

## Human difficulties related to infection control practices of healthcare workers (HCW)

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### **Author contributions:**

GRA: writing of the project, data collection and analysis, writing of manuscript

GGB, CGV and MLTM: psychological methods, discussion of results

RPS, JMS and ACPL: statistical analyses and sample size determination

RDL and MCP: writing of the project and methods

ASL: general supervision of writing, data collection and analysis, writing of manuscript.

## Abstract

**Background.** Failure to comply with infection control guidelines is a universal problem.

**Objectives:** investigate associations between compliance with infection control practices and performance in psychological tests (Styles of Thought, Self Esteem, Quality of Life, Stress and Personality).

**Methods:** In 4 intensive care units, doctors were observed for compliance with hand hygiene (HH); and nurses during CVC dressing and manipulation. HCW were then evaluated psychologically.

**Results:** 7,572 observations of 248 HCW showed that compliance with CVC manipulation practices was 13-95%; lowest for HH and hub disinfection. For dressing, compliance was 14-99%, lowest for HH before. For doctors, HH was 10-98%; lowest before procedures and after touching surroundings. In doctors, compliance was associated with age; self-esteem; and Aggression. For nurses, compliance was associated with Deference, being single; and negatively associated with Deference, Succorance, Nurturance, and Affiliation.

**Conclusions:** Personality and self-esteem were associated with compliance and multidisciplinary holistic interventions may be effective.

## INTRODUCTION

Health care-associated infections (HAI) consistently challenge the quality of care provided in the health system as a whole. Despite knowledge about these infections, their origins, associated factors and the general measures of prevention and control, usually a low adherence of HCW to preventive measures is observed<sup>1</sup>. There are several scientifically based preventive measures; however, the use of these guidelines by HCW remains a major challenge<sup>2</sup>.

HAIs have a great impact on morbidity, mortality, length of hospital stay, and costs. ICUs represent the center of HAIs because of patients' characteristics. In particular, the use of various invasive devices is one of the most important risk factors for acquiring HAIs<sup>3</sup>.

Most bloodstream infections related to vascular catheters can be avoided, as long as evidence-based practices are applied during insertion and maintenance of vascular catheters<sup>4</sup>. Although measures of prevention and control of catheter associated bloodstream infections are well established, in practice, there are unsatisfactory levels of performance of HCW<sup>5</sup>.

Hand hygiene is one of the most effective prevention measure. Nurses and doctors wash their hands less than half the times needed<sup>2</sup>. In critical care situations, with time limitations and great workload, adherence to good practices has been described to be as low as 10%<sup>6</sup>. Research on the cognitive determinants of hand hygiene, was identified by WHO as an object of pending research<sup>7</sup>.

Improving practices involves changing the behavior of HCW, a key challenge today. Studies are needed to evaluate the main determinants of infection control practices and behavior promotion among the different populations of health workers<sup>8</sup>.

Exactly which cognitive variables (eg, knowledge, attitudes, beliefs, personality traits) influence hand hygiene remains unknown. An Australian study that investigated the influence of thinking styles, that are considered personality traits, on the adherence rates of doctors to hand hygiene. Adherence was positively associated with experiential thinking<sup>7</sup>.

We believe that in order to understand the factors that influence decision making for the act of adherence, it is essential for us to reflect on factors in the daily life of HCW. This knowledge may guide strategies to improve healthcare practices.

The aims of this study were: -to evaluate the compliance with infection control practices by healthcare workers (HCW) in ICUs; and -to investigate associations between compliance of HCW and their performance in psychological tests (Styles of Thought, Self Esteem, Quality of Life, Stress and Personality).

## METHODS

### Study site

This study was conducted at Central Institute of the Hospital das Clínicas of the University of São Paulo. It is a university hospital with six institutes and two auxiliary hospitals, totaling 2,220 beds. The Central Institute is the largest institute and has approximately 950 beds, of which 142 are intensive care beds distributed in 12 Intensive Care Units (ICUs). Four ICUs participated in this project: Surgical (16 beds), Infectious Diseases (ID) (7 beds), Medical/Pneumology (8 beds), and Clinical Emergency (13 beds).

### Design

This was an observational study involving doctors and nursing professionals, evaluating their compliance with infection control practices and the association of this compliance with their performance in psychological tests that evaluated thinking styles, self-esteem, quality of life, stress, and personality.

The study was approved by the Research and Ethics Committee of Hospital das Clínicas (protocol 01651412.0.0000.0068). Initially the HCW included in the study were observed as to their practices without their knowledge. For this phase, informed consent was waived, as these observations are part of regular auditing of practices in the hospital. Written consent was obtained from all participants who were submitted to psychological testing.

### Participants and procedure

All physicians and nurses who worked in the four ICU and who performed direct patient care were observed.

During a period of 3 months, trained observers unknown to the HCW performed observations. The data were recorded for each HCW.

- a) Nursing professionals (RN or nurses, nurse technicians and nurse assistants) were observed during CVC manipulation and CVC dressing.

During CVC manipulation, compliance was observed for:

- Hand hygiene before the procedure;
- Use of gloves during the procedure;
- Disinfection of the hub with alcohol;

- Hand hygiene after the procedure

During CVC dressing, compliance was observed for:

- Hand hygiene before;
- Use of sterile gloves
- Antisepsis of the dressing site;
- Hand hygiene after the procedure.

b) Physicians were observed as to compliance with hand hygiene during the 5 moments defined by the World Health Organization <sup>9</sup>.

- 1) Before touching a patient;
- 2) Before clean/aseptic procedure;
- 3) After body fluid exposure;
- 4) After touching a patient;
- 5) After touching a patient's surroundings.

The observations focused on whether or not each step was carried out. Technique was not part of the evaluation. For example, the observations did not include an evaluation of hand hygiene technique such length of time spent or amount of gel used. Both the use of alcohol-based rubs and hand washing with soap and water were considered adequate. Observations occurred during the three work shifts: morning, afternoon and night.

The data from these observations were marked in printed spreadsheets and later entered into an electronic spreadsheet. Data were expressed as a compliance rate for each HCW, defined as the number of observations in which the HCW performed adequately divided by number of opportunities observed, expressed as a percentage.

After the preset number of observations had been achieved, the HCW were invited to participate undergoing psychological testing applied by a team of psychologists. A socio-demographic questionnaire was applied to characterize the participants including data on age, sex, education level, and marital status.

Next, the participants underwent psychological evaluations in the following order: Rational and intuitive thinking styles; Self-esteem evaluation; quality of life assessment; Stress assessment; and Personality assessment. A professional psychologist was present to explain how to complete the questionnaires and, after they were complete, had a 15 to 30 minute interview with each participant. This final interview was considered necessary by the Ethics Committee to ensure that the participants were comfortable and felt supported.

Briefly, we provide a description of the instruments used for psychological testing:

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- A) Rational and Intuitive Thinking Styles: The Rational Experiential Inventory (REI) reliably measures an individual's preference for two thinking styles: need for cognition (rationality) and faith in intuition (experientiality)<sup>10,11</sup>. Each construct has its own subscales relating to self-stated ability to think in each style (ability) and reliance and enjoyment on each type of thinking (favourability). The REI comprises 40 questions with five-point response scales (20 each for need for cognition and faith in intuition, with 10 items each for the subscales of ability and favourability). All scores are averaged to provide variables ranging from one to five, with a higher score reflecting a greater tendency to endorse the construct measured.
- B) Self-esteem evaluation: The Rosenberg-EAR Self-esteem Scale was used, in the version with cross-cultural adaptation, which has been considered efficient and valid for the Brazilian population<sup>12, 13</sup>. The score obtained with the Scale can vary from 0 to 30, being calculated by adding the scores obtained through the answers given to the 10 sentences, five of which evaluate the positive feelings of the human being about oneself and five evaluate negative feelings; each item is evaluated by a three-point Likert scale. Scores between 15 and 25 suggest self-esteem within "normality"; scores below 15 suggest low self-esteem; and above 25 suggest high self-esteem<sup>14</sup>.
- C) Quality of life assessment: The validated Portuguese-language version of the WHOQOL-BREF was used in this study<sup>15</sup>. This questionnaire contains two items assessing overall quality of life and general health, as well as 24 other items divided into four domains: physical health (domain 1) with seven items; psychological health (domain 2) with six items; social relationships (domain 3) with three items; and environmental health (domain 4) with eight items. Each item is rated on a five-point Likert scale and scored from one to five on a response scale. The scores of each domain are scaled in a positive direction (i.e., lower scores denote lower quality of life)<sup>16</sup>.
- D) Stress assessment: Lipp's Inventory of Stress Symptoms for Adults (ISSL)<sup>17</sup> was used. The ISSL is an instrument that assesses symptoms of stress, the patient's stress level (alarm, resistance, near-exhaustion, and exhaustion), and the kind of predominant symptoms present (physical or psychological)<sup>18</sup>. The instrument consists of 53 items: includes 34 items of a somatic nature, and 19 of a psychological nature. The ISSL was validated in 1994 and consists of three frames (Q) which refer to the four phases of stress: The first frame shows symptoms experienced in the last 24 hours: 12 being physical and three psychological. The second shows symptoms in the last week: 10 physical and psychological<sup>17</sup>. The third frame includes symptoms experienced in the last month: 12 physical and 11 psychological. In ISSL, the positive diagnosis is based on the sum of the symptoms of each inventory

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3 frame, and when it exceeds the limit in a specific phase ( $Q1 > 6$ ,  $Q2 > 3$  or  $> 9$ ;  
4  $Q3 > 8$ ), this will indicate that the person has stress, in which stage it is found  
5 and the predominant symptomatology<sup>17</sup>.  
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8 E) Personality Assessment: The instrument used in this study was the Factorial  
9 Inventory of Personality – IFP, which is an inventory of objective  
10 personality, approved by the Brazilian Federal Council of Psychology,  
11 adapted and validated for use in Brazil by the team of Professor Luiz  
12 Pasquali<sup>19</sup>, and approved by the System of Evaluation of Psychological  
13 Tests (Satepsi) of the Federal Council of Psychology (CFP)<sup>20</sup>. The IFP is  
14 based on the Edwards Personal Preference Schedule (EPPS), an instrument  
15 developed by Allen L Edwards in 1953 and revised in 1959. This inventory  
16 aims to evaluate the normal subject in 15 psychological needs or motives<sup>20</sup>:  
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- 21 1) Nurturance: characterized by desires and feelings of pity, compassion  
22 and tenderness, through which the subject wishes to give sympathy and  
23 gratification to the needs of a defenseless subject, to defend him in  
24 danger, to give him emotional support and consolation in sadness,  
25 disease and other misfortunes;  
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- 27 2) Intraception: empathy, to analyze one's feelings and emotions;
- 28 3) Succorance: seeking support and protection; the subject expects to have  
29 his desires satisfied by some dear and friendly person, wants to be  
30 stroked, supported, protected, loved, oriented, forgiven, comforted;  
31 suffers from feelings and anxiety of abandonment, insecurity and  
32 despair;  
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- 34 4) Deference: characterized by respect, admiration and reverence for a  
35 superior; the subject presents the need to praise, imitate, and obey his  
36 superiors;  
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- 38 5) Affiliation: being loyal to friends, to develop strong attachments;
- 39 6) Dominance: to be a leader in groups, to supervise or influence others;
- 40 7) Denegation: desire or tendency to submit passively to external force;  
41 accept disgrace, punishment and guilt; resign themselves to fate, admit  
42 inferiority, error and failure; desire for self-destruction, pain,  
43 punishment, disease and disgrace;  
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- 45 8) Performance: characterized by ambition and commitment, expressed by  
46 the desire to accomplish something difficult, such as mastering,  
47 manipulating and organizing objects, people and ideas; subjects like to  
48 do things independently and as quickly as possible, stand out, overcome  
49 obstacles and maintain high standards of achievement;  
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- 51 9) Exhibition: vanity, desire to impress, to be heard and seen; the individual  
52 likes to fascinate people and even shock them, dramatizing the facts to  
53 impress and entertain;  
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- 10) Aggression: characterized by anger, irritation, hatred and desire to overcome with force the opposition; the subjects like to fight, attack, insult, censor and ridicule others;
- 11) Order: tendency to put all things in order, keeping cleanliness, organization, balance and precision;
- 12) Persistence: need to complete any work started by as difficult as it may seem;
- 13) Change: need to do new and different things, to travel;
- 14) Autonomy: need of independence, unconventional;
- 15) Heterosexuality: need to be regarded as attractive to the opposite sex.

### Calculation of sample size and statistical methodology

For each explanatory variables (for example, morning shift, in the category of doctors) the sample size was obtained using a method previously described <sup>21</sup>, considering different numbers of individuals, number of evaluations per individual, coefficient between intraindividual observations, and expected probabilities of correct execution of the recommended practices.

Were adopted a margin of error of 10% and a coefficient of confidence of 95%.

The sample size defined is presented in Supplemental material.

Descriptive statistics were used to present proportions of adherence to each practice for the entire group of HCW and for each professional category.

The association between the results of the psychological evaluation (scores) and the proportion of compliance was evaluated using logistic regression models with random effects <sup>22</sup>.

The following models were evaluated:

- 1) Association between the adherence of doctors to hand hygiene (HH) and psychological tests, controlling for demographic variables.
- 2) Association between compliance of the nursing team to skin antisepsis during CVC dressing and disinfection CVC hub, and psychological tests, controlling for demographic variables.
- 3) Association between compliance of the nursing team to HH before CVC manipulation and CVC dressing and psychological tests, controlling for demographic variables.



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3 The sample size calculation and statistical analyses were performed at the Center  
4 for Applied Statistics (CEA) of the Institute of Mathematics and Statistics of the  
5 University of São Paulo, Brazil.  
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For Review Only

## RESULTS

There were 7,572 observations in the 4 ICUs. The observations involved 53 nurses, 93 doctors, 34 nursing technicians, and 68 nursing assistants.

Table 1 shows the frequency of compliance of the nursing team to the observed practices.

**Table 1** – Frequency of compliance of the nursing team to infection control measures, by professional category, Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

Stages of the procedure	Proportion of compliance in percentage (Number of Agreements / Observations)			
	Nurse	Nurse technician	Nurse assistant	Total
<b>Procedure</b>				
<b>Manipulation of central venous catheter</b>				
Hand hygiene before procedure	15.6 (136/872)	11.4 (102/895)	13.2 (197/1.496)	13.3 (435/3.263)
Use of gloves during the procedure	97.1 (847/872)	96.6 (865/895)	94.1 (1408/1496)	95.6 (3.120/3.263)
Disinfection of the hub with alcohol	60.8 (530/872)	49.1 (439/895)	63.2 (945/1496)	58.7 (1.914/3.263)
Hand hygiene after procedure	86.2 (752/872)	78.8 (705/895)	82.4 (1.232/1.496)	82.4 (2.689/3.263)
<b>Procedure</b>				
<b>Central venous catheter dressing</b>				
Hand hygiene before	18.5 (94/509)	9.6 (15/156)	10.6 (41/388)	14.2 (150/1.053)
Use of sterile gloves	100.0 (509/509)	98.1 (153/156)	99.7 (387/388)	99.6 (1.049/1.053)
Antisepsis of the dressing site	95.5 (486/509)	89.7 (140/156)	86.1 (334/388)	91.2 (960/1.053)
Hand hygiene after procedure	99.8 (508/509)	96.2 (150/156)	99.5 (386/388)	99.1 (1.044/1.053)

Table 2 shows the frequency of compliance with hand hygiene of the doctors.

**Table 2** - Frequency of compliance of doctors to hand hygiene during the five moments proposed by the World Health Organization (WHO) according to the intensive care unit. Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

<b>Proportion of compliance in percentage (Number of Agreements / Observations)</b>					
<b>Intensive care unit</b>					
<b>Moments</b>	<b>Infectious Diseases</b>	<b>Clinical Emergency</b>	<b>Medical / Pneumology</b>	<b>Surgical</b>	<b>TOTAL</b>
Before touching a patient	0.9 (5/ 548)	3.0 (8/268)	64.8 (81/125)	10.6 (18 /170)	10.1 (112/1111)
After touching a patient	94.8 (511/539)	95.2 (236/248)	90.8 (89 /98)	64.1 (41/64)	92.4 (877/949)
After touching a patient's surroundings	16.8 (36/214)	21.9 (28/128)	7.2 (7 /97)	5.1 (11/217)	12.5 (82/656)
Before clean/aseptic procedure	38.6 (27/70)	43.2 (16/37)	100.0 (84/84)	100.0 (105/105)	78.4 (232 /296)
After body fluid exposure	98.5 (67/68)	85.7 (24/28)	100.0 (46 /46)	100.0 (102 /102)	98.0 (239/244)
<b>TOTAL</b>	44.9 (646/1439)	44.0 (312 /709)	68.2 (307 /450)	42.1 (277 /658)	47.4 (1542/3256)

. After the observation stage, the psychological tests were performed in 166 of the 248 HCW observed.

Table 3 shows the demographic characteristics of the individuals who underwent psychological testing.

Table 3- Demographic characteristics of healthcare workers (HCW) who underwent psychological tests according to the Intensive Care Units (ICU), Central Institute of Hospital das Clínicas, University of São Paulo (July 2012 to December 2013) .

Characteristics	Total number of HCW n=166	ICU			
		Infectious Diseases n= 47	Clinical Emergency n= 65	Medical / Pneumology n=56	Surgical n= 80
<b>Age (years)</b>					
Mean (standard deviation)	37.8 (9.3)	33.9 (8.4)	36.7 (9.2)	41.2 (8.4)	39.1 (9.4)
Median (range) n= 165*	36 (23-63)	31(23-56)	35 (25-55)	41(27-57)	38 (24-63)
<b>Male</b>	45 (27.1%)	7 (15.6%)	16(35.5%)	10 (22.2%)	12 (26.7%)
<b>Profession</b>					
Doctor	42 (25.3%)	17(40.5%)	16 (38.1%)	5 (11.9%)	4 (9.5%)
Nurse	43 (25.9%)	2 (4.6%)	14 (32.6%)	11 (25.6%)	16 (37.2%)
Nursing technician	23 (13.9%)	6 (26.1%)	4 (17.4%)	2 (8.7%)	11 (47.8%)
Nursing assistant	58 (34.9%)	7 (12.1%)	15 (25.9%)	22 (37.9%)	14 (24.1%)
<b>Formal education (n:164)*</b>					
High school	46 (28%)	8 (17%)	9 (20%)	17 (37%)	12 (26%)
Incomplete university education	22 (13%)	7 (32%)	6 (27%)	2 (9%)	7 (32%)
University degree	41 (25%)	10 (24%)	17 (41%)	7 (17%)	7 (17%)
Incomplete post- graduation	17 (10%)	4 (24%)	6 (35%)	4 (24%)	3 (18%)
Postgraduate	38 (23%)	3 (8%)	10 (26%)	9 (24%)	16 (42%)
<b>Civil status (n:162)*</b>					
Married	72 (44%)	11 (15%)	19 (26%)	20 (28%)	22 (31%)
Single	78 (48%)	20 (26%)	25 (32%)	13 (17%)	20 (26%)
Divorced	10 (6%)	1 (10%)	4 (40%)	4 (40%)	1 (10%)
Widowed	2 (1%)	0 (0%)	1 (50%)	1 (50%)	0 (0%)

\*: number of individuals for whom information was available.

There were no significant differences between the proportion of adherence to the infection control practices of the HCW who underwent psychological testing and those who did not (data not shown).

Tables 4 to 9 present the results of the psychological evaluations.

**Table 4** - Distribution of the Thought Style evaluation according to professional category, Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

Professional category (n)	Thought style analysis scores					
	Rational Style Analysis	Rational ability	Rational Favorability	Experiential Style Analysis	Experiential Favorability	Experiential ability
Doctors (42)						
Mean (standard deviation)	57.2 (4,1)	26.6 (3,3)	28.7 (2,3)	61.6 (5.1)	27.4 (2,9)	34.2 (3.5)
Median (range)	57.0 (47-66)	26.0 (17-34)	29.0 (23-35)	62.0 (50-74)	27.0 (22-36)	35.0 (27-43)
Nurses (43)						
Mean (standard deviation)	57.5 (5.4)	27.1 (3,0)	28.4 (4.1)	60.1 (12,0)	27.8 (4.0)	33.8 (4.5)
Median (range)	58.0 (44-69)	28.0 (18-32)	28.0 (18-38)	62.0 (0-74)	28.0 (17-36)	35.0 (24-44)
Nurse assistants (58)						
Mean (standard deviation)	59.1 (7.0)	28.2 (3.9)	28.4 (5.2)	61.7 (8,0)	28.6 (3,9)	33.1 (5.5)
Median (range)	59.0 (42-80)	28.0 (20-42)	28.0 (16-39)	63.0 (34-81)	29.0 (14-38)	33.5 (20-48)
Nurse technicians (23)						
Mean (standard deviation)	59.5 (5.9)	28.6 (4.2)	28.7 (3.9)	64.7 (8.4)	29.7 (3.9)	35.0 (5.5)
Median (range)	59.0 (43-71)	28.0 (20-40)	29.0 (21-36)	66.0 (50-81)	29.0 (20-38)	33.0 (25-44)
<b>TOTAL (166)</b>						
Mean (standard deviation)	58.3 (5.8)	27.5 (3.6)	28.5 (4.1)	61.7 (8.7)	28.3 (3.7)	33.8 (4.8)
Median (range)	58.0 (42-80)	28.0 (17-42)	28.5 (16-39)	62.0 (0-81)	28.0 (14-38)	34.0 (20-48)

**Table 5** - Distribution of the self-esteem evaluation, categorized as low, normal and high, according to professional category, Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

Professional category (n)	Self esteem		
	Low	Normal	high
Doctors (42)	3 (7.1%)	24 (57.1%)	15 (35.7%)
Nurses (43)	2 (4.7%)	24 (55.8%)	17 (39.5%)
Nurse assistants (58)	2 (3.4%)	30 (51.7%)	26 (44.8%)
Nurse technicians (23)	1 (4.3%)	12 (52.2%)	10 (43.5%)
<b>TOTAL: (166)</b>	<b>8 (4.8%)</b>	<b>90 (54.2%)</b>	<b>68 (41.0%)</b>

**Table 6** - Distribution of quality of life assessment scores according to professional category, Central Institute of Hospital das Clínicas, University of São Paulo (July 2012 to December 2013).

WHOQOL						
Quality of life assessment scores						
Professional category (n)	Domain I- Physical	Domain II- Psychological	Domain III- Social relations	Domain IV - Environment	Overall quality of life	General perception of health
Doctors (42)						
Mean (SD)	15.0 (2.8)	14.5 (2.4)	14.4 (3.2)	13.6 (1.6)	13.6 (3.2)	14.2 (2.0)
Median (range)	15.1 (6.3-20.0)	14.7 (9.3-18.7)	14.7 (5.3-20.0)	13.8 (9.5-17.5)	14.0 (6-20)	14.2 (8.5-18.3)
Nurses (43)						
Mean (SD)	14.7 (1.9)	14.6 (2.4)	14 (2.4)	12.7 (2.0)	14.2 (3.0)	13.9 (1.8)
Median (range)	14.9 (10.3-20.0)	15.0 (9.3-19.3)	14.7 (8.0-18.7)	12.8 (8.5-17.5)	14.0 (6.0-20)	14.2 (9.8-18.2)
Nurse assistants (58)						
Mean (SD)	14.6 (2.1)	15.5 (1.9)	14.7 (1.9)	11.8 (2.0)	14.3 (2.9)	13.9 (1.6)
Median (range)	14.9 (10.9-18.3)	15.3 (12.0-19.3)	14.7 (9.3-18.7)	12.0 (7.5-16.5)	15.0 (6.0-20.0)	13.7 (10.3-17.5)
Nurse technicians (23)						
Mean (SD)	15.2 (2.2)	15.7 (2.1)	15.6 (2.5)	12.5 (2.4)	15.7 (1.7)	14.5 (1.9)
Median (range)	14.9 (10.9-20.0)	16.0 (10.0-18.7)	16.0 (10.7-20.0)	12.5 (8.0-18.5)	16.0 (12.0-18.0)	15.1 (10.0-19.1)
<b>TOTAL (166)</b>						
Mean (SD)	14.8 (2.3)	15.0 (2.3)	14.5 (2.5)	12.6 (2.1)	14.3 (2.9)	14.1 (1.8)
Median (range)	14.9 (6.3-20.0)	15.3 (9.3-19.3)	14.7 (5.3-20.0)	12.5 (7.5-18.5)	14.0 (6.0-20.0)	14.2 (8.5-19.1)

SD: standard deviation; WHOQOL: World Health Organization Quality of Life Group

**Table 7** - Distribution of psychological stress test results according to professional category. Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

Professional category (n)	Number of professionals who presented significant stress symptoms	Type of symptoms	
		Somatic	Psychological
Doctors (42)	20 (47.6%)	17 (40.5%)	25 (59.5%)
Nurses (43)	26 (60.5%)	24 (55.8%)	19 (44.2%)
Nurse assistants (58)	30 (51.7%)	27 (46.6%)	31 (53.4%)
Nurse technicians (45)	15 (65.2%)	10 (43.5%)	13 (56.5%)
<b>TOTAL (166)</b>	<b>91 (54.8%)</b>	<b>78 (47.0%)</b>	<b>88 (53.0%)</b>

**Table 8** - Distribution of psychological stress test results according to the professional category and the stage of stress. Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

Professional category (n)	Number of professionals in each stage of stress				
	Alert	Resistance	Almost exhaustion	Exhaustion	Not present
Doctors (42)	2 (4.8%)	15 (35.7%)	2 (4.8%)	1 (2.4%)	22 (52.4%)
Nurses (43)	5 (11.6%)	17 (39.5%)	4 (9.3%)	0 (0.0%)	17 (39.5%)
Nurse assistants (58)	3 (5.2%)	24 (41.4%)	3 (5.2%)	0 (0.0%)	28 (48.3%)
Nurse technicians (23)	3 (13.0%)	11 (47.8%)	1 (4.3%)	0 (0.0%)	8 (34.8%)
<b>TOTAL: (166)</b>	<b>13 (7.8%)</b>	<b>67 (40.4%)</b>	<b>10 (6.0%)</b>	<b>1 (0.6%)</b>	<b>75 (45.2%)</b>

**Table 9** - Distribution of psychological test scores of the Factorial Inventory of Personality according to professional category, Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

	Scores of the Factorial Inventory of Personality									
	Doctors (n=42)		Nurses (n=43)		Nurse assistants (n=58)		Nurse technicians (n=23)		TOTAL (n=166)	
	Mean (SD)	Median (range)	Mean (SD)	Median (range)	Mean (SD)	Median (range)	Mean (SD)	Median (range)	Mean (SD)	Median (range)
<b>Motive/Need</b>										
Nurturance	47.4 (5.9)	47.0 (32-61)	47.1 (6.4)	47.0 (26-58)	46.6 (7.1)	47.0 (28-61)	49.0 (7.6)	49.0 (36-63)	47.3 (6.7)	47.0 (26-63)
Intracception	44.5 (7.8)	43.5 (22-60)	43.4 (7.7)	44.0 (27-60)	39.4 (8.2)	42.0 (18-57)	43.0 (7.1)	44.0 (25-57)	42.2 (8.1)	43.0 (18-60)
Succorance	40.3 (8.7)	42.5 (9-59)	38.1 (9.7)	40.0 (12-56)	36.3 (7.3)	36.0 (12-49)	38.4 (7.5)	37.0 (23-55)	38.1 (8.4)	39.0 (9-59)
Deference	44.9 (6.8)	44.5 (28-57)	46.1 (7.3)	47.0 (26-59)	45.0 (7.1)	46.0 (27-61)	46.0 (6.1)	47.0 (33-59)	45.4 (6.9)	46.0 (26-61)
Affiliation	49.5 (6.5)	50.0 (36-62)	49.7 (6.4)	50.0 (27-61)	50.0 (6.3)	50.0 (36-63)	50.6 (7.3)	50.0 (38-63)	49.9 (6.5)	50.0 (27-63)
Dominance	36.3 (9.3)	38.0 (9-52)	34.8 (8.1)	34.0 (17-50)	26.1 (8.3)	26.0 (9-45)	29.6 (9.5)	29.0 (9-51)	31.4 (9.7)	32.0 (9-52)
Denegation	37.7 (6.1)	39.0 (21-52)	34.7 (7.2)	35.0 (18-48)	32.8 (7.8)	32.0 (16-50)	35.1 (5.8)	37.0 (24-44)	34.9 (7.2)	35.0 (16-52)
Performance	48.9 (7.7)	47.5 (31-63)	47.2 (6.8)	48.0 (30-58)	44.5 (8.3)	44.0 (25-61)	47.0 (6.9)	46.0 (36-58)	46.7 (7.7)	46.0 (25-63)
Exhibition	34.7 (7.9)	34.0 (20-56)	30.4 (9.3)	31.0 (9-46)	26.1 (10.1)	25.0 (9-49)	31.3 (8.6)	32.0 (14-52)	30.1 (9.7)	30.0 (9-56)
Aggression	28.2 (8.6)	28.0 (13-44)	27.0 (7.6)	25.0 (12-43)	24.8 (9.5)	23.0 (9-56)	26.1 (7.2)	27.0 (14-37)	26.4 (8.5)	25.0 (9-56)
Order	40.9 (10.6)	40.0 (18-63)	46.8 (6.6)	46.0 (34-63)	48.6 (7.5)	48.0 (27-63)	48.2 (6.2)	47.0 (39-62)	46.1 (8.6)	47.0 (18-63)
Persistence	45.4 (6.4)	45.0 (28-63)	44.8 (6.1)	45.0 (30-60)	46.1 (7.3)	46.0 (29-60)	45.9 (6.0)	48.0 (31-54)	45.6 (6.5)	45.0 (28-63)
Change	45.4 (6.0)	46.0 (34-58)	42.8 (8.0)	43.0 (18-55)	40.1 (8.2)	39.5 (21-60)	41.9 (8.7)	41.0 (25-58)	42.4 (7.9)	43.0 (18-60)
Autonomy	42.5 (6.8)	42.5 (29-59)	41.3 (6.0)	41.0 (28-54)	40.7 (8.2)	41.0 (23-54)	40.8 (8.2)	41.0 (25-54)	41.3 (7.3)	42.0 (23-59)
Heterosexuality	43.5 (8.2)	44.0 (26-62)	36.5 (10.7)	38.0 (12-55)	32.0 (11.3)	32.0 (12-54)	33.5 (10.5)	32.0 (10-53)	36.3 (11.2)	38.0 (10-62)

Tables 10 to 12 present the final models with the variables significantly associated with compliance of HCW to infection control practices.



**Table 10** - Odds of compliance to hand hygiene, estimated by logistic regression with random effects with 95% confidence intervals (95%CI), for doctors aged 30 years and an Aggression score of 27. Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

Intensive Care Unit	Self esteem	Moments	Odds	95% CI
Infectious Diseases Clinical Emergency and Surgical	Low / Normal	Before touching a patient	0.02	(0.01; 0.04)
		After touching a patient's surroundings	0.11	(0.07; 0.18)
		Before clean/aseptic procedure	0.96	(0.59; 1.58)
		After body fluid exposure/ After touching a patient	22.26	(13.27; 37.32)
	High	Before touching a patient	0.04	(0.02; 0.08)
		After touching a patient's surroundings	0.21	(0.12; 0.36)
		Before clean/aseptic procedure	1.83	(1.02; 3.28)
		After body fluid exposure/ After touching a patient	42.17	(22.89; 77.68)
Medical / Pneumology	Low / Normal	Before touching a patient	0.19	(0.07; 0.51)
		After touching a patient's surroundings	0.91	(0.35; 2.39)
		Before clean/aseptic procedure	8.04	(2.97; 21.79)
		After body fluid exposure/ After touching a patient	185.59	(66.98; 514.26)
	High	Before touching a patient	0.36	(0.14; 0.91)
		After touching a patient's surroundings	1.72	(0.67; 4.4)
		Before clean/aseptic procedure	15.24	(5.66; 41.02)
		After body fluid exposure/ After touching a patient	351.62	(127.29; 971.33)

For each year added to the median age (30 years), the odds of hand hygiene is multiplied by 1.11. For each increase of one point in the median aggression score (27) the odds of hand hygiene is multiplied by 1.06.

The results indicate that the odds of adherence to hand hygiene for doctors are associated with age, aggression score, self-esteem, the ICU, and the moment of hand hygiene.

To interpret table 10 it is necessary to observe that each year added to the median age (30 years) of the doctor, multiplies the odds of hand hygiene by 1.11; and each point above the median aggression score (of 27) multiplies the odds of hand hygiene by 1.06. Based on the odds presented in Table 10, it is possible to calculate odds ratios. For example, Doctor A who works in the Infectious Diseases ICU is 30 years-old with an aggression score of 27. He has low self-esteem so his odds of compliance with hand hygiene before touching a patient is 0.02. However, a similar doctor (Doctor B) in the same ICU with high self-esteem has an odds of 0.04. Thus the odds of Doctor B performing hand hygiene is twice that of Doctor A (0.04/0.02). Furthermore, for a doctor in identical conditions as Doctor A aged 31, the odds of hand hygiene is 0.022 (0.02 x 1.10).

The odds of compliance are higher for doctors who have high self-esteem and perform their activities in the Medical / Pneumology ICU.

**Table 11** - Odds of compliance with antisepsis of the skin during central venous catheter (CVC) dressing and disinfection of the CVC hub, estimated by logistic regression with random effects with 95% confidence intervals (95%CI), for nursing professionals with an Nurturance score of 47, a Deference score of 47, and a Succorance score of 38. Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

Intensive Care Unit	Marital status	Skin antisepsis at the dressing site		Disinfection of the CVC hub	
		Odds	95% CI	Odds	95% CI
Infectious Diseases	Other*	1.46	(0.89; 2.39)	0.26	(0.17; 0.40)
	Single	2.00	(1.20; 3.33)	0.36	(0.23; 0.56)
Clinical Emergency	Other*	6.96	(4.72; 10.28)	1.24	(0.92; 1.67)
	Single	9.52	(6.26; 14.46)	1.69	(1.21; 2.37)
Medical / Pneumology and Surgical	Other*	13.58	(9.94; 18.54)	2.41	(1.94; 3.01)
	Single	18.55	(12.87; 26.73)	3.30	(2.46; 4.42)

\*: married, widowed or divorced; For each point above the median Nurturance score (47) the odds of compliance is multiplied by 0.95; for each point above the median Deference score (47) odds is multiplied by 1.05; for each point above median Succorance score (38) odds is multiplied by 0.98

The odds of a nursing professional of complying with skin antisepsis at the dressing site or to disinfection of the CVC hub during manipulation was directly associated with the score of Deference, and negatively associated with scores of Nurturance and Succorance. Furthermore, the unit in which the HCW worked and his/her marital status were also associated with compliance. Being single increased the odds of compliance.

**Table 12-** Odds of compliance with hand hygiene before dressing/manipulating central venous catheters, estimated by logistic regression with random effects with 90% confidence intervals (90%CI), for Nursing professionals with an Affiliation score of 50. Central Institute of Hospital das Clinicas, University of São Paulo (July 2012 to December 2013).

<b>Intensive Care Unit</b>	<b>Odds</b>	<b>90% CI</b>
Infectious Diseases	0.004	(0.001; 0.014)
Surgical	0.100	(0.082; 0.122)
Medical / Pneumology	0.212	(0.176; 0.256)
Clinical Emergency	0.281	(0.234; 0.337)

For each increase of one point in the median Affiliation score (50), the odds hand hygiene before performing the dressing / manipulation of the central venous catheter is multiplied by 0.98.

The odds of a nursing professional of complying with hand hygiene prior to performing the dressing / manipulation of the CVC, is associated with the HCW's unit and inversely associated with his/her Affiliation score.

There were no significant associations between compliance with to infection control practices and styles of thinking, quality of life or stress.

## DISCUSSION

Our study shows very low compliance rates with preventive practices during CVC dressing and manipulation among the nursing staff. It also shows that compliance with hand hygiene among doctors is very low. Compliance with preventive measures was associated with the unit in which the HCW worked; with sociodemographic variables such as age and marital status; and with psychological characteristics such as self-esteem and personality needs such as Aggression, Deference, Succorance, Nurturance and Affiliation.

In spite of having knowledge on healthcare associated infections, their risk factors and prevention, compliance with preventive measures has been shown to be low among HCW<sup>2</sup>. There are several scientifically based guidelines, however, compliance with these guidelines remains a major challenge<sup>23</sup>.

An evaluation of 65 global studies on compliance with hygiene of hands guidelines in the ICU found a general compliance rate of 30-40% and concluded that non-compliance with hand hygiene guidelines is a universal problem. The study also stated that, to develop successful interventions, more research into the behavioral determinants of hand hygiene non-compliance is needed<sup>24</sup>. This was the aspect that motivated our study.

In our study, among the nursing staff, nurse technicians were the category with lowest compliance. In a recent study on precautionary practices in intensive care units, the category of nurse technicians had below-average adherence in relation to the other categories<sup>25</sup>. This is especially important in our environment because this category has the largest direct contact with patients, as RN are often burdened with administrative duties.

Among the nursing staff there was an association between compliance with infection control practices and personality motives or needs. The personality theorist Murray uses the concept of needs to explain the motivation and functioning of behavior<sup>26</sup>. The physical, biological, psychological and sociocultural factors bring together tendencies innate and experiences acquired in the course of existence, conferring an identity and a pattern of behaviors unique and own to each individual<sup>27</sup>. Each individual presents a personality, a way of acting and thinking, offering subjectivities that lead to a better performance in the organizational environment<sup>28</sup>. According to this theorist, the personality aspects are controlled by the individual's cerebral physiology and involve an idea of the reduction of tension<sup>26</sup>. A need is often brought about directly by certain internal processes; but more often by the occurrence of one of the few effective common pressures - forces of the environment. Necessity causes the body to avoid shock by responding to certain pressures. Regardless of how it presents itself and its durability, it becomes a manifest behavior, which changes the initial circumstance, promoting pacification for the organism<sup>26</sup>.

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3 Deference was directly associated with the odds of performing antisepsis during  
4 CVC dressing and disinfection of the CVC hub. There was a negative association  
5 between compliance and Nurturance and Succorance scores. The need for Nurturance is  
6 related to desires and feelings of compassion and tenderness, the need to render  
7 solidarity to the defenseless and abandoned people. Although it does seem to be an  
8 important personality trait for HCW, it has been pointed out that high scores on this  
9 need lead to emotional vulnerability and stress due to intensive contact with the patient  
10 <sup>29, 30</sup>. This may hamper their performance. This fact may explain the negative  
11 association between high Nurturance scores and compliance. The need of Succorance  
12 reveals a tendency to seek support and protection. HCW with high scores in this need  
13 may expect to have their desires satisfied by dear people. They usually suffer from  
14 feelings of anxiety, of abandonment, insecurity and despair <sup>26, 29</sup>. This may lead to  
15 greater wear and tear, and may compromise the nurturance provided. People with high  
16 scores in Deference are characterized by showing respect, admiration, and reverence for  
17 their superiors <sup>26</sup>. It makes sense that HCW with these characteristics would strive to  
18 adhere to the institution's guidelines as a way of respect to their superiors. Therefore, it  
19 makes sense that the higher the Deference score, the greater the odds of compliance.  
20 Another finding was the inverse association between compliance with hand hygiene of  
21 the nursing staff and Affiliation scores. According to Murray, this need is related to the  
22 desire to give and receive affection, attachment and loyalty to friends, and to keep  
23 people around them. People who are in stressful situations tend to have high affiliation  
24 scores <sup>31,32</sup>. The search for support in others can be perceived by the HCW as weakness,  
25 hindering the search for partnership, help and support between peers. This may affect  
26 their performance and perhaps explain the negative association between compliance  
27 with hand hygiene and high scores of Affiliation.  
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35 Marital status was associated with adherence, and compliance was higher in  
36 singles. This is a difficult result to explain. Nursing is a continuous activity, performed  
37 over 24 hours, with unusual or rotational schedules, in a shift system, including night  
38 shifts. It usually comprises extensive weekly workload, including weekends and  
39 holidays <sup>33</sup>. There are professionals who are unmotivated because of work overload and  
40 feel unable to complete all tasks, without time to reflect on what they are doing. Given  
41 this scenario, we can speculate that the single HCW may have more time and less worry  
42 with family issues, allowing for greater focus and investment in professional career,  
43 thus reflecting in greater involvement and better performance.  
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48 Among doctors, compliance with hand hygiene was directly associated with age,  
49 Aggression score, self-esteem, the unit, and specific moments of hand hygiene.  
50 Aggression is one of the personality motives and involves a necessity to overcome  
51 opposition with strength and vigor. Studies show that medical training includes an  
52 overload of care and work, in addition to sleep deprivation. It has also been shown that,  
53 over time, physicians feel more adapted and experience satisfaction with their  
54 professional choice, feeling safer and more competent <sup>34</sup>. They may start to direct their  
55 need for aggression towards improving their professional performance, thus explaining  
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3 a positive association between the aggression score and compliance. Another study,  
4 which evaluated the personality of physicians<sup>29</sup>, reported that low scores of aggression  
5 contributed to emotional vulnerability, since people with low scores are not willing to  
6 fight and defend their interests. The study states that, for a doctor, this characteristic is  
7 necessary for a quick decision-making.  
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10 The age of the doctors was associated with compliance with hand hygiene. This  
11 may be explained by professional maturity reached over the years. One study shows that  
12 there are stressful factors inherent to young professionals, such as search for  
13 independence and autonomy in relation to parents, conflicts between work and leisure,  
14 and conflicts related to relationships. Young doctors may have fear of mistakes and  
15 difficulty to manage the large bulk of medical knowledge. Over time, medical  
16 professionals feel more confident and competent, thus improving performance<sup>34</sup>. This  
17 may be reflected in improved compliance with hand hygiene.  
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20 There was also an association between compliance to hand hygiene of doctors  
21 and their self-esteem. Doctors with high self-esteem practically have twice the odds of  
22 compliance when compared with doctors with low or normal self-esteem. This  
23 association can be seen as expected because studies show that the individual with high  
24 self-esteem feels confident, competent and as possessing personal value. High self-  
25 esteem has also been associated with the choice, persistence, and success of health-  
26 related behaviors<sup>35, 36</sup>.  
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30 The superiority of adherence to the infection control practices observed in the  
31 Clinical/ Pneumology ICU is probably due to the fact that over the previous years this  
32 unit has received several educational interventions<sup>37, 38</sup>. It cannot be overlooked that  
33 educational interventions, in particular continuous educational work, are one of the most  
34 important measures for the maintenance of good practices<sup>39</sup>. In this ICU, infection  
35 control receives importance from the medical and nursing leadership.  
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40 This study has limitations, mainly due to the complexity of the phenomena  
41 studied and constraints of the methods employed. The use of cross-sectional design  
42 carried out in a single institution for a limited period of time restricts comparative  
43 analysis with other investigations. In addition, the paucity of national and international  
44 studies in this field limited the discussion and comparison of results. On the other hand,  
45 as a strong point our study used standardized and validated measurement tools for all  
46 the variables investigated. Another strong point was to conduct observations of HCW  
47 without their knowledge, which seems to have worked due to the low adherence rate to  
48 many of the observed practices.  
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53 The results of our study demonstrate the need to develop new strategies to  
54 ensure lasting compliance with infection control practices. Identifying professional  
55 categories and units with low compliance can direct the development of strategies.  
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5 Factors such as personality needs and self-esteem, are capable of generating  
6 behaviors that influence compliance of HCW with infection control practices. Our study  
7 can serve as basis for infection control teams to develop successful prevention and  
8 control strategies focused on the technical and biological aspects; and to choose  
9 appropriate alternatives to enable the development of HCW according to desired  
10 behaviors.  
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14 There is an increased interest in personality testing for the work environment  
15 due to the belief in their relation with professional performance. There is a growing  
16 body of evidence confirming that personality motives are logically, statistically, and  
17 significantly related to success in professional practice <sup>40</sup>.  
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20 In conclusion, we believe that we have identified relevant factors to explain  
21 compliance of HCW with infection prevention and control practices: aspects of  
22 personality and self-esteem. This can contribute to the development of actions aimed at  
23 improving practice, such as educational strategies carried out by a multidisciplinary  
24 team with a holistic view of the HCW and focused both on technical aspects and  
25 biopsychosocial aspects. Behavioral changes and greater involvement will probably on  
26 the quality of care provided. We believe that personality and self-esteem as cognitive  
27 determinants of compliance with infection control practices can be a fertile field for  
28 future research.  
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