper hand washing was performed and a scheme, with detailed hand sanitization steps, was located near every sink throughout the whole department.

## Results and Discussion

In phase-2 (after training the staff) no significant differences were noticed in the distribution of pathogenic

Table 1: Results from microbiological testing of hand hygienewithin laboratory staff I phase 1/phase 2.

Groups	I (N=4)	II (N=4)	III (N=6)	IV (N=2)	V (N=8)	VI (N=4)	VII (N=8)	TOTAL
<i>Enterobacter spp.</i>	2/0						4/2	6/2
<i>Enterococcus spp.</i>		2/2			4/2			6/4
<i>Klebsiella pneumoniae</i>			4/0			2/0	2/4	8/4
<i>Pseudomonas aeruginosa</i>	2/0				0/2	0/2	2/0	4/4

No of colonies = number of saprophytic bacteria; Group I - administrative staff; Group II -technicians plating samples; Group III - technicians in bacteriological laboratory; Group IV -technicians in serological laboratory; Group V - Microbiologists; Group VI - doctors running specialization Microbiology; Group VII - cleaning staff.

bacteria among 7 groups of staff. According to this finding we can consider that there is equal risk of hand contamination during work process. It is obvious that training experience has given better professional behavior and awareness of all lab staff that is in accordance with literature data [21, 22].

With the Touch method, pathogenic bacteria as transient micro flora have been detected on the hands of 24 (67%) persons in phase-1 and 14 persons (39%) in phase-2, such as *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Enterobacter spp.*, *Enterococcus spp.* With the Moist Swab, pathogenic bacteria have been detected on the hands of 14 (39%) persons in phase-1 and 6 persons (17%) in phase-2.

Both methods have shown significant differences among number of pathogenic isolates before and after training (touch method - Wilcoxon Matched Pairs Test: Z=2.80, p=0.00506; Moist swab - Wilcoxon Matched

Table 2: Comparison between two different laboratory techniques for collecting samples from hands.

No Staff	Moist Swab	Touch
1	--	<i>Klebsiella pneumoniae</i>
2	<i>Pseudomonas aeruginosa</i>	<i>Pseudomonas aeruginosa</i>
3	<i>Enterobacter spp.</i>	<i>Enterobacter spp.</i>
4	--	<i>Pseudomonas aeruginosa</i>
5	--	<i>Enterococcus spp.</i>
6	--	<i>Enterococcus spp.</i>
7	<i>Klebsiella pneumoniae</i>	<i>Klebsiella pneumoniae</i>

Persons 1, 3, 7 - cleaning staff; Persons 2, 6 - Microbiologists; Person 4 - doctor in specialization Person 5 - technician.

Pairs Test:  $Z=2.52$ ,  $p=0.01171$ ). Number of isolated pathogenic microorganisms is significantly lower in phase 2 by each method.

**Table 3: Isolation of pathogenic bacteria with two different techniques of taking samples from hand in phase-1/ phase-2.**

Method	Pathogenic bacteria				Total
	phase-1		phase-2		
	(+)	(-)	(+)	(-)	
Touch method (right hand)	24 (67%)	12 (33%)	14 (39%)	22 (61%)	72
Moist Swab (left hand)	14 (39%)	22 (61%)	6 (17%)	30 (83%)	72
Total	38	34	20	52	144
	$\chi^2 = 5.57$ $df = 1$ $p = 0.0182$		$\chi^2 = 4.43$ $df = 1$ $p = 0.0353$		

Comparing the results from both techniques as shown in Table 2, illustrate that the touch method has given a significantly higher percentage (67% and 39%) of detecting pathogenic bacteria than the moist swab technique (39% and 17%). This data indicates that the tips of the fingers are the place which is most heavily contaminated during laboratory work.

**Table 4: Distribution of contamination (pathogenic bacteria) on HCWs hands among 7 groups of laboratory staff.**

Groups	I	II	III	IV	V	VI	VII	TOTAL
	(N=4)	(N=4)	(N=6)	(N=2)	(N=8)	(N=4)	(N=8)	36
TOTAL	4/0	2/2	4/0	0/0	4/4	2/2	8/6	24/14

For statistical analysis, the Chi square test was used. It shows that there is significant correlation between the type of method and the results obtained for hand hygiene before training/phase-1 ( $c2 = 5.57$ ,  $df = 1$ ,  $p=0.0182$ ) and after training/phase-2 ( $c2 = 4.43$ ,  $df = 1$ ,  $p=0.0353$ ). Number of isolated pathogenic bacteria in both investigated phases (before and after the training), was significantly higher with touch method compared to the number of isolates obtained with moist swab method.

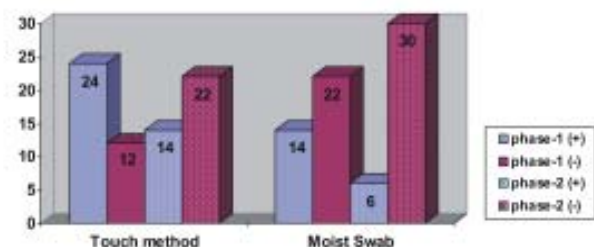


Figure 3: Isolation of pathogenic bacteria with two different techniques of taking samples from hand in phase-1/ phase-2.

Test for sensitivity and specificity can not be performed because the screening did not include both hands (left and right) of the same person with both methods for collecting samples.

The awareness of the problem of the HCWs is fundamental, especially between the administration workers like secretaries or cleaners who generally do not have the medical and hygienic preparation in their knowledge - wrong hand hygiene performance could threaten the health of the patient.

This could be even more important when HCWs have to be in contact with highly contaminated areas, like a microbiology department, because of the amount of pathogenic micro organisms in the environment and of the exposition of doctors, technicians, cleaners and secretaries to them.

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