

# EVALUATION OF HAND HYGIENE ADHERENCE IN A TEACHING HOSPITAL. ANALYSIS USING MIXED EFFECTS MODELS

Ana M. Novoa Pardo<sup>a,b</sup>, MD; M. Teresa Pi-Sunyer<sup>a</sup>; Xavier Castells<sup>a</sup>, MD, PhD  
<sup>a</sup>Clinical Epidemiology Evaluation Department. Hospital del Mar, IMAS.  
<sup>b</sup>Preventive Medicine and Public Health Educational Unit UPF-IMAS-ASPB

## BACKGROUND

Nosocomial infection involves an increase in hospital morbidity and mortality, as well as an increase in costs and hospital stay. Even though hand hygiene is one of the most important measures in its prevention, adherence of health care workers (HCW) to existing recommendations is low. Due to the low

compliment observed in a previous evaluation of hand hygiene, and after a year of implementation of several interventions (mainly HCW education) addressed to increase HCW adherence to recommendations, a reevaluation of hand hygiene compliment was carried out in HCW of a Spanish hospital.

## METHODS

In 2005, adherence to hand hygiene of physicians and nurses was evaluated, by means of direct observation, in several areas of the hospital, collecting hand hygiene carried out whenever indicated (opportunity for hand hygiene). Regarding an opportunity, four type of actions were considered: hand washing, hand disinfection, only glove change, no action. Situations of different risk of cross-infection were observed. Type of HCW, nurse shift, substitute condition (fixed or substitute HCW) and area observed were also collected. Opportunities

were classified according to the level of cross-infection and to the moment with respect to patient contact (before or after patient contact). Compliment was defined as hand washing or hand disinfection in an opportunity for hand hygiene according to criterion exhibited in hospital protocols. Results were analysed using mixed effects models, the individual observed as the random variable.

## RESULTS

There were 1254 opportunities for hand hygiene observed in 247 HCW. The mean compliment was 19.9%. The variability explained by the individual (random effect) was statistically significant in every model. Multivariate analyses indicates that non-adherence depends on the area observed (protective odds ratio (OR) in intensive care units (ICU) (OR 0.04; 95%

Confidence Interval (95% CI) 0.01-0.10) and on if the opportunity for hand hygiene observed was before or after patient contact (lower possibility for non-adherence after patient contact (OR 0.25; 95% CI 0.17-0.38). No improvement with respect to the previous evaluation was observed.

**Table 1. Hand hygiene compliment according to several factors. Mixed effects models\*. Raw and adjusted odds ratios for non-compliance\*\*.**

	Opportunities (n)	Compliment (%; 95% C.I.)	Bivariate analysis OR (95% C.I.)	Multivariate analysis OR (95% C.I.)
<b>Health care workers</b>				
Physician	223	24,7 (19,0 - 30,4)	1	1
Resident physician	150	16,7 (10,7 - 22,7)	2,30 (0,65 - 8,14)	1,56 (0,52 - 4,71)
Nurse	528	22,0 (18,5 - 25,5)	2,05 (0,81 - 5,19)	1,99 (0,88 - 4,51)
Nurse assistant	353	15,0 (11,3 - 18,7)	4,29 (1,53 - 12,03)	2,54 (1,01 - 6,37)
<b>Hospital area</b>				
Medical wards	455	17,8 (14,3 - 21,3)	1	1
Surgery wards	299	4,3 (2,0 - 6,6)	5,73 (2,52 - 13,02)	6,95 (2,72 - 17,73)
Surgery area	256	27,3 (21,8 - 32,8)	0,40 (0,19 - 0,86)	0,30 (0,12 - 0,74)
ICU	106	68,9 (60,1 - 77,7)	0,05 (0,02 - 0,11)	0,04 (0,01 - 0,10)
Other <sup>a</sup>	138	8,7 (4,0 - 13,4)	2,02 (0,83 - 4,90)	2,54 (0,92 - 7,06)
<b>Real risk for cross infection***</b>				
Low risk	310	13,9 (10,0 - 17,8)	1	1
Intermediate risk	425	31,8 (27,4 - 36,2)	0,18 (0,11 - 0,31)	0,21 (0,12 - 0,35)
High risk	519	13,7 (10,7 - 16,7)	1,08 (0,64 - 1,83)	1,21 (0,72 - 2,03)
<b>Risk perception for cross infection***</b>				
Low risk	464	12,5 (9,5 - 15,5)	1	1
High risk	790	24,2 (21,2 - 27,2)	0,25 (0,15 - 0,40)	0,25 (0,15 - 0,41)
<b>Moment with respect to procedure</b>				
Before procedure	562	12,8 (10,0 - 15,6)	1	1
After procedure	692	25,6 (22,3 - 28,9)	0,25 (0,17 - 0,38)	0,22 (0,15 - 0,34)
<b>Shift</b>				
Morning	490	18,0 (14,6-21,4)	1	1
Evening	182	17,6 (12,1-23,1)	0,95 (0,24 - 3,78)	
Night	209	23,0 (17,3-28,7)	0,58 (0,16 - 2,13)	
<b>Contract</b>				
Substitute	187	18,2 (12,7-23,7)	1	1
Fixed	574	20,0 (16,8-23,3)	1,36 (0,33 - 5,58)	

\*The variability explained by the individual (random effect) was statistically significant ( $p \leq 0,001$ ) both for univariate and multivariate models.

\*\*The effect of the variables shift and contract were tested in a multivariate model for nurses and nurse assistants without reaching statistical significance ( $p > 0,05$ ).

\*\*\*See table 2 for variable's definitions.

a. Emergency room, day hospital, haemodialysis, endoscopy.

95% C.I.: 95% confidence interval.

**Table 2. Variable's definitions.**

	Definition
<b>Real risk of cross infection**</b>	
Low risk	Before or after environmental contact and after patient superficial contact*
Intermediate risk	After patient exploration, wound contact, placing of removing feces recipient, aseptic technique
High risk	Before any type of patient contact
<b>Risk perception of cross infection</b>	
Low risk	Before or after environmental contact or patient superficial contact
High risk	Before or after patient exploration, wound contact, placing of removing feces recipient, aseptic technique

\*Includes friendly touch, taking vital signs, feeding and giving medication.

\*\*Adapted from Jarvis WR. Lancet 1994.

## DISCUSSION

Results reveal HCW's low adherence to recommendations. Though, the area where the most critical patients stay, the ICU, is where the highest compliment was observed (69%). Even though hygiene before patient contact diminishes the risk of infection in a larger proportion than hygiene after patient contact, higher adherence was observed after patient contact.

This is the first study to use mixed effect models in the analysis of hand hygiene compliment, which allows to take into account intraindividual variability, as repeated measures were done in each individual.

The low adherence observed and the lack of improvement with respect to the previous evaluation suggest that interventions based upon education are not useful when HCW already have the knowledge about the issue. In order to improve compliment, it is necessary, in first place, to detect HCW's habits and attitudes with respect to hand hygiene. The information collected in the evaluation carried out helps in their identification. The higher adherence after than before patient contact is one of the attitudes observed, that points out that hand hygiene is being done for HCW's own protection rather than for

patient's protection from infection. Glove change without subsequent hygiene is probably due to the fact that it is a habit, rather than due to lack of knowledge, as it was an issue addressed in the lectures. The larger use of hand washing than hand disinfection is another habit as well, as hand disinfection reduces time necessary for hand hygiene. Once HCW's habits and attitudes are identified, interventions must focus on modifying them, working at several levels, both individual -involving HCW in the prevention of hospital infection- and institutional -including hand hygiene as one of the quality objectives of the hospital.

In conclusion, HCW's adherence to recommendations is very low. Interventions based upon education are not useful when knowledge is already available. A new approach in the interventions is required, focusing in HCW's habit and attitude modification and working at several levels, both individual and institutional. Continuous evaluation of compliment is required to ensure that interventions have the desired impact.