

# Hand hygiene in health care settings: the citizens' point of view

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**Abstract.** *Background and aim:* The infection risk prevention is one of the main objectives of all health and sanitary systems, since the reduction of the healthcare associated infections is attainable goals through appropriate prevention strategies. Among these, proper hand hygiene of health care professionals and citizens (visitors/outpatients/caregivers, volunteers) is fundamental to reduce the spreading of micro organisms and prevent infections. The purpose of the study is indeed to explore the self-reported hand washing behavior of citizens who access to health facilities and the variables involved in it, using in particular the Theory of Planned Behaviour. *Method:* A quantitative research was lead using an anonymous questionnaire, filled out online by 195 citizens (53.6% Female). In the survey were included all the associations of volunteers, relatives and caregivers who cooperate in health care settings of Emilia Romagna Region (Italy). *Results:* This study has shown that hand hygiene is influenced by different socio-demographic (e.g. gender, age, education) and socio-cognitive variables (intention, attitude, subjective norms, control beliefs). In particular, citizens have a favorable attitude toward hands hygiene in healthcare settings, but they wash their hands more frequently in other contexts or in case of global infectious diseases. *Conclusion:* The study confirms that the Theory of Planned Behavior adequately explains the hand hygiene behavior in health care settings. Furthermore the threat of infection has a significant impact both on the intention and on the behavior. The results mostly interested those are involved in infectious risk giving the opportunity to intervene with targeted programs for the citizenship.

**Key words:** hand hygiene, citizens, theory of planned behavior, risk perception, healthcare facility

## Background

In many countries, the diffusion of Multi-Drug Resistant Organisms (MDROs) has become a Public Health issue: treatment of infections caused by these MDROs is a constantly increasing problem.

The Report of the European Centre for Disease Prevention and Control (ECDC) shows that the situation is getting worse: in 13 countries out of 38 (Italy included) is reported an inter-regional diffusion of Carbapenemases-Producing Enterobacteriaceae (CPE), or an endemic situation (1). A major goal for

Health Care System is the infective risk reduction and prevention: the reduction of health care-associated infections (HAI) and antimicrobial resistance is possible only with an adequate prevention strategies and a correct antimicrobial stewardship. A careful use of antibiotics, an application of standard and additional precautions based on the specific way of transmission of each micro organism, are some prevention strategies. Others include environmental hygiene, implementation of structured prevention programs and infections control. Several studies have shown that the hand hygiene can reduce the infection rate and the germs cross

transmission. Educational and multimodal programs, including those ones recommended by World Health Organization (WHO), can increase the adherence to hand hygiene, reducing the HAI in industrialized and in developing countries. Unfortunately, despite the multiple promotional campaigns, hand hygiene is not still become a common or adequate practice in hospital (6). For example, the health professionals' adherence to hand hygiene remains low in most of the care settings (2): is less than 40% in hospitals and less than 20% in long term care facilities (7).

Several studies have also focused on patients' and visitors' hand hygiene (3, 8-13). Evidences have shown that hand hygiene practice does not reach satisfying standard levels (6, 9, 13), and in some settings the adherence to hand hygiene is still under the minimum acceptable level (12). Two reviews have shown that the involvement, the consciousness, the empowerment and the education of patients about the importance of hand hygiene are useful to improve the adherence (14, 15).

Many studies have investigated the patient's will and ability to request to health professionals to perform hand hygiene before treatment or assistance and the health care perception about the involvement of patients or visitors in hands hygiene. These studies showed that the patients were generally not at ease with asking the health care professionals if they had washed their hands. This feeling was mitigated if the patients felt "authorized" by a visual reminder or by an explicit invitation from the health professional: "Ask me to wash my hands" (16-24).

The patients' attitude to feel involved and their intention to ask to the health care professionals to sanitize their hands are also influenced by some socio-demographic variables (e.g. age, religion, gender, level of education) (18, 25, 26).

Similarly, the health care professionals, such as physicians or nurses, generally do not appreciate if the patient asking if their hands are sanitized. The reason of this could be found in the negative feeling associated to a negligence or in the concern in compromising the relationship with the patient (27, 28). Literature evidences also suggested that patients can be themselves a source of infections, and, in addition, the hand hygiene is influenced by the value that people give to this practice in everyday life. In this way the patients

with poor hygiene in domestic context are more likely to continue this behaviour in the hospital, while patients who are used to adequate hand hygiene (e.g. before eating, after using the toilet) (29), would probably maintain the same behaviour in the hospital.

Not only patients, but also visitors of the health care facilities, should actively participate in the hands hygiene programs implementation and in the prevention of HAI (4, 7, 30-33). They can be ally of health professionals and patients in the implementation of hand hygiene promotion strategies.

For example, a study in a ICU has shown that visitors are carriers of pathogenic micro organisms: Gram negative micro organisms and Methicillin-resistant *Staphylococcus aureus* (MRSA) were found on visitors' hands who had not sanitized their hands. Conversely, on the visitors who had sanitized their hands, were not detected micro organisms other than the normal skin flora (33).

The Health Organizations promote hand hygiene, for example, providing alcohol solution dispensers or accessible sinks, supplying sanitizing wipes on the meal tray or displaying the informational and educational posters (29, 34, 35). Also the introduction of visual or sound instruments increases attention to hand hygiene and the adherence to the hands washing (31, 34, 36-39). For example a study in a Neonatal Intensive Care has shown that an audio-visual display, with a written or spoken message concerning the hands washing, increased parents' adherence to hand hygiene (39). A significant improvement in adherence has been detected in visitors, especially introducing an audible reminder, at the opening of the lift or at the entrance of the units, which suggests the use of the alcoholic solution dispense (31). Similar results were achieved in both, employees and visitors, using an electronic dispenser equipped with flashing light at the entrance of a hospital (38), or posters hung near the hospital cafeteria (34), although other research has shown that the videos are more effective than posters (36).

The socio-cognitive models developed from the Social Psychology (40), including the "Theory of Planned Behavior" (41), are proved as particularly suitable to predict a variety of health behaviors, (e.g. smoking and using of contraceptives), such as that relating to the hand washing.

The central assumption of the model in its global variables is that the behavior is rationally determined from the intention. This intention is determined from:

- attitudes towards behavior, such as a set of convictions, beliefs, individual opinions;
- subjective norms, internalized by the individual, which correspond to the influence of the opinion of the important people for the individual, in making of his intention;
- perception of behavioral control, that represents the self-perceived ability to be able to perform some behavior.

The combination of attitude toward behavior, subjective norms and behavioral control, leads to the behavioral intention and, consequently, to the behavior itself.

In addition, several studies showed that also risk perception and past experiences of the visitors/citizens increase attention, interest and adherence to hand hygiene, as in case of a pandemic flu (42), of a previous HAI experience (43) or of during a visit to a relative especially susceptible to infection, mostly if visitors are parents of children hospitalized (39).

## Aims

Based on these premises, a quantitative research was implemented designed to:

1. measure the self-reported hand washing behavior of citizens (visitors/outpatients/caregivers, volunteers) who access to health facilities;
2. analyze if such personal habits to hand washing are influenced by the intention and this, in turn, is influenced by attitudes, subjective norms, perception of control (self-efficacy) as described by the Theory of Planned Behavior (41);
3. evaluate whether the threat of infective risk (e.g. previous HAI) has also an impact on intention to washing or on behavior itself;
4. analyze which socio-demographic variables, as suggested by the 2009 WHO guidelines, are significant in determining adherence to hand washing (e.g. gender, age, occupation, religion, washing education), as well as the context appropriateness perception (for information/

health education, availability of equipment/facilities) and the perception about health professionals, family and society hand washing;

5. explore the citizens' preferences and training needs about information and educational on hand washing.

## Method

### *Instrument*

A self-report questionnaire was constructed ad hoc based on the study's aims. The questionnaire, administered online, was accompanied by a letter with instructions and with privacy information. Constructs and items of the questionnaire are described in Table 1.

### *Participants*

*1. Recruitment.* In the survey were included the associations of volunteers, relatives and caregivers who cooperate in health and hospitals setting of the Emilia Romagna Region (Italy) that always were an active part in finding and implementing strategies aimed to hand hygiene (in hospital, social health and community setting). Participants were contacted electronically through the Volunteer Centers, which count 906 Associations in the 9 provinces of the Region. The recruitment choice was dictated by the desire not to interfere with the privacy of citizens who access to hospitals, and to reach the widest possible sample at the same time.

*2. Socio-demographic characteristics.* The questionnaire was filled out between December 2015 and February 2016 from 195 subjects (53.6% female). The middle age (46.78 years) showed a wide variability (SD=14.4, range 19-92 years; modal value=37 years). So were reconstructed 4 age groups that correspond to approximately 25% to 50% to 75 % and 100% of the sample (Table 2).

The 99% of the sample are Italian citizens (99%). 52.3% are married and 24.4% are single. The 50.3% have a high school diploma and 25.1% are university graduates. The 42.6% are employed, 15.3% retired. The 79.6% profess the Christian religion, while the 19.4% is non-believer. Most of the respondents live in the

**Table 1.** The questionnaire (variables, items and ranges)

Variables	Items																																													
Behaviour in general	<p><b>Personally I wash my hands</b></p> <p>(1) before meals never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(2) after using the toilet never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(3) after using public transports never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(4) after having touched surfaces that seem dirty never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(5) after having touched a sick/ill person never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(6) after having been in contact with animals never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(7) after having been in a health care facility (ex: hospital, health centre, medical clinic) never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(8) after having been in public places (ex: post office, cinema, supermarket, shop) never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(9) after having touched banknotes or coins never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p><b>For washing my hands at home I usually use ... (more than one answer possible)</b></p> <p>(1) water</p> <p>(2) soap</p> <p>(3) liquid soap</p> <p>(4) hypoallergenic soap</p> <p>(5) anti-bacterial soap</p> <p>(6) alcoholic sanitizing gel</p> <p>(7) other (please specify) _____</p> <p><b>For drying my hands at home I usually use ... (more than one answer possible)</b></p> <p>(1) my personal hand towel</p> <p>(2) hand towel shared with the family</p> <p>(3) disposable wipes</p> <p>(4) other (please specify) _____</p>																																													
Behaviour in health care facilities	<p><b>Personally I wash my hands in health care facilities</b> never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p><b>If I wash my hands in a health care facilities I usually use (more than one answer possible)</b></p> <p>(1) water</p> <p>(2) wet wipes</p> <p>(3) soap</p> <p>(4) sanitized alcoholic gel</p> <p>(5) other (please specify) _____</p>																																													
Attitude	<p><b>When I am in a health care facilities I think washing hands will be ...</b></p> <table border="0"> <tr> <td>unnecessary</td> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> <td>necessary</td> </tr> <tr> <td>not important</td> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> <td>important</td> </tr> <tr> <td>unhealthy</td> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> <td>healthy</td> </tr> <tr> <td>unpleasant</td> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> <td>pleasant</td> </tr> <tr> <td>difficult</td> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> <td>easy</td> </tr> </table>	unnecessary	1	2	3	4	5	6	7	necessary	not important	1	2	3	4	5	6	7	important	unhealthy	1	2	3	4	5	6	7	healthy	unpleasant	1	2	3	4	5	6	7	pleasant	difficult	1	2	3	4	5	6	7	easy
unnecessary	1	2	3	4	5	6	7	necessary																																						
not important	1	2	3	4	5	6	7	important																																						
unhealthy	1	2	3	4	5	6	7	healthy																																						
unpleasant	1	2	3	4	5	6	7	pleasant																																						
difficult	1	2	3	4	5	6	7	easy																																						

(continued)

**Table 1 (continued).** The questionnaire (variables, items and ranges)

	wrong uneconomic not desirable	1 2 3 4 5 6 7	right economic desirable
Normative beliefs	<p><b>I think hand washing in our society would be</b> Very little practiced 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much practiced</p> <p><b>I think hand washing in my personal surroundings would be ....</b> (ex: family members, friends, known people) Very little practiced 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much practiced</p> <p><b>I think that in health care facilities the hands are washed by ...</b> (1= very little; 6 = very much)</p> <p>(1) physicians very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(2) nurses very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(3) health care workers very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(4) patients very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(5) family members and visitors very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p>		
Subjective norm	<p><b>For me hand hygiene is important</b> I completely disagree with 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 I completely disagree with</p>		
Intention	<p><b>Next time I am in a health care facilities I believe that I will wash my hands</b> I completely disagree with 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 I completely disagree with</p>		
Behaviour belief	<p><b>I think that hand washing in health care facilities restrict the risk of spread of illness</b> I completely disagree with 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 I completely disagree with</p>		
Control belief	<p><b>I know the procedure to wash my hands correctly</b> very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p>		
Perception of the context	<p><b>I think that health care facilities are predisposed to favour correct hand washing practices</b> ( ex: accessibility to the bathrooms, availability of soap and napkins) Little predisposed 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much predisposed</p> <p><b>In the health care facilities I have found tools that inform about hand washing practices (ex: booklets, posters, brochures)</b> never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p><b>In the health care facilities the professionals (ex: physicians, nurses, healthcare workers) adequately educate about hand washing practices</b> very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p>		
Perception of control	<p><b>I personally feel I am able to implement correct hand hygiene practices in health care facilities</b> I completely disagree with 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 I completely disagree with</p>		
Personal education	<p><b>About hand hygiene, I have been educated</b></p> <p>(1) by my family very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(2) by friends or acquaintance very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(3) by the teachers of the nursery school (kindergarten, elementary school) very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(4) by the teachers of high school or grammar school</p>		

(continued)

**Table 1 (continued).** The questionnaire (variables, items and ranges)

	<p>very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(5) from the university docents or during courses of formation (master, specialisation)                  very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(6) by mass media (internet, tv, radio, magazine)                  very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(7) by the family doctor                  very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p>(8) by health care professionals (ex: nurses, physicians, healthcare workers)                  very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p>
Training needs	<p><b>I feel the necessity to have more information about the importance of hand washing</b>                  very little 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 very much</p> <p><b>I would want to be more informed through ... (more than one answer possible)</b></p> <p>(1) internet                  (2) radio                  (3) television                  (4) magazines/newspapers                  (5) informative brochures distributed in the health care settings (ex: waiting rooms, hospital entrance, wards, outpatient clinic)                  (6) informative brochures distributed in other environments (ex: supermarket, shops, pharmacy, public traffic)                  (7) health professionals (ex: physicians, nurses)                  (8) specialization courses                  (9) other (please specify)</p>
Personal experiences and perception of the risk	<p><b>I wash my hands more frequently since I, a family member or an acquaintance caught an infection in health care facilities</b>                  (1) yes, (2) no; (3) I have never had</p> <p><b>I wash my hands with more frequency n case of ... (1 = never, 6= always)</b></p> <p>(1) seasonal flu                  never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(2) gastrointestinal disease (vomiting, diarrhoea)                  never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(3) outbreaks of rare viral illnesses of world interest (ex: Ebola, SARS, avian influenza)                  never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p> <p>(4) after visited a hospitalized relative / friend                  never 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 always</p>
Socio - demographic characteristics	<p>gender, age, nationality, province of residence, marital status, education, occupation, religion</p>

province of Parma (37.3%), Piacenza (18.9%) and Rimini (14.6%).

*Data analysis*

The collected data analysis was conducted through SPSS 20 (Statistical Package for Social Science). The descriptive statistics (averages, standard deviations and

percentages) were performed for all variables included in the research. The Factor Analysis of Principal Components (eigenvalues <1, without rotation) was used for the reconstruction of synthetic variables. The Cronbach's alpha was tested for internal consistency. The Student's t-test for paired samples was used to test for differences in hand washing practice between the same subjects in different contexts. The multivariate ANO-

**Table 2.** Socio-demographic characteristics of the participants (N=195): frequency and valid percentage

Gender	Male	90 (46.4%)
	Female	104 (53.6%)
Age Group	Young Adults (19-36 Years)	47 (24.7%)
	Adults (37-46 Years)	49 (25.8%)
	Older People (47-57 Years)	47 (24.7%)
	Senior People (58-92 Years)	47 (24.7%)
Nationality	Italian	193 (99%)
	Other	2 (1%)
Province of residence	Bologna	12 (6.5%)
	Ferrara	2 (1.1%)
	Forlì-Cesena	9 (4.9%)
	Modena	11 (5.9%)
	Parma	69 (37.3%)
	Piacenza	35 (18.9%)
	Ravenna	3 (1.6%)
	Reggio-Emilia	11 (5.9%)
	Rimini	27 (14.6%)
	Other	6 (3.2%)
Marital status	Married	101 (52.3%)
	Divorced	13 (6.7%)
	Single	47 (24.4%)
	Cohabitant	23 (11.9%)
	Widow/Widower	9 (4.7%)
Education	None	0 (0%)
	Elementary School Degree	3 (1.5%)
	Middle School Degree	26 (13.3%)
	High School Degree	98 (50.3%)
	Bachelor's Degree	19 (9.7%)
	Master's Degree or Postgraduate Degree	49 (25.1%)
Occupation	Farmer	4 (2.3%)

*(continued)*

**Table 2 (continued).** Socio-demographic characteristics of the participants (N=195): frequency and valid percentage

	Entrepreneur	5 (2.8%)
	Manager	2 (1.1%)
	Teacher	7 (4.0%)
	Blue Collar Worker	9 (5.1%)
	Employee	75 (42.6%)
	Self Employed	16 (9.1%)
	Student	8 (4.5%)
	Retired	27 (15.3%)
	Housewife	6 (3.4%)
	Unemployed	13 (7.4%)
	Artist	4 (2.3%)
	Other	18 (9.3%)
Religion	Not Believer	36 (19.4%)
	Christianity Believer	148 (79.6%)
	Believer in other Religion (without specifying)	2 (1.1%)

VA and Post-hoc multiple comparisons (Bonferroni's method) was used to verify the impact of socio-demographic characteristics on research variables. The level of statistical significance was set at  $p \leq .05$ . The verification of the theoretical model (TPB) occurred through a Structural Equation Model (SEM), tested through Amos 5 Software, considering standardized coefficients obtained with the Maximum Likelihood Method.

## Results

### 1. Variables related to hand washing

*Behaviour of hand washing.* Respondents declared a high compliance with hand hygiene in health care settings ( $M=4.95$   $SD=1.26$ ). The most widely used product is the alcohol gel sanitizer (56.9%), followed by soap (32.8%), water (6.7%), wet wipes (3.1%), concentrated disinfectant solution (0.5%). At home they use liquid soap (58.5%), soap (22.1%), anti-bacterial soap (8.7%), water (5.1%), alcoholic sanitizing gel

(3.6%) and hypoallergenic soap (2.1%). To dry their hands they use a towel shared with family members (62.6%) or personal towel (36.4%). Only 1% use disposable wipes. The t-test analysis for paired samples has shown that hand washing in health care settings ( $M=4.46$ ) is practiced less often after touching surfaces that look dirty ( $M=4.99$ ;  $t=4.667$ ;  $p=.000$ ), before meals ( $M=5.3$ ;  $t=4.646$ ;  $p=.000$ ) and after using toilet ( $M=5.34$ ;  $t=7.159$ ;  $p=.000$ ).

This habit is more practiced than washing after using public transports ( $M=8.4$ ;  $t=3.243$ ;  $p=.001$ ), after being in a public place ( $M=3.47$ ;  $t=10.320$ ;  $p=.000$ ) and after handling money ( $M=3.22$ ;  $t=10.752$ ;  $p=.000$ ). No differences were found between hand-washing practiced in health care settings and the one practiced after touching an ill person ( $M=4.61$ ;  $t=1.54$ ;  $p=.125$ ) or animals ( $M=4.37$ ;  $t=0.835$ ;  $p=.405$ ).

*Intention to hand washing in health care settings.* There is a strong intention to practice hand hygiene when respondents find themselves in a health care setting again ( $M=5.54$ ;  $SD=.86$ ).



*Attitude towards hand washing in health care settings.* The average of all items reveals a very positive attitude towards the practice of washing. The Factor Analysis of the Main Components (eigenvalues >1, without rotation) showed a single factor (60,615% of the total variance). From the average of the individual item was then computed the “attitude to hand washing” (8 items;  $\alpha=.80$ ) where higher values correspond to a more favourable attitude ( $M=6.06$ ;  $SD=1.042$ ).

*Perception of sharing of hand washing.* The T test for paired samples showed that the subjects believe they wash their hands in health care settings ( $M=4.95$ ) more than nurses ( $M=4.63$ ;  $t=2.889$ ;  $p=.004$ ), physicians ( $M=4.39$ ;  $t=4.446$ ;  $p=.000$ ) health care workers ( $M=4.18$ ;  $t=6.532$ ;  $p=.000$ ), patients ( $M=2.81$ ;  $t=20.36$ ;  $p=.000$ ) and relatives and visitors ( $M=2.46$ ;  $t=23.57$ ;  $p=.000$ ). They also consider that they wash their hands more often than the society ( $M=2.94$ ;  $t=17.45$ ;  $p=.000$ ) and the personal net ( $M=4.24$ ;  $t=7.113$ ;  $p=.000$ ).

*Subjective norm about hand washing.* Respondents perceive as very important the adherence to hygiene standards shared in their social contexts ( $M=5.49$ ;  $SD=.94$ ).

*Perception of control (self-efficacy) about hand washing.* They also strongly feel able to practice proper hand washing in health care settings ( $M=5.18$ ;  $SD=.97$ ).

*Threat perception of risk infection and personal experiences of infection.* Respondents say they wash their hands more frequently in case of gastrointestinal disease ( $M=5.04$ ), after a visit to a family member/friend hospitalized ( $M=4.79$ ), in the case of seasonal flu ( $M=4.51$ ) and of outbreaks of rare viral illnesses of world interest ( $M=4.49$ ), emphasizing the role of risk perception. The Factor Analysis of Principal Components highlights the presence of a single factor (62.87% of the total variance), called “threat of risk of infection” ( $M=4.71$ ;  $SD=1.19$ ; 4 items,  $\alpha=.80$ ).

The 68.7% reported never having had experience of infections acquired in a health care setting. Among those who have had this experience, 22.6% said they wash their hands more frequently, while 8.7% did not change their own behaviour.

*Education in personal hand hygiene.* Respondents stated that they were trained to hand hygiene by the family ( $M=4.48$ ) and, by health care professionals (nurses, physicians and health care workers), who have a fairly important role ( $M=3.86$ ), compared to the one of the family-doctor ( $M=2.55$ ) or to the one of friends and acquaintances ( $M=2.32$ ). The most significant period in hand hygiene education were represented by childhood / elementary school ( $M=3.24$ ), compared to the middle and high school ( $M=2.51$ ) and universities ( $M=2.08$ ). The same can be said about the media ( $M=2.50$ ). The Factor Analysis of Principal Components has highlighted two factors: “social education”, which explains 57.73% of the total variance (7 items;  $\alpha=.79$ ), and “family education”, which explains 41.12% of variance (item 1). Family education ( $M=4.48$ ) has had a significantly greater impact than social education ( $M=2.72$ ) about hand washing [ $t=15.16$ ;  $p=.000$ ].

*Perception of the health context about hand hygiene.* Looking at the averages achieved to the individual questions, it is clear that health contexts are perceived to be predisposed to favour the correct hand washing ( $M=3.75$ ). In these health contexts there are information tools ( $M=3.66$ ) and professionals who adequately educate to hygienic practice ( $M=3.35$ ). The Factor Analysis of Principal Components has highlighted only one factor, “the perception (in favour) of the context” (61.20% of the total variance, 3 items,  $\alpha=.70$ ), whose average value is reasonably favourable ( $M=3.58$ ;  $SD=1.14$ ).

*Training needs about hand hygiene.* The participants feel the need to receive more information about hand washing ( $M=4.11$ ;  $SD=1.67$ ). The favourite channel is television ( $N=114$ ; 58.50%), followed by brochures distributed in health care settings ( $N=108$ ; 55.40%), education supplied by health professionals ( $N=93$ ; 47.70%), leaflets distributed in supermarkets, in shops and in public transport ( $N=78$ ; 40%), on the Internet ( $N=61$ ; 31.30%), on the magazines or newspapers ( $N=48$ ; 24.6%), on the radio ( $N=37$ ; 19%) and through a training ( $N=12$ ; 6.2%).

## 2. Impact of age and social status on hand washing

The ANOVA highlights the correlation between age and risk of contracting an infection in hospitals

[ $F(3)=3.77$ ;  $p=.012$ ;  $\eta^2=.57$ ]. The data analysis (Bonferroni) suggests that the elderly ( $M=5.04$ ) are more susceptible to infections ( $p=.009$ ) than the young adults ( $M=4.25$ ). Women ( $M=4.96$ ) seem more aware of the risks of getting infections [ $F=10.80$ ;  $p=.001$ ;  $\eta^2=.053$ ] than men ( $M=4.40$ ). This is also confirmed by the awareness of subjective norms [ $F=4.025$ ;  $p=.046$ ;  $\eta^2=.021$ ]: women ( $M=5.62$ ); men ( $M=5.34$ ).

People faith has an impact on social [ $F=6.425$ ;  $p=.012$ ;  $\eta^2=.034$ ] and family education [ $F=4.632$ ;  $p=.033$ ;  $\eta^2=.025$ ]: Christians ( $M=2.8$ ;  $M=4.64$ ) state they have been better educated regarding their hands hygiene, when compared to the not believers ( $M=2.32$ ;  $M=4.06$ ).

The marital status affects how subjective norms are perceived [ $F(4)=4.896$ ;  $p=.001$ ;  $\eta^2=.094$ ]. This is more obvious ( $p=.001$ ) in married people ( $M=5.69$ ) rather than singles ( $M=5.06$ ). Also the awareness of getting infections [ $F(4)=4.972$ ;  $p=.001$ ;  $\eta^2=.096$ ] seems to be affected by the social status: the separated/divorced people ( $p=.003$ ) feel more threatened by infections ( $M=5.54$ ) than singles ( $M=4.21$ ). The separated/divorced people ( $M=5.38$ ) feel the need of more information regarding hands hygiene [ $F(4)=2.659$ ;  $p=.034$ ;  $\eta^2=.034$ ] ( $p=.024$ ) compared to singles ( $M=3.89$ ).

The level of education is also reflected in the need of information regarding hands hygiene [ $F(4)=3.984$ ;  $p=.004$ ;  $\eta^2=.077$ ]: People with a high school diploma ( $M=4.92$ ) need to more information ( $p=.002$ ) than people with a bachelor or master's degree ( $M=3.05$ ).

People's jobs have an affect on: the attitude [ $F(11)=3.226$ ;  $p=.001$ ;  $\eta^2=.178$ ]; the behaviour [ $F(11)=1.913$ ;  $p=.041$ ;  $\eta^2=.114$ ]; the subjective norms [ $F(11)=2.474$ ;  $p=.007$ ;  $\eta^2=.142$ ] and on the social education [ $F(11)=2.579$ ;  $p=.005$ ;  $\eta^2=.147$ ]. Farmers ( $M=2.50$ ) wash their hands less often than the following categories: self-employed ( $M=5.69$ ;  $p=.000$ ); blue collar workers ( $M=5.44$ ;  $p=.003$ ); housewives ( $M=5.67$ ;  $p=.003$ ). The self employed people ( $M=6.36$ )

show a more positive attitude towards hands hygiene ( $p=.032$ ) than farmers ( $M=4.28$ ). The latter category also shows a more negative attitude towards subjective norms than teachers ( $M=6.00$ ). Finally, social education has a greater effect ( $p=.042$ ) on the unemployed ( $M=3.27$ ) than the students ( $M=1.70$ ).

### 3. Model verification

Values obtained from a verification of a theoretical reference model (TPB) and from a confirmatory factor analysis (SEM) show a good fitting (FIT). As suggested by Kline (44), a model can be defined satisfactory if:  $\chi^2/df$  ratio is lower than 3; the CFI and TLI higher than 0.90; the RMSEA equal to 0.08. (Table 3)

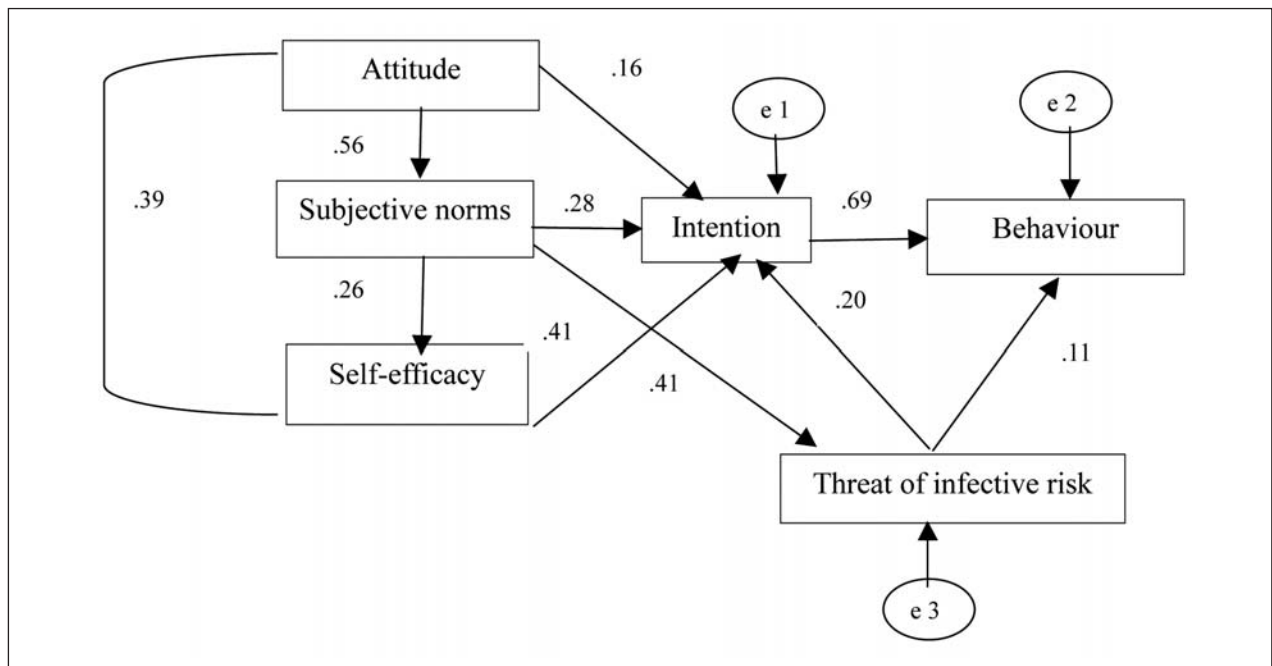
As shown in Figure 1 and within the theoretical reference model, the behaviour of hand washing depends on the intention ( $\beta=.69$ ;  $p<.0001$ ) which is affected by: people's attitude ( $\beta=.16$ ;  $p<.007$ ); subjective norms ( $\beta=.28$ ;  $p<.0001$ ); perception of self-efficacy ( $\beta=.41$ ;  $p<.000$ ). Subjective norms also affect the perception of risk ( $\beta=.41$ ;  $p<.0001$ ) which then has repercussions on the intention ( $\beta=.20$ ;  $p<.000$ ) and on the behaviour itself ( $\beta=.11$ ;  $p=.034$ ). There are also shown significant correlations between attitude and subjective norms ( $\beta=.56$ ;  $p<.0001$ ); between attitude and self-efficacy ( $\beta=.39$ ;  $p<.0001$ ) between subjective norms and self-efficacy ( $\beta=.26$ ;  $p<.0001$ ).

## Discussion and conclusions

This study developed from the interest towards hand hygiene habits of people such as visitors, outpatients, carers, volunteers who access to hospitals/surgeries. The focus on this behaviour is also justified by a lack of literature on the matter. A questionnaire has tried to measure the variables related to health related behaviours (41).

**Table 3.** FIT indexes of the model (TPB)

Model	$\div 2$ (df); sign.	$\div 2/df$	TLI	CFI	RMSEA
	16.800 (5) $p < .05$	3.36	.923	.974	.09



**Figure 1.** Hand hygiene in health care settings: standardized coefficient ( $\beta$ ) of the TPB model (N=195)

Analysis of the answers given by 195 citizens from Emilia Romagna has highlighted that some social factors as well as age affect the different variables of the behavioural reference model. Elderly people seem to be more aware of the risk of getting infections in hospitals/surgeries than young people. In these contexts, women are more aware than men. The social status and type of job are reflected on the subjective norms: women, married people and teachers seem to give more importance to their hands hygiene than men, unmarried people and farmers. It also very interesting to highlight that Christians feel they have been better educated regarding their hands hygiene (within a family and social context), when compared to atheists. People with low level education need more information regarding hands hygiene than more educated people.

Interviewed people believe that hands hygiene is a very effective way to prevent the spread of diseases in hospitals/surgeries. However, results show that hands hygiene is less practiced in these contexts rather than in home environments, especially after using the toilet, before meals or after touching dirty surfaces.

The threat of an infection has an effect on people's behaviour, as shown in previous studies (42): people

seemed to wash their hands more often whilst experiencing gastro-intestinal problems, flu and world spread infective diseases (e.g. Ebola; SARS) or after experiencing HAI (43). Results also show that in home environments, people use soap and water for their hands hygiene, whilst in the hospitals/surgeries they use an alcohol based solution. This makes us think that alcohol based hand rubs are easily found in hospitals/surgeries of Emilia Romagna, as recommended by the hands hygiene campaigns (7). Respondents showed a positive attitude toward hand washing in health care settings: they consider that is right, important, healthy and pleasant.

In relation to the normative beliefs, it is interesting to notice that the hand washing is more practiced into the family compared to the society. Similarly to what stated in literature, this behaviour is perceived little respected by patients, relatives and visitors in health care settings (8, 10, 29, 45). This could reveal a self serving bias: a cognitive or perceptual process distorted by the need to maintain and improve self-esteem, thinking oneself in a more favourable way than the other.

Respondents think that in health care setting those who wash their hands the most are nurses, followed

by doctors and then health professionals. The nurse is also considered the central figure to promote a correct therapeutic education, in addition to the availability of soap, washcloths and information brochures. This confirms that the use of visual or acoustic reminders, placement of alcohol gel dispensers at strategic points, accessible bathrooms and sinks foster the practice of hand hygiene (31, 34, 35, 37-39). Through the Theory of Planned Behaviour, the variables that can influence and predict the behaviour of hands hygiene among people in health care settings have been identified. As expected from the reference model, the hand washing behaviour is turned out to be subordinated to the intention. This intention undergoes the attitudes and even more the subjective norms and the perception of self-efficacy, as well as the perception of infection risk. These results shows the possibility of acting on citizen's perception of the risk, by intervening with educational and interactive programs (e.g. use of video) not during only school age, but also in the later educational phases (high schools, universities) in order to lead citizen's to a greater awareness of the problem. The respondent's favourite informative/educational tool is television, followed by the presence of leaflets in health care environment and by education given by health care professionals. It follows that each chance for citizen to get in contact with health facilities can be an opportunity to educate them, especially during moments of bigger vulnerability, such as during Emergency Services and Emergency Department access, and during outpatient visits, hospitalizations, continuity of care pathways hospital territory, rehabilitation or palliative provision. The points awarded for hand washing present in public areas and baths therefore need to be well cleaned and supplied with water, detergents and wipes. During the phases of planning or renovation, the contracts of environmental cleanup services and ordinary maintenance contracts should consider suitable and lasting materials (from the choice of fittings, toilet paper distributors, soap and towels). This is necessary also to overcome and compensate any possible contamination, acts of vandalism and theft of materials. A health facility who cares about these aspects shows to its own community how sensitive it is to hygienic and logistics elements, promotes concretely the hand hygiene and shows coherence with educational messages thanks

to its professionalism or thanks to the displayed panels inviting visitors to sanitize their hands, to protect themselves and the other (7). Each booklet provided by health facilities and explained to the citizens (e.g. diabetic patient, patient with renal insufficiency, patient taken in charge in the surgical route) may also remember the importance of hand hygiene in the prevention of infection risk, by providing a dedicated space (7). The educational activity could also be undertaken through a global targeted media campaign, as expressly requested by part of the respondents' population. Moreover, being the search of methods/strategies that increase compliance with hand hygiene very urgent, the role of the general practitioner, which at present is not relevant, could be fostered. The specialists in the infection risk control could support these professionals, through educational/training projects in order to share the WHO campaign (7).

We finally hope that, despite the limited number of the participants, the results obtained may serve as a stimulus for further research, addressed also to different categories, in order to design educational interventions targeted on the basis of their distinctive features.

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